Can Dynamic Pricing Unlock Electrification Savings? A Residential Customer Analysis

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ABSTRACT

The customer economics of residential electrification, particularly fuel switching from natural gas to electric heat pumps, are often unfavorable under traditional rate structures. This poses a major barrier to adoption. This research explores whether dynamic electricity rates can improve affordability outcomes for electrified residential homes, especially in cold climates. Conducted in partnership with Commonwealth Edison Company (ComEd), a large Midwestern electric utility, the study applies a shadow billing methodology to evaluate electricity supply cost impacts for 123 residential customers over a 35-month period. Customers were grouped by housing type and electrification level, including fully electrified homes, hybrid heat pump systems, and multifamily buildings.

By comparing fixed-rate and real-time hourly pricing rate structures before and after electrification, the analysis reveals that nearly all customers (99.2%) would have saved under the dynamic pricing rate post-electrification, with average annualized savings of $381 (33.4%), compared to $40 (4.0%) prior to electrification. Fully electrified homes demonstrated the highest savings potential, particularly during non-summer months when heating loads shift consumption to off-peak hours (which historically see the lowest electricity prices). Hybrid and multifamily configurations also showed savings, though with more variability.

These findings suggest that pairing building electrification with dynamic pricing can meaningfully improve bill savings, which is imperative for low-income households. However, variability in savings across customer segments highlights the need for tailored outreach and education. This research offers actionable insights for utilities and program designers seeking to align rate structures with electrification goals and equity or affordability outcomes.

Introduction

This research examines the impact on customer energy bill savings of a dynamic, real-time electric rate combined with electrification retrofit interventions in residential buildings. Specifically, this report seeks to determine whether residential customers adopting air source heat pumps would financially benefit from switching to a real-time hourly electricity rate. This is achieved through a shadow billing analysis comparing bill impacts prior to and after electrification measures were implemented, while also comparing cost differences between fixed and hourly rates.

The Operational Economics of Electrification

The operational economics of switching from natural gas to electric heat pumps in cold climates are highly sensitive to the relative prices of gas and electricity. National modeling conducted by the National Renewable Energy Laboratory (NREL) demonstrates that while electrification with heat pumps reduces greenhouse gas emissions in every state, the economic viability is extremely varied (Wilson et al. 2022). In many regions, the high “spark spread” or price to compare between retail electricity and natural gas means that standard flat rates can lead to cost increases, particularly for households in older, less efficient buildings. Research from the American Council for an Energy-Efficient Economy (ACEEE) identifies that standard rate structures may be the single largest barrier to heat pump adoption, and they fail to reward the inherent flexibility of heat pump loads (Malinowski et al. 2025).

In the Midwest, these economic pressures are particularly acute. Studies by the Center for Energy and Environment (CEE) on hybrid air source heat pumps in cold climates highlight that a lower volumetric electricity rate is often necessary to make electric heating cost-competitive with natural gas (CEE 2023). Space heating demand is highly correlated with outdoor temperatures and thus creates a unique load profile that traditional electric space heat distribution classes, originally designed for legacy technologies like electric resistance baseboards, do not adequately serve. In addition to having a unique load profile throughout the year, modern heat pumps also offer load shifting or demand response potential that flat rates cannot capture. Consequently, many utilities are exploring "electrification-friendly" rates. For instance, utilities in Maine and Massachusetts have introduced seasonal and distribution-level discounts to lower the cost of electric heat during winter months (Malinowski et al. 2025).

In northern Illinois, similar to other cold climate regions across the Midwest like Michigan, Wisconsin, and Minnesota, the operational cost economics of fuel conversion and balance of energy rates has led to the region’s relatively nascent energy efficiency and electrification programs targeting four primary applications of heat pumps – conversion of legacy propane heating systems, inclusion in all-electric new construction, full electrification retrofits for low-income households (which eliminates the fixed costs of the gas bill leading to net savings), and hybrid or dual fuel heat pump system retrofits (where a heat pump covers some heating load but most deep winter capacity is maintained by legacy gas-fired equipment).

Researchers in Europe have also been examining the intersection of heat pump usage and time-variant and dynamic pricing. For example, a recent empirical analysis of a time-of-use tariff in the United Kingdom found that heat pump adopters switching to the tariff could save on average £318 per year, or 18% of annual energy costs. The study also found that heat pump owners are sensitive to the hourly price of electricity and tend to respond with load-shifting behaviors that contribute to household savings and significant electric grid benefits. However, we found limited published causal evidence in the United States regarding how real-time marginal prices impact the energy bills of households with modern electrification measures in cold-climate regions like northern Illinois.

This paper contributes to this research need by analyzing data from a set of electrification participants in the Commonwealth Edison (ComEd) service territory, including single family homes, multifamily buildings, and income eligible program retrofits. By exploring the intersection of building electrification and dynamic pricing, this analysis demonstrates how time-variant rates can serve as a scalable solution to the decarbonization affordability issue. The findings suggest that when electricity costs are aligned with wholesale market conditions, the strong winter consumption trend typically associated with air source heat pumps in cold climates can actually become an opportunity for savings, as most of the increased consumption occurs during off-peak, lower-cost hours.

Whole Home Electrification

In 2022, ComEd launched a large-scale pilot initiative in partnership with Elevate to demonstrate the technical and economic feasibility of whole-home weatherization and electrification retrofits. This initiative, which has since evolved into a full-scale program called Whole Home Electric, provides comprehensive upgrades to both single-family and multifamily income-eligible households by integrating deep energy efficiency measures such as insulation and air sealing with the installation of cold climate air source heat pumps. The program attempts to screen income eligible households for optimal candidates such as those already having received weatherization services and then prioritizes proper design and sizing of new heating systems along with complete electrification of all other gas end uses in the home. By targeting the total home energy system, the initiative aims to not only create deep residential energy savings but also to reduce the disproportionately high energy burdens often faced by underserved communities.

The early adopters of these retrofits provided the empirical data for four of the five study groups analyzed in this research (Groups A, B, D, and E). Selecting this population was a deliberate choice rooted in the heightened price sensitivity of low-income households, for whom the transition to electric heat must deliver immediate and sustained financial benefits. For these residents, avoiding negative net savings is a primary objective; any shift that results in a bill increase could undermine the equity goals of the program. Consequently, identifying rate structures that provide an additional buffer on savings is critical to protecting participants from the financial risks associated with behavioral usage variations, extreme seasonal weather fluctuations, or discrepancies in real-world equipment performance compared to ratings.

Hybrid Heat Pump Systems

Despite the growth of whole-home electric initiatives, the total number of households converting to fully electric energy systems is currently outpaced by those adopting air source heat pumps in varied, incremental configurations. One such configuration that continues to gain significant traction across the Midwest is the hybrid, or dual-fuel, system. These systems combine an electric heat pump with a natural gas furnace to provide reliable heating and cooling throughout the year. Regional research indicates that standalone add-on inverter-driven dual-fuel heat pumps and multizone inverter-driven versions have grown in popularity and product availability, offering increased versatility for homeowners who may not be ready for full fuel switching (Slipstream 2024). The hybrid path is increasingly viewed as a pragmatic decarbonization strategy, as it allows for immediate emissions reductions while building the contractor workforce and consumer familiarity necessary for eventual full electrification (Sussman and Malinowski 2024).

Hybrid systems are designed to automatically switch between electricity and natural gas based on outdoor temperatures, typically optimizing for operating cost, energy efficiency, or indoor comfort. By utilizing a switchover point, these systems can be characterized by significantly lower electric heating demand during extreme cold events compared to fully electric configurations. This technical characteristic is particularly valuable for grid management, as it mitigates the sharp demand spikes that often accompany fully electric heat pump systems equipped with integrated electric resistance supplemental or backup heat. Recent regional analysis in Illinois suggests that while full electrification offers the greatest long-term decarbonization potential, hybrid systems provide a critical entry point for customers concerned about the operational cost trade-offs between gas and electricity in cold climates (Ameren Illinois 2025).

In the ComEd service territory, this application is experiencing dramatic market growth. To better understand the usage patterns and customer experience of these systems, ComEd implemented a pilot program several years ago that studied 30 customers with variable speed, "coil-only" heat pumps installed in a hybrid configuration with an existing or new gas furnace. These participants, who represent a commercially available solution for many existing homes, served as the fifth sample for this research (Group C). By including this cohort, the analysis sought to explore how dynamic pricing impacts not only those who have fully committed to an electric home but also those utilizing heat pumps as a secondary, cost-optimized heating source.

ComEd's Hourly Pricing

Hourly Pricing is an opt-in ComEd program that allows eligible residential customers to pay for their electricity supply at the hourly market price. Upon enrollment, a customers' account transitions from ComEd's default fixed-price rate (tariffed as "Rate BES - Basic Electric Service") to Rate BESH (tariffed as "Rate BESH – Basic Electric Service Hourly Pricing") (ComEd 2024a and ComEd 2024b). Rider RRTP (Residential Real Time Pricing Program) is then automatically applied to residential customers taking service under Rate BESH. Rider RRTP accounts for the supplementary tools, resources, ongoing education, and support to help customers paying real-time market prices on Rate BESH manage their energy use in the form of monthly and annual performance reports, access to detailed pricing and usage information via an online bill comparison tool, price signal notifications about the best times to reduce or shift energy use, seasonal energy guides, and call center support (ComEd 2024c). As such, the combination of Rate BESH and Rider RTTP form what is broadly referred to as "ComEd's Hourly Pricing" or "Hourly Pricing". For purposes of this report, "fixed rate" is used to refer to Rate BES, "hourly rate" to refer to Rate BESH, and "Hourly Pricing participants" or "participants" to refer to residential customers taking service under Rate BESH and Rider RRTP.

Hourly Pricing participants can save money on their electricity supply costs by reducing or shifting energy use to lower-priced hours. Hourly prices follow predictable seasonal patterns and are typically lower during times of lower demand, such as off-peak overnight hours, weekends, and non-summer months. Since 2007, participants have saved over $50 million (19%) on their electric supply costs on the hourly rate compared to the fixed rate (Illinois Commerce Commission 2024).

Hourly Prices

Unlike the fixed rate, prices on the hourly rate fluctuate throughout the day. The highest prices in summer months are typically in the late afternoon and early evening when demand is highest. Hourly prices fluctuate the most in the summer as increased demand is driven by cooling load from higher temperatures. During the fall, winter and spring, prices tend to be higher in the morning and evening, and prices are typically lower overall than in the summer.

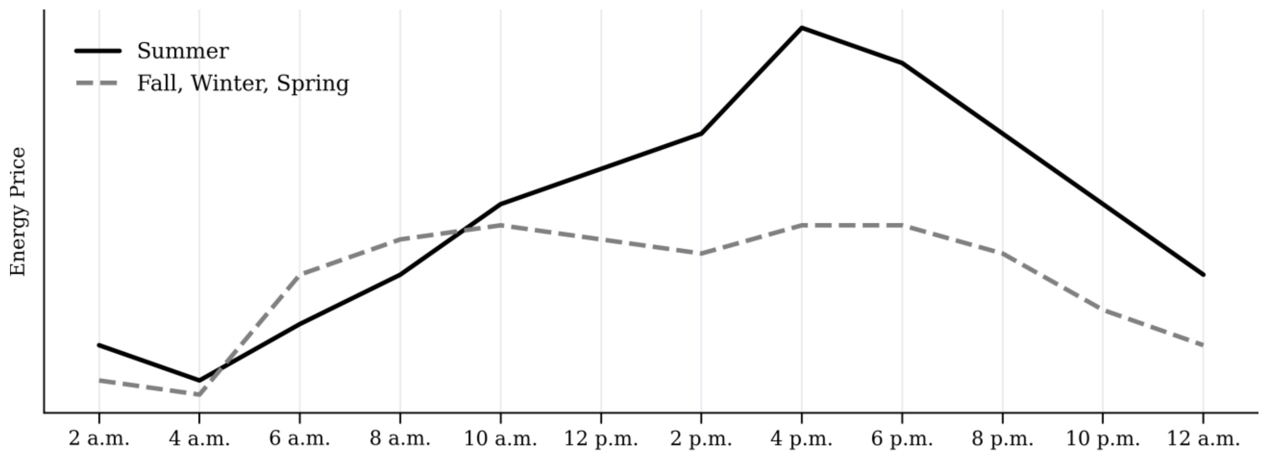


Figure 1. A representation of typical hourly prices for January 2018 through August 2024.

Hourly prices typically follow predictable seasonal patterns, making it easy for Hourly Pricing participants to shift energy use and save money. Most participants can save money in the long run by reducing or shifting their energy use to lower-priced hours; however, monthly bill total variations are more common on the hourly rate, due to the nature of real-time market prices compared to the fixed rate. Customers on real-time rates who are more sensitive to monthly bill total variations may want to also enroll in a budget billing program. Such programs are commonly offered by utilities to help customers have more consistent and predictable monthly bill totals throughout the year that eliminates monthly or seasonal variation.

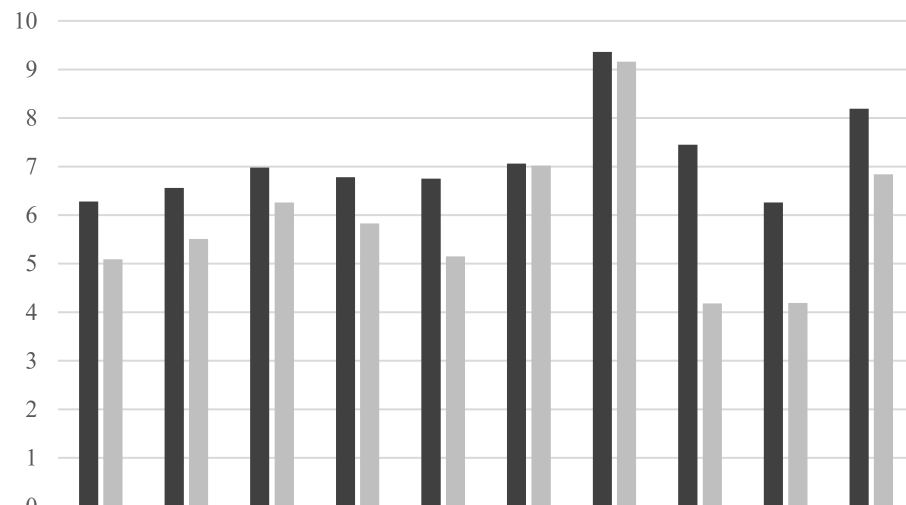
While there are many factors that can result in higher prices, there are three main drivers covering most scenarios. These include increased demand, reduction in available supply, and increased costs of electricity generation fuel sources. Increased demand typically occurs during summer months when air conditioner use can drive up regional demand for electricity. Reductions in the available supply of electricity can occur if an unanticipated heat wave occurs in the spring or fall when some power plants are shut down for maintenance. Brief price spikes can also occur if multiple power plants have technical or mechanical issues at the same time, resulting in less available generating capacity on the grid than anticipated. Because Hourly Pricing participants pay for electricity supply at the PJM real-time hourly market price, increases to the cost of electricity generation fuel sources in PJM's system can also result in higher prices.[1] In 2025, natural gas accounted for approximately 43% of electricity generation in PJM's system. As such, increased volatility in the natural gas market caused by supply chain disruptions or major geopolitical events can have a significant impact on the hourly prices participants pay (Elevate 2022).

Conversely, there are factors that can result in low or even negative prices. Negative prices typically occur during off-peak overnight hours and, under certain circumstances, when electricity supply is greater than demand. In the PJM market, some electricity generators cannot or prefer not to reduce energy output for short periods of time when demand is insufficient. As a result, some generators may provide electricity to the market at prices below zero (negative prices). Since Hourly Pricing participants pay the market price of electricity, they are being paid

[1] PJM is the regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia, including ComEd's service area.

to use electricity supply during negative-priced hours. Other charges like Delivery and Taxes & Fees still apply when hourly supply prices are negative. There were a total of 1,067 negative-priced hours representing 2.4% of all hours over the five-year period between January 1, 2021, and December 31, 2025. Certain customer segments like electric vehicle owners and electric space heat customers are well-suited to take advantage of negative hourly prices.

Additionally, overall reduction in demand can result in lower hourly prices. This is typically seen during off-peak overnight hours, weekends, and non-summer months; however, larger scale changes impacting demand levels can also result in lower hourly prices. For example, in 2020 the COVID-19 pandemic drove reduced overall demand from the commercial and industrial sectors while also increasing the prevalence of remote work which resulted in both lower hourly prices and higher consumption in the residential sector (Elevate 2001).



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Fixed rate (Rate BES)	6.28	6.56	6.98	6.78	6.75	7.06	9.36	7.45	6.26	8.19
Hourly rate (Rate BESH)	5.09	5.51	6.26	5.83	5.15	7.02	9.16	4.18	4.19	6.84

Figure 2. Average annual supply charge per kWh in cents (2016-2025)

Methodology

The methodology used for this research was consistent with the methodology used for marketing campaigns designed to encourage customers to switch from the standard rate to the hourly rate. For purposes of this analysis, shadow billing was used to better understand whether residential customers participating in different electrification programs can save money on their bills by switching from the fixed rate to the hourly rate.

The analysis used a broad observation timeframe of a 35-month period between May 2021 through March 2024 to account for year-over-year variations in weather, electricity prices, and market conditions. To better capture the effects of switching to the hourly rate on customers adopting electrification measures, bill impacts were analyzed both prior to, and after electrification measures were implemented, in addition to looking at the cost differences between the fixed rate and hourly rate. While shadow billing has historically been used as a marketing tactic to promote different rates to utility customers, this study shows how it can also be utilized to answer specific research questions.

Shadow Billing Analysis

Shadow billing refers to a marketing tactic where interval hourly billing and pricing data for all applicable monthly bill line items over a selected period is used to conduct an analysis that provides a personalized savings amount to customers who are targeted for a marketing campaign. Shadow bill campaigns compare what the customer paid on the fixed rate over a 12-month period, what they would have paid on the hourly rate during that same 12-month period, and how much they would have saved or lost if they had been on the hourly rate. Elevate and ComEd have shown that Hourly Pricing marketing campaigns featuring customized shadow billing are correlated with higher customer enrollment rates. The goal of using the shadow billing marketing tactic is to better identify customers who are likely a good fit for the hourly rate, and to help encourage new enrollments from those customers utilizing compelling data made possible through widespread smart meter installation. By identifying and recruiting customers more likely to perform well on the hourly rate, it also reduces the number of new participants that would otherwise likely not experience savings. This in turn also improves operational efficiencies by reducing time spent processing opt-out requests for participants not experiencing savings, and reduces the likelihood of complaints, thereby improving overall customer satisfaction.

Shadow billing analysis results are generated in calendar months instead of following a utility meter reading schedule that has 21 distinct bill groups with varying bill cycle start and end dates. This approach fits well with the goal of this research as we examine the seasonal monthly variations in usage patterns for electrified homes that rely on electricity to meet their heating needs during the non-summer heating months. This approach also allows for a more direct comparison between the fixed and hourly rates to account for monthly line item adjustments on customer bills as the shadow billing analysis monthly billing period start and end dates are identical for the hourly and fixed rates. Interval hourly billing data was furnished by ComEd. Pricing data and bill line item rates for the 35-month period from May 2021 to March 2024 for Rate BES and Rate BESH was collected by Elevate. Elevate then used the interval hourly billing data, pricing data, and bill line item inputs to calculate estimated monthly total bill costs for each account on the fixed rate and the hourly rate and compared savings or losses across five customer groups before and after electrification measures were implemented.

Assumptions

Bill credits from adjacent programs like ComEd's Central Air Conditioning (AC) Cycling program and ComEd's Peak Time Savings (PTS) program were not considered as those credits are applied to the Taxes & Fees section of the customer bill in the same way regardless of a customers' supply rate and would have no impact on cost differences between the hourly and fixed rate. Additionally, customers with net metered solar generation were not included in the analysis. While it's possible to conduct a shadow billing analysis for net metered customers, the volume of input data and shadow billing analysis methodology is sufficiently different from non-net metered customers and keeping them in the analysis would not allow for a reasonable comparison to non-net metered customers. Further investigation into electrified homes with net metered solar generation is warranted as excess solar generation credits built up on the hourly rate during summer months could help offset increased costs in non-summer heating months.

Data Disposition of Customer Accounts

A total of 128 customer accounts were included in the original dataset. To successfully conduct the shadow billing analysis, a sufficient amount of hourly data per account is required. A total of five accounts were dropped due to incomplete data. Incomplete data can include data quality issues like gaps in interval hourly billing data or missing data. After excluding accounts with incomplete data, 123 accounts remained in the analysis.

The relatively small number of accounts in the analysis could result in a sampling error given that not all 123 accounts had the same amount of billing data, housing type, electrification type or electrification completion date. Electrification intervention completion dates ranged from March 1, 2022, to December 17, 2023. There were 55 accounts (45%) with electrification completion dates in 2022 and 68 accounts (55%) with electrification completion dates in 2023. This could potentially introduce bias towards a particular month or season due to weather or market conditions. For purposes of this analysis, testing for statistical significance was not conducted. For these reasons, it will be more meaningful to compare the annualized average electric supply savings or losses over the duration of the analysis period rather than by individual month or year to avoid potential monthly or seasonal bias.

Customer Groups

In a marketing context, customers with similar characteristics are grouped together so that the messaging can be tailored to that group of customers (e.g., customers with solar generation, customers with electric space heat, electric vehicle owners). For purposes of this analysis, a sample of customers was split into five distinct customer groups based on program intervention and housing type (e.g., single family, multifamily). Table 1 shows characteristics of each of the five groups.

- Group A (52 accounts): Whole Home Electrification program participants with a fully electric heat pump and all other home energy end uses fully electrified (i.e., full electrification where gas account was ended)
- Group B (8 accounts): Whole Home Electric projects with electric heat pump but not all other home energy end uses electrified (i.e., customer maintained a gas range, gas dryer, or gas boiler for heating backup)
- Group C (25 accounts): Hybrid/dual fuel air source heat pump pilot projects with (i.e., variable speed heat pump as central air conditioner replacement with gas furnace backup in various configurations; some heat pumps in this group are assumed to be not operating in cold weather, while some are assumed to be operating at some level in tandem with a gas furnace)
- Group D (21 accounts): Whole Home Electric multifamily sample 1 (one building where all apartments were fully electrified, and heat pumps systems included supplemental electric heat)
- Group E (17 accounts): Whole Home Electric multifamily sample 2 (one building where all apartments were fully electrified, but no supplemental electric heat was installed)

Study Group	Program Type	Electrification Type	Income Eligible	Single Family	Multifamily (2+ Units)	Total Accounts
A	Whole Home Electric	Full	Yes	49	3	52
B	Whole Home Electric	Partial	Yes	5	3	8
C	Hybrid Heat Pump	Partial	No	23	2	25
D	Whole Home Electric	Full	Yes	0	21	21
E	Whole Home Electric	Full	Yes	0	17	17
Total				77	46	123

Table 1: Study group characteristics.

Table 2 provides details on the number of months of interval hourly billing data present in the analysis prior to electrification completion dates (pre-electrification), indicated by the number of bills per group.

Study Group	Total Number of Bills by Group	Average Number of Bills by Account	Median Number of Bills by Account	Minimum Number of Bills by Account	Max Number of Bills by Account
A	1,094	21.0	23	4	30
B	107	13.4	16	4	17
C	314	12.6	13	0	19
D	422	20.1	26	0	26
E	340	20.0	28	0	28
Overall	2,277	18.5	19	0	30

Table 2: Billing information available for each study group.

Results

The level of savings across groups varies depending on the type of electrification, housing type, and seasonal electricity consumption patterns. It's important to note that the results could potentially be biased toward a particular month, season, housing type or electrification type due to market conditions and the variation across accounts, groups and volume of billing data pre-electrification and post-electrification.

Pre-electrification results show that 78% of customers would have saved on the hourly rate compared to the fixed rate, with 22% not saving. Pre-electrification annualized average supply savings per customer were $40 (4%). Post-electrification results show that 99.2% of customers would have saved on the hourly rate compared to the fixed rate, with only one customer not saving (0.8%). Post-electrification annualized average supply savings per customer were $381 (33.4%).

The one customer that did not show savings post-electrification on the hourly rate from Group B (partially electrified homes) serves as a good example of how irregularities in the dataset can bias results. On the hourly rate, the Electricity Supply Charge, Transmission Services Charge and the Purchased Electricity Adjustment Charge are volumetrically calculated whereas the monthly Capacity Charge is based on peak demand, not on how much electricity was consumed in a given billing period. On the fixed rate, the Electricity Supply Charge, Transmission Services Charge and the Purchased Electricity Adjustment Charge are all volumetrically calculated. Because capacity costs are bundled in the Electricity Supply Charge on the fixed rate, customers on the fixed rate are volumetrically charged for the cost of capacity. On the hourly rate, the monthly Capacity Charge is incurred even if total electricity consumed in that billing period is zero. This can result in losses on the hourly rate in months with abnormally low usage.

Table 3 shows the overall percentage of accounts that would have saved on the hourly rate compared to the fixed rate for all 123 accounts in the shadow billing analysis, pre-electrification. The terms "saver" or "non-saver" indicates whether it was found through shadow billing that a customer would have saved on supply costs had they been on the hourly rate.

Study Group	Program Type	Electrification Type	Number of Accounts	Savers	Non-Savers
A	Whole Home Electric	Full	52	56%	44%
B	Whole Home Electric	Partial	8	63%	38%
C	Hybrid Heat Pump	Partial	25	12%	88%
D	Whole Home Electric	Full	21	81%	19%
E	Whole Home Electric	Full	17	82%	18%

Table 3: Accounts that would have saved on the hourly rate compared to fixed rate, pre-electrification intervention.

Table 4 shows the overall percentage of accounts that would have saved on the hourly rate compared to the fixed rate for all 123 accounts in the shadow billing analysis, post-electrification.

Study Group	Program Type	Electrification Type	Number of Accounts	Savers	Non-Savers
A	Whole Home Electric	Full	52	100%	0%
B	Whole Home Electric	Partial	8	88%	13%

C	Hybrid Heat Pump	Partial	25	100%	0%
D	Whole Home Electric	Full	21	100%	0%
E	Whole Home Electric	Full	17	100%	0%

Table 4: Accounts that would have saved on the hourly rate compared to fixed rate, post-electrification.

Tables 5 and 6 show annualized average savings on the hourly rate compared to the fixed rate for all 123 accounts in the shadow billing analysis. Annualized average savings offer a fairer comparison of the pre- and post-electrification impacts of switching from the fixed rate to the hourly rate as it better accounts for the many variations in the dataset. These values represent annualized average savings on the hourly rate compared to the fixed rate at an account level for each of the five groups.

Group	Pre-Electrification	Post-Electrification
A	$67.14	$454.88
B	$0.05	$605.57
C	-$53.76	$573.29
D	$52.38	$98.57
E	$99.64	$115.28
Overall	$40.18	$380.98

Table 5: Annualized average dollar supply savings on the hourly rate compared to the fixed rate, pre-electrification and post-electrification.

Group	Pre-Electrification	Post-Electrification
A	5.1%	35.7%
B	0.0%	31.2%
C	-5.5%	30.6%
D	6.9%	33.1%
E	17.7%	35.3%
Overall	4.0%	33.4%

Table 6: Annualized average percentage supply savings on the hourly rate compared to the fixed rate, pre-electrification and post-electrification.

Discussion

The results of this analysis suggest that the transition to modern, high-efficiency electric heating systems fundamentally alters a household's relationship with the electric grid in a way that is compatible with most dynamic pricing structures. This compatibility stems from the fact that dynamic pricing reflects real-time wholesale market conditions, and because supply exceeds demand during most hours, the resulting price signals typically favor the consumer. Whereas the analysis shows that some customers would have seen meaningful savings from hourly pricing even prior to electrification, the post-electrification data reveals a near-universal savings advantage, as over 99% of participants would have experienced savings on the dynamic rate without taking any action. It is therefore evident that a customer with increased electric load associated with heat pump operation can realize cost savings under a real-time pricing structure compared to a typical flat rate structure. A primary takeaway of this analysis is that space heating demand in a cold climate appears to align well with lower-cost periods of electricity generation. This finding is further demonstrated by Figure 3, which shows data from over 42,000 electric bills from 2025 of customers known to heat their homes primarily with electricity. The graph shows how average monthly electricity usage and average monthly supply charge savings on Hourly Pricing for these customers generally align seasonally.

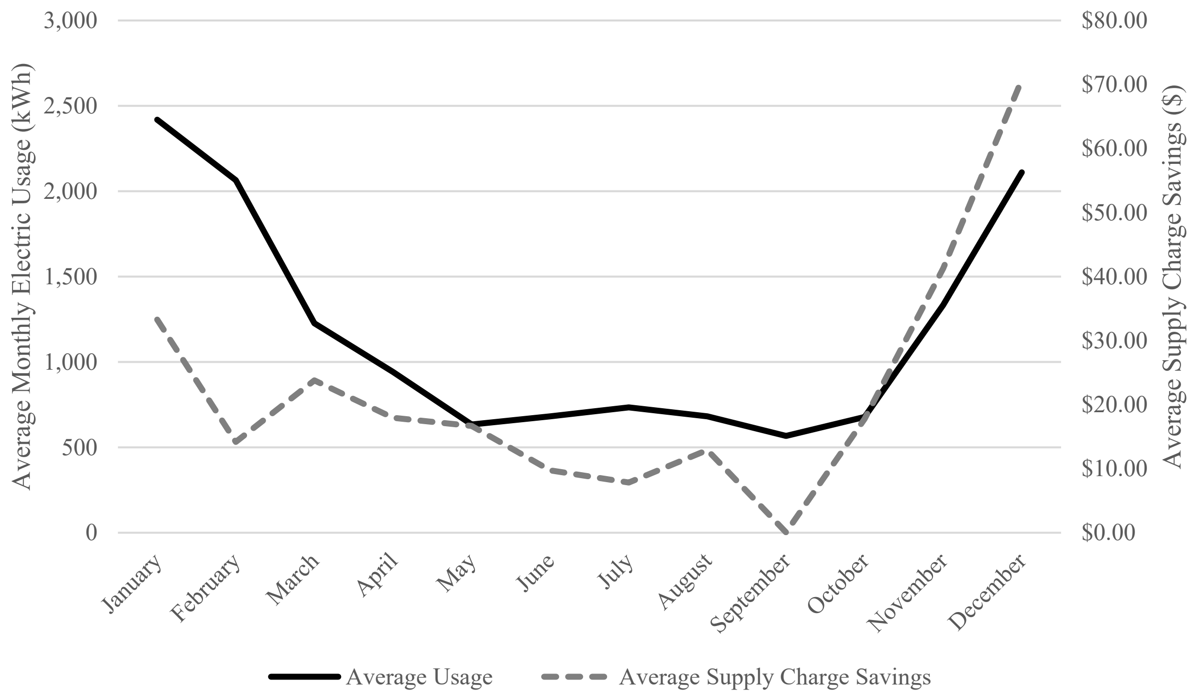


Figure 3: Average electricity usage (kWh) and average monthly supply charge savings on Hourly Pricing ($) of electric heating residential customers for each month of 2025.

This finding reinforces national modeling which shows that while the economics of electrification are varied, specific rate interventions can mitigate unfavorable economics of fuel switching for decarbonization interventions (Wilson et al. 2022). The analysis also reveals that bundling electrification with time variant rates can increase the margin of savings outcomes in ways that are critical for energy equity and program interventions aimed at households facing high energy burden. Rather than hourly price spikes representing a risk, this analysis shows that the additional savings gained over an annual basis can actually become an important risk mitigation strategy for program administrators operating in regions with low average cost savings potential from fuel switching.

The variation in savings across the different cohorts highlights the importance of the specific electrification strategy employed by the resident. Fully electrified single family homes emerged as the most consistent beneficiaries of the hourly rate. These homes represent the largest increase in total kilowatt-hour consumption, and their estimated savings suggest that the high volume of off-peak usage during the winter heating season outweighs the impact of any incidental peak-hour consumption. In contrast, the results for hybrid or dual-fuel systems were more nuanced. These customers saw fluctuating savings that were likely influenced by the interplay between electricity prices and the thermal performance of larger homes, as well as the specific market conditions during the study period.

Seasonality plays a critical role in the economic outcomes for these customers. During the winter months, the continuous demand for space heating shifts the bulk of a home's energy profile into the overnight and early morning hours when wholesale electricity prices are typically at their lowest. This creates a natural hedge against the higher costs often seen during summer afternoon peaks or occasional high price events during other times of the year. While summer savings remain significant due to cooling loads, the magnitude of winter savings provides a compelling argument for the year-round adoption of dynamic rates by heat pump users. The more moderate savings observed during the shoulder months of spring and autumn likely reflect the lower heating and cooling requirements of the transition seasons, which reduce the total volume of energy available for generating supply savings.

The presence of several outliers suggests that technical and behavioral factors still influence individual outcomes. Customers who experienced lower savings often exhibited high levels of consumption during the few hours of extreme peak demand. Some of these customers likely resided in buildings with poor thermal efficiency. In such cases, the heat pump may be required to operate at maximum capacity, including electric supplemental heating which in cold climates is often integrated into a ducted air source heat pump system, throughout high-price events to maintain indoor comfort. This underscores the need of coupling electrification with building envelope improvements and control technologies that can facilitate occupant responsiveness or automatic load shifting. Furthermore, the findings from multifamily buildings indicate that shared heating loads and different occupancy patterns can create variability in savings, suggesting that a one-size-fits-all approach to rate education may not be sufficient for all housing types.

It is important to note that the shadow billing methodology employed for this analysis does not assume any changes in behavior by the households under examination. Rather, the approach assumes the same energy usage patterns and load profile, just under a different rate environment. This combined with the 99% savings finding emphasizes how combining electrification interventions and dynamic pricing is likely to be lower risk than many industry stakeholders may believe. If a program administrator were to actively communicate and educate enrolled customers in the ways presented in the Recommendations section, it is likely that annual savings can be increased and the risk presented by real-time price spikes can be even further mitigated.

Overall, the findings of this research support the conclusion that dynamic pricing is a powerful tool for improving the affordability of building electrification. By aligning customer incentives with grid conditions, program administrators and utilities can facilitate a more equitable and cost-effective transition away from fossil fuels while increasing the affordability of these interventions and reducing energy burden on residential consumers.

Recommendations

To ensure that the transition to dynamic rates remains equitable and accessible, electrification programs should integrate protective billing mechanisms alongside robust communication strategies. Pairing dynamic rates with budget billing is strongly recommended for customers sensitive to monthly fluctuations, particularly income-eligible households, as it provides a necessary buffer against seasonal bill spikes while maintaining the long-term savings of a real-time rate.

This financial safeguard should be complemented by universal enrollment in pricing alerts, which empower residents to respond to market signals and manage their costs during periods of high demand. Some utilities have even gone so far as piloting physical devices that display the real-time cost of electricity in hopes of increasing the accessibility of this information. Effective electrification initiatives must prioritize customer education and training, focusing on how specific behavioral changes and load-shifting techniques can maximize the economic benefits of these pricing structures.

To help overcome risk aversion bias among potential rate adopters, program administrators should also consider a limited bill protection feature when pairing electrification with dynamic pricing, such as a temporary guarantee that participants will not pay more than under the standard tariff. ComEd tested this approach through a pilot offering a risk-free introductory period, which produced mixed results in driving overall enrollment but showed clear value for certain customers. Survey findings indicated that two-thirds of participants offered bill protection would not have enrolled without it, and nearly half of non-participants said it could motivate enrollment. These results suggest that bill protection can reduce perceived risk and support adoption of dynamic rates (ComEd 2022).

Outreach efforts should be tailored to the distinct needs of different housing segments, with a primary focus on fully electrified single family homes. As this group represents the largest share of the analyzed population and demonstrated the highest savings potential, they are the strongest candidates for prioritized enrollment. Conversely, partially electrified households require a more nuanced, case-by-case approach due to the variability in their savings performance and the need for further investigation into their specific usage patterns. For residents with hybrid or dual-fuel systems, who may manage larger homes and higher overall loads, education should focus on optimizing electricity use during the winter heating season to leverage favorable off-peak rates. Also, the consistent savings observed in multifamily buildings suggest that these residents are well-positioned for dynamic pricing when supported by ongoing education and automated price signal notifications.

Finally, further research is necessary to refine these findings with larger sample sizes and to explore the intersection of electrification with other distributed energy resources, such as rooftop solar and electric vehicles. Future studies should specifically evaluate how Peak Load Contribution (PLC) charges are impacted by electrified loads and whether distribution-level discounts like those being considered or implemented in some parts of the county can further enhance the affordability of the transition.

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