Fragmented, Not Broken: How Households Manage Multi-Program Energy Participation

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ABSTRACT

As utilities build residential "Demand Stacks" that combine time-of-use rates, managed charging, thermostat demand response, and virtual power plants, the customer experience is becoming more complex. We conducted a late 2025 qualitative ethnographic study of 19 U.S. homeowners across 11 states enrolled in two or more demand-side programs to understand how households manage this growing overlap. We found that multi-program participation is usually experienced as fragmented rather than integrated: customers navigate separate apps, portals, incentives, and event signals, often without a clear view of total value. But fragmentation alone did not drive burnout. Many households remained enrolled for years, suggesting that customers will absorb substantial friction when participation stays low-effort and financially worthwhile. Attrition was more likely when overlapping program events undermined comfort, control, or expected earnings. These findings suggest that scaling the Demand Stack will require more coordinated customer experience design, clearer visibility into total program value, and better management of cross-program interactions.

Introduction

The modern electric grid is shifting from a centralized, supply-side model to a more distributed system that increasingly relies on flexible demand. As solar, battery storage, electric vehicles, and connected home devices become more common, utilities are no longer asking customers to participate in just one demand-side program at a time (Wood Mackenzie 2025; U.S. Department of Energy 2025). Instead, many households are beginning to layer together multiple forms of participation, including time-of-use rates, managed charging, thermostat demand response, and virtual power plants. In this emerging Demand Stack, customers are asked to manage a growing mix of incentives, devices, platforms, and program rules (Uplight 2025).

While the technical value of stacked distributed energy resources is well established (Frick et al. 2021), less is known about how customers experience this growing overlap in everyday life. As households add more devices and enroll in more programs, they may need to navigate utility portals, OEM apps, third-party aggregators, rate structures, and event notifications that were not designed to work together. This creates a new customer experience challenge: not simply whether customers will enroll in demand-side programs, but whether they can successfully manage multiple programs at once.

This paper examines how households experience and manage multi-program participation. Drawing on a late 2025 qualitative ethnographic study of 19 U.S. homeowners across 11 states who were enrolled in two or more demand-side programs, we focus on three questions: How fragmented does multi-program participation feel at the customer level? Under

what conditions do customers tolerate that fragmentation? And when does that tolerance begin to break down?

By documenting how multi-program households behave, this paper offers practical guidance for utilities and their partners as they design the next generation of residential demand-side offerings. Scaling the Demand Stack will require more than adding new ways to enroll. It will also require better coordination across programs, clearer visibility into total program value, and customer experience design that reflects the realities of overlapping participation.

Methodology

This study used a qualitative ethnographic approach to understand how households experience and manage participation across multiple demand-side programs. The goal was not to estimate prevalence in the broader market, but to examine how multi-program participation is interpreted, navigated, and sustained in everyday life. We focused on households actively enrolled in two or more demand-side offerings in order to capture the lived experience of overlapping devices, incentives, interfaces, and event signals within the emerging Demand Stack.

Participant Recruitment

We recruited 21 residential homeowners across 11 U.S. states through third-party paid research platforms, including dscout, Respondent, and Strella. To ensure participants could speak directly to the experience of multi-program participation, all recruits were double-screened. Eligibility criteria required that participants be the household electricity bill payer or account holder, the primary user of relevant smart energy devices, and currently enrolled in two or more demand-side programs. Qualifying programs included smart thermostat demand response, EV managed charging, battery storage virtual power plants, time-varying rates such as time-of-use or critical peak pricing, and smart water heater demand response. All DR programs in this sample offered participants the ability to override demand response events.

Following data collection, two participants were excluded from analysis after further review revealed they did not meet the multi-program enrollment criteria at the time of the study. Both had passed initial screening but were subsequently found to be enrolled in fewer qualifying programs than reported. Their interviews were completed but their data are not reflected in the findings. The final analytic sample consists of 19 participants.

Table 1. Participant sample summary

Sample characteristic	Summary
Participants	19 homeowners
Geography	11 U.S. states (AZ, CA, CO, CT, GA, MA, NH, NJ, NY, TX, WA)
Eligibility	Enrolled in 2+ demand-side programs

Program types represented	Thermostat demand response, EV managed charging, battery virtual power plants (VPP), time-varying rates, smart water heater demand response
Device ownership represented	EVs, chargers, smart thermostats, batteries, rooftop solar, smart water heaters
Income	Approximately one-third low-to-moderate income (based on household size and income relative to the Area Median Income and/or the Federal Poverty Level)

A full participant profile table is provided in Appendix Table A1.

Data Collection

Data collection combined 45–60-minute semi-structured video interviews with digital ethnographic activities. Interviews explored participants' enrollment journeys, event experiences, perceived benefits and tradeoffs, and how they understood financial value across multiple programs. Participants also completed asynchronous video walkthroughs and screen recordings showing how they interacted with utility, OEM, and third-party platforms such as Tesla, Enphase, and Google Home. Together, these materials captured both participants' own accounts of multi-program participation and the digital environments through which that participation was managed.

Analysis

Across interviews and digital ethnography materials, the research team analyzed approximately 26 hours of qualitative data using a structured thematic coding process. Analysis focused on identifying recurring patterns in how participants experienced multi-program enrollment, interpreted financial value, navigated overlapping interfaces, and responded to friction across programs and devices.

Initial coding was supported by AI-assisted synthesis tools, including dscout and Google's NotebookLM, to help surface cross-participant themes and organize emerging patterns. All themes and interpretations were then reviewed, refined, and validated by the research team. This process supported the development of the final findings related to fragmentation, friction tolerance, and the conditions under which multi-program participation began to break down.

Findings

Finding 1. The Multi-Program Customer Experience Is Fragmented, Not Integrated

Across the sample, multi-program participation was typically experienced as fragmented rather than integrated. Participants described managing separate apps, portals, incentives, and event signals across utilities, OEMs, and third-party providers, often with no single reliable place to understand what was happening across their full set of programs. As one participant put it, participation felt like "multiple separate things" that were "quite different," with some programs tied to a particular device ecosystem and others operating entirely differently from a thermostat demand response program.

This fragmentation appeared across the full customer journey, from enrollment to incentives to event participation. Enrollment pathways were often siloed by device and provider: a participant might enroll a thermostat through a utility portal, a battery through the Tesla app, and EV charging through a separate channel, even when all three affected the same household energy use. Incentives were similarly fragmented, arriving as bill credits, direct deposits, prepaid cards, or annual payouts, with different timing and different levels of visibility. Participants often lacked a clear way to understand the cumulative value of participation across programs, and some resorted to spreadsheets or manual tracking to estimate what they were earning overall.

Operationally, fragmentation also shaped the day-to-day experience of participation. Notifications arrived through multiple channels with inconsistent branding, and participants were often unclear whether an adjustment was being made by the utility, the device manufacturer, or the participant themselves. The result was not necessarily confusion about each individual program in isolation, but a broader sense that multi-program participation had to be pieced together across disconnected systems.

A smaller group (7 of 19 participants) described a more cohesive experience. These participants shared several common characteristics: they organized their programs around a unified end goal rather than by device or provider, favored passive "set-it-and-forget-it" engagement that minimized daily cognitive load, and reported high satisfaction even when they lacked visibility into which specific program was making adjustments. As one participant explained, "I see them as holistic... it's one program meaning one way to efficiently save." In other words, when households experienced the stack as unified, that unity was typically psychological rather than structural — shaped by user orientation and low-effort engagement, not by integrated program design.

Finding 2. Customers Tolerate Fragmentation When Value Feels Clear and Effort Stays Low

Despite the fragmented customer experience described above, multi-program participation did not automatically lead to fatigue or attrition. Many participants had remained enrolled in multiple programs for roughly two years, suggesting that households can absorb a meaningful amount of friction when participation continues to feel relatively low-effort and financially worthwhile.

Financial value was the dominant reason participants stayed enrolled. Across interviews, households consistently described bill savings and incentives as the primary benefit of participation, far outweighing motivations related to environmental values or grid support. Participants often framed incentives less as one-time rebates and more as a form of recurring, low-effort income. As one participant explained, “It’s like… if you write a book and you get royalties… you’re gonna keep getting royalties… I like that feeling of money in the bank.”

Just as important, the value did not need to be perfectly measured to sustain participation. Many households lacked a single clear way to track total earnings across programs, yet still stayed enrolled because the overall payoff felt directionally worthwhile. In other words, customers were often willing to tolerate fragmentation as long as the experience stayed manageable and the benefits seemed to outweigh the effort. For some, that low-effort threshold was especially important. As one participant put it, “I’m able to save without hardly thinking about it… it’s still better than nothing.”

Taken together, these patterns suggest that retention is shaped less by complexity alone than by a simple behavioral calculus: customers remain enrolled when the perceived value of participation continues to outweigh the effort required to manage it. This also helps explain why fragmentation has not yet produced widespread burnout. Households are often doing the work of stitching together a messy experience because, at least for now, it still feels worth it.

Finding 3. Tolerance Breaks Down When Coordination Failures Threaten Comfort, Control, or Expected Earnings

Participants were generally willing to tolerate disconnected interfaces, limited transparency, and minor inconvenience. Frustration and unenrollment were more likely when coordination broke down across programs in ways that made participation no longer feel worth the tradeoff. In these cases, the issue was not complexity alone, but the sense that overlapping programs were compromising comfort, reducing control, or eroding the financial value that had justified participation in the first place.

This dynamic was most visible when program events overlapped in ways that felt misaligned or counterproductive. One participant described a thermostat precooling event coinciding with a battery discharge event, creating a situation where the household became uncomfortable while stored energy was depleted during peak hours. Another described not knowing whether different programs were "fighting each other," and whether the combined effect was actually helping or hurting. These moments made the Stack feel less like a set of complementary opportunities and more like a set of poorly coordinated demands.

When these conflicts occurred, participants often reassessed the value of staying enrolled. As one participant put it, "If it starts to cost me more money than I'm saving, or if it becomes a hassle, then I'm out." Another participant, whose program offered an override option, appreciated having the flexibility to use it when household needs took priority. Together, these responses suggest that tolerance depends not just on low effort, but on preserving a baseline sense of comfort, agency, and credible financial return.

Even then, households rarely exited all programs at once. Instead, they tended to drop the highest-friction offering while remaining enrolled in programs that felt more passive or less intrusive, such as time-varying rates, EV charging optimization, or battery programs. This suggests that attrition in the Demand Stack is selective rather than wholesale. Customers do not reject multi-program participation outright; they shed the components that feel most effortful, least coordinated, or least worthwhile.

Finding 4. Battery Storage May Fundamentally Shift How Customers Engage with Multi-Program Participation

An emerging signal from this study is that battery storage may change not just what customers can do within the Demand Stack, but how they relate to participation itself. Participants without storage tended to describe demand-side programs primarily as a way to reduce monthly costs — a passive, savings-oriented frame. In contrast, households with solar and batteries more often treated the home as an energy asset capable of generating value. Battery ownership appeared to make participation feel more active, visible, and engaging, giving customers a stronger reason to monitor events, track performance, and stay engaged with how their home participates in the grid.

In this sense, batteries may help turn customers from passive consumers into active owners. This shift in orientation — from cost reduction to value generation — has implications beyond individual engagement. For utilities seeking to expand virtual power plant capacity and deepen customer relationships, battery adoption may accelerate the transition toward a more participatory customer base.

Recommendations For Utilities and Implementation Partners

1. Design for the Multi-Program Customer, Not the Standalone Program

This study suggests that the core customer experience challenge is no longer participation in any single demand-side offering, but participation across multiple programs at once. Households in this study often navigated separate enrollment pathways, interfaces, incentives, and support systems across utilities, OEMs, and third-party providers, with little evidence of a coordinated customer-facing experience. As demand-side offerings continue to accumulate, utilities and their partners should shift from single-program design to multi-program customer experience design. That includes reducing fragmentation across enrollment, communications, account management, and support touchpoints, and designing journeys that reflect the reality of overlapping participation rather than assuming customers are interacting with one program in isolation.

2. Give Customers a Clearer View of Total Program Value

Participants in this study were often willing to tolerate fragmented participation as long as the experience remained manageable and the financial return felt worthwhile. What counted as "worthwhile" varied considerably — shaped by comfort tradeoffs, asset degradation concerns, and payout structure — and thresholds dropped significantly when participation required little to no effort or disruption. At the same time, many lacked a clear way to understand the cumulative value of participation across programs. Utilities are well positioned to make bill credits, incentive payments, and rate-based savings easier to see in one place, helping customers connect participation to outcomes and reducing the burden of manually piecing together value across disconnected systems. Clearer visibility into total program value could strengthen trust, reinforce retention, and make multi-program participation feel more coherent even when underlying systems remain fragmented.

3. Coordinate Cross-Program Interactions to Prevent Selective Attrition

The most consequential failures in this study were not caused by complexity alone, but by poor operational coordination across programs once customers were already enrolled. Overlapping events sometimes reduced comfort, depleted stored energy at the wrong time, or made customers question whether participation was financially worthwhile. In these situations, households rarely exited all programs; instead, they tended to drop the highest-friction offering while remaining enrolled in lower-effort ones. This means that uncoordinated dispatch is not just a customer experience problem — it is also a retention risk. Utilities, retailers, and OEM partners should better coordinate event timing, control logic, and override rules across devices and

programs in order to preserve comfort, maintain a sense of control, and reduce selective attrition from the most disruptive parts of the stack.

Together, these recommendations suggest that scaling the Demand Stack will require not just more opportunities for enrollment, but more coordinated customer experience design across programs, devices, platforms, vendors, and program hosts.

Conclusion

As utilities expand residential demand-side offerings into increasingly layered Demand Stacks, the customer experience is becoming more complex. This study found that households enrolled in multiple programs typically experience participation as fragmented rather than integrated, navigating separate apps, incentives, and event signals across utilities, OEMs, and third-party providers. Yet fragmentation alone did not automatically produce fatigue or attrition. Many households remained enrolled across multiple programs for years, suggesting that customers will tolerate substantial friction when participation remains relatively low-effort and financially worthwhile. Tolerance was more likely to break down when coordination failures disrupted comfort, reduced perceived control, or undermined the expected financial benefit of participation.

Taken together, these findings suggest that scaling the Demand Stack will require more than adding new opportunities for enrollment. It will also require a more coordinated customer experience across programs, devices, and platforms. Customers are already doing the work of stitching together fragmented systems; the next phase of program design should reduce that burden by making value easier to understand and participation easier to manage over time.

A fourth signal from this study points to the potential role of battery storage in shifting how customers engage with multi-program participation — moving from a passive, cost-reduction frame toward treating the home as an active energy asset. For utilities seeking to expand virtual power plant capacity and deepen customer relationships, this shift may be worth tracking as battery adoption grows.

Limitations

This study has some limitations. First, it is a qualitative ethnographic study of 19 homeowners across 11 U.S. states, designed to surface behavioral patterns and lived experiences rather than estimate prevalence in the broader market. The findings should therefore be interpreted as directional and explanatory, not population-level estimates. Second, participants were recruited through third-party paid research platforms and were required to already be enrolled in two or more demand-side programs, which means the sample likely overrepresents households that are more engaged, more technically equipped, or more willing to participate than the average utility customer. Finally, because the study focused on homeowners already participating in multiple programs, it does not capture the perspectives of renters, single-program participants, or households that considered enrollment but chose not to participate. Future research could test how broadly these patterns hold across larger and more diverse customer populations, including households earlier in the DER adoption journey.

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Appendix

Table A1. Full participant profile table

ID	Income category	Electric rate plan	Devices owned	Program participation
P1	Low-to-moderate income	NEM2 Solar + TOU	• 1 Smart thermostat • 1 Smart water heater • 1 EV • 1 Level 2 charger • 1 PHEV • 1 battery • Rooftop solar	• AC Switch and/or smart thermostat DR • EV managed charging • Battery DR • Water heater DR
P2	Low-to-moderate income	RTP	• 1 Smart thermostat • 1 EV • 1 Level 2 charger	• AC Switch and/or smart thermostat DR • EV managed charging
P3	Low-to-moderate income	NEM2 Solar + TOU	• 1 Smart thermostat • Smart water heater • Rooftop solar • 2 Smart plugs	• Smart thermostat DR • Smart plug DR
P4	Low-to-moderate income	NEM3 Solar + TOU	• 2 EVs • 1 PHEV • 1 Level 2 charger • 2 Batteries • Rooftop solar	• Battery VPP
P5	Low-to-moderate income	TOU	• 1 Smart thermostat • 1 EV • 1 Level 2 charger	• Smart thermostat DR • EV managed charging
P6	Low-to-moderate income	Standard / Tiered	• 1 Smart thermostat • 2 EVs • 1 Level 2 charger	• Smart thermostat DR • EV managed charging
P7	Low-to-moderate income	NEM3 Solar + TOU	• 1 Smart thermostat • 1 Battery • Rooftop solar	• Smart thermostat DR
P8	Above LMI threshold	EV TOU	• 1 Smart thermostat • 1 EV • 1 Level 2 charger	• EV managed charging

P9	Above LMI threshold	Solar + TOU	• 1 Smart thermostat • 1 EV • 1 Level 2 charger • 2 Batteries • Rooftop solar	• Smart thermostat DR • Battery VPP
P10	Above LMI threshold	NEM2 Solar + TOU	• 1 Smart thermostat • 2 EVs • 2 Level 2 chargers • 2 Batteries • Rooftop solar	• Smart thermostat DR (recently unenrolled) • Battery VPP
P11	Above LMI threshold	NEM2 Solar + TOU	• 1 Smart thermostat • 2 EVs • 2 Level 2 chargers • 1 Battery • Rooftop solar	• Smart thermostat DR • Battery VPP
P12	Above LMI threshold	EV TOU	• 1 Smart thermostat • 1 EV • 1 Level 2 charger • Smart water heater	• Smart thermostat DR • EV managed charging • Smart water heater DR
P13	Above LMI threshold	TOU + CPP	• 1 Smart thermostat • 1 EV • 1 Level 2 charger • Smart water heater	• Smart thermostat DR • EV managed charging
P14	Above LMI threshold	TOU	• 1 Smart thermostat • 1 EV • 1 Level 2 charger	• Smart thermostat DR • EV managed charging
P15*	Above LMI threshold	Standard / Tiered	• 1 Smart thermostat • 1 EV • 1 Level 2 charger • 2 Batteries • Rooftop solar	• Smart thermostat DR
P16	Above LMI threshold	TOU	• 1 Smart thermostat • 1 EV • 1 Level 2 charger	• Smart thermostat DR • EV managed charging
P17	Above LMI threshold	House 1: Solar + Standard / Tiered	For each home: • 1 Smart thermostat • 2 EVs • 2 Level 2 chargers • 2 Batteries	For 1 home, soon to be both homes: • Smart thermostat DR • Battery VPP

		House 2: Solar + TOU	• Rooftop solar	
P18*	Above LMI threshold	Standard / Tiered	• 1 Smart thermostat • 1 EV • 1 Level 2 charger • 1 Battery • Rooftop solar	• Smart thermostat DR
P19	Above LMI threshold	Standard / Tiered	• 4 Smart thermostats • 3 EVs • 3 Level 2 chargers	• Smart thermostat DR • EV managed charging
P20	Above LMI threshold	Standard / Tiered with Flat Budget Billing	• 1 Smart thermostat • 1 EV	• Smart thermostat DR • EV managed charging (BDR)
P21	Above LMI threshold	NEM2 Solar + TOU	• 1 Smart thermostat • 1 Hubitat • 2 EVs • 2 Level 2 chargers • 2 Batteries • Rooftop solar	• Smart thermostat DR • Battery VPP

*P15 and P18 were interviewed but excluded from analysis. See Participant Recruitment for details.

Table A2. Summary of devices owned

Device	Participants (n)
Smart thermostat	18
EV	17
Level 2 charger	16
Battery storage	7
Rooftop solar	9
Smart water heater	4
Smart plugs	1
Home energy hub / controller	1

Table A3. Summary of program participation

Program	Participants (n)
Smart thermostat DR	17
EV managed charging	11
Battery VPP / battery DR	7
Smart water heater DR	2
Smart plug DR	1
Time-varying rate plan (TOU / RTP / CPP)	16

Disclosure

AI-assisted tools used: dscout, Strella, NotebookLM, and ChatGPT.
Used for: transcriptions, thematic clustering, interview moderation support, text drafting.
Extent: data collection, synthesis, and text drafting.
Human review: The authors reviewed and verified all content, calculations, and citations.