



County of Los Alamos

1000 Central Avenue
Los Alamos, NM 87544

Agenda - Final Board of Public Utilities Work Session

Robert Gibson, Chair; Matt Heavner, Vice Chair
Eric Stromberg, Charles Nakhleh and Jennifer Hollingsworth,
Members
Philo Shelton, Ex Officio Member
Anne Laurent, Ex Officio Member
Ryn Herrmann, Council Liaison

Wednesday, August 5, 2026

5:30 PM

Municipal Building, Council Chambers

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1. CALL TO ORDER

2. PUBLIC COMMENT

3. **APPROVAL OF AGENDA**

4. **PRESENTATIONS**

- 4.a. [21210-26](#) UNM & NMSU Pathways to Zero Natural Gas Usage - Presentation of Findings

Presenters: Philo Shelton, Utilities Manager

Attachments: [A - White Paper](#)
[B - Presentation Slides](#)

5. **PUBLIC HEARINGS**

- 5.a. [CO0768-26.3](#) Introduction of Incorporated County of Los Alamos Code Ordinance No. 02-387; An Ordinance Amending the Department of Public Utilities' Water Service Rate Schedules, Chapter 40, Article III, Sections 40-171, 40-173 and 40-175, and adding new Sections 40-176, 40-177, and 40-178 to the Incorporated County of Los Alamos Code

Presenters: Joann Gentry, Deputy Utility Manager-Finance & Admin.

Attachments: [A - Incorporated County of Los Alamos Code Ordinance No. 02-387](#)
[B - Water Rate Presentation](#)
[C - Water Rate FAQ](#)

6. **BUSINESS**

- 6.a. [21995-26a](#) Discussion on the Electric Coordination Agreement (ECA)

Presenters: Ben Olbrich, Deputy Utility Manager-Power Supply

- 6.b. [21693-26](#) A Presentation on Future Department of Public Utilities Plug-in Solar Policy

Presenters: Ben Olbrich, Deputy Utility Manager-Power Supply

Attachments: [A - Plug-In Solar Presentation](#)

- 6.c. [21386-26](#) Annual Update on Wastewater Systems

Presenters: Clay Moseley, Deputy Utility Manager-GWS Services

Attachments: [A - 2026 Wastewater Systems Annual Update](#)

- 6.d. [21574-26](#) Transactional Survey Report: January - June 2026

Presenters: Abbey Hayward, Public Relations Manager

Attachments: [A - Los Alamos Transactional Report CY2026 H1](#)

6.e. [21575-26a](#) Annual Review of the Board of Public Utilities Procedural Rules

Presenters: Cristella Valdez, Assistant County Attorney

Attachments: [A - BPU Procedural Rules](#)
 [B - B&C Orientation Manual & Procedural Rules](#)
 [C - Draft Revised BPU Procedural Rules](#)

6.f. [21572-26](#) Open Meetings Act and Inspection of Public Records Presentation

Presenters: Cristella Valdez, Assistant County Attorney

Attachments: [A - OMA Training Presentation](#)
 [B - Incorporated County of Los Alamos Resolution 26-01](#)
 [C - 2026 BPU Meeting Calendar](#)

7. **PUBLIC COMMENT**

8. **ADJOURNMENT**

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County of Los Alamos

Staff Report

August 05, 2026

Los Alamos, NM 87544
www.losalamosnm.us

Agenda No.: 4.a.

Index (Council Goals): DPU FY26 - 3.0 Be a Customer Service Oriented Organization that is Approachable, Communicative, Efficient, and Transparent; DPU FY26 - 6.0 Develop and Strengthen Partnerships

Presenters: Philo Shelton, Utilities Manager

Legislative File: 21210-26

Title

UNM & NMSU Pathways to Zero Natural Gas Usage - Presentation of Findings

Body

DPU has a goal to eliminate natural gas usage by 2070. While this is a long-term goal, DPU has partnered with the University of New Mexico (UNM) and New Mexico State University (NMSU) to explore pathways to zero natural gas usage. The project began January 1, 2025 and it is now at its completion. Major elements of this project started with a customer survey, and discrete choice experiments, and then it coupled these data with utility usage data to analyze household energy use and the potential impact of transitioning from natural gas to electric appliances. There are several findings and recommendations in this study that should help DPU with identifying next steps in meeting DPU's Environmental Sustainability focus areas.

Attachments

A - White Paper

B - Presentation Slides

Pathway to Zero Natural Gas

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July 28, 2026

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Keywords: Appliances electrification, zero natural gas, willingness to switch, load projection, solar rebound



Executive Summary

The Los Alamos Department of Public Utilities (LADPU) has set a goal of eliminating natural gas service in Los Alamos County by 2070. Reaching it depends on residential customers replacing gas furnaces, water heaters, and stoves with electric alternatives, largely through voluntary decisions over the coming decades. This white paper combines a survey of LADPU customers, a discrete choice experiment, and household-level metered electricity and natural gas data from 2022 through 2025 to assess how willing households are to switch, what it would cost them, and how the transition would reshape electricity demand.

Our key findings are:

1. **Households are receptive in principle but highly cost-sensitive, and few are planning to switch.** Nearly all surveyed households use natural gas, and most are satisfied with their gas appliances. About three-quarters report no near-term intention to electrify. Asked what would change their decision, respondents rank cost savings and appliance efficiency far above environmental benefits, and most would face hardship from a bill increase of \$50–\$100 per month. Stated support for the 2070 goal is currently low.
2. **Households value efficiency and bill savings over emissions, and the electrical-panel upgrade is a major barrier.** In the choice experiment, households are willing to pay the most for appliance efficiency, somewhat less for carbon reductions, and least for one-time rebates. The roughly three-quarters of homes that would need a 200-amp electrical-panel upgrade are markedly less willing to electrify. Offsetting that barrier would take about \$800 per year in lower energy bills or incentives. Pro-environmental attitudes, more than current energy bills, explain who is willing to pay for emissions reductions, and an informational message about the health and climate effects of gas had little measurable effect.
3. **Rooftop solar lowers grid purchases but raises total energy use (a rebound effect).** Among solar adopters, grid electricity purchases fall sharply, yet total electricity use rises and natural gas use is essentially unchanged, so total household energy consumption increases by roughly 7% after adoption. This rebound offsets a meaningful share of the emissions reductions that solar would otherwise deliver, and it varies by season and time of day.
4. **What drives consumption differs by fuel.** Persistent natural gas use is governed mostly by the building envelope (home size, age, and structure), whereas persistent electricity use reflects the building, the appliance stock, and household characteristics together. The two fuels therefore call for different policy levers.

-
5. **Meeting the 2070 goal would sharply raise electricity demand and reshape it toward a winter peak, and households' stated plans fall well short of it.** Eliminating residential natural gas on LADPU's schedule would raise annual residential electricity use by about 61% by 2070. Because electric heating concentrates the new load in winter, the seasonal peak grows even faster (about 74%), so sizing the distribution system to the winter peak, rather than to annual energy, becomes the binding planning constraint. Voluntary switching at the pace households say they intend would stall well short of the goal, leaving roughly 60% of today's gas use still burning in 2070. Closing that gap depends on electric becoming the default choice when gas equipment is replaced. Rooftop solar lowers the grid load the utility must serve, but only modestly, about 5% by 2070 even if it reaches 40% of homes.

These findings carry several policy implications. First, because households weigh efficiency, comfort, and bill savings far above emissions, and an informational message about the climate and health effects of gas changed willingness to pay very little, outreach that highlights bill savings and performance is likely to reach more households than climate framing. Second, the largest near-term gains come from lowering the cost and friction of getting homes ready, through streamlining electrical-panel permitting, helping households find and stack the federal and state incentives already available, offering loans to financially constrained households, and reaching households at the moment their gas equipment fails. Third, the two fuels respond to different levers, so the largest gas reductions come from the older, larger homes where gas use is concentrated and from sequencing weatherization, run through county and state programs, ahead of electric heating, while space and water heating, not cooking, are the high-load end uses worth prioritizing. Fourth, rooftop solar offsets only a small share of the added load and the rebound erodes its carbon benefit, so solar compensation that rewards self-consumption and load-shifting, especially toward the winter-evening peak, would raise its grid value. Fifth, the added load is large, about a 61% rise in annual residential electricity use and a steeper winter peak by 2070, so capacity planning that carries the rebound into load forecasts and builds affordability and equity into program design is central to the transition.

Suggested citation: Yang, Y., Mamkhezri, J., Jawhari, A., Zhao, J., & Cornelius, B. (2026). *Pathway to Zero Natural Gas*. White paper prepared for the Los Alamos Department of Public Utilities. University of New Mexico and New Mexico State University.

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1 Introduction

Residential buildings account for roughly one-fifth of greenhouse gas emissions in the United States, and the largest share of that footprint comes from burning natural gas on-site for space heating, water heating, and cooking (U.S. EPA, [2024](#)). Decarbonizing the residential sector therefore requires replacing natural gas appliances with electric alternatives, such as heat pumps, electric water heaters, and induction cooktops, and supplying the additional electricity from an increasingly clean grid. Eliminating in-home gas combustion also removes a source of indoor air pollutants, including carbon monoxide, nitrogen dioxide, and fine particulate matter, that have been linked to respiratory illness (Lin et al., [2013](#)).

The Los Alamos Department of Public Utilities (LADPU), the municipal utility serving Los Alamos County, New Mexico, has adopted the goal of eliminating natural gas service by 2070 as part of the county’s long-term sustainability plan. Because the target lies decades away, it functions as an active planning horizon rather than an imminent mandate. To meet the goal, the utility must understand whether, and how quickly, its residential customers are willing to move away from natural gas, what that transition will cost households, and how it will reshape electricity demand on the local grid.

Yet the environmental and health case for electrification does not by itself determine whether, or how fast, the county will reach the goal. Whether a household replaces a working gas furnace or water heater with an electric system depends on upfront and operating costs, the perceived reliability of electric appliances, the condition of the home’s electrical service, and the household’s own attitudes and circumstances. The transition also raises distributional concerns. If higher-income households electrify first, the fixed costs of the legacy gas system may fall on a shrinking and lower-income set of remaining customers (L. Davis and C. Hausman, [2022](#)). It raises engineering concerns as well, about how shifting a large heating load from gas to electricity will affect peak demand and system planning.

This report assembles several sources of evidence to inform LADPU’s pathway to zero natural gas. It combines a survey of LADPU residential customers, a discrete choice experiment (DCE) that elicits households’ willingness to pay for the attributes of an electrification decision, and hourly metered electricity and natural gas consumption data from January 2022 through June 2025, linked to households at the meter level. Together these allow us to describe who LADPU’s customers are and what appliances they own, to quantify how they trade off cost, efficiency, incentives, and emissions when considering switching, and to project how electricity load would evolve under alternative switching scenarios.

The report is organized into five parts. Part I summarizes the resident survey, covering demographics, billing and housing characteristics, the household appliance stock, and stated preferences toward switching from natural gas to electric appliances. Part II presents the dis-

crete choice experiment and uses it to estimate households' willingness to pay for electrification attributes. Part III examines rooftop solar adoption and its rebound effect on household energy consumption. Part IV analyzes the household characteristics that drive natural gas and electricity use and projects residential electricity load under a range of appliance-switching scenarios. Part V synthesizes the findings, centering on the gap between households' stated willingness and their observed switching, and sets out the resulting policy recommendations.

2 Background

2.1 Los Alamos County

Los Alamos County is an atypical utility service territory. Los Alamos National Laboratory (LANL) is the dominant employer, accounting for an estimated 60 to 70% of county employment, and the resulting population is highly educated and affluent. Roughly half of adults hold a graduate degree and median household income is approximately \$143,000 (U.S. Census Bureau, [2023](#)), more than double the New Mexico median of about \$62,000 and well above the national median of about \$79,000. LADPU is a municipally owned utility that provides electricity, natural gas, water, and sewer service to the community, including approximately 8,500 residential customers.

Los Alamos County comprises two neighboring communities, Los Alamos and White Rock, about ten miles apart. Los Alamos sits at an elevation of 7,425 feet, while White Rock lies lower, at 6,548 feet, and has a warmer, drier climate (Bruggeman and Waight, [2021](#)). White Rock's population is roughly half that of Los Alamos. At these elevations the county has a high-desert climate, with cold winters, mild summers, large day-to-night temperature swings, and low humidity. Space heating is therefore the dominant seasonal load and natural gas use is heavily concentrated in winter, a pattern central to how electrification would reshape the county's electricity demand.

Much of the county's housing stock dates to LANL's expansion between the 1940s and the 1970s. These older homes were not built for whole-home electrification. Many are served by 100- or 150-amp electrical panels that cannot accommodate the combined load of a heat pump, a heat pump water heater, and an induction cooktop without an upgrade to 200-amp service.

2.2 Zero natural gas policies

Los Alamos County has adopted a target of eliminating natural gas service by 2070 as part of the county's sustainability plan. Unlike a near-term regulatory mandate, a 2070 horizon gives the utility and its customers decades to plan, but it also means the transition will unfold gradually and largely through voluntary household decisions about when to replace aging equipment.

Understanding the drivers of those decisions today is therefore central to whether the long-run goal is met.

The local goal sits within a broader policy environment that increasingly favors electrification, from state-level standards that phase out fossil-fuel appliances in new construction (California Air Resources Board, 2023; New York State Legislature, 2023) to federal incentives. At the federal level, the home energy rebate and tax-credit provisions of the Inflation Reduction Act of 2022 subsidized heat pumps, electric appliances, and in some cases the electrical-panel upgrades that enable them, lowering the upfront cost of switching during the period of this study.¹ The case for moving away from residential natural gas rests on two pillars. The first is climate. On-site combustion of natural gas for heating and cooking is a substantial source of household greenhouse gas emissions, and switching to efficient electric appliances reduces those emissions to the extent that the electricity grid is clean. The second is indoor air quality and health. Gas appliances emit carbon monoxide, nitrogen dioxide, fine particulate matter (PM_{2.5}), and formaldehyde indoors, and these pollutants are linked to elevated rates of childhood asthma and respiratory illness, particularly where gas stoves are used. Eliminating in-home combustion removes these exposures regardless of the grid mix.

¹The federal incentive landscape shifted during the study. When the survey was fielded (July to September 2025), the Inflation Reduction Act's Section 25C Energy Efficient Home Improvement Credit (covering heat pumps, electric appliances, and electrical-panel upgrades) and Section 25D Residential Clean Energy Credit (covering rooftop solar) were both in effect. The One Big Beautiful Bill Act (Public Law 119-21, signed July 4, 2025) subsequently terminated both credits for property placed in service after December 31, 2025, roughly seven years earlier than the Inflation Reduction Act had scheduled. The Act did not rescind the \$8.8 billion in Inflation Reduction Act Home Energy Rebates (the HOMES and Home Electrification and Appliance Rebate programs), which had already been obligated to the states; New Mexico's rebate program launched in September 2024 and remains available, but is limited to income-qualified households (broadly, those below 80% of area median income). The analysis in this report reflects the incentive environment at the time of the survey.

Part I

Resident Survey

3 Overview

In collaboration with LADPU, we surveyed the utility’s residential customers from July to September 2025 to learn how they use natural gas today and how they view switching to electric appliances. The survey had two parts, a questionnaire on demographics, housing, billing, and the household appliance stock, and a discrete choice experiment. We received 912 responses, of which 582 were complete. The survey was distributed through several channels, namely the utility’s customer email list, a paper billing insert, the county newsletter, and community social media, so a single conventional response rate is not well defined. As a rough gauge, the 912 responses represent about 11% of LADPU’s roughly 8,500 residential customers, and the 582 complete responses about 7%.

The respondents are broadly representative of Los Alamos County. About 78% report household incomes above \$100,000 and 55% above \$150,000, 60% hold a graduate degree, and nearly half are employed full-time while about 40% are retired (Figure 1). The sample nonetheless departs from the county demographics in several dimensions. It under-represents Hispanic or Latino residents (about 8% of the sample versus 17% county-wide) and skews towards older and more male (Table A.1).

The difference between the survey sample and the county demographics can be corrected with calibrated post-stratification weighting on age, sex, ethnicity, and education, after which the weighted sample matches county benchmarks. Full demographic breakdowns, the weighting procedure, and the formal representativeness tests are reported in Appendix A.1, with housing characteristics in Appendix A.3 and billing in Appendix A.2. The remainder of this part focuses on the three survey findings that bear most directly on the transition. These are the natural gas appliances households own, how sensitive they are to energy costs, and their stated attitudes toward switching.

4 Natural Gas Appliance Stock

Los Alamos households rely heavily on natural gas. Nearly all (96%) use gas appliances, and gas is the primary heating fuel for 90% of homes, against just 8% for electricity. Heating is delivered mostly by central furnaces (59%) and steam or hot-water systems (32%), with heat pumps a marginal 5%. Gas is also the main fuel source for water heating, where 90% of homes use gas and only 9% electric. Cooking is more mixed. Gas powers about 63% of ranges and

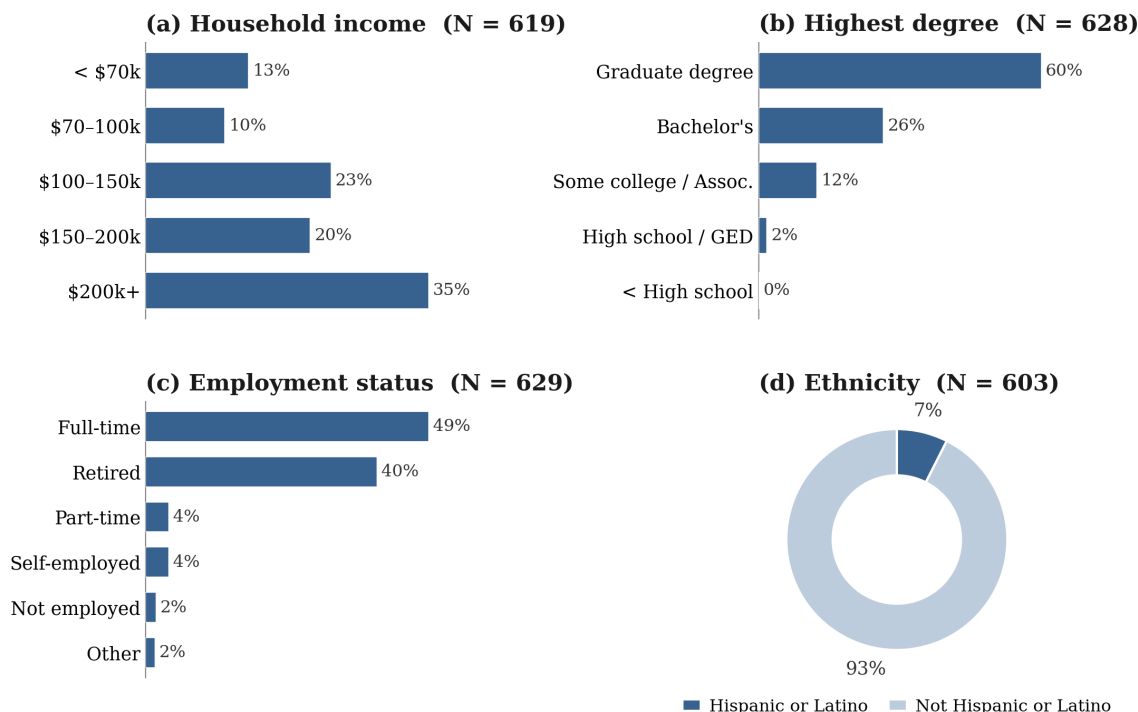


Figure 1: Survey respondents at a glance

59% of cooktops, but wall ovens (83%) and clothes dryers (74%) are predominantly electric, indicating that households already accept electric versions of some appliances more readily than others. Much of the heating stock is also aging, with about a third of primary heating systems at least 20 years old, so a large share of homes will face a replace-or-switch decision within the planning horizon. Detailed appliance counts, fuels, ages, and usage patterns are reported in Appendix A.4.

5 Cost Sensitivity

Households are sensitive to energy bill changes. Modest bill increases of \$10–\$25 per month cause no hardship for most households (77% and 63%, respectively), but sensitivity rises sharply beyond that. At \$50 per month, 61% would face some or great hardship, and at \$100 per month, 82% would, with over half (52%) reporting great hardship. The affordability threshold for most households therefore lies between \$25 and \$50 per month. Households also perceive electricity as already the larger cost burden, with 47% putting their peak electricity bill at \$150 or more, against 28% for gas (Table 1, with full bill estimates in Appendix A.2).

Table 1: Hardship of a Net Monthly Out-of-pocket Increase for all Energy-Related Costs

Increase (\$/month)	No hardship (%)	Some hardship (%)	Great hardship (%)	N
\$10	77.0	12.9	10.1	435
\$25	62.7	24.3	13.0	437
\$50	39.2	35.1	25.7	436
\$75	24.3	34.3	41.4	437
\$100	17.8	30.6	51.5	454

Note: Most households report no hardship at \$10/month (77%) and still a majority at \$25 (63%), but the response shifts sharply by \$50, where 61% say they would face hardship (35% “some,” 26% “great”). Hardship grows at higher amounts: at \$75, three in four report hardship, and by \$100 a clear majority (82%) say it would cause hardship.

6 Attitudes Toward Switching

Households’ stated attitudes are the most direct survey evidence on the transition, and they are consistently cautious. Most (88%) are satisfied with their current gas appliances and only 4% are dissatisfied. A majority (54%) believe electric appliances are less reliable than gas, while only 11% think they are more reliable. Consistent with this, about three-quarters (74%) are not planning to switch to electric appliances at all (Figure 2).

The factors households weigh in a switching decision are practical rather than environmental. Cost savings, performance, efficiency, and incentives rank highest, while environmental and health benefits rank lowest, and 16% report that no factor would lead them to switch. The perceived obstacles are financial and infrastructural (Figure 3). The most-cited obstacle is the upfront installation cost (73%), followed by higher ongoing energy bills (65%) and grid reliability (65%). About half (51%) cite insufficient electrical-panel capacity, a barrier specific to this older housing stock in which roughly three-quarters of homes would need a 200-amp panel upgrade to electrify. Part II quantifies how much this panel requirement lowers willingness to pay. Concerns about the carbon content of electricity (25%) or poor home insulation (16%) are far less common, and only 5% report none at all.

The appliance-by-appliance question drew far fewer responses than the general attitude items (175 respondents) and from a more self-selected group, so it indicates which equipment the more engaged households would switch first rather than any softening of overall reluctance. Among those who sorted individual appliances into “very likely to switch,” “no intention to switch,” and “already electric,” the predominantly gas-powered appliances, water heaters, space heaters, and ranges, were most often marked as switch candidates (Figure 4). This points to the equipment a voluntary transition would most plausibly begin with, consistent with framing it as a sequence of concrete replacements rather than an all-at-once decision.

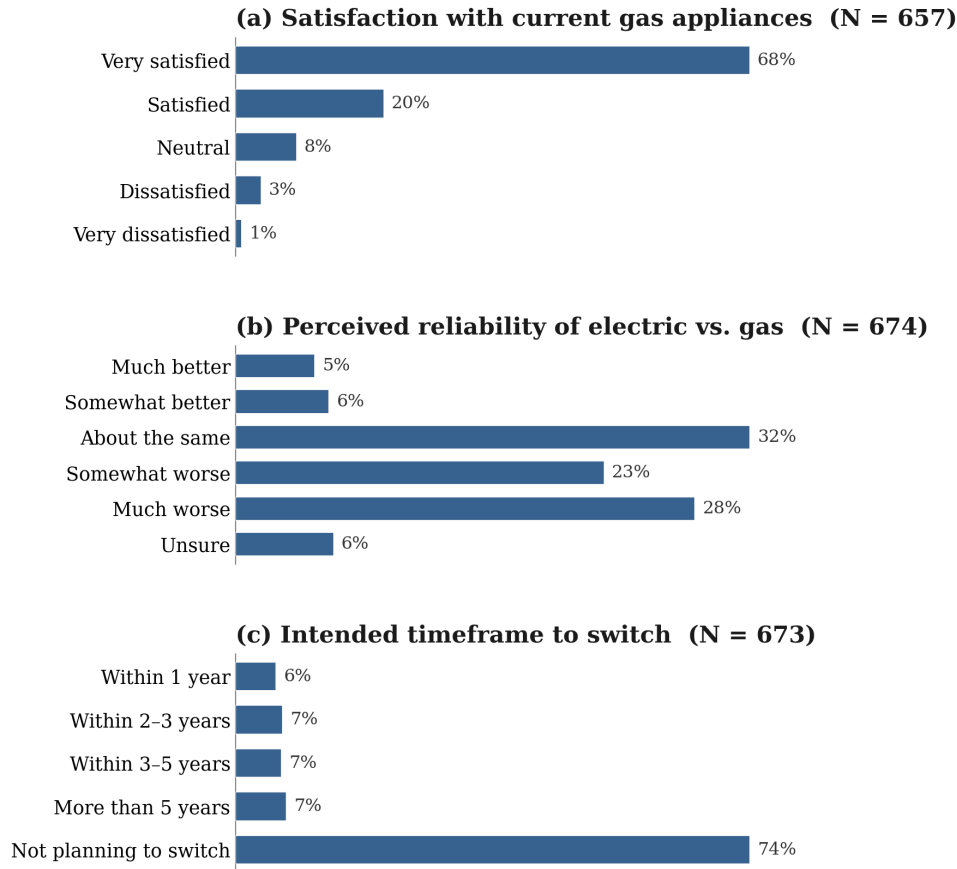


Figure 2: Household attitudes toward switching to electric appliances

Notes: Likert-scale responses on satisfaction with current gas appliances, the perceived reliability of electric appliances relative to gas, and how soon respondents would consider switching.

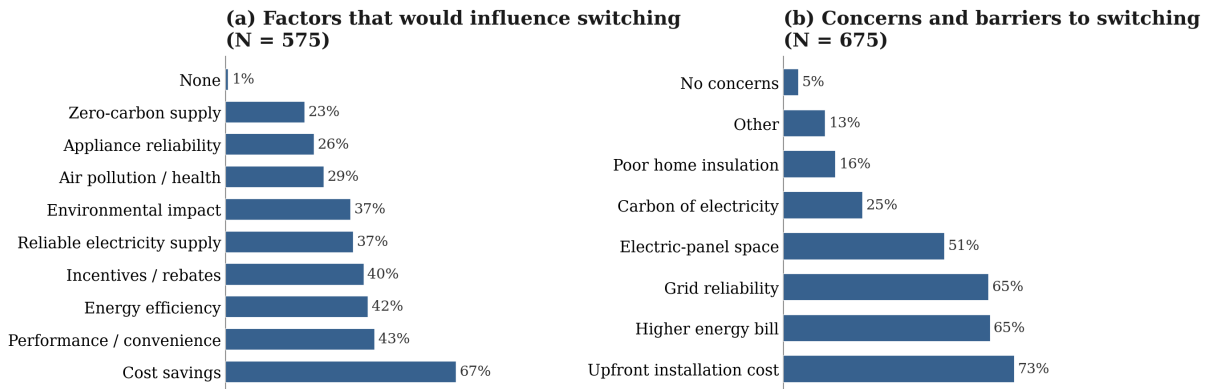


Figure 3: Drivers of and barriers to switching to electric appliances

Notes: Respondents could select all options that apply, so shares do not sum to 100%.

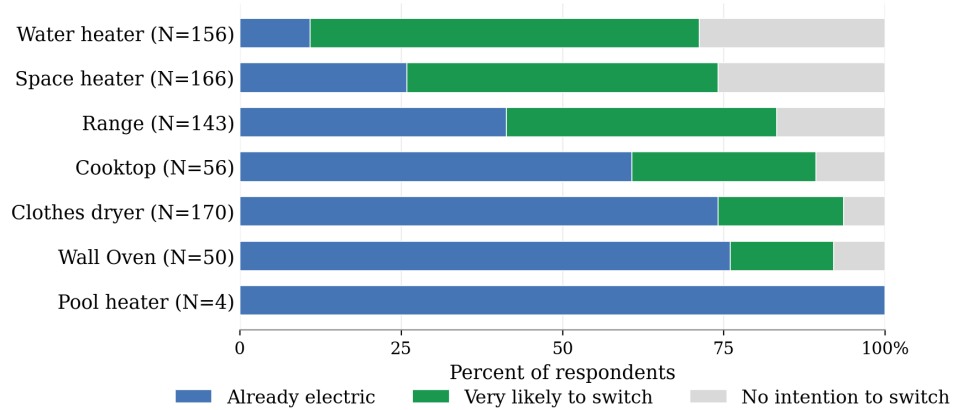


Figure 4: Intentions to switch a given appliance to electric

Notes: Respondents sorted each appliance into “very likely to switch,” “no intention to switch,” or “already electric.” They were not required to classify every appliance.

7 Environmental Attitudes

We also measured environmental attitudes with six items from the New Ecological Paradigm (NEP) scale (Dunlap, Van Liere, et al., 2000), a standard measure of pro-environmental world-view. Respondents express moderate environmental concern on average. Most respondents acknowledge ecological limits and human responsibility for the environment, while agreement with the reverse-coded items is relatively low. As the attitudes above make clear, however, this concern is not the primary driver of their appliance decisions (Figure 5). Item-level summary statistics are reported in Appendix A.5.

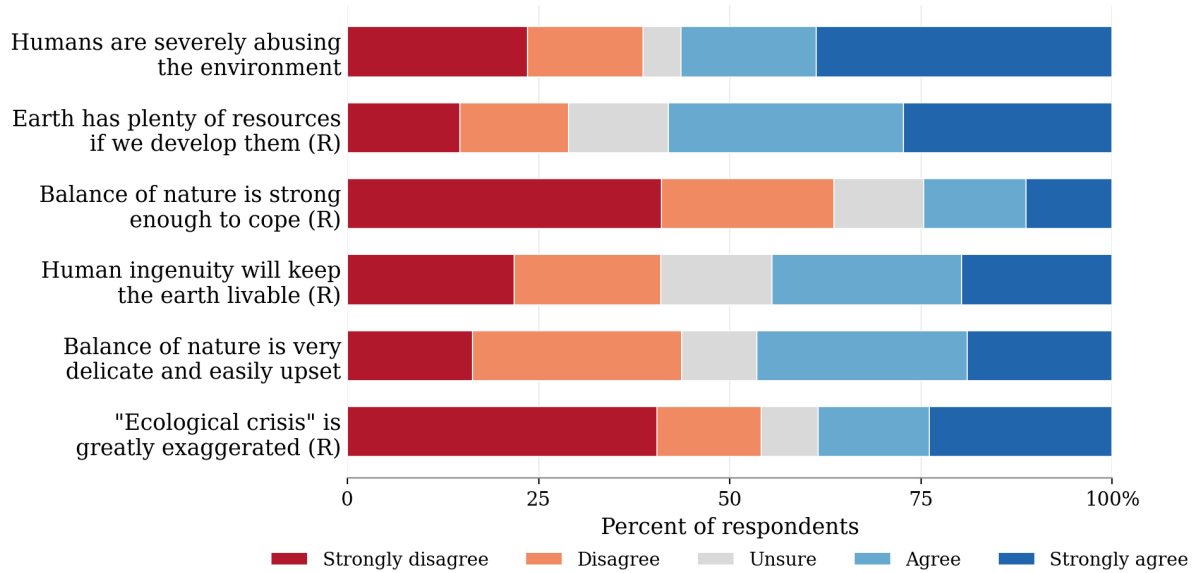


Figure 5: Attitudes Toward NEP Questions

Notes: Responses to six New Ecological Paradigm items, each rated on a five-point scale from strongly disagree to strongly agree. Items marked with “(R)” are reverse-coded statements, where higher scores indicate lower environmental concern.

Part II

Household Willingness to Switch

8 Overview

To quantify how households trade off the costs and benefits of switching to electric appliances, we fielded a discrete choice experiment (DCE) in which respondents repeatedly chose among hypothetical electrification options that varied in carbon reduction, appliance efficiency, financial incentive, and net monthly cost. This part estimates how much households are willing to pay (WTP) for each attribute, how the prospect of a required electrical-panel upgrade changes those valuations, and how preferences vary with environmental attitudes.

9 Data and Methods

9.1 Survey Design and Sample

The survey and its administration are described in Part I. The analysis sample for the DCE is the 403 respondents who completed all six choice tasks. Because this analysis subsample is more selective than the full survey, Table 2 reports its characteristics against Los Alamos County census figures. The full-survey demographics and the formal representativeness analysis are in Part I and Appendix A.1.

Table 2: Sample Demographics and Census Comparison

Variable	Sample ($N = 403$)	Los Alamos County
<i>Panel A: Demographics</i>		
Age (mean years, SD)	51.8 (15.0)	42.5 ^a
Age 65+ (%)	18.2	26.7
Female (%)	35.4	49.7
Hispanic or Latino (%)	10.1	16.5
<i>Panel B: Education</i>		
Graduate degree (%)	42.1	50.5
Bachelor's degree (%)	18.8	22.0
Some college or less (%)	26.9	21.6
<i>Panel C: Household Income</i>		
< \$35,000 (%)	2.7	15.9
\$35,000–\$70,000 (%)	7.8	17.4

Continued on next page

Table 2 continued

Variable	Sample ($N = 403$)	Los Alamos County
\$70,000–\$150,000 (%)	8.3	32.0
> \$150,000 (%)	81.2	34.7
<i>Panel D: Housing and Energy</i>		
Homeowner (%)	84.6	77.2
Panel upgrade required (%)	78.7	–
Solar adoption (%)	14.1	–
<i>Panel E: Survey Design</i>		
NEP score (mean; range 6–30)	18.8	–
Protesters, all opt-out (%)	31.1	–
Information treatment (%)	20.8	–
Effective N (Kish)	318	–

Notes: Los Alamos County figures from U.S. Census Bureau, American Community Survey 2023 five-year estimates (U.S. Census Bureau, 2023). ^aCensus reports median age; survey reports mean age. Sample statistics are computed using the age $\times$ education post-stratification (raking) weights described in Part I, whose design effect gives the Kish effective N of 318 reported in Panel E; unweighted analysis-sample values therefore differ (for example, unweighted mean age is 55.9, and the unweighted protester share is 29.3%, i.e. 118 of 403; Table B.5 reports unweighted values). “Protesters” are respondents who selected the status-quo (opt-out) alternative on all six choice tasks; they are retained in estimation through a separate constant rather than dropped (see Appendix B.1). The sample overrepresents older, male, White, and high-income residents relative to the county population. The sample’s high-income skew reflects the Los Alamos labor market, where LANL is the dominant employer. Of the 607 matched households in the broader survey, 403 provided complete responses for all variables required in the analysis (demographics, NEP items, and all six DCE choice tasks). The remaining 204 were excluded due to incomplete NEP responses ($N = 89$), incomplete choice tasks ($N = 74$), or missing demographic fields ($N = 41$). Comparing the analysis sample with all 204 excluded respondents, attrition was not selective on gender ($p = 0.34$), homeownership ($p = 0.51$), or solar adoption ($p = 0.67$), but completers were slightly younger (mean 51.8 vs. 54.2, $p = 0.04$) and had higher incomes (81% vs. 73% above \$150K, $p = 0.03$). Table B.5 reports a complementary, unweighted comparison against the subset of excluded respondents who began the choice experiment but did not complete it; that subset is markedly older than the analysis sample, and the difference between the two comparisons reflects their different bases, not conflicting data.

9.2 Environmental Attitudes: New Ecological Paradigm Scale

Part I introduced the six-item NEP scale (Dunlap, Van Liere, et al., 2000) and the distribution of responses. Here we use those items to construct the environmental-attitude measure that enters the choice model.

Exploratory factor analysis confirms a single underlying factor (eigenvalue = 3.54, KMO = 0.88, Cronbach’s $\alpha = 0.89$). We compute factor scores using regression scoring. Results are stable under Bartlett scoring and simple averages (Table B.6).

The NEP scale may function differently in a population dominated by scientists and engineers. High NEP scores in Los Alamos may reflect climate-science knowledge as much as the

affective environmental concern the scale captures in more representative samples. We therefore interpret the NEP–WTP gradient as an association specific to this population rather than a transferable behavioral primitive, and its magnitude may not carry over to other populations even if the qualitative pattern persists.

9.3 DCE Attribute Development

We identified four attributes based on a literature review and three focus groups with 10 Los Alamos residents in May 2025. Focus group participants discussed their current energy use, attitudes toward electrification, concerns about switching, and the factors that would most influence their decisions. Below we describe each attribute in detail.

The first attribute, annual reduction in household carbon footprint, captures preferences for the environmental benefits of electrification. Households switching from natural gas to electric appliances can reduce on-site carbon emissions by varying degrees depending on the local electricity generation mix (Tarroja et al., 2018; Waite and Modi, 2020). We specified four levels of 0% (status quo), 33%, 66%, and 100% reduction. The 100% level represents complete elimination of on-site fossil fuel combustion.

The second attribute, energy efficiency of electric appliances, captures preferences for appliance performance improvements. The DCE literature on heating systems consistently finds that operating cost and efficiency are primary drivers of technology choice, often exceeding environmental considerations (Achtnicht, 2011; Michelsen and Madlener, 2012; Michelsen and Madlener, 2016). In the survey, this attribute was defined as the percentage improvement in energy efficiency of electric appliances over current gas appliances, with levels of 0% (status quo), 10%, 25%, and 50%. Respondents were informed that electric stoves, water heaters, and furnaces can be approximately 20 to 50% more efficient than their gas counterparts, and that higher efficiency can lead to lower operating costs.

The third attribute, financial incentives (rebates/subsidies), reflects the role of upfront cost subsidies in adoption decisions. The Inflation Reduction Act of 2022 allocated \$8.8 billion in home energy rebates, and state and local programs offer additional incentives. This attribute represents the percentage of electrification costs covered by rebates or subsidies, with levels of 0% (status quo), 30%, 50%, and 75%.

The fourth attribute, net monthly out-of-pocket cost, serves as the payment vehicle. This attribute captures the change in monthly household energy costs over the first decade after switching, with levels of \$0 (status quo), −\$50, +\$50, +\$150, and +\$200. The negative value represents potential savings, while positive values represent net cost increases. These levels were informed by engineering estimates of the cost differential between gas and electric systems at current LADPU rates.

In addition to these four attributes, electrical panel upgrade status emerged from the focus groups as a critical household-specific factor. Because panel upgrade requirements vary by household (78.7% of respondents indicated they would need an upgrade), we did not include panel status as a DCE attribute with varying levels. Instead, each respondent was reminded of their self-reported panel status before beginning the choice tasks: “Earlier you indicated your property [needs / does not need] an electrical panel upgrade. Please remember this while you make your choices.” Panel upgrade status enters the model as a fixed interaction term (Equation B.3) rather than a choice attribute.

Table 3 summarizes the four attributes and their levels and Figure 6 shows an example DCE choice question for the respondents.

Table 3: DCE Attributes and Levels

Attribute	Definition	Levels	Variable
Financial Incentives (Rebates/Subsidies)	Percentage of electrification costs covered by utility rebates or government subsidies	0% , 30%, 50%, 75%	Rebate
Energy Efficiency of Electric Appliances	Percentage improvement in energy efficiency of electric appliances over current gas appliances	0% , 10%, 25%, 50%	Efficiency
Annual Reduction in Household Carbon Footprint	Percentage reduction in household carbon emissions from switching to electric appliances	0% , 33%, 66%, 100%	Carbon
Net Monthly Out-of-Pocket Cost (First 10 Years)	Change in monthly household energy costs over the first decade after switching	-\$50, \$0 , +\$50, +\$150, +\$200	Cost

Notes: Levels in bold are status quo levels. Attributes were identified through three focus groups with 10 Los Alamos residents. The cost attribute is framed as the net change in monthly costs, with negative values indicating savings. Each choice task presented two electrification alternatives with varying attribute levels plus an opt-out (status quo) option. Figure 6 shows an example choice question as presented to respondents.

	Option A	Option B
Financial Incentives (Rebates/Subsidies) 	0% rebate	75% rebate
Energy Efficiency of Electric Appliances 	25% more efficient	10% more efficient
Annual Reduction in Household Carbon Footprint 	33% ↓ (1.5 metric tons of CO ₂ e)	0% ↓ (0 metric tons of CO ₂ e)
Net Monthly Out-of-Pocket Cost (First 10 Years) 	↓ \$50/month	↑ \$200/month

Images from Freepik.com

Figure 6: Example DCE choice question as presented to survey respondents. Each task presented two electrification alternatives (Option A, Option B) with varying levels of the four attributes, plus the option to choose neither (status quo).

The DCE employed a Bayesian D-efficient experimental design (Hensher et al., 2015) optimized using priors from a separate pilot sample ($N = 45$, not included in the main analytical sample), achieving a D-error of 0.0082. Each respondent completed six choice tasks, yielding 2,418 choice observations across 403 respondents. We tested for order effects across the six tasks and found no evidence of systematic fatigue or learning effects (Table B.7).

9.4 Information Treatment

We randomly assigned respondents to a control or information treatment group. Before completing the choice tasks, the treatment group received the following informational nudge, reproduced verbatim from the survey instrument:

Natural Gas Use in Homes in Los Alamos County. Natural gas is commonly used for heating, water heating, cooking, and drying clothes. The main ingredient in natural gas is methane, a powerful greenhouse gas. Most emissions from natural gas come from burning it, which releases CO₂, but small methane leaks during extraction and transportation also

contribute significantly to climate change. In Los Alamos County, the average household uses about 743 therms of natural gas per year, resulting in about 4.5 metric tons of greenhouse gas emissions, mostly from home heating. Burning natural gas indoors, for example using a gas stove, also creates indoor air pollutants such as carbon monoxide, nitrogen dioxide, fine particulate matter (PM_{2.5}), and formaldehyde. Poor ventilation can cause these pollutants to build up inside the home, increasing health risks like asthma, respiratory infections, dizziness, and headaches. Children and people with asthma or allergies are especially vulnerable. Studies have found that gas cooking can worsen asthma symptoms and reduce lung function, particularly in children. Frequent use of gas stoves without proper ventilation can significantly increase cancer risks, often exceeding WHO safety limits. Children are especially vulnerable, facing 1.85 times higher cancer risk than adults. Using a high-efficiency vented hood can greatly reduce harmful exposure. In rare cases, leaks inside the home can also create risks of suffocation or explosion if not properly managed. Lastly, using fuel-burning appliances at home also impacts the environment. The report showed that residential and commercial emissions made up 13% of total U.S. global warming emissions in 2020. Petroleum-based fuels, including natural gas, propane, fuel oil and kerosene are the primary driver of these emissions.

We verified randomization ex-post: treatment and control groups are balanced on NEP, income, education, and all other observables except age (Table B.8). The treatment effect disappears when NEP is included not because of differential assignment, but because NEP mediates the treatment pathway.

Balance tests confirm that treatment ($N = 84$) and control ($N = 319$) groups are statistically indistinguishable on NEP score, graduate education, female share, panel upgrade status, solar adoption, and all income brackets. Age shows a statistically significant imbalance, which we address by including age as a covariate in all specifications. The correlation between treatment assignment and NEP is negligible, confirming that the null treatment effect conditional on NEP is not an artifact of differential assignment.

We estimate willingness to pay with a mixed-logit model specified directly in willingness-to-pay space, with environmental attitudes (the NEP score), self-reported panel-upgrade status, and the information treatment entering as interactions, and with respondents who always chose the status quo (“protesters”) handled through a separate constant rather than dropped. Full estimation details, covering the utility specification, distributional assumptions, model selection, recovery of household-level WTP, and protester handling, are reported in Appendix B.1.

9.5 Administrative Data Linkage

We matched survey respondents to LADPU administrative billing records (January 2022 through June 2025, the roughly three and a half years of metered consumption leading up to the survey) using fuzzy matching algorithms on name and address fields, followed by manual verification. Of the 403 analysis-sample respondents, 376 (93.3%) were successfully linked to monthly electricity and natural gas billing histories. Among matched respondents, 350 have complete natural

gas records and 362 have complete electricity records. The remainder have billing gaps due to account changes or service interruptions.

Mean monthly electricity consumption is 621 kWh (SD = 341, median = 525), and mean monthly natural gas consumption is 80 hundred cubic feet (CCF) (SD = 40, median = 72). At current LADPU rates of approximately \$1.10 per CCF, the median monthly gas bill is \$79 and the mean is \$88. Gas expenditure varies widely, with the interquartile range spanning \$58 to \$111 per month. The 90th percentile household spends \$149 per month on natural gas, while the 10th percentile spends only \$41. This variation in gas expenditure creates heterogeneous financial incentives for electrification.

Figure 7 displays the seasonal profile of household energy consumption. Electricity peaks in both winter and summer (reaching approximately 790 kWh in January and July), reflecting combined heating and cooling loads in this high-desert climate. Natural gas consumption is heavily winter-concentrated. January averages 185 CCF, roughly ten times the June–August baseline of 18 CCF. This seasonal concentration means that electrification through heat pump adoption would primarily displace winter gas loads, with the largest bill impacts falling in December through February.

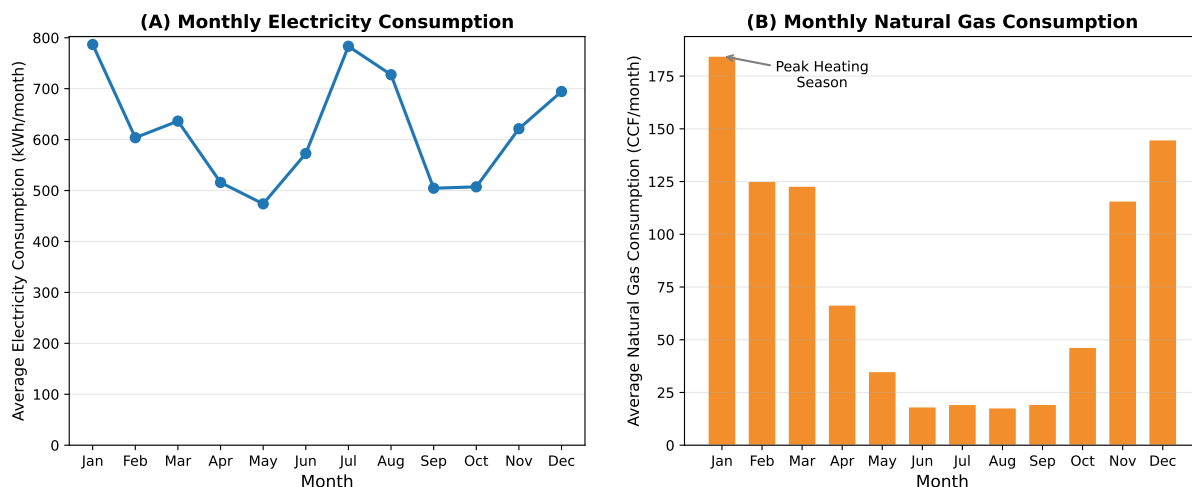


Figure 7: Average monthly energy consumption for matched LADPU households ($N = 362$ electricity, $N = 350$ gas). Panel A: Monthly electricity consumption (kWh). Panel B: Monthly natural gas consumption (CCF). Consumption records span January 2022 through June 2025.

The average electricity share of total household energy expenditure is 0.45, indicating that these households already derive roughly half their energy services from electricity. 14% of matched respondents have rooftop solar installations.

10 Discrete Choice Experiment Results

10.1 Population-Level WTP Estimates

Table 4 reports the headline WTP estimates. The full mixed-logit specification, with all interaction terms and model diagnostics, is reported in Appendix Table B.1. Because the model is estimated directly in the WTP space, the attribute coefficients are marginal WTP in dollars per month per percentage point of each attribute, denominated over the first decade after switching to match the payment vehicle framing described above.

Table 4: Headline Willingness to Pay Estimates

Electrification attribute	WTP (\$/month per %-point)	Implied value (\$/year)
Energy efficiency	2.31***	1,385 (at +50%)
Carbon reduction	1.49***	1,788 (at 100%)
Financial rebate (upfront)	1.10***	988 (at 75%)
<i>Key adoption barrier</i>		
Electrical-panel upgrade (resistance cost)	\$813 per year	

Notes: Mean WTP from a WTP-space mixed-logit model ($N = 403$ respondents, 2,418 choice observations). All figures are expressed over the first decade (the first 10 years) after switching, consistent with the survey's payment-vehicle framing. WTP is in dollars per month per percentage-point improvement in each attribute, and the implied annual value applies that WTP to the attribute's maximum level (efficiency +50%, carbon 100%, rebate 75%) over twelve months (for example, energy efficiency: $\$2.31 \times 50 \text{ points} \times 12 \text{ months} \approx \$1,385$ per year). The electrical-panel-upgrade figure is the resistance cost, the additional annual benefit a panel-needing household requires to choose electrification. It is a stated-preference measure of the barrier, not the physical upgrade cost (\$2,000–\$5,000 one-time). The full mixed-logit specification, with all interaction terms (panel upgrade, NEP, information treatment, sociodemographics) and diagnostics, is reported in Appendix B.1 (Table B.1). *** $p < 0.01$.

Energy efficiency commands the highest WTP at \$2.31 per month per percentage point, followed by carbon reduction (\$1.49) and rebates (\$1.10). The ordering indicates that performance and operating cost savings matter more to households than either environmental benefits or upfront cost reductions. For the maximum efficiency improvement of 50%, the implied WTP is \$115.40 per month (\$1,385 annually).

The efficiency WTP estimate reflects bundled performance expectations. Respondents likely value reliability, comfort, and modernization alongside energy savings. A heat pump operating at a coefficient of performance of 3.5 replacing an 80% efficient gas furnace saves approximately \$38 per month at Los Alamos energy prices, and the percentage-point framing generates large aggregate values. Applying the Penn and Hu (2018) trimmed-sample mean calibration factor of 1.94, the ratio of hypothetical to real willingness to pay in their meta-analysis, scales the headline efficiency estimate of \$2.31 per month per percentage point to about \$1.19 ($\$2.31 \div 1.94$), or roughly \$59 per month at a 50% efficiency improvement, moving the stated value toward revealed-preference benchmarks.

Carbon reduction WTP of \$1.49 per month per percentage point translates to \$149 per month for complete decarbonization from natural gas use (\$1,788 annually). The ordering, where efficiency exceeds carbon exceeds rebates, is consistent with a population that values electrification primarily for private rather than social benefits.

The rebate coefficient of \$1.10 per month per percentage point implies that households value a 75% rebate at \$82.35 per month (\$988 annually). The low standard deviation (CV = 0.09) indicates homogeneous rebate preferences. A two-class latent class model (Table B.11) identifies Class 1 (59%) with significant WTP similar to the main model and Class 2 (41%) with imprecise estimates and a large status-quo alternative-specific constant (ASC, the model's baseline pull toward the no-switch option), consistent with protesters and disengaged respondents rather than attribute-specific non-attendance.² Design-based non-attendance diagnostics show 37.7% of respondents with choice sequences consistent with rebate non-attendance, comparable to 37.0% for carbon and 39.5% for efficiency. The similarity of these rates alone would not rule out non-attendance as the source of rebate's low variance; the more direct evidence is that non-attendance rates do not track WTP dispersion across the attributes. Efficiency has the highest non-attendance rate (39.5%) yet a CV of 0.54, six times rebate's 0.09, so the attribute with the most apparent non-attendance shows wide dispersion while rebate shows almost none. If non-attendance were compressing rebate's variance, the same mechanism should compress efficiency's variance at least as much. The low rebate variance therefore reflects genuine preference homogeneity rather than attribute non-attendance.

Standard deviations are large relative to means (carbon CV = 0.70, efficiency CV = 0.54), indicating wide preference variation that motivates the individual-level analysis in Section B.4. Average shrinkage factors (posterior SD / population SD)³ are 0.54 for carbon, 0.57 for efficiency, and 0.16 for rebate. Read consistently against the definition, all three values indicate posteriors concentrated relative to their population spreads, confirming that six choice tasks provide adequate individual-level identification. For rebate, however, the population distribution is itself nearly degenerate (CV = 0.09), so its very low shrinkage means individual rebate WTPs are precisely located within an extremely narrow band: households are both well identified and nearly identical. The rebate value should therefore be read together with the homogeneity documented above, not as evidence of wide, well-measured individual differences.

We test the maintained independence assumption by computing individual-level posterior

²Attribute non-attendance refers to respondents ignoring one or more attributes when making their choices, rather than trading them all off as the standard model assumes. It is common in stated-preference studies, and if left unmodeled it can bias willingness-to-pay estimates (Hensher et al., 2005; Scarpa, Gilbride, et al., 2009).

³The shrinkage factor is the ratio of the posterior standard deviation of an individual's parameter estimate to the standard deviation of the estimated population distribution. Values near zero indicate that an individual's choices are highly informative and the posterior is tightly concentrated, while values near one indicate that the posterior remains diffuse and largely reflects the population distribution, implying that individual-level data add little information beyond the population mean (Revelt and K. Train, 2000).

WTP correlations from the M4A.NEP1 specification (Table B.13). Among 360 non-protester respondents, the posterior correlations are modest, with carbon-efficiency $r = 0.226$ ($p < 0.001$), carbon-rebate $r = 0.156$ ($p = 0.009$), and efficiency-rebate $r = 0.071$ ($p = 0.234$). The largest correlation implies shared variance of only 5.1%. A correlated specification allowing the full variance-covariance matrix was estimated but encountered numerical instability in the Cholesky decomposition before convergence, consistent with the weak correlations providing insufficient signal to identify the off-diagonal elements. The low posterior correlations support the independent specification, which we retain for parsimony (Hess and K. Train, 2017).

The NEP interaction effects are all statistically significant (Table B.1) and are interpreted in the Environmental Attitudes subsection below. A one-standard-deviation increase in NEP is associated with \$0.76 higher carbon WTP (51% of the \$1.49 baseline), \$0.66 higher efficiency WTP, and \$0.35 higher rebate WTP. Panel upgrade interactions are also significant, reducing carbon and efficiency WTP by \$0.89 and \$0.80 per month, respectively. These magnitudes are large relative to the base attribute WTP values. Krinsky-Robb confidence intervals are reported in Table B.2.

10.2 Electrical-Panel Upgrade

Panel upgrade requirements reduce WTP for both carbon and efficiency while increasing responsiveness to financial rebates (Table B.1). The panel interaction for carbon is $-\$0.89$, meaning households expecting panel upgrades value carbon reduction at only \$0.60 per month per percentage point (versus \$1.49 for households not needing upgrades). The panel interaction for efficiency is $-\$0.80$, reducing efficiency WTP to \$1.51 (versus \$2.31). The rebate-panel interaction is positive ($+\$0.32$) though not statistically significant. Panel-needing households may be somewhat more responsive to upfront financial incentives.

The panel upgrade coefficient on the ASC (\$67.73 per month) represents the additional monthly amount a panel-needing household requires to choose electrification over the status quo. This is a stated preference measure of the additional hurdle, not an engineering cost estimate. It captures the combined financial, logistical, and psychological burden that panel upgrades impose on the electrification decision. We refer to it as a “resistance cost” for brevity. With 78.7% of surveyed households indicating panel upgrade needs, this barrier affects roughly four in five potential adopters and translates to approximately \$813 annually. Programs that directly address panel upgrade costs through subsidies, financing, or streamlined permitting would reduce the single largest adoption obstacle.

10.3 Environmental Attitudes

NEP interactions demonstrate strong positive associations with all attribute valuations. A one-standard-deviation increase in NEP is associated with \$0.76 ($= \$0.794 \times 0.954(\text{SD})$) per month higher carbon WTP (+51% relative to baseline), \$0.66 higher efficiency WTP (+29%), and \$0.35 higher rebate WTP (+32%). These effects are captured in the fixed portion of the model, meaning the systematic NEP-WTP relationship is controlled when examining residual heterogeneity through the random parameters.

To illustrate the policy segmentation potential of NEP interactions, Table 5 reports predicted WTP at NEP percentiles (10th, 25th, 50th, 75th, 90th), showing how carbon, efficiency, and rebate WTP vary across the environmental attitude distribution.

Table 5: Predicted WTP at NEP Percentiles (\$/month per percentage point)

NEP Percentile	NEP factor score	Carbon WTP	Efficiency WTP	Rebate WTP
10th	−1.462	\$0.33	\$1.30	\$0.56
25th	−0.867	\$0.81	\$1.71	\$0.78
50th	0.160	\$1.62	\$2.42	\$1.16
75th	0.911	\$2.22	\$2.94	\$1.43
90th	1.111	\$2.38	\$3.08	\$1.51

Notes: The NEP factor score is the standardized regression factor score (mean 0, standard deviation 1) from the exploratory factor analysis, not the raw 6–30 summed scale reported in Table 2; negative values indicate below-average environmental concern. Predicted WTP computed from individual-level posterior WTP scores regressed on NEP factor scores. The NEP-carbon gradient is \$0.794 per unit NEP, implying that moving from the 10th to the 90th percentile of environmental attitudes is associated with \$2.05 higher carbon WTP. The NEP-efficiency gradient (\$0.693 per unit) produces a \$1.78 increase over the same range. Rebate WTP increases by \$0.95 across the NEP distribution (slope = \$0.368), consistent with financial incentive preferences being partly associated with environmental attitudes. The posterior gradient reflects the population-level NEP interaction coefficient (\$0.794 in Table B.1), which captures the systematic NEP-WTP relationship in the fixed interaction terms.

10.4 Information Treatment

The information treatment effects are not statistically significant for any attribute once NEP is included (Table B.1). In models without NEP controls, the treatment shows significant positive effects on carbon WTP, confirming that the treatment effect is absorbed by the NEP variable. This pattern indicates a “ceiling” rather than a “null.” The information works, but its effect is captured by the NEP variable with which it correlates. While information interventions reduce energy consumption in other settings (Allcott, 2011) and shift conservation behavior (Ferraro and Price, 2013), our results indicate that health and environmental risk information primarily activates pre-existing environmental concern rather than creating it. With only 84 treated respondents,

the study had limited statistical power to detect interaction effects. The standard errors on the treatment interaction terms are large relative to the coefficients (Table B.1), meaning that effects up to \$0.30 per percentage point could not be ruled out. A further caveat is differential attrition: respondents assigned to the treatment were about twice as likely as controls to start but not complete the choice experiment (40.0% of the dropped group in Table B.5 was treated, versus 20.8% of the analysis sample, $p = 0.003$), which we take up in the Limitations below. Programs targeting households with low environmental concern may need to lead with cost savings and comfort rather than environmental or health information.

10.5 Sociodemographic Patterns

Education shows the largest sociodemographic effect on the status-quo constant. Graduate degree holders have a \$179.69 lower ASC than those without college education, about \$2,156 less resistance annually, exceeding the NEP, income, and panel-status effects on the ASC. This outsized effect may capture several mechanisms, including knowledge about electrification technology, trust in the survey instrument, openness to change, or familiarity with the scientific rationale for electrification. In a community where about half of adults hold graduate degrees and most work in scientific or technical fields, education likely proxies for a constellation of traits associated with technology adoption rather than education per se.

Age and income, by contrast, raise status-quo preference. Age increases opt-out propensity by \$1.45 per year, so a 60-year-old has about \$58 per month higher status-quo preference than a 20-year-old. Higher-income groups likewise show greater status-quo preference (\$94 to \$101 per month versus the under-\$35,000 baseline), consistent with satisfaction with existing high-quality gas appliances in expensive homes, higher absolute switching costs in larger residences, and lower marginal utility of the environmental benefits electrification offers. An alternative interpretation is that higher-income respondents were more sensitive to the hypothetical nature of the exercise and more likely to treat the opt-out as a default when uncertain. Either pattern is consistent with the status-quo-bias literature, in which households with greater investment in existing systems show stronger default preferences.

Retirement status deserves separate attention, because retired households make up about a third of the analysis sample (33% unweighted, and 29% after the age-by-education post-stratification weighting) and might be expected to resist large discretionary expenditures while on a fixed income. Two pieces of evidence bear on this. First, their recovered attribute WTP is statistically indistinguishable from that of non-retired households (carbon \$1.53 versus \$1.52, efficiency \$2.30 versus \$2.32, and rebate \$1.10 versus \$1.09, all $p > 0.5$). Second, we re-estimated the choice model with an explicit retirement interaction on both the attribute valuations and the status-quo constant. Retirement leaves attribute WTP unchanged (all interactions $p > 0.6$), and it raises the status-quo constant by about \$34 per month, in the direction of a

fixed-income resistance to switching, but this effect is not statistically significant once age and income are controlled ($p = 0.14$). Because retirement in this sample is almost entirely a function of age, with retired respondents averaging 71 years against 49 for the non-retired, the fixed-income channel operates largely through the age and income terms already in the status-quo constant, where both older age and higher income raise status-quo preference.

Beyond these population averages, the household-level WTP estimates show that environmental attitudes explain most of the variation in carbon and efficiency valuations, whereas WTP for rebates rises with a household's actual natural gas use. Private financial interest surfaces mainly in responsiveness to incentives. These individual-level distributions, and the relationship between stated WTP and metered consumption, are reported in Appendix B.4.

11 Discussion

11.1 Key Findings and Interpretation

Three patterns in our estimates inform electrification program design. Efficiency leads attribute valuations, followed by carbon reduction and then rebates. This ordering, with private benefits exceeding social benefits exceeding upfront cost reductions, suggests that communication strategies should lead with performance and operating cost messaging.

Environmental worldview co-varies systematically with preferences through the NEP interaction terms. After controlling for these systematic effects, very few respondents have negative residual carbon WTP (Table B.12). Panel upgrade requirements impose a substantial annual barrier affecting most households. The individual-level analysis reveals residual heterogeneity even after controlling for observables.

The consumption data linkage (Section B.5) is consistent with the interpretation that this heterogeneity is associated primarily with attitudes rather than energy expenditure. Carbon and efficiency WTP are not significantly correlated with actual gas consumption, while rebate WTP increases significantly with gas bills (Table B.16). The WTP-to-expenditure ratio declines from 7.11 for the lowest gas quartile to 1.89 for the highest, indicating that stated preferences are better calibrated to financial reality among households with the largest gas expenditures.

11.2 Comparison to Existing Literature

Our findings can be situated within the DCE literature on heating system preferences. The dominance of efficiency over environmental attributes aligns with Achtnicht (2011), who finds that investment cost is the primary driver of fuel-type preferences in German heating choices, and with Michelsen and Madlener (2012), who reach a similar conclusion. That the efficiency-over-environment ordering appears in both the German heating market (with different gas prices,

climate, and policy frameworks) and a U.S. municipal utility planning gas elimination suggests a broader behavioral pattern. Our efficiency WTP estimates, however, exceed the 5 to 15% premiums typically found for efficient appliances (Galarraga et al., 2011). Applying the Penn and Hu (2018) trimmed-sample mean hypothetical-bias calibration factor of 1.94 brings the estimates closer to the expected range. Contributing factors also include our high-income sample, the percentage-point framing, and possible conflation of efficiency with cost savings despite the separate cost attribute.

The NEP-WTP-space integration approach speaks to the broader environmental valuation literature beyond heating-system DCEs. WTP-space estimation has been applied to recreation demand (Scarpa, Thiene, and Train, 2008), health valuation (Hole and Kolstad, 2012), and transportation choice (W. H. Greene and Hensher, 2010), but we are not aware of published work combining attitudinal scale interactions in the fixed portion of a WTP-space random parameter logit with individual-level posterior estimation. Mariel et al. (2021), in their review of environmental valuation with discrete choice experiments, do not document this specific combination. The approach is applicable wherever researchers suspect that observable attitudes or beliefs drive a large share of preference heterogeneity that would otherwise be absorbed into random parameters.

The null information treatment result is consistent with recent evidence that information interventions interact with pre-existing attitudes. Allcott (2011) and Ferraro and Price (2013) demonstrate information effects in energy conservation, but these studies use social comparison or norm-based messaging rather than environmental risk information. Our result suggests that environmental and health risk information faces diminishing returns when targeting populations with well-formed environmental attitudes. Information campaigns should be paired with tangible incentives and streamlined adoption pathways rather than relied upon as standalone interventions.

The panel upgrade barrier (\$813 per year) is consistent with Lane et al. (2024), who identify hassle costs as major obstacles. Our quantification provides specific program design guidance. Panel upgrade subsidies or financing equivalent to approximately \$800 to \$1,000 annually would offset this barrier.

11.3 Limitations

Several limitations bear on interpretation. First, the Los Alamos sample's unusual demographics limit generalizability. WTP magnitudes may exceed those in more typical communities, though the efficiency-over-carbon ordering aligns with cross-country evidence that private benefits motivate adoption more than social benefits (Achtnicht, 2011; Michelsen and Madlener, 2012). The methodological approach transfers to any population. Replication in lower-income communities is a priority. An unweighted specification produces qualitatively similar WTP estimates

and identical sign patterns (Table B.9), confirming that the post-stratification weights do not drive the main results.

Second, the 31.1% protest rate is comparable to the 15 to 30% range common in DCE studies of environmental goods (Meyerhoff and Liebe, 2006). Because low-NEP respondents disproportionately protest (Table B.10), the non-protester subsample skews toward higher environmental concern. A Heckman selection correction yields insignificant inverse Mills ratios for all three WTP attributes (carbon $p = 0.97$, efficiency $p = 0.89$, rebate $p = 0.54$), indicating that selection on NEP does not materially bias the WTP estimates.

Third, the unbalanced treatment allocation ($N = 84$ treated, 20.8%) limits power to detect information treatment effects, and attrition from the choice experiment was differential by treatment arm: treated respondents were about twice as likely as controls to begin the choice tasks without completing them (40.0% of the dropped group versus 20.8% of the analysis sample, $p = 0.003$; Table B.5). This is a more direct threat to the null information-treatment finding than limited power alone. If the information script itself discouraged completion among the respondents least receptive to it, the surviving treated sample would be selected toward those already sympathetic to the message, which works in the same direction as the NEP-mediation interpretation and could contribute to the null conditional effect. The lengthy treatment script placed immediately before the choice tasks is the most likely mechanism, since the dropped group is also much older. More intensive interventions with balanced allocation, and a shorter treatment placed earlier in the instrument, may yield detectable differences.

Part III

Solar Rebound

12 Overview

Many LADPU customers have installed rooftop solar, and more are expected to as the county electrifies. A natural question is whether solar adoption actually lowers a household's total energy use and emissions, or simply changes where its energy comes from. Prior studies find that solar adopters tend to consume more electricity afterward, a "rebound" effect, but they examine electricity alone and so cannot tell whether that extra electricity displaces natural gas or adds to total energy demand.

This part uses LADPU's household-level hourly electricity and natural gas data (2022–2025) to estimate the causal effect of solar adoption on both fuels, using a staggered difference-in-differences design that compares adopters with matched non-adopters before and after installation.

13 Data and Descriptive Patterns

In collaboration with LADPU, we assemble a household-level dataset for Los Alamos County that combines hourly electricity consumption, natural gas consumption, and system-level solar installation information.

13.1 Data description

Our main dataset is the household hourly electricity and natural gas consumption data covering all households served by LADPU for the period January 2022 to June 2025. The data include household identifiers, meter identifiers, household addresses, geographic coordinates, hourly consumption timestamps, electricity drawn from the grid, electricity exported to the grid, adjusted total electricity consumption, and natural gas consumption.

The second dataset contains solar installation information from LADPU, which we matched to households using service addresses. This dataset includes system-level information on installed capacity and installation date.

The third dataset is simulated hourly solar generation data from the Photovoltaic Geographical Information System (PVGIS). Because solar generation is not directly observed in the utility data, we use PVGIS to simulate hourly PV output for each solar household from 2022 to 2023, based on each system's geographic coordinates. The simulation period is limited to 2022–2023 due to PVGIS data availability. In the simulation, we allow PVGIS to optimize the system slope and azimuth,⁴ and use its default assumption of 14% overall system losses.

The fourth dataset is hourly weather and solar irradiance data from the National Solar Radiation Database (NSRDB), which we use to project household-level solar generation for 2024–2025. We combine PVGIS simulated solar generation for 2022–2023 with NSRDB weather and irradiance variables to train a two-stage random forest model, then apply the trained model to NSRDB weather and irradiance data for 2024–2025 to project hourly household-level solar output. The two sources together provide uninterrupted coverage of the study period: the PVGIS series runs through December 2023, and the random-forest projection covers January 2024 through June 2025, so there is no gap year between them. Should PVGIS later extend its public time series beyond 2023, the projected years could be replaced with, or validated against, the extended simulations.

We combine these data sources to construct a unique household-level hourly panel dataset. To form a control group to the solar households, we match each solar household to its five nearest non-solar neighbors by straight-line distance, so the panel pairs 447 solar adopters with 1,729 matched non-solar controls. We match on geography because nearby households face the same weather, neighborhood characteristics, and utility-pricing environment, which makes the

⁴PVGIS calculates the slope and azimuth of the PV modules that yield the highest annual energy output.

controls a credible counterfactual for the difference-in-differences and absorbs local confounders that could otherwise be mistaken for an effect of solar adoption. The staggered difference-in-differences identifies the rebound from the 198 households that adopt within the study window, compared with the never-adopting controls, excluding the 249 households that already had solar before the window for lack of a pre-adoption period. To study heterogeneity across different time horizons, we further aggregate the hourly data to the daily and monthly levels according to the corresponding model specifications. The detailed data construction process is described in Appendix C.1 and C.2.

13.2 Electricity and Natural Gas Consumption Patterns

Table C.4 presents summary statistics for the full sample. Among solar households, the average installed capacity is 5.52 kW. Average hourly solar generation is 2.28 kWh per generating hour. Average hourly electricity consumption is 1.05 kWh, of which 0.96 kWh is drawn from the grid. Average hourly natural gas consumption is approximately 0.01 MMBtu. There is substantial variation across solar households, especially in installed solar capacity, solar generation, and electricity consumption.

Solar and non-solar households exhibit different electricity consumption patterns (Table C.18). Grid electricity use is initially higher among future solar households than non-solar households, but after installation the pattern reverses, with solar households drawing less electricity from the grid while maintaining higher total electricity consumption.

Figure 8 compares the hourly dynamics of electricity consumption over the full study period, distinguishing between solar and non-solar households. Panel (a) shows a pronounced morning peak for solar households, with usage rising sharply and reaching its maximum around 8–9 AM, suggesting a shift in consumption toward anticipated solar-generation hours. Panel (b) reveals a duck-curve pattern for solar households, where grid electricity use declines during daylight hours as on-site solar generation displaces grid demand. Appendix C.3 reports additional figures on consumption dynamics within the calendar year and over the monthly cycle, which display pronounced temporal variation.

Natural gas consumption does not differ meaningfully between future solar and non-solar households before installation, but after installation non-solar households consume more natural gas than solar households. This pattern suggests a substitution away from natural gas toward electricity use following solar adoption.

13.3 Solar Installations and Solar Generation

Figure 9 illustrates the temporal distribution of solar installations and installed capacity over the study period. The figures show that solar adoption is dispersed across months and years, with

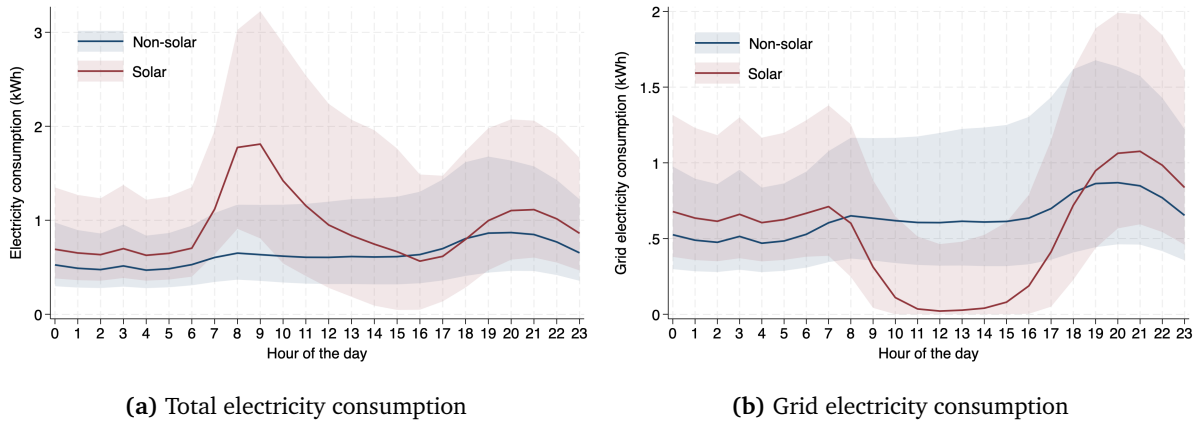


Figure 8: Hourly electricity consumption patterns of solar and non-solar households

Notes: The figure plots hourly electricity consumption patterns for solar and non-solar households. Panel (a) shows total electricity consumption, and Panel (b) shows grid electricity consumption. Solid lines represent the median hourly consumption for each group, and shaded bands indicate the 25th–75th percentile range. Consumption is measured in kWh.

noticeable variation in both the number of installations and total installed capacity. While there are relatively more installations in late 2023, installations are not concentrated within a narrow time window. Instead, adoption occurs gradually over time, generating meaningful variation in treatment timing across households.

This staggered pattern of adoption motivates our empirical strategy. In particular, the variation in installation timing allows us to exploit a staggered difference-in-differences framework, which leverages differences in treatment timing to identify causal effects while accounting for heterogeneous treatment effects across cohorts and over time.

Figure 10 compares monthly electricity consumption and solar generation relative to the pre-adoption electricity consumption baseline among solar-adopting households. Total electricity consumption rises above the pre-solar baseline after adoption, providing descriptive evidence of a rebound response. At the same time, monthly solar generation fluctuates around the pre-adoption consumption baseline after installation. This pattern suggests that households install solar systems with generation capacity roughly aligned with their historical electricity demand on average. This is also consistent with LADPU’s interconnection requirement that residential solar systems be sized to offset actual electricity consumption over the immediately preceding 12 months.⁵ Therefore, the observed post-adoption increase in electricity consumption is unlikely to be driven by households installing excessively large systems in anticipation of future demand growth. Instead, it is more consistent with a post-adoption behavioral response, where households increase electricity use after gaining access to self-generated solar electricity.

⁵Details on LADPU’s solar installation and system-sizing requirements can be found at <https://www.losalamosnm.gov/Business/Apply-for-a-permit/Solar-Power-Installation>.

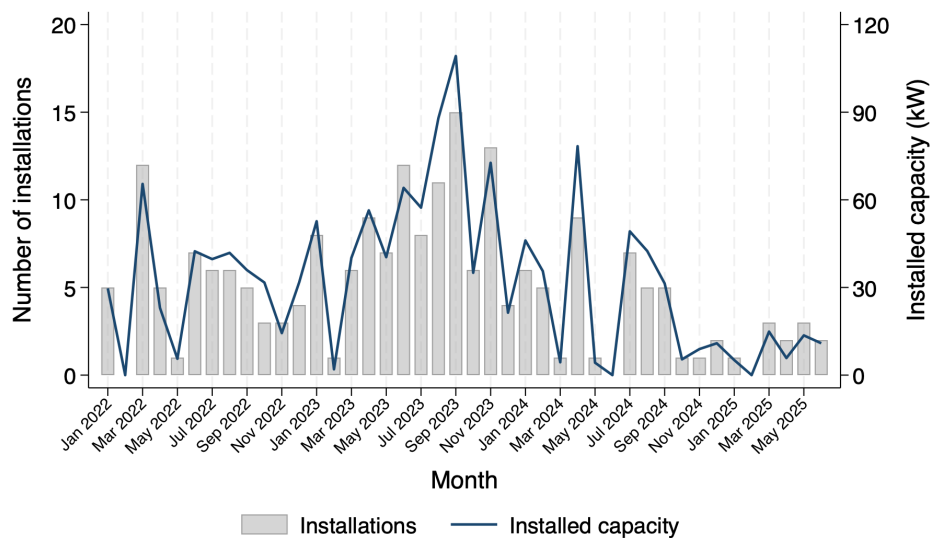


Figure 9: Monthly solar installations and installed capacity

Notes: The figure summarizes monthly solar adoption from January 2022 to June 2025. Grey bars show the number of solar installations in each installation month, measured on the left y-axis. The navy line shows total installed solar capacity in kW among households installed in each month, measured on the right y-axis. Each household is counted once in its installation month.

We estimate the causal effect of solar adoption with a staggered difference-in-differences design (Callaway and Sant’Anna, 2021) that compares adopting households with matched non-adopters before and after installation. The estimator and its identifying assumptions are detailed in Appendix C.4.

14 Main Results

14.1 Average Effects

Table 6 reports the estimated average treatment effect on the treated (ATT) of solar adoption on household monthly energy consumption. Treatment timing is defined by the year-month of solar installation, and we use households that never adopt solar as the control group. Standard errors are clustered at the household level. The parallel trend assumption holds in our analysis and the event study plots are reported in Section C.5.

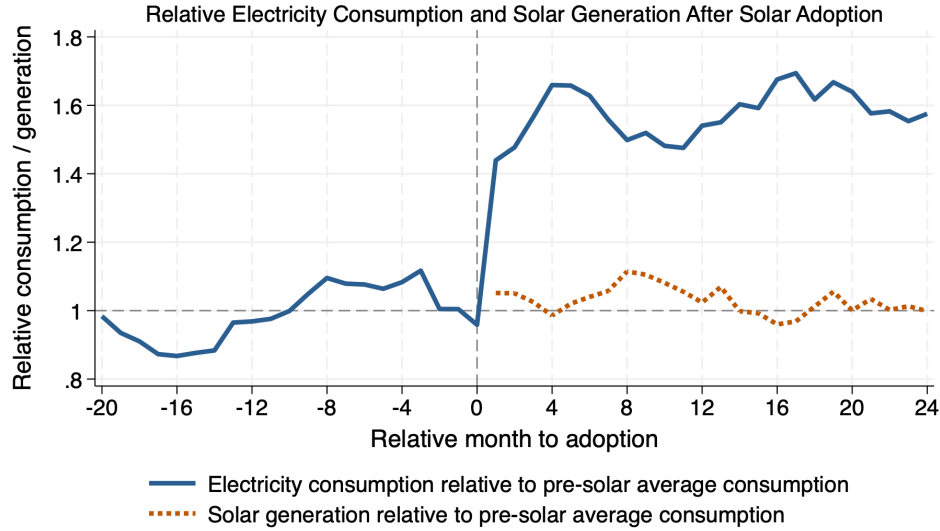


Figure 10: Relative electricity consumption and solar generation after solar adoption

Notes: The sample includes all households that adopted solar within the study period. The monthly electricity consumption and solar generation are normalized by the same pre-solar electricity consumption baseline. The horizontal dashed line represents the pre-solar baseline, and the vertical dashed line marks the month of solar adoption. Solar generation in the installation month is omitted because installation may occur at any point within the month and the generation in that month may reflect only partial-month production and may not be comparable to full-month solar generation in subsequent months.

Table 6: Effects of solar adoption on monthly household energy consumption

	Electricity consumption	Grid electricity consumption	Natural gas consumption
ATT	118.696*** (44.088)	-131.117*** (41.573)	-0.345 (0.266)
Pre-treatment Mean	631.794	631.782	6.541
% change	+18.79%	-20.75%	-
Unit	kWh	kWh	MMBtu

Note: This table reports the ATT of solar adoption on household monthly energy consumption. Treatment timing is defined by the year-month of solar installation, and we use households that never adopt solar as the control group. Standard errors, reported in parentheses, are clustered at the household level. Pre-treatment means are calculated using observations prior to solar adoption for treated households. Percentage changes are computed relative to pre-treatment means and are not reported when the ATT estimate is statistically insignificant. Significance levels are denoted as *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

The results show a substantial increase in total electricity consumption following solar adoption. On average, electricity use increases by 118.70 kWh per month (18.79%). Grid electricity consumption falls by 131.12 kWh (20.75%), which provides direct evidence that self-generated solar power is substituting for grid-supplied electricity. Natural gas consumption does not exhibit a statistically significant response to solar adoption. The final column of Table 6 standardizes

electricity and natural gas into a common energy unit (MMBtu) to gauge the net effect across fuels, converting electricity at $1 \text{ kWh} = 0.003412 \text{ MMBtu}$ and summing it with metered natural gas at the household-month level. On average, solar adoption increases total energy consumption by 7.29% relative to the pre-treatment mean.⁶

These estimates show that solar adoption increases both total electricity and total household energy consumption, with part of the additional electricity use possibly substituting for other fuels. Although the average ATT on natural gas consumption is statistically insignificant, this aggregate estimate may mask substantial temporal heterogeneity in household energy use. Electricity is used for a broad range of end uses, including cooling, lighting, appliances, and small electric heating equipment, whereas natural gas in our household sample is primarily used for space heating and cooking. As a result, the substitution relationship between electricity and natural gas is likely to depend on heating demand and may vary across seasons and hours of the day. The following subsections examine this heterogeneity across seasons, days of the week, and hours of the day.

14.2 Seasonal Heterogeneity

The rebound effect varies sharply across seasons. Figure 11 reports the seasonal ATT for total electricity, grid electricity, natural gas, and total energy. Within each panel, the top plot shows the ATT with its 95% confidence interval and the bottom plot the implied rebound as a percentage of the pre-adoption seasonal mean. Total-electricity use (panel a) rises by 175 kWh per month in Spring, a 31% rebound, and by 459 kWh per month in Winter, a 65% rebound, both precisely estimated. The Summer and Fall estimates are statistically indistinguishable from zero. The rebound is thus absent in the high-generation cooling seasons and concentrated in the low-generation heating seasons, the opposite of what self-consumption of midday solar output alone would predict. The full seasonal ATT tables, in native units (Table C.19) and in MMBtu (Table C.20), are reported in Appendix C.8.

The grid-electricity panel (panel b) shows how households source this additional consumption. In Spring, Summer, and Fall, grid consumption falls sharply, by 18%, 36%, and 60% respectively, as self-generated solar displaces electricity that would otherwise have been bought from the grid. In winter it does not fall, and the point estimate is a statistically insignificant +152 kWh. The additional winter consumption is large enough to offset the grid-displacement effect of solar entirely, so grid consumption shows no decline even as households consume their own generation. This is the first indication that the winter rebound is not a consumption timing

⁶The total-energy ATT is estimated directly on this summed household-month outcome, not computed by adding the electricity and natural-gas ATTs. Because each outcome's group-time effects are estimated and aggregated separately, the total-energy estimate need not equal the sum of the component estimates, and its standard error reflects the covariance between the two fuels rather than treating them as independent.

shift to absorb on-site generation but a genuine increase in the level of demand.

Sorrell (Sorrell, 2009) distinguishes between conventional rebound effects and backfire, which represents the more extreme case in which behavioral responses more than offset the expected engineering energy savings, leading to energy consumption that ultimately exceeds the level that would have occurred without the efficiency improvement. Although Sorrell's discussion is developed in the context of energy efficiency improvements, similar behavioral responses can also arise when distributed generation changes the perceived marginal cost of electricity consumption. Our empirical design does not estimate engineering energy savings and therefore cannot directly quantify rebound rates or determine whether backfire occurs in the strict sense. Nevertheless, the winter results suggest that the additional electricity generated by rooftop PV is largely absorbed by higher household electricity demand rather than displacing electricity purchased from the grid. Although these findings do not establish backfire as formally defined in the literature, they are qualitatively consistent with the behavioral response described by Sorrell (Sorrell, 2009). Under winter heating conditions, residential solar adoption induce sufficiently large increases in electricity demand to offset a substantial share of the potential reduction in conventional energy use.

Natural gas (panel c) responds only in Spring, where it falls by 0.95 MMBtu per month (14%). No other season shows a significant change. The all-fuel total in panel (d) combines these outcomes in common energy units. Averaged over the year, solar adoption raises total household energy use by 7.3%. The net increase is statistically significant in Summer and Winter, and largest in absolute terms in Winter (+1.6 MMBtu per month).⁷ Spring is the exception, because there the rise in electricity is matched by the fall in gas, so the net energy effect is indistinguishable from zero. The seasonal evidence therefore distinguishes two mechanisms. In spring, households substitute electricity for gas, which leaves total energy roughly unchanged. In winter, total energy use rises, and the next subsection identifies the within-day source of that increase.

⁷As with the annual estimate, each seasonal total-energy ATT is estimated directly on the summed outcome rather than by adding the fuel-specific seasonal estimates, so a season in which neither fuel-specific estimate is individually significant can still show a statistically significant total: the summed outcome is estimated with its own precision, which incorporates the covariance between the two fuels.

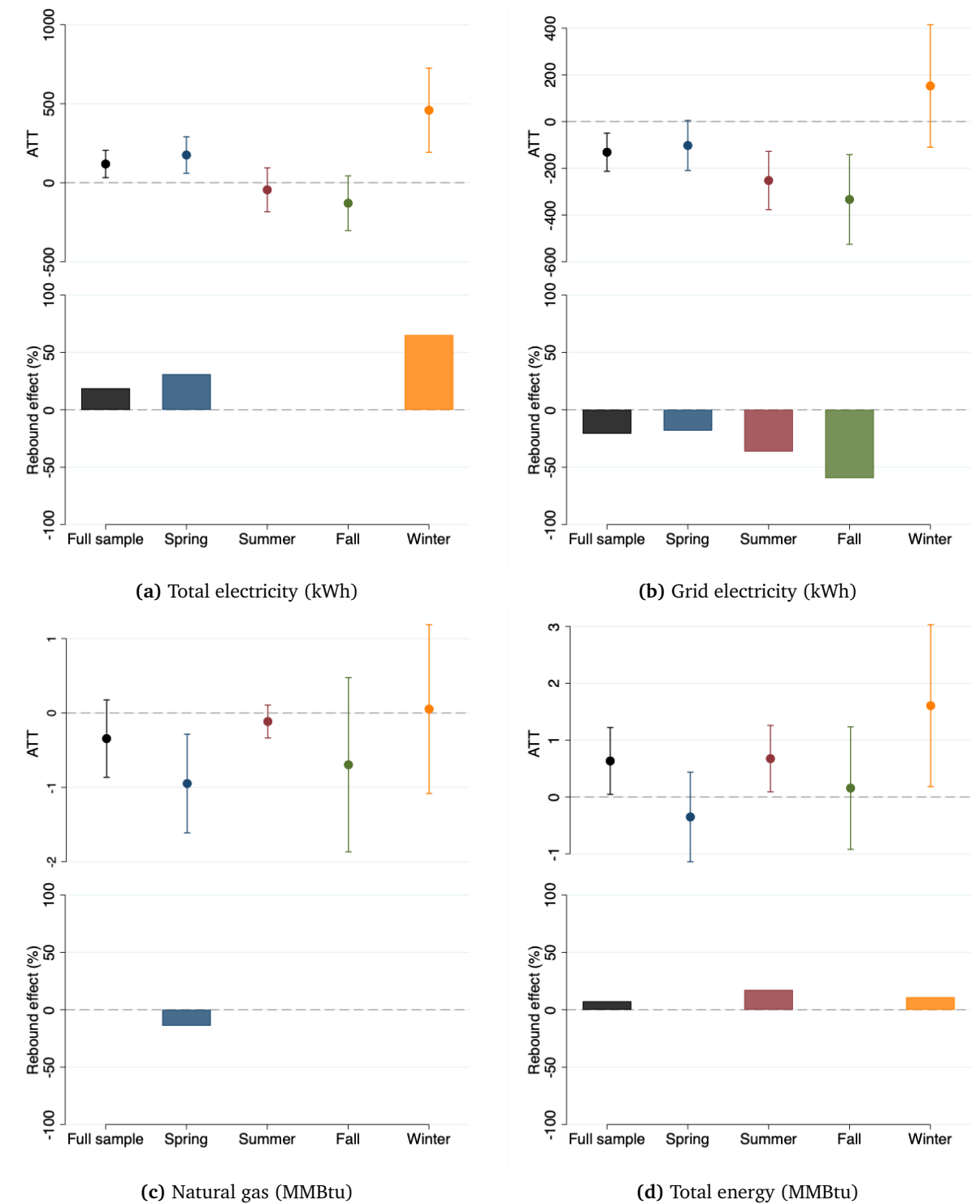


Figure 11: Seasonal treatment effects by energy outcome

Notes: Each panel plots the ATT with 95% confidence intervals (top) and the implied rebound as a percentage of the pre-adoption mean (bottom), for the full sample and by season.

14.3 Day-of-Week and Within-Day Patterns

We next examine the effect by day of the week (Figure 12). The rebound in total electricity is positive and stable across the week. The daily-average rebound ranges from 28% on Wednesdays and Sundays to 39% on Saturdays, every estimate is significant at the 1% level, and the confidence intervals overlap across all seven days. Grid electricity falls by a comparable 19–26% on every day. The absence of a weekday–weekend gap is informative. If the rebound reflected households spending more time at home after adopting solar, it would concentrate on weekends. Its stability across days instead indicates a uniform change in the level of consumption, consistent with always-on heating and baseload uses rather than greater weekend occupancy. The day-of-week ATT table is reported in Appendix C.8.

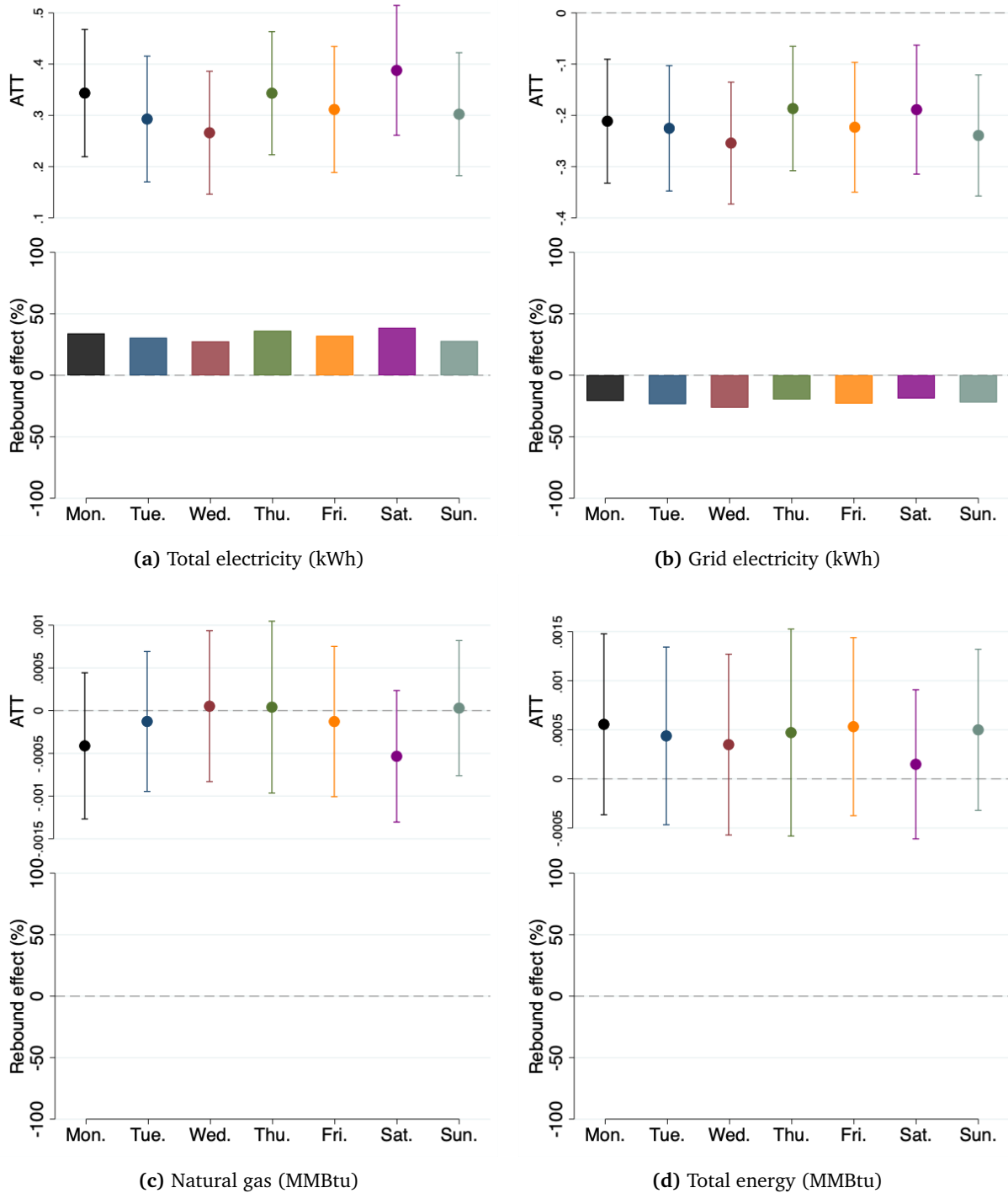


Figure 12: Day-of-week treatment effects by energy outcome

Notes: ATT with 95% confidence intervals (top) and implied rebound (bottom) by day of the week, for each energy outcome.

We next estimate the effect on electricity consumption by hour of the day. Figure 13 plots the hourly ATT on electricity use against the average solar-generation profile shown for reference. In Spring (panel a) the additional electricity use rises with the morning increase in generation, but it peaks earlier in the day than generation does. It reaches about +1.1 kWh near 9 a.m., a few hours before solar output peaks at midday, then declines to approximately zero by midday and to a small negative value in the afternoon. The increase is concentrated in the hours when the panels are producing. Because LADPU adopts the net billing structure for solar generation where the buy-back price of excess solar power sent back to the grid is low, on-site consumption during solar-generating hours is worth more than exporting. Total electricity in spring nonetheless rises by 31% (Table C.19), so the response is a genuine increase rather than a consumption timing shift within the day. Because the spring decline in gas offsets this increase in energy terms, total household energy is roughly unchanged, and the spring rebound reflects substitution of electricity for gas rather than a rise in total energy. This gas reduction is identified at the seasonal level, where the monthly ATT is significant, and the hourly gas estimates are too imprecise to localize it within the day (Figure C.11).

The response in winter (panel b) differs. The ATT is both larger and more persistent. It rises to about +2.4 kWh in the early morning, remains elevated through the generation hours, declines to near zero only briefly in the late afternoon, and then rises again in the evening and stays positive overnight, when the panels produce nothing. An effect that persists well past sunset cannot reflect self-consumption of contemporaneous solar output. It is instead consistent with an income effect, in which the bill savings from solar raise the budget available for additional heating and comfort, in addition to the daytime self-consumption channel. The cold high-desert winter, at elevations of 6,500–7,400 feet, makes this additional heating demand substantial.

Table C.22 summarizes the rebound effect difference between spring and winter hours. The spring rebound occurs during solar hours and substitutes for gas, whereas the larger winter rebound extends throughout the day and reflects both self-consumption and income effects. The hourly grid-electricity and natural-gas figures and the remaining seasons are reported in Appendix C.6.

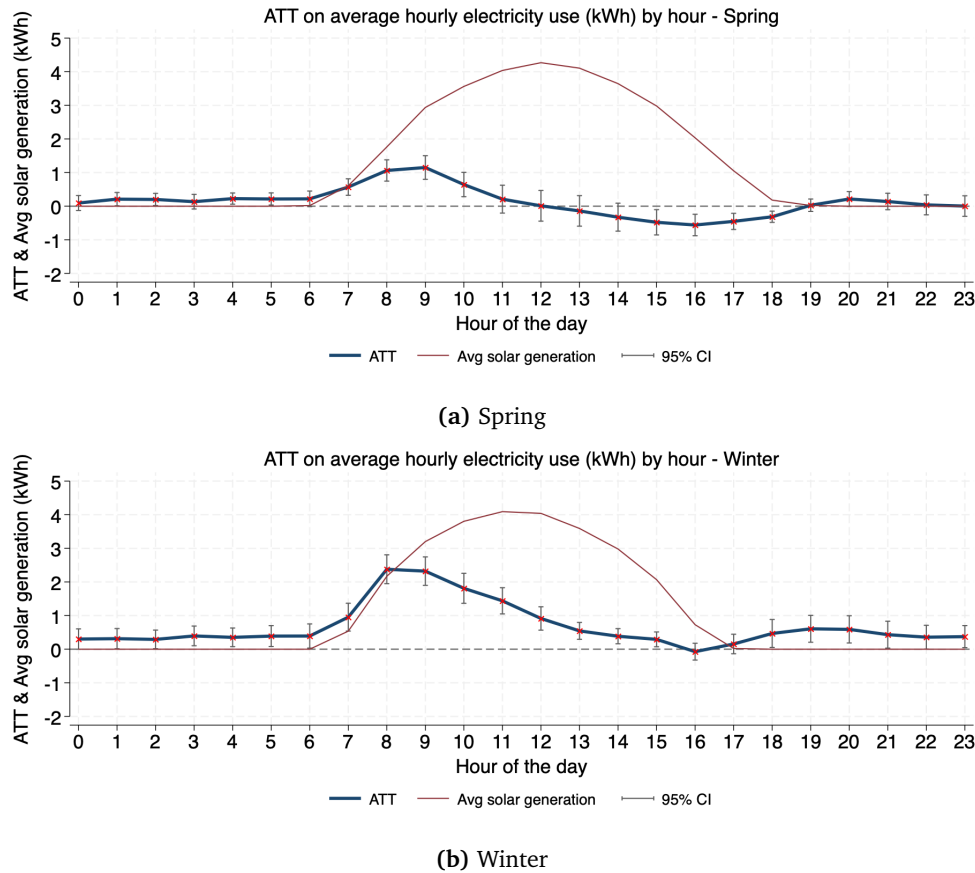


Figure 13: ATT on hourly electricity use (kWh) by hour of day, Spring vs. Winter

Notes: Each panel plots the ATT on hourly electricity use (kWh) with 95% confidence intervals against hour of the day; the lighter line shows average hourly solar generation for reference. Spring (top) and Winter (bottom) are shown; the remaining seasons and the grid-electricity and natural-gas analogues are reported in Appendix C.6.

15 Carbon Reduction Analysis

A central rationale for supporting residential solar is its climate benefit. Because photovoltaic output is carbon-free, each kWh a household generates is expected to displace a kWh of grid electricity and to avoid the emissions of the fossil-fueled generation that would otherwise have supplied it. The environmental case for distributed solar, and much of the public support for it, rests on this displacement. The rebound effect documented above complicates the accounting. When a household raises its electricity use after adopting solar, part of the clean generation meets the additional demand rather than displacing grid purchases, and any consumption drawn from the grid is supplied at the grid's emission factor. The realized carbon offset is therefore smaller than the household's gross solar output would imply, and the size of the shortfall

depends on how large the rebound is and when it occurs.

We next translate the consumption effects into carbon emissions, combining each household's ATT on grid electricity and natural gas with hourly carbon emission factors for the Public Service Company of New Mexico (PNM) grid. We use this factor because LADPU, a municipal utility, generates or procures part of its supply and purchases the remainder from the surrounding grid, which lies in the PNM balancing authority area. Marginal changes in a household's grid electricity are therefore served by generation dispatched within PNM. The grid factor is the marginal emission factor implied by a merit-order dispatch of generation. The method and the full by-hour, by-season calculations are in Appendix C.8.

Figure 14 summarizes the result. Reduced grid purchases lower CO₂ emissions by 332, 329, and 240 kg per household per year in Spring, Summer, and Fall, but by essentially nothing in Winter (a slight 1.6 kg increase), when the rebound is strongest (panel a). Reduced natural gas use adds a further 78 kg per year, concentrated in Spring. Summing both channels, observed solar adoption avoids about 978 kg of CO₂ per household per year, just under one metric tonne (1 tonne = 1,000 kg). Valued at the U.S. Environmental Protection Agency's updated central social cost of carbon of roughly \$190 per metric tonne (U.S. Environmental Protection Agency, 2023), each adopting household generates about \$185 per year in avoided climate damages, compared with roughly \$745 under the no-rebound counterfactual of 3,915 kg discussed below.

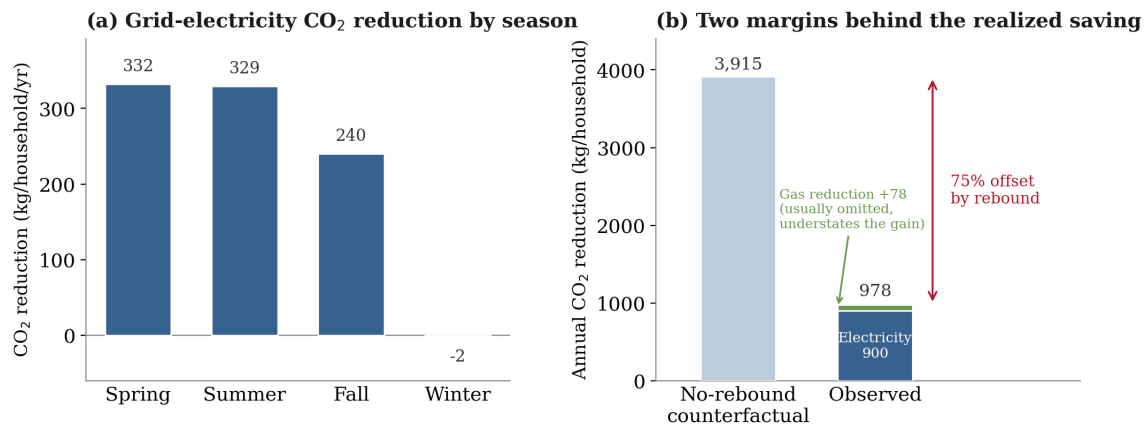


Figure 14: Carbon reduction from solar adoption, the rebound offset and the omitted gas margin

Notes: Panel (a) shows the annual CO₂ reduction from reduced grid-electricity purchases, by season. Panel (b) decomposes the observed reduction of 978 kg CO₂ per household per year into the grid-electricity channel (about 900 kg, which the literature typically counts) and the natural-gas channel (about 78 kg, usually omitted), and compares the total with a no-rebound counterfactual of 3,915 kg that credits each household's hourly solar generation at the marginal emission factor with no behavioral response; the gap between the two bars is the roughly 75% of potential savings forgone to the rebound.

That observed reduction reflects two offsetting margins (panel b). On one side, the realized saving of 978 kg falls far below the no-rebound counterfactual of 3,915 kg per household per

year, so the rebound effect offsets roughly 75% of the carbon savings solar would otherwise deliver. On the other side, most studies of distributed solar count only the electricity channel and ignore the accompanying reduction in natural-gas use. That gas channel adds about 78 kg per household per year here, so an electricity-only accounting understates the true emissions benefit of adoption. Because both the rebound and the grid's emission intensity vary by season and hour, the net figure is also sensitive to how emission factors are applied. A comparison across emission-factor specifications is reported in Appendix [C.8](#).

16 Discussion

16.1 Key Findings and Interpretation

Residential solar adoption raises total household electricity use by 18.8% on average, even as metered grid purchases fall by about 21% (Table 6). The difference is self-consumed solar generation. Because the accompanying change in natural gas offsets only part of the higher electricity use, total household energy use rises by 7.29%. The headline result is a net increase in the energy a household consumes, not only a substitution of self-generated power for purchased power.

The rebound is heterogeneous across seasons and hours, and two mechanisms drive it. In spring the additional electricity use is concentrated in solar-generation hours, consistent with a self-consumption response to net billing, and total energy is roughly unchanged because a seasonal decline in natural gas offsets the higher electricity use. In winter the rebound is larger, a 65% increase in electricity, and is spread throughout the day, including evening and overnight hours when the panels generate nothing, consistent with an income effect and added heating demand rather than self-consumption alone. Observing natural gas alongside electricity is what separates these cases, because it distinguishes a net increase in energy demand from a reallocation across fuels.

These responses do not change how much clean power the panels produce, but they reduce the grid emissions that this production displaces. Counting both the grid-electricity and natural-gas channels, solar adoption avoids about 978 kg of CO₂ per household per year, far below the 3,915 kg that a no-rebound counterfactual credits to the same generation, so the rebound forgoes roughly three-quarters of the grid-emission reduction solar would otherwise deliver. The natural-gas channel adds about 78 kg per year, which an electricity-only accounting would miss. This shortfall is not a fixed property of the technology. Because both the rebound and the grid's emission intensity vary across seasons and hours, the timing of the rebound governs its emissions cost, and a single average emission factor can materially misstate the carbon benefit of distributed solar.

16.2 Comparison to Existing Literature

Our estimates can be situated within the literature on residential solar rebound. Quasi-experimental studies typically report rebound effects of roughly 8 to 18% (Aydin et al., 2023; Bigler, 2025; Havas et al., 2015; Qiu et al., 2019; Spiller, Sopher, et al., 2017). Our average electricity rebound of 18.8% is at the upper end of that range, consistent with the strong self-consumption incentive of LADPU's net-billing tariff, under which a low export price makes on-site use more valuable than export (Gautier, Hoet, et al., 2019). The rebound concept originates in the energy-efficiency literature, where a lower effective price of energy services induces additional consumption that offsets part of the intended savings (Gillingham et al., 2014; Sorrell and Dimitropoulos, 2008). That literature reserves a stronger term, "backfire," for cases in which the induced consumption more than exhausts the expected savings, the household-scale analogue of the economy-wide Jevons paradox (Sorrell, 2009). Our winter estimates fit that stronger description for the season: total electricity use rises 65% above the pre-adoption baseline while grid purchases show no statistically detectable decline, so during the heating season the behavioral response absorbs the entire grid-displacement benefit of the panels rather than a fraction of it. Averaged over the year the response remains a partial rebound, but the winter result is better described as seasonal backfire than as a partial offset.

Most of this literature measures electricity alone. By observing electricity and natural gas together, we connect the solar-rebound question to the literature on cross-fuel substitution in the home (Alberini et al., 2011; Dubin and McFadden, 1984; Mansur et al., 2008). The distinction matters for interpretation. The spring pattern, in which higher electricity use accompanies lower gas use with little change in total energy, is substitution across fuels, whereas the winter pattern is a net increase in energy demand. An electricity-only design cannot separate the two and would read the spring response as pure rebound when it is partly a move away from gas.

Our results also bear on whether distributed solar delivers its expected emissions reduction. Several studies argue that rebound and grid carbon intensity can erode the emissions benefit of rooftop PV (Deng and Newton, 2017; Toroghi and Matthew E. Oliver, 2019). We quantify that erosion in one setting with hourly data and find it large, about three-quarters of the potential grid-emission reduction, which shows that the gap between solar's engineering potential and its realized climate benefit can be first-order rather than marginal.

16.3 Limitations

The central finding of a positive, seasonally varying rebound is robust, but the data and setting bound how well it can be measured and how far it generalizes. First, the total-electricity outcome combines metered consumption with imputed solar generation, since household self-generation is not separately metered. The imputation is validated out of sample (Appendix C.2),

but the total-electricity and total-energy estimates inherit its uncertainty. Two features limit how much this matters. The grid-electricity estimate uses only metered data and is independent of the imputation, so the core displacement result does not rest on the imputed series. In addition, because the same imputation is applied to every solar household, a bias common to all of them would change the magnitude of the rebound but not its qualitative features, including the seasonal heterogeneity and the within-day concentration on which the interpretation rests.

Second, the causal interpretation relies on the Stable Unit Treatment Value Assumption. A placebo test that assigns adoption timing to nearby non-adopters yields no significant effect, which provides no evidence of neighborhood spillovers, although we cannot rule out small or indirect interference or heterogeneity in treatment intensity across systems.

Third, the event-study estimates suggest the rebound is strongest shortly after adoption and attenuates beyond about two years, consistent with households learning to balance self-consumption and export over time, so a single average effect understates the initial response and overstates the long-run one.

Fourth, the setting is a high-income, high-altitude community with cold winters and a specific net-billing tariff, and both the size of the rebound and its carbon cost depend on the local tariff and grid mix, so the external validity of the point estimates is limited even where the mechanisms are general.

Finally, we quantify the rebound but do not take a welfare stance on it. By revealed preference, the additional consumption is worth more to the household than its private cost, so part of what the carbon accounting records as forgone emissions savings is welfare-enhancing comfort. Quantifying that consumer-surplus gain would require estimating a household demand function, and LADPU's residential tariff offers no cross-household price variation with which to identify one: every household faces the same flat volumetric rate in any given month, so average price paid does not vary across customers the way it does under the increasing block rates exploited in, for example, the municipal water-demand literature. Estimating the welfare value of the rebound from tariff changes over time, or across neighboring utilities with different rate structures, is a natural direction for future research.

Part IV

Household Factors and Load Projection

17 Overview

Los Alamos has committed to phasing out residential natural gas, which moves space heating, water heating, cooking, and drying onto the electric system. For the utility, the first-order question is how this switch will reshape electricity demand. Answering this question requires knowing what factors govern household energy use.

This part studies how much household and housing characteristics explain persistent electricity and natural gas use, combining the resident survey (appliance stock, demographics, and housing characteristics) with daily metered consumption (2022–2025) and a two-step estimator that removes weather and calendar effects to recover each household’s persistent (baseload) demand. Using the estimated coefficients, we project the electricity load that gas-to-electric conversion would add under alternative switching pathways.

18 Data and Empirical Approach

The analysis links five household-level data sources for Los Alamos County, New Mexico. LADPU provides daily smart-meter records of electricity and natural gas consumption, observed from January 2022 through June 2025. These are merged with the resident survey (appliance stock, housing characteristics, and demographics), property records scraped from online real-estate platforms (home size, age, structure), PRISM gridded daily weather, and vehicle-registration and Census benchmarks. After trimming physically implausible reads, the estimation panel covers about 580 surveyed households for electricity, of which 562 also have a gas meter, with roughly 1,080 daily observations per household. The full data description and weather summary are in Appendix D.2, and expanded descriptive statistics in Appendix D.5.

Because the characteristics of interest (home structure, appliance stock, and demographics) are fixed over the study period, a conventional household fixed-effects regression cannot recover their association with consumption, since the fixed effect absorbs everything time-invariant. We therefore use the two-step fixed-effects-filtered (FEF) estimator of Pesaran and Zhou (2018), run separately for each fuel. Step 1 regresses daily consumption on a flexible temperature response (interacted with each home’s primary heating fuel), other weather controls, and calendar effects, then removes them to recover each household’s persistent (baseload) consumption. Step 2 then regresses that persistent component on housing structure, appliance portfolio, and demographic characteristics, in a progression of nested models (M1–M3). The estimator, the

Step 1 specification and equations, and the temperature-binning approach are detailed in Appendix D.3.

19 Results

The household characteristics that explain persistent consumption differ sharply by energy carrier. Step 1 strips weather and calendar variation from daily consumption. The residual is a household's stable demand level, and what explains it depends on whether the carrier is electricity or natural gas. Electricity baseload is shaped by household characteristics. Appliances, housing structure, tenure, and time-at-home behaviors each leave a detectable mark. Natural gas baseload is shaped by the physical characteristics of the home. The pattern is not an artifact of how weather is modeled. It survives all six Step 1 specifications.

The Step 1 filter itself reveals a first asymmetry. Weather and calendar variation account for 63.5% of the daily variation in a household's natural gas use but only 9.3% for electricity. Daily natural gas use is therefore tightly governed by thermal conditions and seasonal timing, whereas electricity use contains a much larger non-weather component that reflects appliances, occupancy, and the number and type of electric devices in the home. Substantial household heterogeneity remains after filtering, which motivates the household-level decomposition below. The Step 1 temperature-response estimates, the remaining weather and calendar coefficients, and the distribution of the persistent component are reported in Appendix D.

Step 2 explains the household-level persistent component $\bar{u}_i$, defined as the average Step 1 residual for each household. The regressors fall into three groups, namely housing structure, appliance portfolio, and demographic covariates.

Table 7 reports the preferred specification (M3).⁸ It is estimated separately for electricity and natural gas. Each coefficient is a difference in average daily consumption after weather and calendar variation have been filtered out. The estimates are persistent-component associations and not causal effects on total consumption. The percentage columns express each coefficient as a share of mean daily consumption in the estimation sample.

Table 7: Persistent-Component Decomposition (Step 2)

	Electricity		Natural gas	
	Coef. (kWh/d)	% of mean	Coef. (therms/d)	% of mean
Panel A: Housing Characteristics				
Home size (1,000 Sqft)	4.897*** (0.736)	24.5%	0.683*** (0.073)	32.6%
Residence type (ref: single-family detached)				

continued on next page

⁸Appendix D.7 reports the full M1 through M3 progression.

Table 7 – continued

	Electricity		Natural gas	
	Coef. (kWh/d)	% of mean	Coef. (therms/d)	% of mean
Mobile/manufactured	-2.115* (1.089)	-10.6%	-0.099 (0.118)	-4.7%
Multi-family	-2.013 (1.659)	-10.0%	-0.043 (0.154)	-2.1%
Residence age (decades)	0.280 (0.258)	1.4%	0.048** (0.023)	2.3%
Stories	0.386 (0.829)	1.9%	-0.157* (0.085)	-7.5%
Rooftop solar	-3.723** (1.489)	-18.6%	-0.219* (0.122)	-10.5%
Panel B: Appliance Portfolio & Usage				
Electric primary cooking [†]	1.471* (0.893)	7.3%	-0.061 (0.082)	-2.9%
Electric primary water heating [†]	4.278** (1.718)	21.4%	-0.249 (0.155)	-11.9%
Electric clothes dryer [†]	1.428 (0.969)	7.1%	-0.157* (0.089)	-7.5%
Clothes dryer use (times/week)	1.587*** (0.282)	7.9%	0.065*** (0.024)	3.1%
Primary heating appliance age (yrs)	0.007 (0.057)	0.0%	0.015*** (0.005)	0.7%
Panel C: Demographics & Occupancy				
High income (\$100k+)	1.709* (1.056)	8.5%	0.123 (0.106)	5.9%
Graduate degree	-1.098 (0.860)	-5.5%	-0.019 (0.077)	-0.9%
Works from home	0.970 (1.037)	4.8%	-0.131 (0.090)	-6.3%
Respondent age	-0.068* (0.038)	-0.3%	0.003 (0.004)	0.1%
Renter	-4.587*** (1.539)	-23.0%	-0.417* (0.246)	-19.9%
Retired	3.306*** (1.261)	16.5%	-0.027 (0.124)	-1.3%
Intercept	4.920 (3.326)	—	1.081 (0.297)	—
Observations	418		406	
R ²	0.328		0.440	
Adjusted R ²	0.300		0.415	
Mean daily load	20.030 kWh/d		2.094 therms/d	

Notes: Pesaran-Zhou (2018) estimator standard errors in parentheses. The “% of mean” column expresses each coefficient as a share of the observed mean daily consumption (20.030 kWh/d for electricity, 2.094 therms/d for gas). Estimation sample is restricted to households heating with electricity or NG. Primary heating fuel enters Step 1 as an interaction. It is excluded from Step 2 since heating demand is mainly weather-driven. [†]Binary indicators with the reference category being natural gas appliances. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The main result is that persistent natural gas consumption is mainly tied to housing structure, while persistent electricity consumption is explained by a wider set of household characteristics. Panel A shows that home size is the largest predictor for both energy carriers. An additional 1,000 square feet is associated with 4.90 kWh/day higher electricity use and 0.68 therms/day higher gas use. Relative to mean consumption, the association is larger for gas, at 32.6% compared with 24.5% for electricity. Residence age and number of stories are also statistically significant only for natural gas. This pattern is consistent with gas use being tied to the home’s thermal characteristics. Rooftop solar is associated with lower consumption of both energy carriers. The electricity result is expected because solar generation reduces metered grid

use. The negative natural gas association should not be interpreted as a direct effect of solar panels on gas consumption. It likely reflects unobserved differences between solar and non-solar households, such as conservation preferences, efficiency investments, or other home upgrades. Appliance fuel matters more clearly for electricity.

The appliance-fuel indicators in Panel B use natural gas as the reference category for each type of end use (i.e., cooking, water heating, and clothes drying). This allows the same appliance contrast to be read across electricity and natural gas consumption. For cooking, electric appliances are associated with higher electricity use, about 7.3% of mean electricity consumption, and lower natural gas use, about 2.9% of mean gas consumption. The signs are consistent with fuel substitution, though only the electricity-side estimate is statistically significant at conventional levels. Electric dryers are associated with 7.5% lower natural gas use and 7.1% higher electricity use, the former significant. Electric water heating is associated with 21.4% higher electricity use, while the natural gas estimate is negative but imprecise.

Panel C shows that demographic and tenure covariates matter mainly for electricity. Retired households and higher-income households consume more electricity, while older respondents consume less. Renter status is negative for both energy carriers. Because the model already controls for housing structure and primary appliance fuel, this coefficient likely proxies for unobserved energy-related capital such as appliance efficiency, insulation, window quality, or heating-system maintenance. For natural gas, most demographic coefficients are small and statistically insignificant.

The Step 2 estimates reinforce the contrast from Step 1. Natural gas consumption is more tightly linked to weather in the daily panel and more tightly linked to housing and heating-related characteristics in the household-level regression. Electricity consumption is different. After weather and calendar variation are removed, its persistent component is associated with a wider set of margins (e.g., home size, appliance fuel, rooftop solar, tenure, and some demographic characteristics). Persistent natural gas consumption is mainly a building and heating-stock outcome, while persistent electricity consumption is distributed across the building, appliances, and household routines. Robustness checks, covering re-estimation of the decomposition under alternative temperature-response filters, verification of specification stability across the progressive models, and confirmation of the absence of multicollinearity, are reported in Appendix D.13.

20 Electricity Load Projection under Various Switching Scenarios

This section translates the household-level estimates from the preceding parts into a utility-scale projection of residential electricity load through 2070, the horizon of LADPU's gas-elimination goal. It combines the household characteristic estimates, the stated switching intentions of

the resident survey (Part I), and the solar-rebound estimates of Part III. The projection can be reproduced in the fully interactive workbook ([LADPU_load_projection_tool.xlsx](#)) in which the milestones, willingness ceilings, appliance lifetimes, solar path, and growth rate are editable inputs.

20.1 Projection methodology

We use the 8,646 residential meters' real 2024 monthly electricity and gas use to aggregate the baseline load profile with about 62,400 MWh of electricity and 5.76 million therms of gas, of which 6,906 homes heat with gas. Electrifying a gas end-use in a home adds the Part-IV per-home electricity effect, a weather-weighted space-heating load concentrated in winter plus flat appliance increments for water heating, cooking, and clothes drying, and removes that home's actual gas for that end-use, so a fully converted home's gas use falls to zero. Each scenario detailed below specifies how fast homes convert each end-use, and both the baseline and the conversions grow with the housing stock at 0.4% per year. Bands are 95% confidence intervals propagated from the regression standard errors. The full construction, covering the actual-2024 per-home baseline, the machine-learning inference of each home's appliance fuels, the gas apportionment, and the conversion arithmetic, is detailed in [Appendix D.14](#).

20.2 Scenarios

We project the annual electricity load and natural gas demand change under three scenarios. Scenario 1 (S1) is a top-down planning path built to achieve the 2070 zero-natural gas goal. Scenarios 2a and 2b are bottom-up scenarios based on the survey responses we gathered. [Table 8](#) summarizes the assumptions of each scenario, and the paragraphs below detail each.

S1: Top-down (the 2070 goal). S1 is backward-induced from LADPU's target and answers a planning question: if the utility eliminates residential gas by 2070, what load must it serve along the way? Each converting home goes all-electric at once, with space heating, water heating, cooking, and drying together, and the share of gas homes fully converted rises on fixed decadal milestones (10% by 2030, 30% by 2040, 50% by 2050, 75% by 2060, 100% by 2070), interpolated linearly between them. The pace is imposed, not behavioral. S1 deliberately sets willingness aside to trace the demand consistent with hitting the goal on schedule. By construction it ends gas service in 2070.

S2a: Bottom-up, stated intentions only. S2a replaces the forced schedule with what households told us they will do, and converts each appliance independently rather than whole homes. Only the willing switch, at the "very likely to switch" shares from the survey (48% of gas space

Table 8: Switching-scenario assumptions

Scenario	Conversion rule	Households that switch, and timing	Elec. 2070	Gas 2070
S1: Top-down	Whole-home switch on a schedule set by the 2070 goal.	Every gas home, paced to decadal milestones: 10/30/50/75/100% all-electric by 2030/40/50/60/70.	100%	0%
S2a: Stated only	Per-appliance; only survey-willing homes ever switch.	Willing households switch on the survey's stated timing (saturating ~2034); the 74% with no plan never switch. Willing ceilings: space heating 48%, water heater 60%, range 42%, dryer 19%.	48%	60%
S2b: Replace-on-burnout	Per-appliance; same as S2a and the reluctant majority switch at equipment end-of-life.	Willing on the stated timing; the rest replace gas with electric at one over the appliance lifetime per year. Lifetimes (year): space heating 18, water heater 12, range 15, dryer 13.	96%	4%

Notes: “% elec.” is the share of gas homes that have electrified space heating in 2070, and “Gas left” is the share of 2024 residential gas still consumed in 2070 (grown with the housing stock). Willing ceilings and stated timing are from the resident survey (Part I), and appliance lifetimes are standard engineering values. All parameters are editable in the delivered workbook. The table reports only the 2070 endpoints; the full decadal trajectories under each scenario are reported in Table 9 and Figures 15 and 16.

heating, 60% of water heating, 42% of ranges, and 19% of dryers), and they convert on the survey's stated timing, which fills the willing pool over roughly a decade (saturating near 2034). The 74% who report no plan to switch never do. Adoption therefore plateaus at each appliance's willing ceiling, leaving about 60% of 2024 gas use still flowing in 2070. S2a is the lower, “intentions-only” bound on voluntary adoption.

S2b: Bottom-up, replace-on-burnout. S2b keeps S2a's willing adopters but adds the mechanism most likely to electrify the reluctant majority, namely equipment turnover. A household that would never scrap a working furnace will still face a choice when it fails, and S2b assumes that at replacement the gas unit is swapped for electric. Reluctant homes therefore convert each appliance at a rate of one over its expected lifetime per year (space heating 18 years, water heating 12, ranges 15, dryers 13). This drives electrification to about 96% of gas homes by 2070, close to the goal, without anyone replacing equipment early. S2b is the “natural replacement” path, the outcome if electric simply becomes the default at end-of-life.

20.3 Projected Load Growth

Figure 15 and Table 9 report the trajectories. Meeting the 2070 goal (S1) raises residential load from about 62,400 MWh in 2024 to roughly 100,600 MWh in 2070 (95% CI 97,300–103,800),

a 61% increase. About 20 percentage points of that is housing growth alone, and the remaining 41 points, some 25,500 MWh, is the electrification add-on. The bottom-up paths fall short of the goal by differing margins. Under stated intentions alone (S2a), adoption plateaus once the willing households convert. About 48% of gas homes electrify space heating, roughly 60% of 2024 gas use is still burning in 2070, and load reaches only about 88,300 MWh. Allowing the reluctant majority to switch at equipment failure (S2b) lifts electrification to about 96% of gas homes by 2070 and load to about 100,000 MWh, close to the goal, but reached through organic turnover rather than on the milestone schedule. Both bottom-up paths rise faster than S1 in the near term because the 2070 milestones are back-loaded (only 10% by 2030), whereas willing and replacement-driven adoption begin immediately. S1 overtakes them only as it accelerates toward full conversion after 2050. The gap between the goal and stated intentions, about 12,300 MWh in 2070, with the majority of gas use still unconverted, is the willingness–action gap of Parts I–II expressed in load terms.

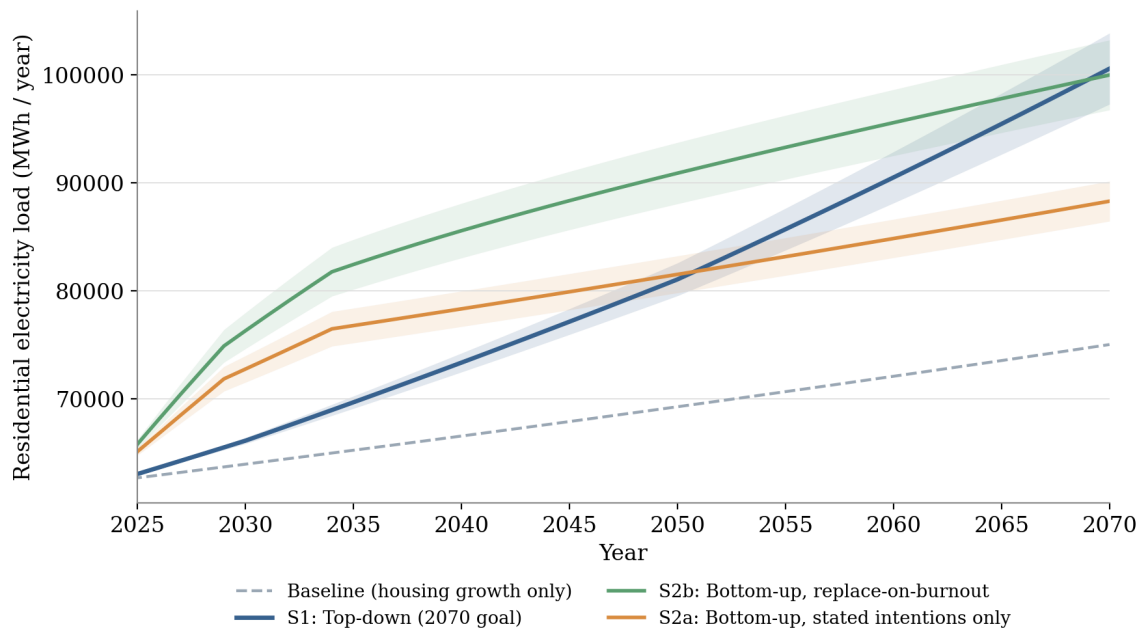


Figure 15: Projected residential electricity load by switching scenario, 2024–2070

Notes: Annual residential electricity load (MWh) for Los Alamos under the top-down 2070-goal path (S1), the bottom-up survey paths (S2a stated-intentions-only, S2b replace-on-burnout), and the baseline of housing growth alone, anchored to actual 2024 metered consumption. Each scenario path carries a shaded 95% confidence interval propagated from the Part-IV coefficient standard errors. The effect of rooftop solar on grid load is shown separately in Figure 18.

Table 9: Residential electricity-load projections by switching scenario

Scenario	Total electricity load (MWh/yr)				In 2070	
	2030	2040	2050	2070	% elec.	Gas left
Baseline (growth only)	63,949	66,553	69,264	75,021	0%	100%
S1: Top-down	66,126	73,350	81,054	100,560	100%	0%
95% CI, 2070				[97,273, 103,848]		
S2a: Stated only	72,756	78,326	81,516	88,291	48%	60%
S2b: Replace-on-burnout	76,304	85,561	90,887	99,974	96%	4%

Notes: Total residential electricity load (MWh/year) at decadal milestones, anchored to actual 2024 metered consumption. “% elec.” is the share of gas homes that have electrified space heating and “Gas left” the share of 2024 residential gas still consumed (which grows with the housing stock), both in 2070. The 95% CI propagates the Part-IV coefficient standard errors. The net grid load after the rooftop-solar overlay is reported separately in Table 10. Reproduced by the delivered standalone workbook LADPU_load_projection_tool.xlsx.

The mirror image of that load growth is the decline in gas use (Figure 16). Under S1, residential gas falls from 5.76 million therms in 2024 to zero in 2070 by construction. Under stated intentions (S2a) it falls only to about 3.4 million therms, roughly 60% of today’s use, and plateaus there once the willing pool is exhausted. Replace-on-burnout (S2b) drives gas down to about 0.2 million therms (4%) by 2070 through equipment turnover alone. The vertical distance between S1 and S2a is the same willingness–action gap, now measured in unburned gas rather than added electricity.

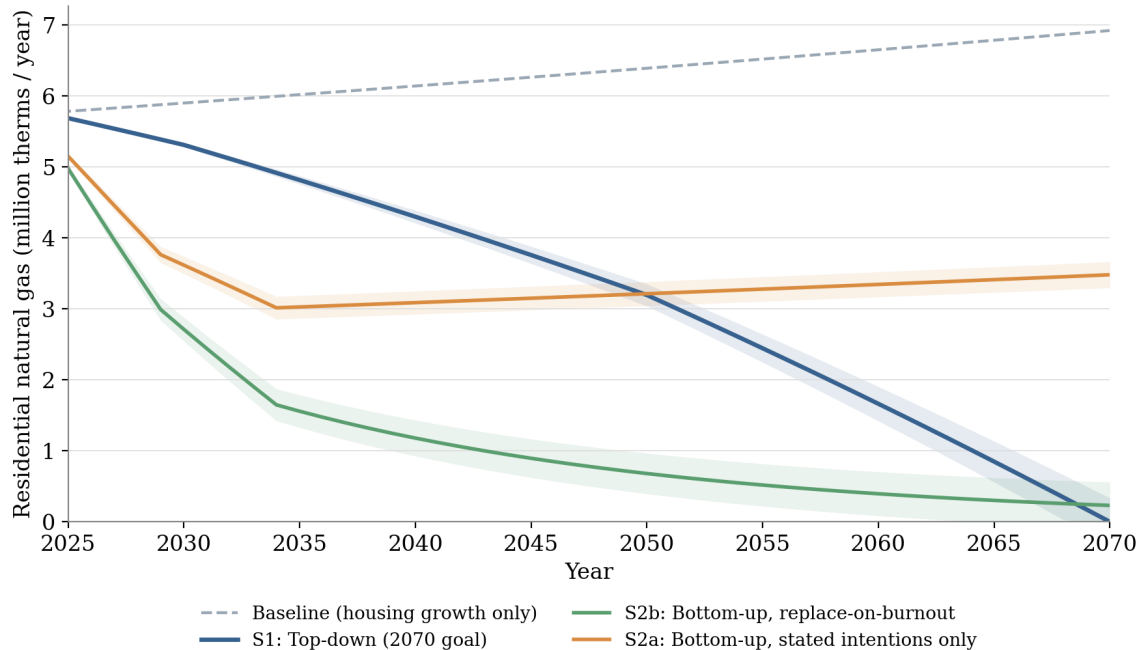


Figure 16: Projected residential natural gas consumption by switching scenario, 2024–2070

Notes: Annual residential natural gas use (million therms) under each scenario, anchored to actual 2024 metered consumption. S1 eliminates gas by 2070 by construction. S2a plateaus as the survey-willing pool is exhausted, leaving about 60% of today’s gas, while S2b approaches zero through equipment turnover. The baseline rises with the housing stock. Shaded bands are 95% confidence intervals constructed exactly as for the load projection, propagated from the gas-coefficient standard errors and clipped at zero, so S1’s band is one-sided as the central path reaches zero. Rooftop solar also reduces gas. Part III estimates a statistically significant spring reduction (–0.948 MMBtu/month, –13.85%, with the annual average smaller and not significant). The projection applies this as a small solar-gas overlay, scaled by the gas a home still uses so it does not double-count electrified homes. It lowers remaining gas by about 1% and is reported separately (“gas net of solar”) in the delivered workbook.

20.4 Seasonal Pattern

Because electric space heating concentrates the added load in winter, the seasonal peak grows faster than the annual total. January load, the monthly proxy for the winter peak, rises from about 5,900 MWh in 2024 to about 10,300 MWh in 2070 under S1, a 74% increase that far outpaces the 61% growth in annual energy. Figure 17 shows the reshaping directly. Today’s mild seasonal profile gives way, under full electrification, to a pronounced winter peak. Sizing distribution capacity to that winter peak, rather than to annual energy, is therefore the binding planning constraint.

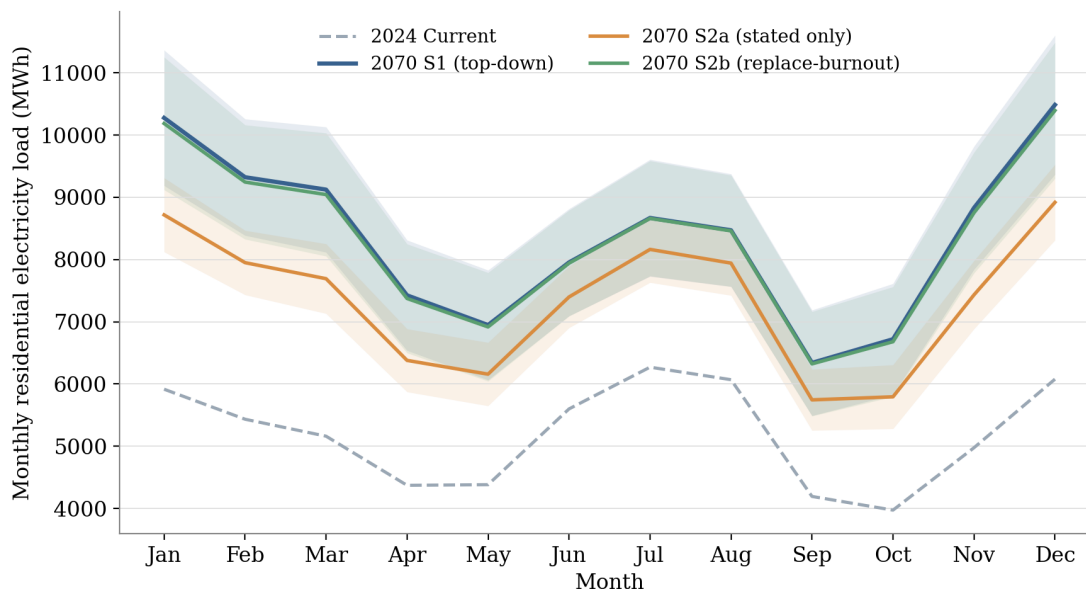


Figure 17: Monthly residential electricity load shape, 2024 versus 2070 by scenario

Notes: Monthly residential electricity load (MWh) for actual 2024 and for 2070 under each electrification scenario, with shaded 95% confidence intervals on the 2070 paths (the 2024 line is metered actuals). Electrifying space heating concentrates the new load in the winter months, turning today's mild seasonal profile into a pronounced winter peak, while the shoulder and summer months rise far less.

20.5 Rooftop Solar

Rooftop solar lowers the load LADPU must serve but does not close the electrification gap. Growing solar to 40% of homes by 2050 trims the S1 2070 grid load from about 100,600 to about 95,900 MWh, a reduction of roughly 4,700 MWh (about 5%). The offset is modest both because solar reaches a minority of homes and because, as Part III shows, the rebound returns part of the would-be grid reduction to consumption, so each adopter's measured grid saving is already net of an 18.8% rise in total use. Solar also trims gas. Part III finds a statistically significant spring reduction (about -14% of spring gas, though the annual average is not significant), which the projection carries through as a roughly 1% further cut in whatever gas remains under each scenario. Figure 18 shows the top-down path with and without solar for each fuel, Table 10 reports the net grid load for all three scenarios, and the bottom-up panels are in Appendix D.14. Solar is a useful but partial hedge against the new winter load, and compensation that rewards self-consumption and load-shifting would raise its value to the grid.

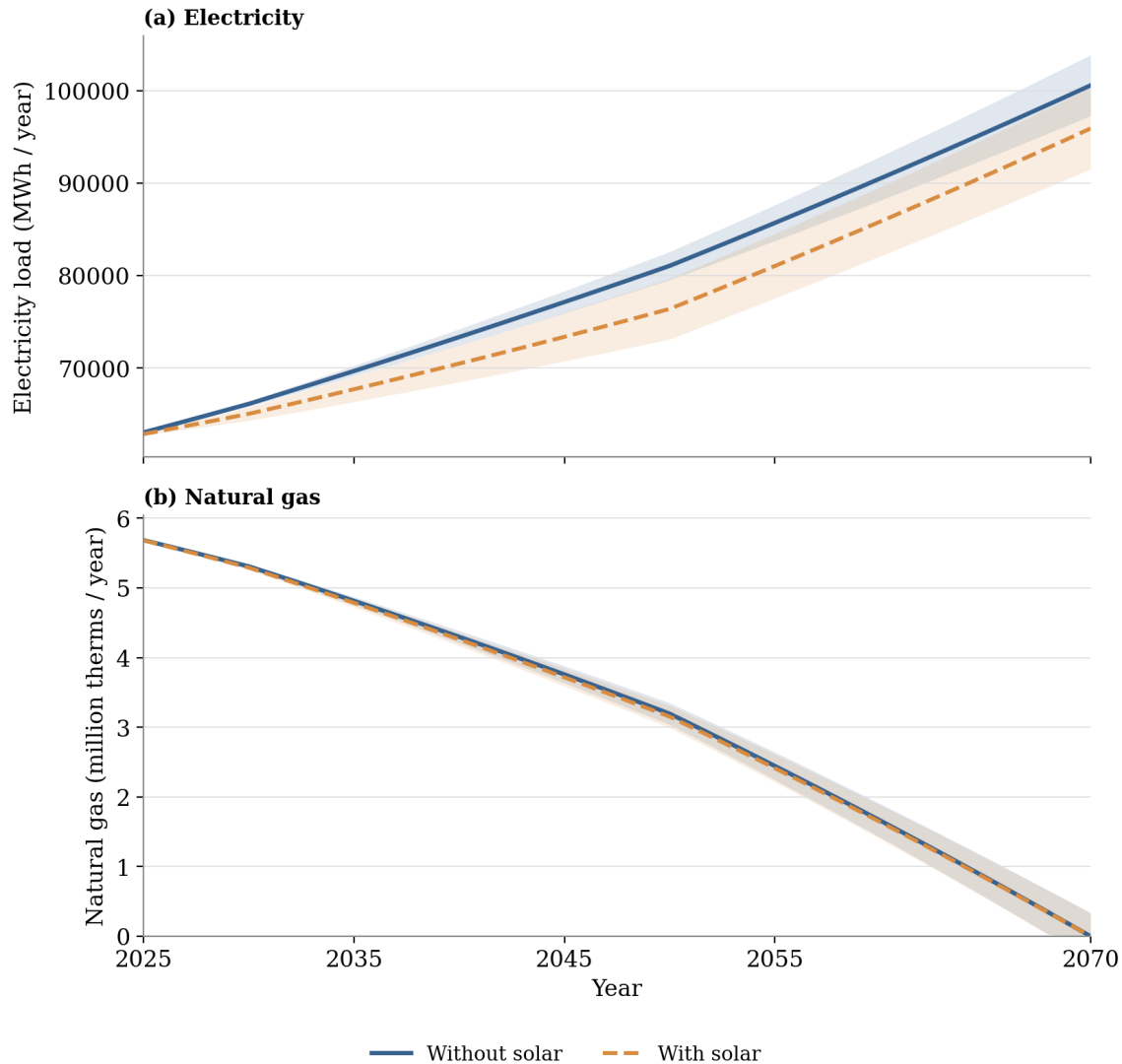


Figure 18: Rooftop solar’s effect on projected residential electricity and gas under S1, 2024–2070

Notes: The top-down scenario (S1) with and without the rooftop-solar overlay (growing to 40% of homes by 2050), with 95% confidence intervals on both paths. In Panel (a), solar lowers the electricity grid load LADPU must serve by the Part-III grid ATT (–131 kWh per month per adopting home), about 4,700 MWh (5%) by 2070. In Panel (b), because S1 eliminates residential gas by 2070, little gas remains for solar to displace, so the with- and without-solar gas paths nearly coincide. The corresponding panels for the bottom-up scenarios (S2a, S2b), where gas persists, are in Appendix D.14 (Figure D.9).

Table 10: Residential electricity-load projections net of rooftop solar

Scenario	Net grid load (MWh/yr)				Solar saving, 2070
	2030	2040	2050	2070	
S1: Top-down	65,051	70,483	76,394	95,901	4,659 (4.6%)
S2a: Stated only	71,680	75,458	76,856	83,632	4,659 (5.3%)
S2b: Replace-on-burnout	75,229	82,694	86,227	95,314	4,660 (4.7%)

Notes: Net grid load (MWh/year) after the rooftop-solar overlay, for the three switching scenarios. Gross loads are in Table 9. Solar grows to 40% of homes by 2050 and reduces grid purchases by the Part-III grid ATT (–131 kWh per month per adopting home). Because the solar path is the same across scenarios, the 2070 saving is nearly identical in level (about 4,700 MWh) and differs in percentage only with each scenario’s total load. Reproduced by the delivered standalone workbook `LADPU_load_projection_tool.xlsx`.

21 Discussion

21.1 Key Findings and Interpretation

This part combines two analyses. The first decomposes what drives persistent household energy use. Persistent natural gas consumption is concentrated in the building envelope, with home size, age, and number of stories its main predictors, whereas persistent electricity consumption is spread across a wider set of margins, namely appliances, structure, tenure, and demographics. Weather and the calendar explain 63.5% of the daily variation in gas use but only 9.3% for electricity, so once weather is removed gas baseload is a building-stock outcome while electricity baseload reflects the household. The levers therefore differ by fuel. Envelope measures such as insulation, sealing, and windows are the primary instrument for reducing gas, while appliances, efficiency, and behavior are what move electricity.

The second analysis carries these household relationships, the survey’s stated switching intentions, and the solar rebound effect we identified into a utility-scale load projection to 2070. Meeting LADPU’s gas-elimination goal (S1) raises residential electricity load by about 61%, from roughly 62,400 to 100,600 MWh, of which about 20 percentage points is housing growth and the remainder the electrification add-on. The seasonal reshaping is sharper than the annual total, because electrifying space heating concentrates the new load in winter. The January peak rises about 74%, so distribution capacity sized to the winter peak rather than to annual energy is the binding constraint. The bottom-up paths express the willingness–action gap in load terms. Stated intentions alone (S2a) leave about 60% of today’s gas still burning in 2070 and fall roughly 12,300 MWh short of the goal, whereas allowing the reluctant majority to convert at equipment failure (S2b) reaches about 96% electrification through turnover alone. Rooftop solar trims the grid load by about 5% but does not close the gap.

21.2 Comparison to Existing Literature

Our household-level decomposition is the consumption-side counterpart to the literature on household fuel choice and appliance adoption, which has emphasized why households switch more than what governs their use once the stock is fixed. That work finds adoption shaped by income, infrastructure, and social context (Alem et al., 2016; Edwards et al., 2024; Lane et al., 2024), with Lane et al. (2024) finding hassle and reliability concerns to outweigh equipment cost. Our estimates add that, conditional on the existing stock, gas use is governed by the building and electricity by the household, which is why a given retrofit changes the two fuels by different amounts.

The load projection connects to work on the grid consequences of electrification. Studies of heat-pump uptake and feeder limits show that electrification concentrates new load where hosting capacity is already strained (Brockway et al., 2021; Edwards et al., 2024), and techno-economic analyses warn that under high volumetric rates a retrofit can raise winter bills (Borenstein et al., 2022). Our metered, winter-peaked 74% growth in the seasonal maximum is the local analogue of those concerns, and it quantifies a gap the adoption literature describes qualitatively, namely that stated intent falls well short of the conversion a public target requires, so the binding question for planners is the pace of replacement rather than willingness.

The contrast between a goal-driven and a turnover-driven path also speaks to the equity literature on transition sequencing. Distributional analyses warn that if higher-income homes electrify first, the fixed costs of the legacy gas system fall on a shrinking, lower-income remainder (L. Davis and C. Hausman, 2022; Hill, 2025; Waite and Modi, 2020). Because our bottom-up paths electrify the willing first and the reluctant only at burnout, they trace the ordering those studies flag, which is why the drawdown of gas infrastructure and the protection of remaining customers, taken up in Part V, are part of a credible pathway.

21.3 Limitations

The two findings are robust to the checks we run, but several features of the data and method bound their interpretation. First, the household-level estimates are conditional associations rather than causal effects. They locate where persistent consumption differences sit, in the building stock for gas and across a broader set of margins for electricity, but they do not identify the effect of changing any single characteristic.

Second, the projection is monthly, so it bounds winter energy rather than the hourly megawatt peak that ultimately drives distribution upgrades, and a full hourly peak analysis is left for future work. Relatedly, the household demand model contains no price term. LADPU's residential tariff is a flat volumetric rate plus a fixed service charge, identical for every residential customer at any point in time, so there is no cross-household variation in marginal or average price with

which to identify a price response, and the common month-to-month rate changes are absorbed by the Step 1 calendar effects. A demand elasticity could be identified only from tariff variation the setting does not provide, such as the increasing block rates used in municipal water-demand studies.

Third, the solar-rebound effect carried into the projection was estimated on today's largely gas-heated stock, so its application to future all-electric homes is an approximation. Finally, the confidence bands propagate only the regression estimation uncertainty and treat the end-use coefficients as independent. They do not capture the larger uncertainty in the pace of adoption, which the scenarios are designed to bracket rather than to estimate.

Part V

Synthesis and Policy Recommendations

22 From Analysis to a Transition Roadmap

The four part analyses point to a sequence of steps for LADPU to transition away from natural gas use under the current policy goal. The transition will be voluntary and gradual, and what governs it is the cost and friction of replacing working gas equipment more than households' awareness or attitudes. The survey and choice experiment show that customers weigh efficiency and bill savings far above emissions and that most are not planning to switch (Figure 4 and Table 4). The metered-consumption analyses describe how the transition will impact the grid, namely a winter-peaked rise in electricity demand (Figure 17) and a solar rebound that limits the reduction of grid electricity demand (Figure 14). The implications below are organized by horizon, from the near-term measures that lower the cost of switching to the long-run planning the new load will require.

22.1 Near-term steps to lower the cost of switching

The barriers customers name are financial and infrastructural, not informational. The most common is the upfront installation cost, cited by about three-quarters of households, followed by concern about higher ongoing bills and grid reliability (each about two-thirds) and insufficient electrical-panel capacity (about half) (Figure 3). Each of these has a corresponding lever. Upfront cost is what federal and state rebates and low-interest financing are designed to offset. The concern about higher bills is met by the efficiency of modern heat pumps and by rate design. The panel constraint is a one-time upgrade that incentives and streamlined permitting can cover. The reliability concern is largely a perception of older electric equipment, which targeted information and the utility's own grid investment can address. The steps below take these barriers in turn, starting with the ones that bind for the most households.

Outreach that highlights bill savings and performance might work better than one that focuses on climate benefits. Households weigh efficiency, comfort, and bill savings above emissions, and an informational message about the climate and health effects of gas moved willingness to pay very little (Table B.1). Modern heat pumps deliver two to three times the efficiency of a gas furnace, add summer cooling, and can lower or stabilize bills where the rate structure supports it. Climate and air-quality benefits are real and worth stating, but the evidence suggests they work better in support of that case than as the lead, since the pro-environmental minority adopts early in any event while the cost-focused majority responds to savings.

The largest near-term barrier is the cost and hassle of getting homes physically ready. About

three-quarters of homes would need a 200-amp electrical-panel upgrade, typically \$2,000–\$5,000, before they could run electric heating, water heating, and cooking together, and the choice experiment implies that roughly \$800–\$1,000 per year in lower bills or incentives, or support that directly covers the panel, is about what it takes to move a panel-needing household (Table 4). Streamlining permitting for panel upgrades and appliance swaps, helping households become aware of the federal and state incentives already available, and offering infrastructure loans to financially constrained households could each lower that cost and friction.

Programs that target fuel switching when appliances reach the end of their life are likely to be the most effective. Switching is cheapest at equipment failure, when a household faces only the incremental cost of going electric rather than the cost of scrapping a working appliance. About a third of primary heating systems in the sample are already at least twenty years old (Appendix A.4), and the projection shows that conversion at natural replacement alone would electrify most homes over the coming decades (Table 9). Reaching households at that moment, with a ready electric option and incentives lined up, is where near-term effort pays off most. Solar adopters are a natural place to start, since they are more likely to have already electrified heating and water heating (Yang and Mamkhezri, 2026), so bundling outreach or a panel upgrade with a solar installation concentrates effort where uptake is most likely.

22.2 Medium-term steps to target and sequence conversions

As the transition broadens, focusing first on the homes that use the most gas could deliver the largest reductions. What governs persistent consumption differs sharply between the two fuels. Persistent gas use is concentrated in the building envelope, in larger, older, multi-story homes, while persistent electricity use is spread across appliances, occupancy, and household characteristics (Table 7). The homes that burn the most gas today are therefore both the largest source of gas reductions and the largest future electric load once they convert, and they can be identified directly from meter and property records. Weatherizing those homes before they electrify would lower both their current gas use and the load they later add. The utility can coordinate its electrification outreach with the county and state programs that can would capture that envelope-first benefit for the grid as well as the household.

Concentrating on space and water heating, rather than spreading effort across all appliances, could do more for both the goal and the grid. These two end uses remain almost entirely gas and account for most of both the gas use and the new electric load (Appendix A.4), and they are also among the appliances households are most willing to switch (Figure 4). Clothes drying is already largely electric. Cooking is the harder case. A substantial share of households prefer gas cooking, and although measures like LADPU’s induction-cooktop rental program help them try the electric alternative, cooking is unlikely to be a first-order source of gas reductions or new load.

Solar compensation structure is the medium-run lever most under the utility's control. Rooftop solar lowers a household's grid purchases but raises its total energy use, offsetting roughly three-quarters of the carbon reduction it would otherwise deliver (Figure 14), and the rate structure shapes when households consume. The effect matters most in winter, where the new electric load and the solar rebound fall in the same hours. Electrification raises the January peak by about 74% (Figure 17), and the solar rebound is largest in winter and extends into the evening, after the panels stop generating (Figures 11 and 13). Both push load increases into the winter evening hours, when rooftop solar provides no offset. Rate structure that rewards self-consumption and load-shifting, through time-varying export and retail prices and support for on-site storage that moves midday solar toward the evening, would raise solar's grid value rather than simply maximizing exports.

22.3 Long-run steps to plan for load and affordability

The transition's largest long-run consequence is the load it adds. Meeting the 2070 goal would raise annual residential electricity use by about 61% and the winter peak by about 74%, so distribution capacity sized to the winter peak, not to annual energy, becomes the binding planning constraint (Table 9 and Figure 17). The load projection, under the goal-driven, stated-intention, and replacement-driven paths, gives the utility a range to plan against, and it can be revisited as adoption unfolds. The rebound belongs in those forecasts as well, since solar adopters reduce their grid purchases by less than their panels generate, so treating solar generation as a one-for-one reduction in grid load would overstate the relief it provides (Table 6).

Building affordability and equity into the program design could keep the transition's costs from falling on the households least able to bear them. A bill increase of \$50–\$100 per month would impose hardship on a majority of households (Table 1), and if higher-income homes electrify first, the fixed costs of the legacy gas system fall on a shrinking, lower-income set of remaining customers. Planning the drawdown of the gas system in step with conversions, and attending to who is left on it, belongs in the transition plan from the start rather than at the end. The most direct counter to that dynamic is to aim subsidy at the constraint that binds hardest for lower-income households, namely the one-time cost of getting the home electric-ready. Income-qualified support for electrical-panel upgrades and pre-wiring, of the kind New Mexico's Home Energy Rebate program now reserves for households below 80% of area median income, would move the households least able to pay the \$2,000–\$5,000 upgrade cost into the electrification pool early, rather than leaving them to carry the fixed costs of a shrinking gas system at the end.

23 Conclusion

Los Alamos County has set out to eliminate natural gas service by 2070. For the residential sector, that means converting the county's homes to all-electric heating, water heating, and cooking over the coming decades, largely through the voluntary decisions of individual households. This report finds the goal feasible on a natural-replacement timeline but well out of reach on stated intent alone. What households say about switching runs far ahead of what they do, and the binding constraint is the cost and friction of replacing working gas equipment rather than awareness or attitudes. The switch will also reshape the electric system, raising annual residential load by about 61% and the winter peak more steeply still, while rooftop solar offsets only a modest share of that load and returns part of its carbon benefit to consumption through the rebound. Reaching the goal will therefore take coordinated action rather than any single lever. The utility can lower the cost and friction of switching and plan for the load it adds, but closing the gap will also depend on the federal and state incentives, financing, and weatherization programs that reach homes the utility cannot serve directly, and on managing the affordability of the transition so that its costs do not fall on the households least able to bear them.

List of Abbreviations

Abbreviation	Definition
ACS	American Community Survey
AIC	Akaike Information Criterion
ASC	Alternative-specific constant
ATT	Average treatment effect on the treated
BIC	Bayesian Information Criterion
CCF	Hundred cubic feet (natural gas volume)
CDD	Cooling degree days
CO ₂	Carbon dioxide
CV	Coefficient of variation
DCE	Discrete choice experiment
DiD	Difference-in-differences
EF	Emission factor
EV	Electric vehicle
FEF	Fixed-effects filtered (estimator)
HDD	Heating degree days
IRA	Inflation Reduction Act of 2022
KMO	Kaiser–Meyer–Olkin measure of sampling adequacy
kWh	Kilowatt-hour
LADPU	Los Alamos Department of Public Utilities
LANL	Los Alamos National Laboratory
LPG	Liquefied petroleum gas
MEF	Marginal emission factor
MMBtu	Million British thermal units
NEP	New Ecological Paradigm (environmental-attitude scale)
NSRDB	National Solar Radiation Database
OLS	Ordinary least squares
PHEV	Plug-in hybrid electric vehicle
PM _{2.5}	Fine particulate matter (diameter $\leq 2.5 \mu\text{m}$)
PNM	Public Service Company of New Mexico
PRISM	Parameter-elevation Regressions on Independent Slopes Model (climate data)
PV	Photovoltaic
PVGIS	Photovoltaic Geographical Information System
RMSE	Root mean squared error
SD	Standard deviation
SE	Standard error
SUTVA	Stable Unit Treatment Value Assumption
TWFE	Two-way fixed effects
VIF	Variance inflation factor
WTP	Willingness to pay

A Appendix to Part I: Resident Survey

This appendix collects the full descriptive detail behind Part I, namely respondent demographics and the representativeness analysis, billing preferences, housing characteristics, the detailed appliance stock, and the environmental-attitude items.

A.1 Respondent Demographics and Representativeness

Figure A.1 summarizes additional respondent and household characteristics. Among respondents who reported sex at birth, 64% identified as male, and White respondents accounted for 89% of the sample. About 80% live in homes at least 30 years old, and 15% have rooftop solar.

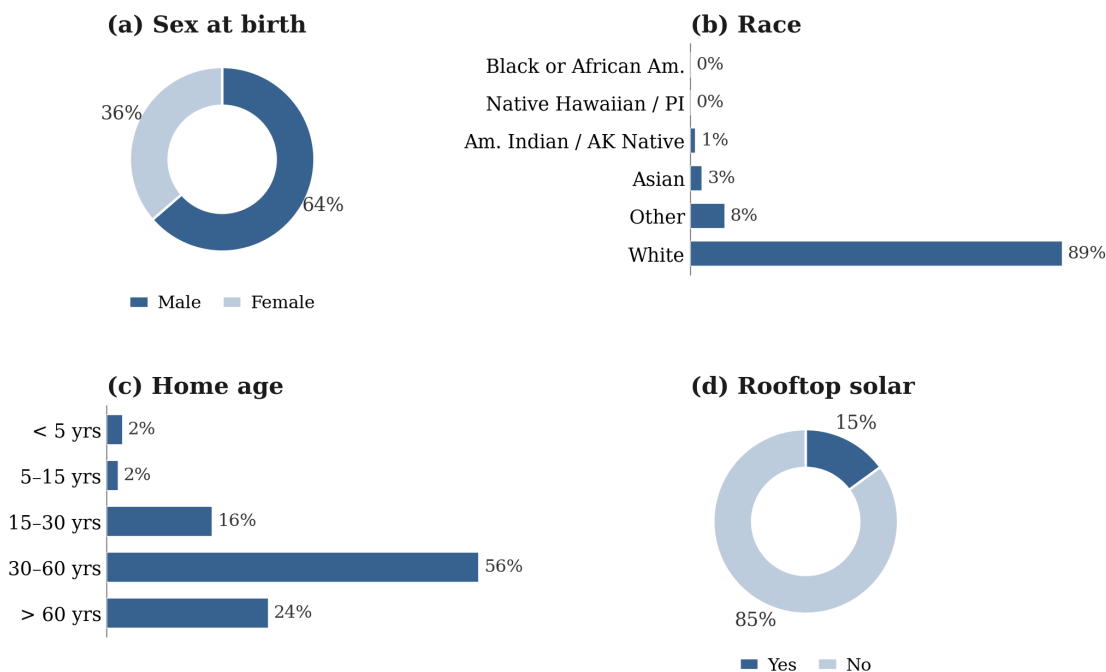


Figure A.1: Survey respondents: additional respondent and household characteristics

To check whether the survey respondents are representative of the broader LADPU customer base, we compare the sample to U.S. Census Bureau benchmarks for Los Alamos County (U.S. Census Bureau, 2023) and reweight it to match them. We apply a multi-stage post-stratification and raking procedure to generate respondent-specific weights (Battaglia et al., 2009; Kolenikov, 2014). Each weight begins at 1 (set to 0 when all key demographic variables are missing) and is iteratively adjusted so that the weighted sample matches county benchmarks on sex, Hispanic origin, housing tenure, and educational attainment, with an additional exponential-tilting step (Kim, 2010; Wu and Lu, 2016) that calibrates the resident age distribution. All weights are

bounded between 0 and 10.

Table A.1 compares the survey sample to the county census benchmarks before and after weighting. The unweighted sample over-represents older, more-educated, non-Hispanic homeowners, while the weighted shares match the census targets across sex, Hispanic origin, tenure, education, and age. Table A.2 summarizes the resulting weight distribution, which carries a design effect of 2.43 (a Kish effective sample size of 273).

Table A.1: Los Alamos County Demographics: Census Benchmark and Survey Sample

	Census benchmark	Survey (unweighted)	Survey (weighted)
% Male	51.6	64.0	51.6
% Hispanic or Latino	17.9	7.4	17.9
% Homeowner	77.5	95.3	77.5
% High school or higher	98.3	99.8	98.5
% Bachelor's degree or higher	68.2	86.2	68.2
<i>Resident age distribution (%)</i>			
Under 18	21.4	21.6	21.4
18 to 64	60.4	49.3	60.4
65 or older	18.2	29.1	18.2
Mean household income (\$)	143,728	146,400	137,717

Notes: Census benchmarks are U.S. Census Bureau (American Community Survey) estimates for Los Alamos County. Survey columns are response shares among respondents answering each item, before and after post-stratification weighting (Table A.2). The unweighted sample over-represents older, more-educated, non-Hispanic homeowners; the weighted shares match the census targets on the calibration margins. Household income is not a calibration margin and is shown for reference.

Table A.2: Survey Raking-Weight Distribution

Statistic	Value
Respondents with positive weight	663
Mean weight	1.00
Weight range (min–max)	0.12–10.00
Effective sample size (Kish)	273
Design effect	2.43

Notes: Weights are constructed by iterative proportional fitting (raking) on sex, Hispanic origin, housing tenure, and education (high-school-or-higher and bachelor's-or-higher), with an exponential-tilt calibration of the resident age distribution, and are bounded to $[0, 10]$. The Kish effective sample size is $(\sum w)^2 / \sum w^2$; the design effect is the ratio of nominal to effective N . The achieved calibration is shown in Table A.1.

Table A.3: Survey Summary Statistics for Demographic Variables

Variables	Mean	S.D.	Min	Max	N
Number of current residents in each of the following age categories					
0 to 17 years old	0.82	1.08	0	5	427
18 to 64 years old	1.53	0.92	0	5	524
65 years or older	0.93	0.93	0	5	509
Age of the survey respondent					
Age	58.3	16.99	18	120	650
Sex at birth					
Male	0.64	–	–	–	642
Female	0.36	–	–	–	642
Hispanic or Latino					
Yes/No	0.07	–	–	–	625
Race (Multi-select)					
White	0.88	–	–	–	623
Black or African American	0.00	–	–	–	623
American Indian or Alaska Native	0.01	–	–	–	623
Asian	0.02	–	–	–	623
Native Hawaiian or Pacific Islander	0.00	–	–	–	623
Other	0.08	–	–	–	623
Highest degree or level of school of the survey respondent					
Less than high school diploma or GED	0.00	–	–	–	653
High school diploma or GED	0.02	–	–	–	653
Some college or Associate's degree	0.12	–	–	–	653
Bachelor's degree	0.26	–	–	–	653
Master's, Professional, or Doctoral degree	0.60	–	–	–	653
Total combined income of all household members for the past year					
Less than \$20,000 per year	0.04	–	–	–	627
\$20,000 to \$34,999	0.02	–	–	–	637
\$35,000 to \$49,999	0.02	–	–	–	637
\$50,000 to \$64,999	0.03	–	–	–	637
\$65,000 to \$69,999	0.02	–	–	–	637
\$70,000 to \$84,999	0.04	–	–	–	637
\$85,000 to \$99,999	0.06	–	–	–	637
\$100,000 to \$149,999	0.23	–	–	–	637
\$150,000 to \$199,999	0.21	–	–	–	637
\$200,000 or more	0.34	–	–	–	637
Current employment status of the survey respondent					
Employed full-time	0.49	–	–	–	637
Employed part-time	0.04	–	–	–	637
Self-employed	0.04	–	–	–	637
Retired	0.40	–	–	–	637
Not employed	0.02	–	–	–	637
Other	0.02	–	–	–	637
Having residents work from home more than three days per week?					
Yes/No	0.28	–	–	–	637

Note: Standard deviation, minimum, and maximum values are not reported for dummy variables. The mean values can capture the spread in the dataset, while the minimum and maximum are always 0 and 1, respectively, and therefore omitted for brevity.

A.2 Billing Preferences

Most households still receive paper bills (73%), but the majority use electronic payment options, with 42% enrolled in autopay and 41% paying online. Only a small share pays by check (12%) or in person (4%). Customer-portal use is almost evenly split, and a small share (6%) is unaware the portal exists (Figure A.2).

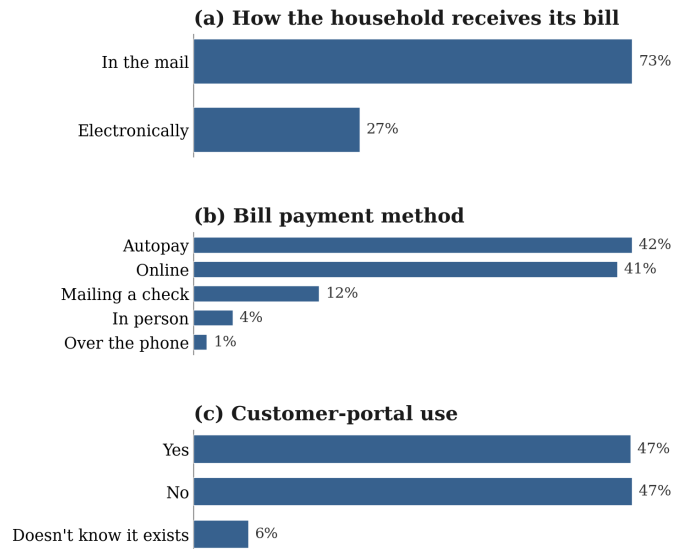


Figure A.2: Survey Respondents Billing Preferences

Table A.4: Survey Summary Statistics for Billing Variables

Variables	Mean	N
How does your household receive the monthly utility bill from LAC-DPU?		
Electronically	0.27	713
In the mail	0.73	713
How do you pay your utility bill?		
Autopay	0.42	712
In person	0.04	712
Mailing a check	0.12	712
Online (credit/debit/checking account)	0.41	712
Over the phone	0.01	712
Do you use the LAC-DPU customer portal to see your bill and usage?		
No	0.47	713
Yes	0.47	713
I do not know what this is	0.06	713
How often do you examine your utility usage in the LAC-DPU customer portal? (only recorded for the portal users.)		
Never	0.01	334
Sometimes (1 to 2 times per year)	0.22	334
Often (3 to 6 times per year)	0.22	334
Regularly (7 to 12 times per year)	0.55	334
Which of the following best explains why you do not track your utility usage in the LAC-DPU customer portal?		
I do not have an account in the customer portal	0.08	333
I prefer receiving utility information through traditional methods	0.43	333
I find the customer portal difficult to navigate or use	0.12	333
I don't see a need to track my utility usage online	0.20	333
I don't have reliable internet/computer access	0.01	333
I don't pay attention to how much my energy bill is	0.03	333
Other	0.14	333
Are you enrolled in the LAC-DPU Utilities Assistance Program?		
No	0.97	705
Yes	0.01	705
Not sure	0.01	705
Are you enrolled in the Budget Billing Program?		
No	0.93	708
Yes	0.05	708
Not sure	0.02	708

Note: Standard deviation, minimum, and maximum values are not reported for dummy variables. The mean values can capture the spread in the dataset, while the minimum and maximum are always 0 and 1, respectively, and therefore omitted for brevity.

A.3 Housing Characteristics

The majority of respondents are homeowners, and 82% live in single-family detached homes. More than half (56%) reside in homes built between 30 and 60 years ago. The most common sizes are 1,000–2,000 square feet (43%) and 2,000–3,000 square feet (36%) (Figure A.3). Home age and rooftop-solar adoption are shown in the main text (Figure 1).

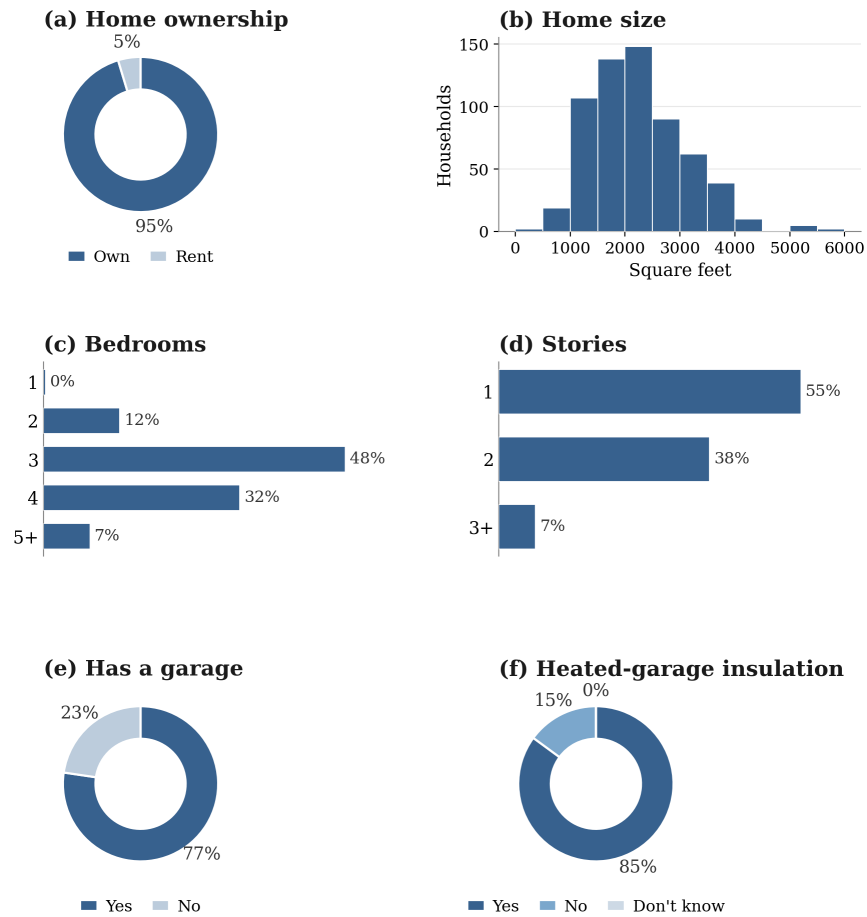


Figure A.3: Additional Housing Characteristics

Table A.5: Survey Summary Statistics for Residence Variables

Variables	Mean	S.D.	Min	Max	N
Type of Residence					
Single-family detached house	0.82	–	–	–	708
Single-family attached house	0.12	–	–	–	708
Apartment/condominium	0.04	–	–	–	708
Mobile home	0.02	–	–	–	708
Other	0.004	–	–	–	708
Do you own or rent your primary residence?					
Rent	0.05	–	–	–	642
Own	0.95	–	–	–	642
Is your utility bill included in your rent? (only recorded for renters).					
Yes/No	0.03	–	–	–	30
Approximately how old is your primary residence?					
Less than 5 years old	0.02	–	–	–	639
5 to 15 years old	0.02	–	–	–	639
15 to 30 years old	0.16	–	–	–	639
30 to 60 years old	0.56	–	–	–	639
Older than 60 years	0.24	–	–	–	639
What is the square footage of your home?					
Size	2175.50	875.81	0	6000	628
How many bedrooms does your primary residence have?					
1	0.00	–	–	–	631
2	0.12	–	–	–	631
3	0.48	–	–	–	631
4	0.32	–	–	–	631
5+	0.07	–	–	–	631
Excluding basements and attics, how many stories does your primary residence have?					
1	0.55	–	–	–	633
2	0.38	–	–	–	633
3+	0.07	–	–	–	633
Does your primary residence have a garage?					
Yes/No	0.77	–	–	–	635
What size is the garage at your primary residence? (only recorded if having garage).					
1	0.19	–	–	–	484
2	0.72	–	–	–	484
3+	0.08	–	–	–	484
Which of these describes your garage? (only recorded if having garage).					
Attached and heated	0.14	–	–	–	490
Attached and not heated	0.76	–	–	–	490
Detached and heated	0.02	–	–	–	490
Detached and not heated	0.09	–	–	–	490
Is your heated garage insulated? (only recorded if having heated garage).					
No	0.15	–	–	–	67
Yes	0.85	–	–	–	67
I don't know	0.00	–	–	–	67
Do you have rooftop solar system on your primary residence?					
Yes/No	0.15	–	–	–	634

Note: Standard deviation, minimum, and maximum values are not reported for dummy variables. The mean values can capture the spread in the dataset, while the minimum and maximum are always 0 and 1, respectively, and therefore omitted for brevity.

A.4 Appliance Stock Detail

The following tables report the full appliance stock summarized in the main text, covering primary and secondary space heating, temperature control, cooking appliances, and water heating and laundry. The final table reports respondents' estimated highest monthly electricity and gas bills.

Table A.6: Survey Summary Statistics for Household & Primary Space Heating.

Variables	Mean	N
Natural Gas Usage		
Natural gas appliance use	0.96	708
Main Heating Equipment		
Central furnace	0.59	693
Steam or hot water system	0.32	693
Central heat pump	0.02	693
Ductless heat pump	0.03	693
Other	0.04	693
Main Equipment's Fuel		
Electricity	0.08	690
Natural gas (underground pipes)	0.90	690
Other	0.02	690
Main Equipment's Age		
Less than 2 years old	0.12	670
2 to 4 years old	0.11	670
5 to 9 years old	0.18	670
10 to 14 years old	0.16	670
15 to 19 years old	0.10	670
20 or more years old	0.33	670
Main Equipment's Use		
Use all or almost all of the time	0.91	690
Use at least once per week	0.05	690
Use a few times per month	0.001	690
Use only when it is very cold	0.04	690
Use only in rare situations	0.001	690

Table A.7: Survey Summary Statistics for Secondary Space Heating.

Variables	Mean	N
Secondary Heating Equipment		
No other equipment used	0.32	689
Portable electric heaters	0.16	689
Fireplace	0.16	689
Wood/pellet stove	0.11	689
Built-in electric units	0.04	689
Ductless heat pump	0.11	689
Other	0.10	689
Secondary Equipment's Fuel		
Electricity	0.46	469
Natural gas (underground pipes)	0.22	469
Wood or pellets	0.29	469
Other	0.03	469
Secondary Equipment's Age		
Less than 2 years old	0.16	449
2 to 4 years old	0.19	449
5 to 9 years old	0.20	449
10 to 14 years old	0.11	449
15 to 19 years old	0.08	449
20 or more years old	0.27	449
Secondary Equipment's Use		
Use all or almost all of the time	0.28	471
Use at least once per week	0.25	471
Use a few times per month	0.15	471
Use only when it is very cold	0.21	471
Use only in rare situations	0.11	471

Table A.8: Survey Summary Statistics for Controls & Setpoints.

Variables	Mean	S.D.	Min	Max	N
Thermostat Type					
Manual/non-programmable	0.31	–	–	–	476
Programmable	0.54	–	–	–	476
Smart (internet-connected)	0.13	–	–	–	476
No Thermostat	0.02	–	–	–	476
Winter indoor temperature (F)					
During the day- Someone home	68.75	3.06	58	78	476
During the day- No one home	65.18	4.66	45	76	467
At night	65.21	4.59	45	78	473

Table A.9: Survey Summary Statistics for Cooking Appliances: Stock & Fuels.

Variables	Mean	N
Number of Ranges		
0	0.21	692
1	0.76	692
2	0.02	692
3+	0.01	692
Fuel for Ranges		
Electricity	0.34	547
Natural gas from pipes	0.63	547
Other	0.03	547
Number of Cooktops		
0	0.64	692
1	0.34	692
2+	0.01	692
Fuel for Cooktops		
Electricity	0.40	250
Natural gas from pipes	0.59	250
Propane (bottled gas)	0.02	250
Number of Wall Ovens		
0	0.70	692
1	0.19	692
2+	0.11	692
Fuel for Wall Ovens		
Electricity	0.83	207
Natural gas from pipes	0.17	207
Propane (bottled gas)	0.00	207

Table A.10: Survey Summary Statistics for Water Heating & Laundry.

Variables	Mean	N
Main Water Heater Size- house		
Small (30 gallons or less)	0.05	534
Medium (31 to 49 gallons)	0.43	534
Large (50 gallons or more)	0.41	534
Tankless or on-demand	0.11	534
Main Water Heater Fuel- house		
Electricity	0.09	580
Natural gas from pipes	0.90	580
Other	0.01	580
Main Water Heater Age- house		
Less than 2 years old	0.13	566
2 to 4 years old	0.14	566
5 to 9 years old	0.26	566
10 to 14 years old	0.19	566
15 to 19 years old	0.11	566
20 or more years old	0.17	566
At-Home Clothes Dryer		
Yes/No	0.99	690
At-Home Dryer Fuel		
Electricity	0.74	678
Natural gas from pipes	0.26	678
Propane (bottled gas)	0.00	678
Pool Heater at home		
Yes/No	0.03	609

Table A.11: Survey Summary Statistics for Bills' Guesstimates

Variables	Mean	N
Highest electricity bill guesstimate		
Less than \$50	0.04	457
\$50-\$99	0.18	457
\$100-\$149	0.31	457
\$150-\$200	0.18	457
More than \$200	0.29	457
Highest natural gas bill guesstimate		
Less than \$50	0.11	457
\$50-\$99	0.26	457
\$100-\$149	0.35	457
\$150-\$200	0.18	457
More than \$200	0.10	457

Note: Electricity bills tend to be higher than natural gas bills: 47% of households report electricity bills $\geq$ \$150 (including 29% over \$200), compared with 28% for natural gas (10% over \$200). The most common bracket for both utilities is \$100-\$149 (electricity 31%, gas 35%), while lower bills are more common for gas, with 37% under \$100 versus 22% for electricity.

A.5 Environmental Attitudes (NEP)

Table A.12 summarizes household responses to the six New Ecological Paradigm (NEP) items. The distribution of responses to each statement is shown in the main text (Figure 5). Respondents exhibit a moderate level of environmental concern. Most recognize human responsibility for environmental stewardship and the fragility of ecological systems, while agreement with the reverse-coded items is relatively low.

Table A.12: Survey Summary Statistics for NEP Variables

How strongly do you agree with the following statement?	Mean	S.D.	Min	Max	N
Humans are severely abusing the environment.	3.35	1.64	1	5	480
The earth has plenty of natural resources if we just learn how to develop them. (R)	3.38	1.40	1	5	480
The balance of nature is strong enough to cope with the impacts of modern industrial nations. (R)	2.31	1.41	1	5	477
Human ingenuity will ensure that we do NOT make the earth unlivable. (R)	2.99	1.45	1	5	478
The balance of nature is very delicate and easily upset.	3.06	1.40	1	5	479
The so-called “ecological crisis” facing humankind has been greatly exaggerated. (R)	2.68	1.66	1	5	478

Note: Responses were coded on a scale ranging from 1 = “Strongly disagree”, 3 = “Unsure”, to 5 = “Strongly agree”. Items marked with “(R)” are reverse-coded statements, where higher scores indicate lower environmental concern. For the non-reverse statements, higher scores instead reflect greater environmental concern.

B Appendix to Part II: Discrete Choice Experiment

This appendix collects the estimation detail and supplementary tables behind Part II, namely the full mixed-logit specification and model selection, the recovery of individual-level willingness to pay, the handling of protest responses, and the linkage between stated willingness to pay and metered consumption.

B.1 Econometric Specification

We estimate WTP using a random parameter logit in WTP-space (K. E. Train and Weeks, 2005). For respondent i , alternative j , and choice occasion t , indirect utility takes the standard additive form:

$$U_{ijt} = V_{ijt} + \varepsilon_{ijt} \quad (\text{B.1})$$

where V_{ijt} is the systematic component and ε_{ijt} is an i.i.d. type I extreme value error term. Following K. E. Train and Weeks (2005), we decompose systematic utility in WTP-space by factoring out the cost coefficient:

$$V_{ijt} = -\alpha_i \cdot p_{jt} + \alpha_i \sum_k \beta_{ik} x_{kjt} \quad (\text{B.2})$$

where α_i is the respondent-specific cost coefficient and the β_{ik} are WTP coefficients, directly interpretable as marginal WTP in dollars per month per percentage point of attribute k . Because the alternative-specific constant (ASC) enters multiplied by α_i , it too is expressed in WTP-space units and represents the WTP for choosing any electrification alternative over the status quo, already denominated in dollars per month. The WTP coefficients incorporate observed heterogeneity through interactions:

$$\beta_{ik} = \bar{\beta}_k + \sigma_k v_{ik} + \gamma_k^{NEP} \cdot NEP_i + \gamma_k^{Panel} \cdot Panel_i + \gamma_k^{Info} \cdot Info_i \quad (B.3)$$

where $\bar{\beta}_k$ is the population mean WTP for attribute k , σ_k is the standard deviation of unobserved preference heterogeneity, v_{ik} is a respondent-specific random draw, NEP_i is respondent i 's standardized NEP factor score (mean 0, standard deviation 1, from the exploratory factor analysis), $Panel_i$ is an indicator equal to one if the respondent reported that their home requires an electrical-panel upgrade, $Info_i$ is an indicator equal to one if the respondent was randomly assigned to the information treatment, and γ_k^{NEP} , γ_k^{Panel} , and γ_k^{Info} capture the corresponding systematic preference variation. The same variable names are used in the model-selection schematic (Figure B.1), where the panel-upgrade interaction appears under its estimation-code label `elect_upgrade`. NEP enters linearly. We tested a quadratic specification (NEP-squared interaction) and found the squared term non-significant for all three attributes ($p > 0.25$), which supports the linear functional form over the observed range of NEP scores. The ASC enters with sociodemographic and protester interactions:

$$ASC_i = \delta_0 + \mathbf{Z}_i' \boldsymbol{\delta} + \delta^{Protest} \cdot Protest_i \quad (B.4)$$

where $\mathbf{Z}_i$ includes age, income, education, and homeownership, and $Protest_i$ identifies respondents who selected the opt-out on all six choice tasks. The distributional assumptions are:

$$\ln(\alpha_i) \sim N(\mu_\alpha, \sigma_\alpha^2), \quad \beta_{ik} \mid NEP_i, Panel_i, Info_i \sim N(\cdot, \sigma_k^2) \quad (B.5)$$

The lognormal specification for the cost coefficient ensures $\alpha_i > 0$, while the normal specification for β_{ik} permits both positive and negative WTP for the non-cost attributes.

We specify the three WTP coefficients (β_{ik} for carbon, efficiency, and rebate) as independent random draws, while all interaction terms (γ) enter as fixed parameters. We also tested lognormal distributions for efficiency (which is entirely positive in individual estimates) and triangular distributions. The results are presented in Table B.3.

The lognormal specification for the cost coefficient implies a right-skewed distribution (median 0.028, mean 0.131), meaning some respondents have near-zero price sensitivity and cor-

respondingly large WTP.⁹ Trimming the top and bottom 2.5% of posterior WTP scores has negligible effects on mean WTP (less than 0.5% change for all three attributes), confirming that population-level estimates are not driven by extreme cost sensitivities.

All models use 10,000 scrambled Sobol draws. Simulation stability was verified at 1,000, 2,500, and 5,000 draws (Table B.4).

We tested over 150 specifications drawn from a design space of twelve base model structures crossed with three protester-handling approaches (no adjustment, ASC interaction, and dropping protesters) and nine weighting schemes, a space of $12 \times 3 \times 9 = 324$ candidate combinations. The full weighting grid was not estimated for every combination of base structure and protester handling, which is why the number of estimated specifications (over 150) is smaller than the number of possible combinations. Figure B.1 summarizes the selection structure. The final specification was selected based on AIC/ n (1.1014), theoretical consistency, and policy relevance (Table B.2). No pre-registration or holdout validation was employed.

⁹The estimated underlying normal distribution for $\ln(\alpha_i)$ has mean -3.573 and SD 1.756 , so the 5th and 95th percentiles of the cost coefficient α_i are 0.002 and 0.504 (both positive, consistent with $\alpha_i > 0$). The price term in Equation B.2 enters as $-\alpha_i$ and therefore ranges from -0.504 to -0.002 across the same percentiles; the positive values in the text describe α_i itself, and the negative values describe the utility weight on cost, $-\alpha_i$. Mean and median WTP at the attribute level are close (e.g., carbon mean $\$1.49$ versus median $\$1.47$), indicating that the skewness does not substantially distort population-level estimates.

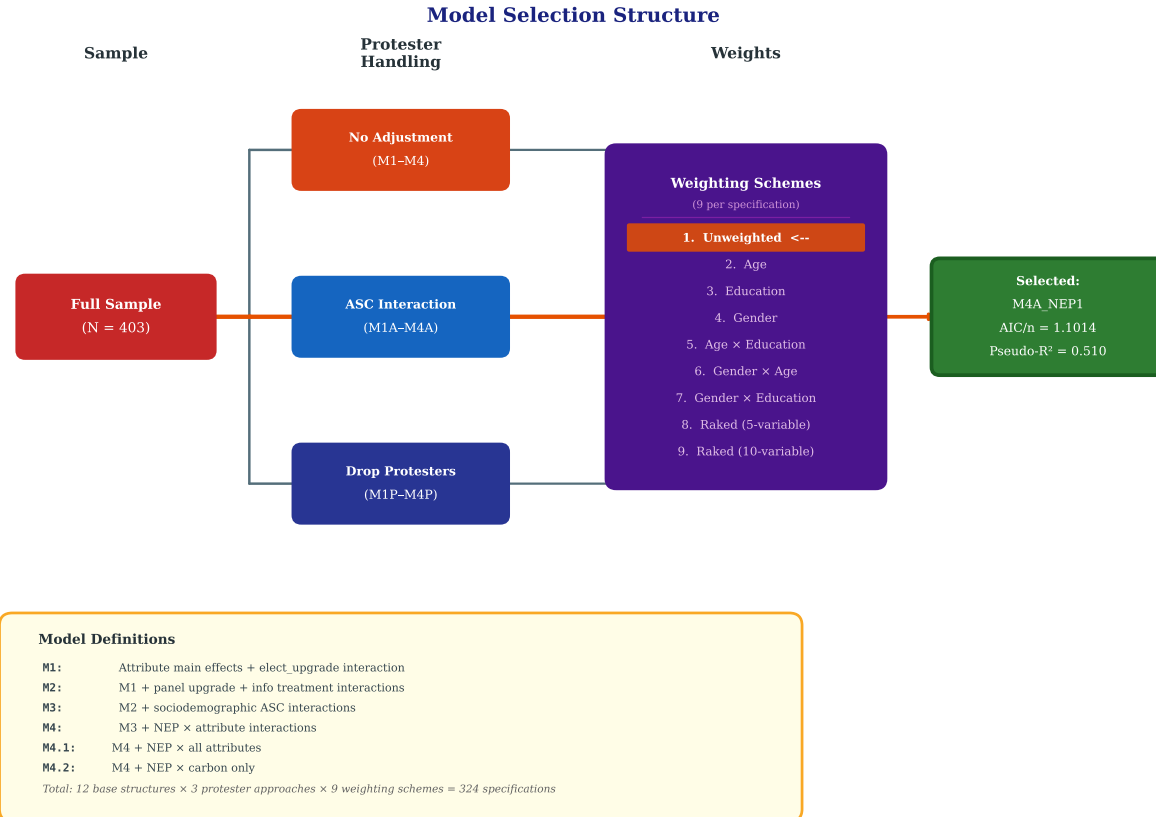


Figure B.1: Model selection schematic. Twelve base model structures were crossed with three protester-handling approaches (no adjustment, M1–M4; ASC interaction, M1A–M4A; drop protesters, M1P–M4P) and nine weighting schemes; over 150 of the 324 candidate combinations were estimated (the weighting grid was not run for every branch). The interaction labelled `elect_upgrade` in the schematic is the panel-upgrade interaction $Panel_i$ (γ^{Panel}) of Equations B.3–B.4. The selected model (M4A.NEP1) achieves the lowest AIC/ n among all estimated specifications.

Table B.1 reports the full WTP-space mixed-logit specification summarized in Part II, including all interaction terms and model diagnostics.

Table B.1: Mixed Logit Results in WTP-Space, Selected Model (M4A.NEP1)

Variable	Mean		SD	
	Coeff.	SE	Coeff.	SE
<i>Random parameters</i>				
Carbon reduction	1.494***	(0.188)	1.051***	(0.071)
Energy efficiency	2.308***	(0.230)	1.243***	(0.074)
Financial rebate	1.098***	(0.197)	0.611***	(0.058)
<i>Panel upgrade interactions</i>				

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Table B.1 continued

Variable	Mean		SD	
	Coeff.	SE	Coeff.	SE
Carbon $\times$ Panel	-0.894***	(0.165)	–	
Efficiency $\times$ Panel	-0.800***	(0.201)	–	
Rebate $\times$ Panel	0.323	(0.198)	–	
ASC $\times$ Panel	67.731***	(9.362)	–	
<i>Information treatment interactions</i>				
Carbon $\times$ Info	0.034	(0.152)	–	
Efficiency $\times$ Info	0.257	(0.243)	–	
Rebate $\times$ Info	-0.224	(0.177)	–	
ASC $\times$ Info	-3.079	(9.458)	–	
<i>NEP interactions</i>				
Carbon $\times$ NEP	0.794***	(0.096)	–	
Efficiency $\times$ NEP	0.693***	(0.113)	–	
Rebate $\times$ NEP	0.368***	(0.082)	–	
ASC $\times$ NEP	0.842	(4.236)	–	
<i>Sociodemographic ASC interactions</i>				
ASC $\times$ Age	1.447***	(0.243)	–	
ASC $\times$ BA degree	-174.901***	(13.503)	–	
ASC $\times$ Some college	-153.399***	(10.924)	–	
ASC $\times$ Graduate degree	-179.686***	(11.670)	–	
ASC $\times$ Female	34.849***	(4.694)	–	
ASC $\times$ Income \$35–70K	94.379***	(10.789)	–	
ASC $\times$ Income \$70–150K	95.248***	(10.189)	–	
ASC $\times$ Income >\$150K	101.161***	(10.409)	–	
<i>Protester and cost</i>				
Protester ASC [†]	2,184,388	(2,770,055)	–	
–Price (lognormal)	-3.573***	(0.200)	1.756***	(0.300)
ASC (constant)	-25.564	(24.423)	–	
<i>Model diagnostics</i>				
Log-likelihood	-1,301.61			
McFadden pseudo- R^2	0.510			
AIC/ n	1.101			
Observations	2,418			
Respondents	403			

Parameters

30

Notes: Mixed logit estimated in WTP-space with 10,000 scrambled Sobol draws and age $\times$ education post-stratification weights. Mean coefficients for the three random parameters (carbon, efficiency, rebate) represent WTP in \$/month per percentage point. Interaction terms are fixed. Carbon, efficiency, and rebate are normally distributed, and price is lognormally distributed. Robust standard errors clustered at the respondent level to account for the panel structure of six choice tasks per respondent. [†]The Protester ASC is constrained to a large positive value that functions as a binary switch ensuring opt-out dominance for protester-classified respondents; its striking magnitude and standard error are expected and not economically interpretable (see Section 9). The effective sample for attribute WTP identification is approximately 285 non-protester respondents (1,710 choice observations). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table B.2: Model Comparison, Mixed Logit in WTP-Space

Variable	Model A (Full)		Model B (No NEP)		Model C (Non-prot.)		Model D (Main eff.)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<i>Random parameters (means)</i>								
Carbon	1.494*** (0.188)	1.051*** (0.071)	1.708*** (0.041)	1.345*** (0.021)	1.530*** (0.086)	1.027*** (0.055)	-0.068 (0.072)	2.864*** (0.308)
Efficiency	2.308*** (0.230)	1.243*** (0.074)	2.376*** (0.043)	1.371*** (0.035)	2.347*** (0.173)	1.197*** (0.072)	1.276*** (0.213)	2.588*** (0.146)
Rebate	1.098*** (0.197)	0.611*** (0.058)	1.120*** (0.040)	0.726*** (0.021)	1.121*** (0.120)	0.682*** (0.060)	1.080*** (0.137)	1.526*** (0.128)
ASC	-25.564 (24.423)		-151.6*** (35.524)		-38.576 (36.606)		87.149*** (12.562)	
<i>Panel upgrade interactions</i>								
Carbon $\times$ Panel	-0.894*** (0.165)		-1.032*** (0.046)		-0.920*** (0.090)			
Efficiency $\times$ Panel	-0.800*** (0.201)		-0.723*** (0.047)		-0.794*** (0.185)			
Rebate $\times$ Panel	0.323 (0.198)		0.184*** (0.047)		0.240* (0.138)			
ASC $\times$ Panel	67.731*** (9.362)		88.379*** (4.195)		67.241*** (8.435)			
<i>Information treatment interactions</i>								
Carbon $\times$ Info	0.034 (0.152)		0.221*** (0.021)		0.070 (0.075)			
Efficiency $\times$ Info	0.257 (0.243)		0.546*** (0.082)		0.231* (0.128)			
Rebate $\times$ Info	-0.224 (0.177)		0.069 (0.067)		-0.178** (0.082)			
ASC $\times$ Info	-3.079 (9.458)		-3.736 (3.883)		-2.462 (8.163)			
<i>NEP interactions</i>								
Carbon $\times$ NEP	0.794*** (0.096)				0.816*** (0.047)			
Efficiency $\times$ NEP	0.693***				0.613***			

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Table B.2 continued

Variable	Model A (Full)		Model B (No NEP)		Model C (Non-prot.)		Model D (Main eff.)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
	(0.113)				(0.096)			
Rebate $\times$ NEP	0.368***				0.365***			
	(0.082)				(0.078)			
ASC $\times$ NEP	0.843				0.690			
	(4.236)				(4.992)			
<i>Sociodemographic ASC interactions</i>								
ASC $\times$ Age	1.447***		1.663***		1.464***			
	(0.243)		(0.111)		(0.257)			
ASC $\times$ BA degree	-174.9***		-341.7***		-169.8***			
	(13.503)		(5.225)		(22.554)			
ASC $\times$ Some college	-153.4***		-310.6***		-147.5***			
	(10.924)		(5.794)		(28.199)			
ASC $\times$ Graduate	-179.7***		-349.9***		-175.6***			
	(11.670)		(5.098)		(21.694)			
ASC $\times$ Female	34.849***		24.321***		35.538***			
	(4.694)		(2.977)		(8.547)			
ASC $\times$ Inc. \$35–70K	94.379***		346.4***		103.9***			
	(10.789)		(34.391)		(15.864)			
ASC $\times$ Inc. \$70–150K	95.248***		353.7***		101.0***			
	(10.189)		(35.207)		(17.969)			
ASC $\times$ Inc. >\$150K	101.2***		366.2***		108.9***			
	(10.409)		(34.345)		(15.158)			
<i>Protester and cost</i>								
Protester ASC	2,184,388		4,894,019					
	(2,770,055)		(7,292,746)					
–Price (lognormal)	-3.573***	1.756***	-3.464***	2.102***	-3.564***	1.775***	-3.414***	1.307***
	(0.200)	(0.300)	(0.233)	(0.382)	(0.203)	(0.304)	(0.194)	(0.241)
<i>Model diagnostics</i>								
Log-likelihood	-1,301.61		-1,358.10		-1,318.03		-1,777.32	
McFadden pseudo- R^2	0.510		0.489		0.298		0.331	
AIC/ n	1.101		1.145		1.575		1.478	
BIC/ n	1.173		1.207		1.668		1.499	
Observations	2,418		2,418		1,710		2,418	
Respondents	403		403		285		403	
Parameters	30		26		29		9	

Notes: Standard errors in parentheses (robust sandwich). SD = standard deviation of random parameter distribution. All models estimated with 10,000 Sobol draws and age $\times$ education post-stratification weights. Model A: full specification with NEP interactions. Model B: no NEP interactions. Model C: non-protester subsample ($N = 285$). Model D: main effects only (no interactions). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table B.3: Sensitivity of WTP Estimates to Distributional Assumptions

Distribution	Attribute	Mean WTP	SD	Log-likelihood	AIC/ n	Note
Normal (baseline)	Carbon	1.494	1.051	-1,301.61	1.1014	Selected
	Efficiency	2.308	1.243			
	Rebate	1.098	0.611			
Lognormal	Carbon	1.781	1.263	-1,321.47	1.1178	
	Efficiency	2.334	1.398			
	Rebate	1.236	1.258			
Triangular	Carbon	1.457	1.030	-1,321.57	1.1179	
	Efficiency	1.985	1.404			
	Rebate	1.107	0.783			

Notes: Distributional assumption sensitivity for random parameters. Compares WTP estimates under normal, lognormal, and triangular mixing distributions for carbon, efficiency, and rebate coefficients. Reports log-likelihood and AIC/ n for each specification.

Table B.4: Sobol Draw Stability Analysis

Draws	Carbon WTP	Efficiency WTP	Rebate WTP	Log-likelihood
1,000	1.692	2.433	1.124	-1,313.68
2,500	1.712	2.349	1.186	-1,316.47
5,000	1.571	2.379	1.213	-1,319.64
10,000	1.494	2.308	1.098	-1,301.61

Notes: Sobol draw stability analysis. Reports WTP estimates at 1,000, 2,500, 5,000, and 10,000 Sobol draws to verify convergence. The selected model uses 10,000 draws, and estimates should stabilize by 5,000.

Table B.5: Comparison of Analysis Sample and Excluded Respondents

Variable	Analysis ($N = 403$)	Dropped ($N = 70$)	t -statistic	p -value
Age (years)	55.93	73.31	-4.597	0.000
Female (%)	34.49	31.58	0.260	0.798
NEP factor score	-0.00	0.01	-0.130	0.897
Panel upgrade (%)	76.67	72.86	0.663	0.509
Information treatment (%)	20.84	40.00	-3.072	0.003
Graduate degree (%)	60.79	14.29	9.558	0.000

Notes: Unweighted comparison of the 403 respondents in the analysis sample with the “Dropped” group, defined as the subset of excluded respondents who began the choice experiment but did not complete it ($N = 70$); the dropped group is a subset of the 204 excluded respondents described in the notes to Table 2, which compares the analysis sample against all 204 exclusions using the post-stratification weights. The two comparisons therefore differ by construction: respondents who started the choice tasks and quit are markedly older than the analysis sample (73.3 vs. 55.9 years here), whereas the full excluded group, most of whom never reached the choice tasks, is close in age to completers (54.2 vs. 51.8 weighted). Percentages are computed over respondents with non-missing values for each row item. Differences are assessed with t -tests (chi-squared for categorical variables).

Table B.6: Sensitivity of Posterior WTP–NEP Correlations to NEP Scoring Method

NEP Scoring Method	Carbon WTP	Efficiency WTP	Rebate WTP	w/ Baseline
Factor analysis (baseline)	0.086	0.033	-0.051	1.000
Simple mean	0.084	0.023	-0.052	0.992
Sum score	0.084	0.023	-0.052	0.992
Bartlett scoring	0.084	0.024	-0.051	0.994

Notes: Sensitivity of WTP estimates to alternative NEP scoring methods: (1) baseline factor analysis score, (2) simple mean of 6 NEP items, (3) sum score, (4) Bartlett scoring. w/ Baseline is the Pearson correlation between the alternative score and the baseline factor score. Shows that WTP estimates are robust to the NEP operationalization.

Table B.7: Test for Choice Task Order Effects

Metric	Early tasks (1–3)	Late tasks (4–6)	p -value
Program choice rate	0.549	0.532	0.375
N tasks	1,419	1,407	
N observations	4,257	4,221	
N respondents	473	473	

Notes: Test for choice task order effects. Compares WTP estimates from early choice tasks (1-3) vs. late choice tasks (4-6) to check for learning or fatigue effects. Includes Hausman test for parameter stability across task blocks.

Table B.8: Randomization Balance Check for Information Treatment

Variable	Treatment (N = 84)	Control (N = 319)	<i>t</i> -statistic	<i>p</i> -value
Age (years)	60.99	54.60	3.201	0.002
Female (%)	35.71	34.17	0.262	0.794
NEP factor score	-0.03	0.01	-0.355	0.723
Panel upgrade (%)	80.95	75.55	1.094	0.276
Graduate degree (%)	61.90	60.50	0.234	0.815

Notes: Randomization balance check for the information treatment. Comparison of treatment ($N = 84$) and control ($N = 319$) groups in the 403-responder analysis sample. *t*-statistics from two-sample *t*-tests (continuous) or tests of proportions (binary). Randomization is balanced on all observables except age: treated respondents are significantly older ($p = 0.002$). NEP scores, gender, panel upgrade status, and education do not differ significantly between groups.

Table B.9: Unweighted vs. Weighted Mixed Logit Estimates

Parameter	Unweighted		Weighted	
	Coeff.	SE	Coeff.	SE
<i>Random parameters (means)</i>				
Carbon	0.564***	(0.159)	0.862***	(0.016)
Efficiency	1.330	(0.809)	2.425***	(0.054)
Rebate	0.705**	(0.320)	1.106***	(0.038)
ASC	156.694***	(43.699)	545.176***	(7.973)
<i>Panel upgrade interactions</i>				
Carbon × Panel	-0.484**	(0.200)	-0.590***	(0.027)
Efficiency × Panel	-0.179	(0.894)	-0.885***	(0.056)
Rebate × Panel	0.645	(0.406)	0.414***	(0.046)
ASC × Panel	63.740***	(23.171)	87.686***	(3.657)
<i>Information treatment interactions</i>				
Carbon × Info	-0.012	(0.155)	-0.516***	(0.040)
Efficiency × Info	0.600**	(0.252)	-0.041	(0.042)
Rebate × Info	-0.268*	(0.142)	-0.390***	(0.030)
ASC × Info	-17.060	(12.309)	-37.232***	(4.236)
<i>NEP interactions</i>				
Carbon × NEP	1.534***	(0.146)	1.409***	(0.020)
Efficiency × NEP	0.874***	(0.099)	0.517***	(0.034)
Rebate × NEP	0.313*	(0.162)	0.291***	(0.023)
ASC × NEP	-38.467***	(9.073)	-47.186***	(2.582)
<i>Sociodemographic ASC interactions</i>				
ASC × Age	1.253***	(0.383)	3.207***	(0.051)
ASC × BA degree	-10.892	(17.323)	-148.258***	(5.781)

Continued on next page

Table B.9 continued

Parameter	Unweighted		Weighted	
	Coeff.	SE	Coeff.	SE
ASC × Some college	2.940	(20.203)	−131.459***	(6.035)
ASC × Graduate	−51.917**	(23.518)	−189.278***	(4.993)
ASC × Female	33.032***	(6.349)	23.464***	(1.553)
ASC × Inc. \$35–70K	−114.304**	(57.998)	−413.495***	(5.360)
ASC × Inc. \$70–150K	−170.593***	(36.434)	−514.997***	(6.027)
ASC × Inc. >\$150K	−165.752***	(35.003)	−513.764***	(5.125)
<i>Cost</i>				
−Price (lognormal)	−3.352***	(0.188)	−3.203***	(0.253)
<i>Standard deviations</i>				
SD: Carbon	1.991***	(0.198)	2.128***	(0.022)
SD: Efficiency	1.961***	(0.232)	1.681***	(0.017)
SD: Rebate	1.209***	(0.070)	1.176***	(0.013)
SD: −Price	1.675***	(0.296)	2.187***	(0.376)
<i>Model diagnostics</i>				
Log-likelihood	−1,616.71		−1,593.20	
AIC/ <i>n</i>	1.361		1.342	
BIC/ <i>n</i>	1.431		1.411	
Pseudo- R^2	0.561		0.595	
Parameters	29		29	
Observations	2,418		2,418	
Respondents	403		403	
Sobol draws	10,000		10,000	

Notes: Weighting sensitivity check. Reports unweighted and weighted mixed logit estimates side by side using the same specification with NEP interactions, 10,000 Sobol draws, and 403 respondents. Weighted specification uses age × education post-stratification weights. Sign patterns are identical across specifications, and magnitude differences reflect the reweighting of older and less-educated respondents. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

B.2 Individual-Level WTP Estimation

Following Revelt and K. Train (2000), we derive individual-level WTP from posterior scores of the random parameter distributions. The posterior mean for each respondent is computed as the expected value of the random parameters weighted by the likelihood of their choice sequence, conditioning on observed choices via Bayes' theorem.

Because the model includes NEP interactions in the fixed portion, the individual scores represent residual heterogeneity after controlling for environmental attitudes. The individual carbon WTP scores do not reflect the systematic NEP-carbon relationship, which is captured in the fixed interaction term. The individual scores instead capture unexplained variation in preferences not

attributable to NEP, panel upgrade status, or other observable characteristics in the model.

B.3 Protester Handling

Approximately 29% of respondents (118 of 403) selected the opt-out on all six choice tasks, a rate at the upper end of the 15 to 30% range typical for environmental goods DCEs (Meyerhoff and Liebe, 2006).¹⁰ Following Meyerhoff and Liebe (2006) and Lancsar and Louviere (2006), we retain protesters in estimation using an ASC interaction term rather than deleting them. The protester ASC absorbs the additional status quo preference, whether motivated by format rejection or genuine satisfaction with natural gas, allowing remaining coefficients to reflect attribute preferences among engaged respondents. The effective sample for attribute WTP identification is approximately 285 non-protester households providing 1,710 choice observations. We report WTP estimates from a non-protester-only subsample in Table B.2 Model C. The differences from the full-sample estimates are small (less than 1.3% for all attributes).

Table B.10: Probit Model of Protest Response Determinants

Variable	Coefficient	SE	<i>z</i>	<i>p</i> -value	ME
Intercept	−0.689	(0.403)	−1.71	0.087	
Age	0.010**	(0.005)	2.17	0.030	0.003
NEP	−0.753***	(0.085)	−8.86	0.000	−0.229
Graduate degree	−0.431***	(0.153)	−2.81	0.005	−0.131
Panel upgrade	−0.013	(0.191)	−0.07	0.944	−0.004
Solar	−0.325	(0.239)	−1.36	0.174	−0.099
Female	0.060	(0.163)	0.36	0.716	0.018
High income	−0.407**	(0.192)	−2.12	0.034	−0.123

Notes: Probit model of protest response ($N = 473$). Dependent variable: 1 if respondent always chose status quo. Independent variables: age, income, education, homeownership, NEP score, information treatment, gas consumption quartile. Reports marginal effects at means. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

¹⁰Protesters are older (mean age 60 versus 55, $p = 0.002$), have lower NEP scores (mean −0.67 versus 0.28, $p < 0.001$), and are less likely to hold graduate degrees (42 versus 59%, $p < 0.001$). Table B.10 reports full protester determinants. The Protester ASC coefficient (approximately \$2.2 million/month in WTP-space units) functions as a binary switch ensuring opt-out dominance for protest-classified respondents. Its precise magnitude is not economically interpretable.

Table B.11: Two-Class Latent Class Model (WTP-Space)

Variable	Class 1 (58.6%)		Class 2 (41.4%)	
	Coeff.	SE	Coeff.	SE
Carbon	1.075***	(0.165)	−0.296	(1.301)
Efficiency	2.075***	(0.295)	3.352	(2.991)
Rebate	1.645***	(0.195)	3.934**	(1.984)
ASC	37.375***	(13.897)	843.124*	(490.193)
−Price	0.012***	(0.001)	0.005**	(0.002)
<i>Model diagnostics</i>				
LL at convergence	−1,765.00			
McFadden pseudo- R^2	0.335			
AIC/ n	1.469			
BIC/ n	1.495			
Observations	2,418			
Parameters	11			

Notes: Two-class latent class model estimated in WTP-space with 1,000 Sobol draws. Class probabilities are average posterior probabilities. Class 1 (58.6%) shows well-identified WTP for all three attributes. Class 2 (41.4%) exhibits imprecisely estimated WTP across all attributes and a very large status-quo ASC, consistent with protesters and disengaged respondents rather than attribute-specific non-attendance. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

B.4 Individual-Level WTP Analysis

B.4.1 Distribution of Individual WTP

Table B.12 presents individual-level WTP distributions. Carbon WTP has a mean of \$1.52, efficiency \$2.31, and rebate \$1.09. Only 1.2% of non-protester respondents have negative carbon WTP.

Table B.12: Individual-Level WTP Distribution (\$/month per percentage point)

Attribute	Mean	SD	P5	P25	Median	P75	P95	% Neg.
Carbon reduction	1.524	0.569	0.534	1.280	1.494	1.815	2.569	1.2%
Energy efficiency	2.315	0.712	1.193	2.045	2.308	2.437	3.828	0.0%
Financial rebate	1.093	0.096	0.916	1.065	1.098	1.131	1.251	0.0%

Notes: Individual-level posterior means from the M4A_NEP1 specification. $N = 403$ respondents. Percentiles computed across individual posterior WTP scores. % Negative is the share of respondents with negative individual WTP.

The rate of negative individual carbon WTP requires careful interpretation. In the model with NEP interactions, 5 non-protester respondents (1.2%) have negative carbon WTP. If one

conservatively assumes all 118 protesters have negative carbon preferences, the upper-bound rate is 31%.

A decomposition (Table B.14) traces the negative carbon WTP rate from 10.2% (population parametric from the no-NEP model) to 3.0% (Bayesian shrinkage alone) to 1.2% (shrinkage plus NEP conditioning). Shrinkage accounts for most of the reduction, with NEP conditioning providing additional compression.

Three caveats apply. The 1.2% is conditional on the normal mixing distribution (a bimodal distribution would produce higher rates), on the model specification (omitting NEP interactions yields 3.0%), and on the non-protester subsample.

The 10.2% represents unconditional heterogeneity relevant to population-level policy, while the 1.2% represents residual heterogeneity after conditioning on attitudes and choice histories. The gap between them quantifies the information value of measuring environmental attitudes.

The five respondents with negative carbon WTP do not form a single archetype. NEP scores range from -0.93 to $+0.86$, ages from 31 to 53, and all hold graduate degrees. Their negative WTP likely reflects idiosyncratic preference patterns rather than a coherent anti-carbon stance.

Efficiency WTP is entirely positive. No respondent has negative efficiency WTP. This result is consistent with the interpretation that households universally value the performance and cost-saving aspects of efficient appliances, even as they disagree about the value of environmental benefits.

Figure B.2 presents the distribution of individual WTP. Panel A shows carbon WTP by NEP status (above and below median), revealing that the low-NEP group shows greater dispersion with a small mass in the negative range. Panel B shows the entirely positive efficiency WTP distribution. Panel C presents violin plots across all three attributes. Panel D presents a scatter plot of individual carbon versus efficiency WTP colored by NEP score, showing the positive but weak correlation.

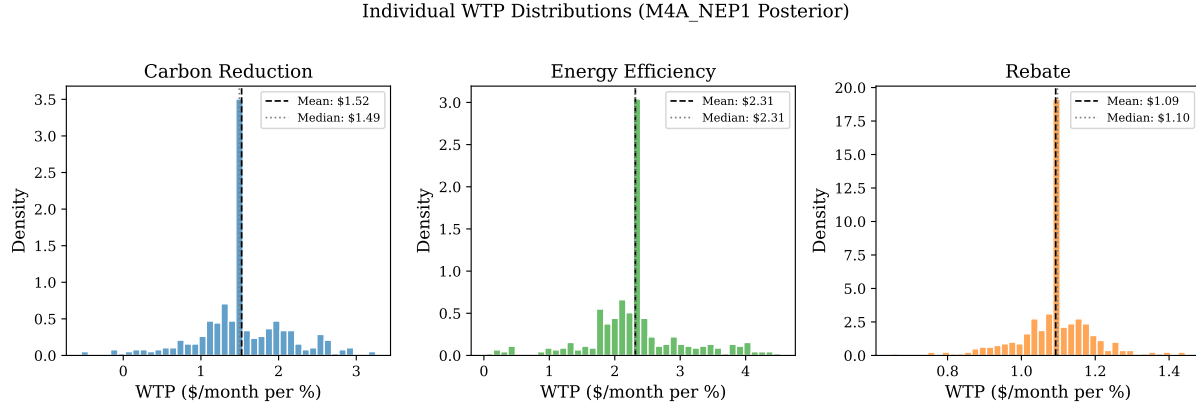


Figure B.2: Individual-level WTP distributions from Bayesian posterior scores ($N = 403$). Panel A: Carbon WTP kernel densities by NEP median split. Panel B: Efficiency WTP histogram. Panel C: Violin plots for carbon, efficiency, and rebate WTP. Panel D: Scatter plot of carbon vs. efficiency WTP colored by NEP factor score.

Table B.13: Posterior WTP Correlations

	Carbon	Efficiency	Rebate
Carbon	1.000		
Efficiency	0.226***	1.000	
Rebate	0.156***	0.071	1.000

Notes: Pearson correlations of individual posterior WTP scores from the M4A_NEP1 specification ($N = 360$ non-protester respondents). The largest correlation (carbon–efficiency, $r = 0.226$) implies shared variance of 5.1%. A correlated random parameters specification was estimated but encountered numerical instability before convergence, consistent with weak off-diagonal elements. The low correlations support the maintained independence assumption. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table B.14: Decomposition of Negative Carbon WTP Rates

Metric	Value
<i>Population parameters (no-NEP model)</i>	
Mean carbon WTP (\$/mo/pp)	1.708
SD carbon WTP	1.345
$P(\text{WTP} < 0)$ parametric	10.2%
<i>Individual posteriors (no-NEP model)</i>	
N	402
Mean posterior carbon WTP	1.852
SD posterior carbon WTP	0.951
N with negative WTP	12
% with negative WTP	3.0%
<i>Individual posteriors (NEP model)</i>	
N	403
Mean posterior carbon WTP	1.524
SD posterior carbon WTP	0.573
N with negative WTP	5
% with negative WTP	1.2%
<i>Non-protester subsample</i>	
N non-protesters	285
N with negative WTP	5
% with negative WTP	1.8%
Decomposition path	10.2% $\rightarrow$ 3.0% $\rightarrow$ 1.2%

Notes: The no-NEP model drops the four NEP interaction terms from the M4A.NEP1 specification, and all other covariates remain. LL (no-NEP) = -1,358.1, LL (NEP) = -1,301.6. Bayesian shrinkage reduces the negative rate from 10.2% to 3.0% by compressing individual posteriors toward the conditional mean. NEP conditioning provides further compression from 3.0% to 1.2%.

B.4.2 Heterogeneity by Panel Upgrade Status

In contrast to the strong panel effects in the fixed interactions, individual-level estimates show no significant differences by panel status. Households requiring upgrades have mean individual carbon WTP of \$1.52 versus \$1.55 without upgrades, a difference that is not statistically significant. Efficiency WTP is \$2.33 versus \$2.26 (also not significant), and rebate WTP is essentially identical at \$1.09 for both groups. These null results confirm that panel effects are properly captured in the fixed interactions rather than leaking into the random parameters. Programs can use the fixed effects to predict systematic differences (e.g., panel-needing households require larger incentives) while the individual scores capture remaining uncertainty.

B.4.3 Residual Heterogeneity by NEP Quartile

Table B.15 presents individual-level WTP by NEP quartile.

Table B.15: Individual-Level WTP by NEP Quartile (\$/month per percentage point)

NEP Quartile	<i>N</i>	NEP Mean	Carbon WTP	Efficiency WTP	Rebate WTP
Q1 (lowest)	101	−1.336	1.516 (0.361)	2.254 (0.430)	1.092 (0.062)
Q2	101	−0.324	1.419 (0.559)	2.301 (0.727)	1.099 (0.095)
Q3	100	0.577	1.568 (0.704)	2.461 (0.826)	1.103 (0.102)
Q4 (highest)	101	1.080	1.593 (0.590)	2.244 (0.789)	1.077 (0.117)

Notes: Individual-level posterior means from the M4A.NEP1 specification. NEP quartiles defined within the 403-respondent analysis sample. Standard deviations in parentheses reflect within-quartile dispersion. The lower within-quartile SD for Q1 (e.g., 0.361 for carbon versus 0.559–0.704 for Q2–Q4) may reflect stronger Bayesian shrinkage for low-NEP respondents whose choice patterns are less informative, compressing their posterior estimates toward the conditional mean. Mean carbon WTP ranges from \$1.42 (Q2) to \$1.59 (Q4), a spread of just \$0.17. Efficiency WTP ranges from \$2.24 (Q4) to \$2.46 (Q3), and rebate WTP shows minimal variation from \$1.08 to \$1.10. The weak residual correlation between NEP and individual WTP confirms that the NEP interactions capture the systematic relationship, with remaining variation representing genuine unobserved heterogeneity. This residual heterogeneity might reflect personal experience with electric appliances, social network effects, aesthetic preferences, or unmeasured aspects of household circumstances.

Figure B.3 visualizes the NEP quartile analysis. Panel A shows mean WTP by quartile for all three attributes with 95% confidence intervals, demonstrating the relatively flat relationship after controlling for NEP. Panel B shows within-quartile standard deviations, which are similar across quartiles, suggesting homogeneous residual heterogeneity. Panel C shows the distribution of respondents across quartiles with mean NEP scores.

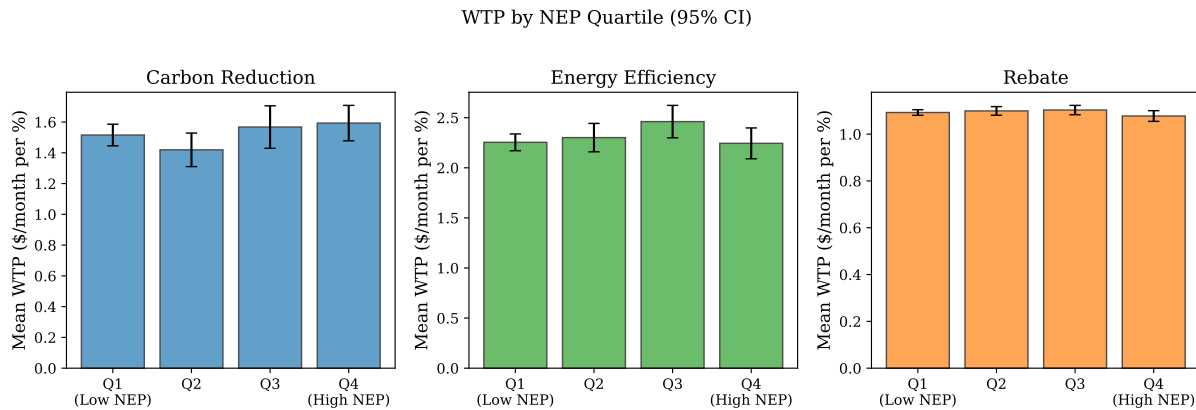


Figure B.3: Individual-level WTP by NEP quartile ($N = 403$). Panel A: Mean WTP (\$/month per percentage point) for carbon, efficiency, and rebate by NEP quartile with 95% confidence intervals. Panel B: Within-quartile standard deviations. Panel C: Respondent counts per quartile with mean NEP factor scores.

The correlation between individual carbon and efficiency WTP is positive but modest, indicating some commonality in pro-electrification attitudes, though with considerable independent variation in how households value environmental versus performance attributes.

Correlations between rebate WTP and the other attributes are weak, indicating modest positive associations that do not suggest strong common drivers of financial and non-financial attribute preferences. This independence has practical implications. Households that value carbon reduction do not necessarily respond more to rebates, and those most responsive to financial incentives are not systematically more or less environmentally motivated. Multi-attribute programs combining incentives with performance messaging may reach broader audiences than single-attribute approaches.

B.5 Consumption and Stated Preference Linkage

B.5.1 Consumption Patterns and Individual WTP

Linking administrative consumption records to individual-level posterior WTP estimates enables a direct test of whether stated electrification preferences covary with economic self-interest (proxied by actual energy expenditure) or with attitudinal factors. Table B.16 reports Pearson correlations and mean WTP by natural gas consumption quartile.

Table B.16: Individual WTP by Natural Gas Consumption Quartile (\$/month per percentage point)

Gas Quartile	Gas (CCF/mo)	<i>N</i>	Carbon WTP	Efficiency WTP	Rebate WTP
Q1 (lowest)	35	93	1.593	2.295	1.082
Q2	57	91	1.537	2.210	1.087
Q3	81	94	1.578	2.438	1.098
Q4 (highest)	130	98	1.403	2.305	1.097
Pearson <i>r</i>			−0.079	+0.064	+0.132**
<i>p</i> -value			0.138	0.229	0.013
Linear trend			−0.104**	+0.039	+0.064

Notes: WTP values are individual-level posterior means from the M4A.NEP1 specification. Gas consumption is average monthly CCF from LADPU billing records. Quartiles defined within the matched sample ($N = 376$ with complete gas records). Pearson *r* is the bivariate correlation between gas consumption and WTP. Linear trend is the OLS slope of WTP on standardized gas consumption. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The pattern across gas quartiles reveals an economically coherent but statistically modest relationship. Carbon WTP declines from \$1.59 in the lowest gas quartile to \$1.40 in the highest, a difference of \$0.19 per month per percentage point. In an OLS regression controlling for NEP, panel status, and solar adoption, the highest-consumption quartile is associated with lower

carbon WTP, though the difference is not statistically significant (Table B.16). This negative gradient is consistent with high-gas households perceiving greater switching costs or valuing the status quo more highly. Alternatively, it may reflect compositional differences in environmental attitudes across gas consumption levels, though the regression controls for NEP.

The negative but statistically insignificant correlation between carbon WTP and gas consumption (Table B.16) deserves attention for program targeting. If high-gas users, who stand to produce the largest carbon reductions from switching, have somewhat lower carbon WTP, then carbon-framed messaging may be least effective for the households with the greatest abatement potential. This suggestive pattern, though not statistically significant, indicates that programs seeking maximum emissions reductions should pair carbon messaging with financial incentives for high-consumption households. A formal power calculation indicates that with $N = 376$ matched observations, the minimum detectable effect at 80% power is \$0.27 per month, while the observed Q1–Q4 difference is \$0.19. The analysis is thus underpowered for detecting consumption-carbon WTP effects of this magnitude (ex-post power of 43%). The absence of a significant consumption-carbon WTP relationship may therefore reflect insufficient sample size rather than a true null effect.

Efficiency WTP shows no monotonic trend, peaking in Q3 at \$2.44 and declining to \$2.31 in Q4. The absence of a strong consumption-efficiency relationship suggests that efficiency valuations are driven more by general preferences for performance than by household-specific energy bills.

Rebate WTP, in contrast, shows a positive and statistically significant linear trend across gas quartiles (Table B.16). OLS regression of rebate WTP on standardized gas consumption with controls confirms this relationship. High-gas users (above-median consumption) value rebates at \$1.097 per month per percentage point compared to \$1.078 for low-gas users, a difference that is marginally significant. This pattern is economically intuitive. Households facing larger gas bills are more sensitive to financial incentives because the absolute dollar stakes of switching are greater.

B.5.2 Consumption, Attitudes, and the Decomposition of WTP

The weak and statistically insignificant consumption-WTP correlations for carbon and efficiency contrast sharply with the strong NEP-WTP relationships documented in Section B.4. In multivariate regressions of carbon WTP on standardized gas consumption, NEP, panel status, and solar adoption, the model explains very little variation. Adding a gas-by-NEP interaction does not improve fit. NEP remains the only consistent predictor of carbon and efficiency WTP, and consumption enters significantly only for rebate preferences.

A methodological caveat applies to this finding. Because the individual posterior scores condition on NEP through the fixed effects, any consumption variable correlated with NEP is

partly controlled by construction, which could mechanically attenuate the consumption-WTP correlation for attitudinal attributes. Two observations mitigate this concern. First, the NEP-consumption correlation in the matched sample is modest, which limits the scope for mechanical attenuation. Second, the rebate-consumption correlation is significant and in the expected direction, and it would also be attenuated if the mechanism were purely mechanical. The selective significance pattern (rebate responds to consumption, while carbon and efficiency do not) is more consistent with a substantive interpretation than with a purely mechanical one.

With this caveat, the finding carries a specific interpretation. Stated environmental valuations in this population are associated primarily with attitudes and worldview rather than with the financial scale of each household's gas dependency. High-gas and low-gas users express similar willingness to pay for carbon reduction conditional on their environmental attitudes. The consumption-rebate link, the one significant relationship, is precisely the channel where financial self-interest should operate most directly.

Comparing respondents at the tails of the carbon WTP distribution reinforces this conclusion. The bottom decile of carbon WTP consumes 85 CCF of gas per month on average, while the top decile consumes 77 CCF. The difference is not statistically significant. NEP scores differ modestly between tails (0.26 versus 0.44), but the variation within each tail is large. What separates high and low carbon valuers is not their gas bills but their residual preference heterogeneity after NEP is accounted for.

B.5.3 Stated WTP and Actual Energy Expenditure

A central concern in stated preference research is whether hypothetical WTP is calibrated to actual financial magnitudes. We construct a benchmark by comparing individual-level aggregate WTP for a representative electrification scenario (66% carbon reduction, 50% efficiency improvement, 50% rebate) against actual monthly gas expenditure.

The mean aggregate WTP for this scenario is \$270 per month, roughly three times the mean gas bill of \$88. The ratio of stated WTP to actual gas expenditure varies systematically across the consumption distribution. For the highest gas quartile (mean bill \$143 per month), the ratio is 1.89. For the lowest quartile (mean bill \$38), it is 7.11. The declining ratio suggests that stated WTP is more closely anchored to real financial stakes among high-consumption households, where the economic consequences of fuel switching are most tangible. For low-consumption households, the gap between stated WTP and actual expenditure is consistent with the well-documented hypothetical bias in stated preference studies (Penn and Hu, 2018), compounded by the fact that low-gas households face smaller absolute switching costs and may therefore treat the WTP question as more abstract.

Engineering cost estimates provide an additional calibration. At a heat pump coefficient of performance of 3.5 and 80% gas furnace efficiency, full fuel switching would save the median

household approximately \$19 per month in net energy costs (gas savings of \$79 minus incremental electricity cost of approximately \$60). Stated efficiency WTP for a 50% improvement (\$115 per month at the mean) exceeds plausible realized savings by a factor of roughly six, consistent with the Penn and Hu (2018) trimmed-sample mean hypothetical-bias calibration factor of 1.94 and suggesting additional sources of inflation (percentage-point framing effects, high-income sample effects, and possible conflation of efficiency with broader performance benefits).

The consumption data thus serve two functions. First, they provide suggestive evidence for the economic coherence of WTP estimates. The consumption-rebate link is significant in the expected direction, the WTP-to-expenditure ratio declines with consumption as expected if respondents anchor partly to real costs, and consumption does not predict carbon or efficiency WTP once attitudes are controlled, consistent with the model's decomposition. The WTP-to-expenditure ratio is not a standard measure of hypothetical bias, which is conventionally defined as the ratio of hypothetical to real WTP for the same good. The ratio of stated electrification WTP to current gas expenditure conflates hypothetical bias with genuine consumer surplus, since households may value electrification above their current gas spending if they value carbon reduction, efficiency improvements, and comfort gains. Second, the consumption data provide quantitative benchmarks for calibrating stated preferences to revealed financial magnitudes, which is necessary for translating DCE estimates into program cost-benefit calculations.

C Appendix to Part III: Solar Rebound

C.1 Data Construction

Hourly Solar Generation To impute unobserved hourly solar generation and recover gross household electricity consumption, we use a two-stage random forest model (Breiman, 2001). The model is trained by combining PVGIS simulated hourly solar generation for 2022–2023 with NSRDB hourly weather and irradiance variables.

We then apply the trained model to NSRDB weather and irradiance data for 2024–2025 to project hourly solar generation for each solar household. The predicted solar output is added to metered net electricity consumption to construct hourly gross electricity consumption, which serves as one of the main electricity outcomes in the rebound analysis. Additional details on the imputation procedure, validation designs, and diagnostic results are reported in Appendix C.2.

Standardizing Electricity and Natural Gas Consumption To quantify the rebound effect on total energy consumption, we convert electricity and natural gas usage into a standardized energy unit, million British thermal units (MMBtu). Specifically, electricity consumption measured

in kilowatt-hours (kWh) is converted using the standard conversion factor¹¹, while natural gas consumption measured in hundred cubic feet (CCF) is converted based on its elevation factor and a time-varying heat content obtained from LADPU¹². For White Rock, the elevation factor is 0.81, and 0.78 for the Los Alamos townsite.

Formally, total energy consumption for household i in period t is constructed as

$$\text{TotalEnergy}_{it} = \text{Elec}_{it} \times \kappa^E + \text{Gas}_{it} \times \hbar_i \times \kappa_t^G,$$

where κ^E is the constant kWh-to-MMBtu conversion factor, $\hbar_i$ is the elevation adjustment factor for the city in which household i is located, and κ_t^G is the time-varying heat content factor for natural gas. All components are expressed in MMBtu.

Treatment and control group construction To construct a comparable control group, we restrict the sample of non-solar households to the five geographically closest neighbors (based on straight-line distance) to each solar-adopting household. This spatial matching approach helps ensure similarity in local conditions, including exposure to weather patterns (e.g., temperature, solar irradiance), neighborhood characteristics (such as housing density, building age, and infrastructure), and local energy environments (including utility pricing, grid conditions, and policy exposure). The geographic proximity may also capture localized social interactions and information spillovers, such as peer effects in solar adoption and energy use behavior. While matching on nearby households does not fully eliminate concerns about unobserved heterogeneity or selection, it helps reduce these concerns by limiting comparisons to geographically proximate households that are more likely to share similar environmental and neighborhood conditions.

The final dataset includes 447 treated households with solar installations and 1,729 unique control households without solar installations, yielding 66,370,003 household-hour observations. The 447 treated households are those among the 487 solar sites with imputed generation that also meet the panel-coverage and control-matching requirements of the staggered design. Table C.2 reports the number of households in each treatment group.

C.2 Solar Generation Imputation

To recover solar output, the imputation procedure combines two primary data sources at the household-hour level for 2022–2023. The first source is the historical hourly simulations for

¹¹Electricity consumption is converted from kilowatt-hours to British thermal units using the standard conversion factor 1 kWh = 3,412 Btu.

¹²Natural gas consumption is converted from CCF to MMBtu using the elevation adjustment factor and time-varying heat content reported by LADPU. See <https://www.losalamosnm.us/files/sharedassets/public/v/30/departments/utilities/documents/regularly-updating-files/dpu-cost-of-gas-sched.pdf>.

487 solar households in the LADPU service territory from PVGIS, which includes hourly AC power output, plane-of-array irradiance, and PV system capacity, yielding more than 8,453,833 household-hour observations after non-missing screens. The second source is the NSRDB, which provides hourly weather and irradiance variables on an approximately 4 km spatial grid, including global horizontal irradiance (GHI), diffuse horizontal irradiance (DHI), direct-normal irradiance (DNI), solar zenith angle, ambient temperature, and wind speed. Each solar household is matched to its nearest NSRDB grid cell by great-circle distance. While PVGIS hourly generation data end in 2023, NSRDB extends through 2025, allowing the model to project household-level solar generation beyond the PVGIS coverage period.

We use a two-stage random forest framework (Breiman, 2001) to impute hourly solar generation. In the first stage, household-level plane-of-array irradiance is predicted using NSRDB weather and irradiance variables, hour of day, and month of year. In the second stage, the predicted plane-of-array irradiance is combined with PV system characteristics, including installed capacity, household location, and long-run average daily temperature and precipitation, to estimate hourly solar power generation. Both stages are estimated using random forests with 120 trees and a minimum leaf size of five.

We evaluate the model using four out-of-sample validation designs, including a chronological 80/20 holdout that trains on the earlier 80% of the panel and tests on the remaining later 20% of observations, a year-ahead holdout that trains on 2022 and tests on 2023, a household holdout that excludes entire solar households from training, and five-fold cross-validation. The two-stage random forest demonstrates strong predictive performance across all specifications. Under the year-ahead validation design, which most closely resembles the deployment setting, the model achieves an R^2 of 0.949, while the chronological holdout yields an R^2 of 0.961. The normalized mean absolute error remains below 4% of peak generation, and the prediction bias is negligible relative to productive-hour solar output. Validation results also indicate strong cross-household transferability, with an R^2 of 0.998 when entire households are excluded from the training sample. Because the irradiance input in stage-2 is itself a model output rather than a measurement, these diagnostics establish that the NSRDB-driven random forest reliably reproduces PVGIS-style projections. PVGIS's own validation against measured systems is documented in Huld et al. (2012). The full table and diagnostics are in Table C.1, and we summarize the two-stage performance visually in Figure C.1. The trained two-stage model is then deployed on NSRDB weather observations for 2024–2025 to project hourly household-level solar generation, and the predicted output is added back to metered electricity consumption to recover gross household electricity demand.

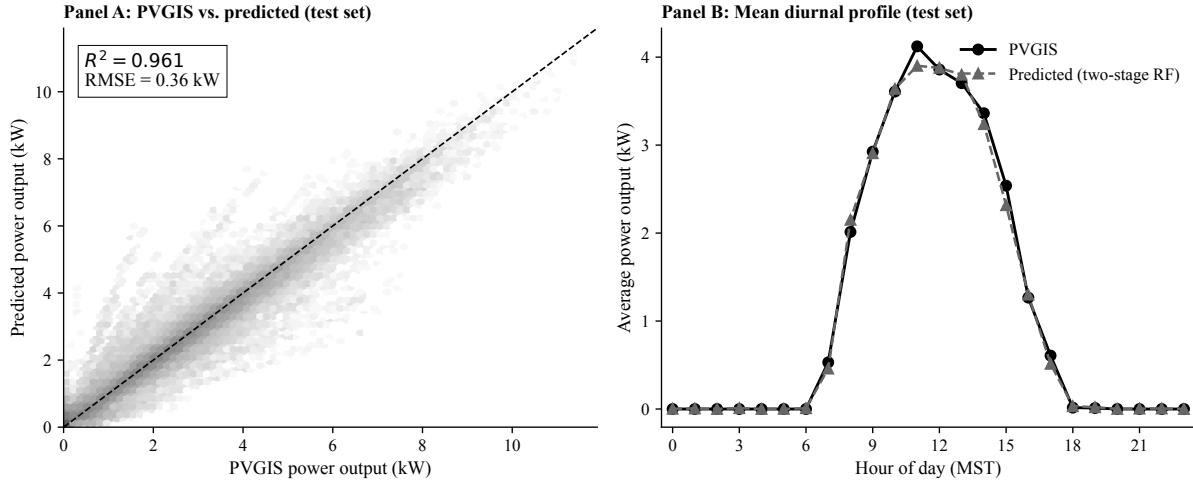


Figure C.1: Main model validation - chronological 80/20 test

Notes. Panel A shows the hexagonal-bin density of test-set household-hour observations, PVGIS versus model prediction. The dashed line is the 45-degree reference. Panel B shows average power output by hour of day (mountain standard time) on the test set, where black is PVGIS and dashed grey is the two-stage random-forest prediction.

Table C.1: Out-of-sample performance of the household solar-generation model

Validation design	R^2	RMSE (W)	nMAE (%)
Time-ordered (80/20)	0.961	365	2.94
Train 2022 / Test 2023	0.949	428	3.71
Household hold-out (20%)	0.998	99	0.82
5-fold CV (mean)	0.998	80	0.61

Note: Two-stage random forest, with stage-1 mapping NSRDB grid variables to plane-of-array irradiance and stage-2 mapping the stage-1 prediction together with PV system characteristics to power output. R^2 is the coefficient of determination against the PVGIS target on the held-out fold; RMSE is in watts; nMAE is the mean absolute error normalised by the 95th-percentile site-hour power output. Five-fold cross-validation reports the cross-fold mean.

C.3 Temporal Patterns in Household Energy Consumption

Figures C.2 and C.3 plot daily and monthly electricity consumption for solar and non-solar households, separately for total and grid electricity.

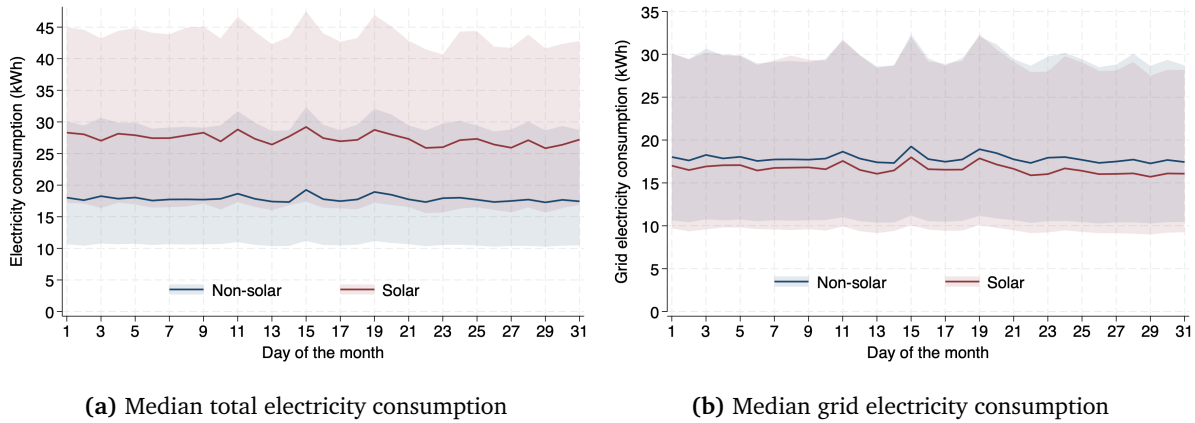


Figure C.2: Daily electricity consumption patterns for solar vs. non-solar households

Notes: The figure plots daily electricity consumption patterns for solar and non-solar households. Panel (a) shows total electricity consumption, and Panel (b) shows grid electricity consumption. Solid lines represent the median hourly consumption for each group, and shaded bands indicate the 25th–75th percentile range. Consumption is measured in kWh.

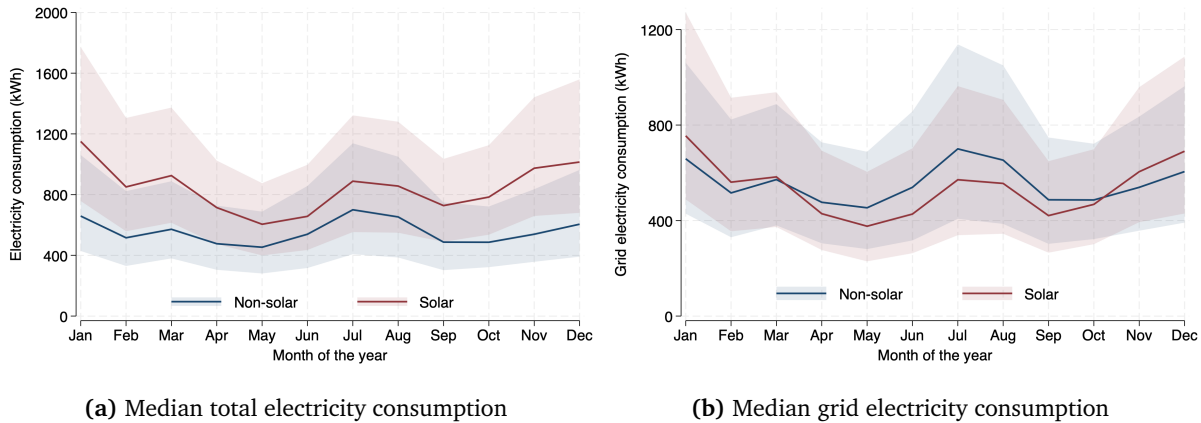


Figure C.3: Monthly electricity consumption patterns for solar vs. non-solar households

Notes: The figure plots monthly electricity consumption patterns for solar and non-solar households. Panel (a) shows total electricity consumption, and Panel (b) shows grid electricity consumption. Solid lines represent the median monthly consumption for each group, and shaded bands indicate the 25th–75th percentile range. Consumption is measured in kWh.

C.4 Energy Rebound Analysis

We employ a staggered difference-in-differences approach to estimate the solar rebound effect in the residential sector. This framework allows us to exploit variation in the timing of solar adoption across households and to account for heterogeneous treatment effects. Our objective is to identify the causal impact of solar adoption on electricity consumption and natural gas

consumption. To provide a unified measure of energy use, we convert both electricity and natural gas consumption into million British thermal units (MMBtu) to estimate the rebound effect on total energy consumption. Detailed model specifications and estimation procedures are presented below.

C.4.1 Methodology

We estimate the dynamic effects of solar adoption using the staggered difference-in-differences framework developed by Callaway and Sant’Anna (2021). To improve computational tractability, we conduct our baseline analysis at the monthly level. We aggregate household-level hourly energy consumption data to monthly frequency and define treatment timing based on the month-year of solar adoption.

$$Y_{it} = \gamma_{-K-} D_{it}^{<-K} + \sum_{k=-K}^{-2} \gamma_k D_{it}^k + \sum_{k=0}^L \gamma_k D_{it}^k + \gamma_{L+} D_{it}^{>L} + \alpha_i + \alpha_t + \varepsilon_{it} \quad (\text{C.1})$$

where $D_{it}^k = \mathbf{1}\{t - G_i = k\}$ is an event-time indicator equal to one when household i is k months from its adoption month G_i , the period immediately before adoption ($k = -1$) is the omitted reference, and $D_{it}^{<-K} = \mathbf{1}\{t - G_i < -K\}$ and $D_{it}^{>L} = \mathbf{1}\{t - G_i > L\}$ bin any event times beyond the endpoints into single indicators with one coefficient each (γ_{-K-} and γ_{L+}). K and L are set to the longest lead and lag observable in the January 2022–June 2025 monthly panel, so the estimation uses the full event window and the endpoint bins are included for generality; the event-study figures display event times -20 to $+40$ for visual clarity.

As specified in Equation C.1, this approach allows us to estimate group-time average treatment effects on the treated group (ATT) by comparing households that adopt solar in a given period to never-treated households.

$$ATT(g, t) = \mathbb{E}[Y_{it}(1) - Y_{it}(0) \mid G_i = g], \quad t \geq g \quad (\text{C.2})$$

$$ATT = \sum_{g \leq t} w_g ATT(g, t) \quad (\text{C.3})$$

where the aggregation weights w_g follow the “simple” aggregation of Callaway and Sant’Anna (2021): each post-treatment group-time cell (g, t) with $t \geq g$ receives a weight proportional to the size of adoption cohort g , so the overall ATT is the cohort-size-weighted average of all post-treatment group-time effects.

In our application, Y_{it} denotes the outcome of interest for household i in month-year t . Let G_i denote the first month in which household i adopts solar. For never-treated households, $G_i = 0$. Following Callaway and Sant’Anna (2021), we first estimate the group-time average

treatment effect, $ATT(g, t)$, which measures the average effect of solar adoption in month-year t for the cohort of households that first adopt in month-year g . Formally, $ATT(g, t)$ is defined as the expected difference between the treated potential outcome, $Y_{it}(D = 1)$, and the untreated potential outcome, $Y_{it}(D = 0)$, conditional on belonging to treatment cohort g . We then aggregate these group-time effects across treatment cohorts to obtain overall time-specific treatment effects, ATT , and event-time treatment effects, $ATT(e)$, where $e = t - g$ denotes months relative to adoption. Insignificant lead coefficients (i.e., $e < 0$) support the validity of the identification strategy. The lag coefficients (i.e., $e \geq 0$) capture the magnitude and persistence of the rebound effect following adoption.

C.4.2 Identification strategy

A central identification concern in estimating the causal effect of solar adoption on energy consumption is self-selection. Households voluntarily choose whether and when to install solar panels, and the factors driving adoption may also be correlated with subsequent energy consumption behavior. While household fixed effects account for time-invariant unobserved heterogeneity, they do not address the possibility that households adopt solar in response to evolving consumption preferences or expectations.

More broadly, the identification concern is whether solar adoption is driven by time-varying household-level factors that also affect energy consumption. These factors could operate in either direction. For example, households may adopt solar because they anticipate a future increase in electricity demand, such as adding electric appliances, working more from home, or planning other lifestyle changes. Conversely, households with increasing environmental awareness may adopt solar while also becoming more attentive to energy conservation. Their electricity consumption may decline after adoption. However, not all post-adoption changes represent a threat to identification.

For example, if households increase electricity consumption only after adoption because self-generated electricity lowers the effective cost of electricity or enables additional electricity services, then this behavioral adjustment is precisely the rebound effect of interest. Similarly, if households reduce electricity consumption only after adoption because they learn to manage energy use more efficiently, or respond to limited compensation for exporting excess generation back to the grid, then this post-adoption adjustment is also a treatment-induced behavioral response. In both cases, the change in energy consumption is part of the causal effect of solar adoption as long as the behavioral response is induced by adoption itself and would not have occurred otherwise. The identification threat arises only if the same consumption trajectory would have emerged even in the absence of treatment because of underlying time-varying factors correlated with adoption timing.

To assess this concern, we examine pre-treatment trends using the event-study specification.

If solar adopters were systematically on different energy consumption trajectories before installation, we would expect to observe significant pre-treatment effects. The parallel pre-treatment trends provide supportive evidence that households followed similar trends before adoption, making it more plausible that the post-adoption change reflects the causal effect of solar adoption rather than pre-existing demand growth or conservation trends.

C.5 Parallel Trend Tests

Figures C.4 and C.5 report the monthly event-study estimates for the full sample and the restricted surveyed sample, respectively. In both, the pre-adoption coefficients are flat, supporting the parallel-trends assumption.

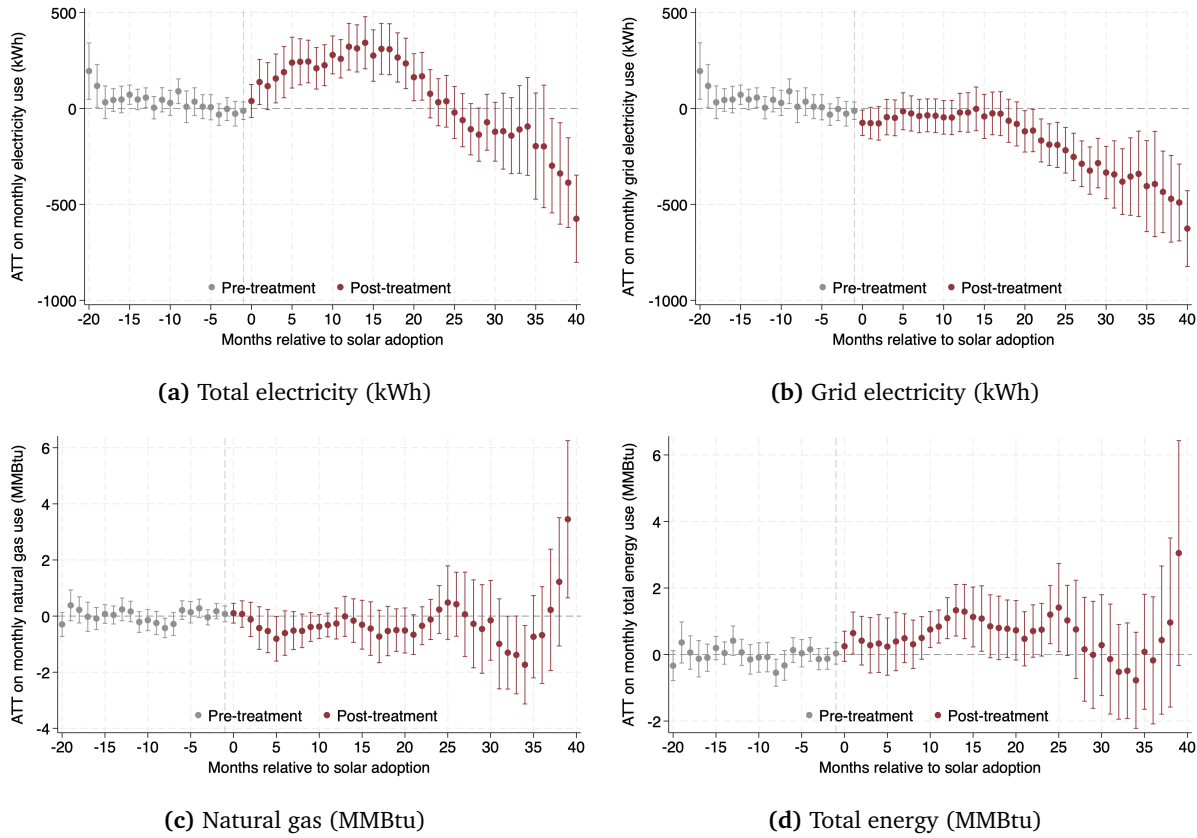


Figure C.4: Event study estimates for monthly energy consumption (full sample)

Notes: The figure displays event-study estimates for 20 periods before and 40 periods after solar adoption for visual clarity, while the regression specification includes the full event window.

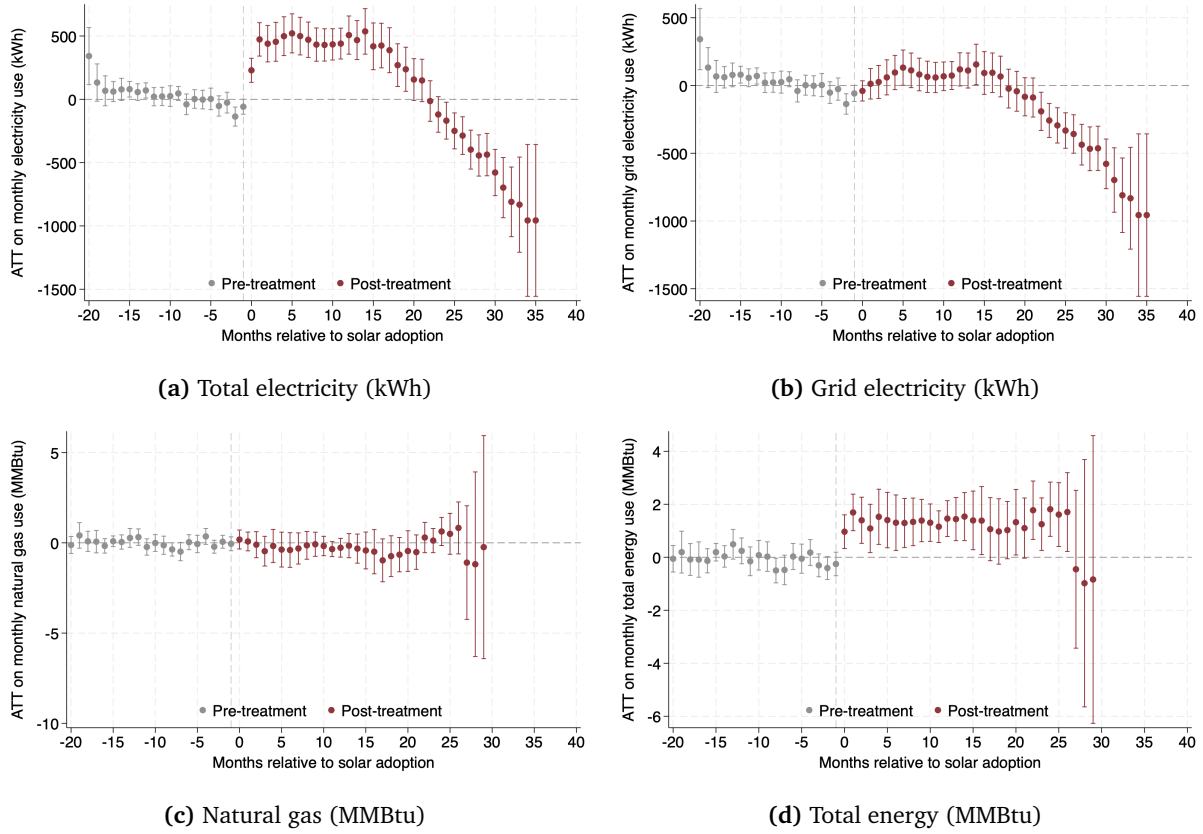


Figure C.5: Event study estimates for monthly energy consumption (restricted sample)

C.6 Supplementary Figures

This subsection collects supporting figures for the solar-rebound analysis. Figure C.6 relates monthly electricity consumption to average installed capacity by installation month. Figures C.7 and C.8 report the ATT on hourly grid-electricity and natural-gas use by day type, and Figure C.12 plots the hourly solar-generation profile against the grid emission factor.

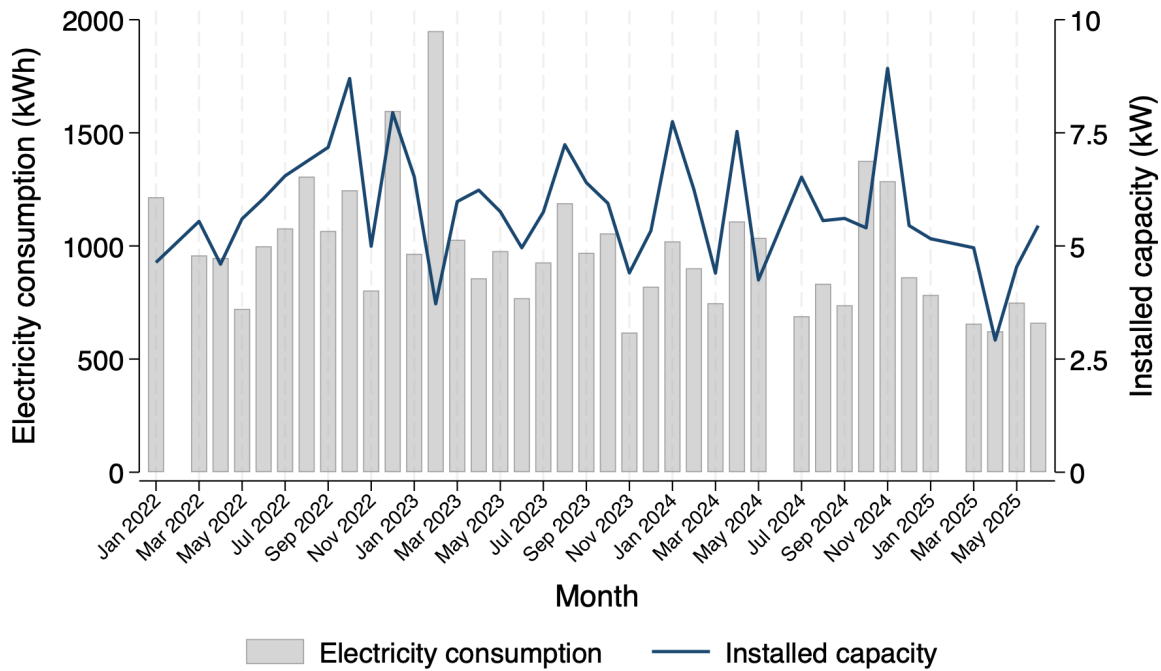


Figure C.6: Monthly electricity consumption and average installed capacity

Notes: The figure is based on solar households only. Grey bars show average monthly household electricity consumption in kWh, calculated at the household-month level and averaged by installation month. The navy line shows average installed solar capacity in kW for households installed in each month. The x-axis reports the month of solar installation. (the outlier in 2023m2 is for only 1 household)

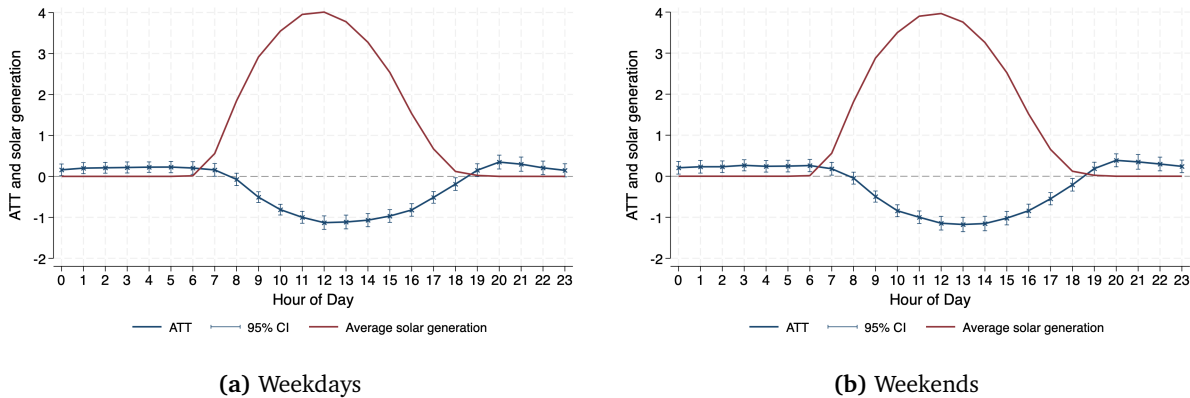
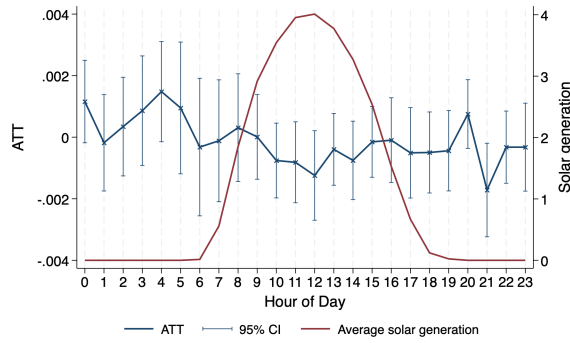
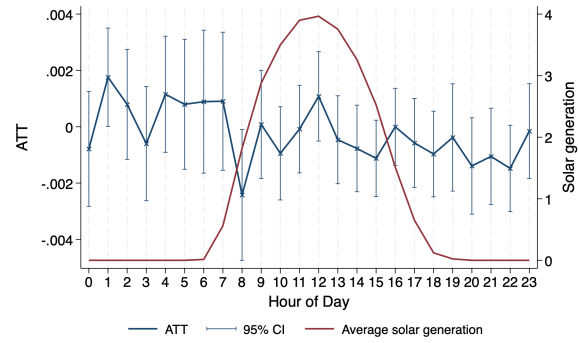


Figure C.7: ATT on hourly grid electricity use (kWh) by day type

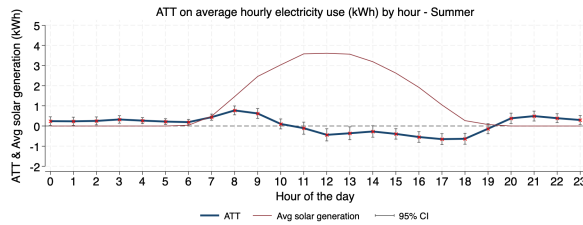


(a) Weekdays

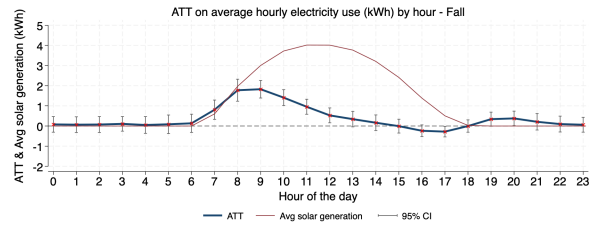


(b) Weekends

Figure C.8: ATT on hourly natural gas use (MMBtu) by day type

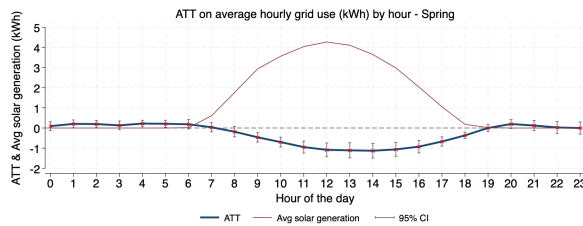


(a) Summer

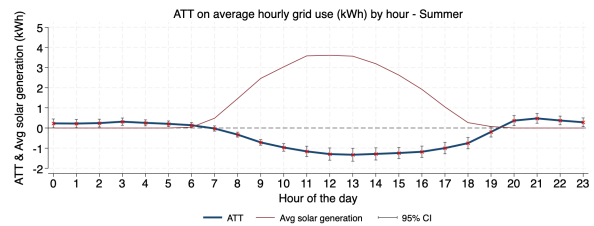


(b) Fall

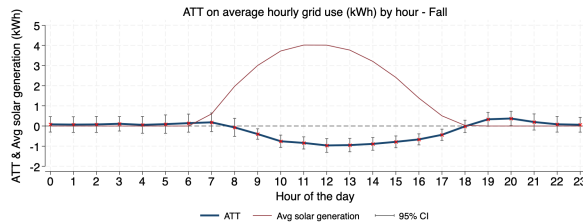
Figure C.9: ATT on hourly electricity use (kWh) by season



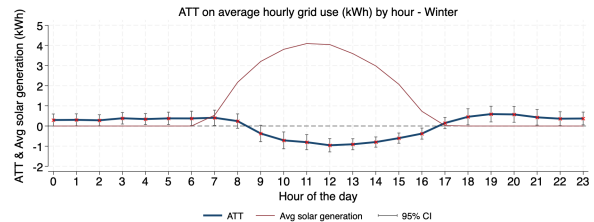
(a) Spring



(b) Summer



(c) Fall



(d) Winter

Figure C.10: ATT on hourly grid electricity use (kWh) by season

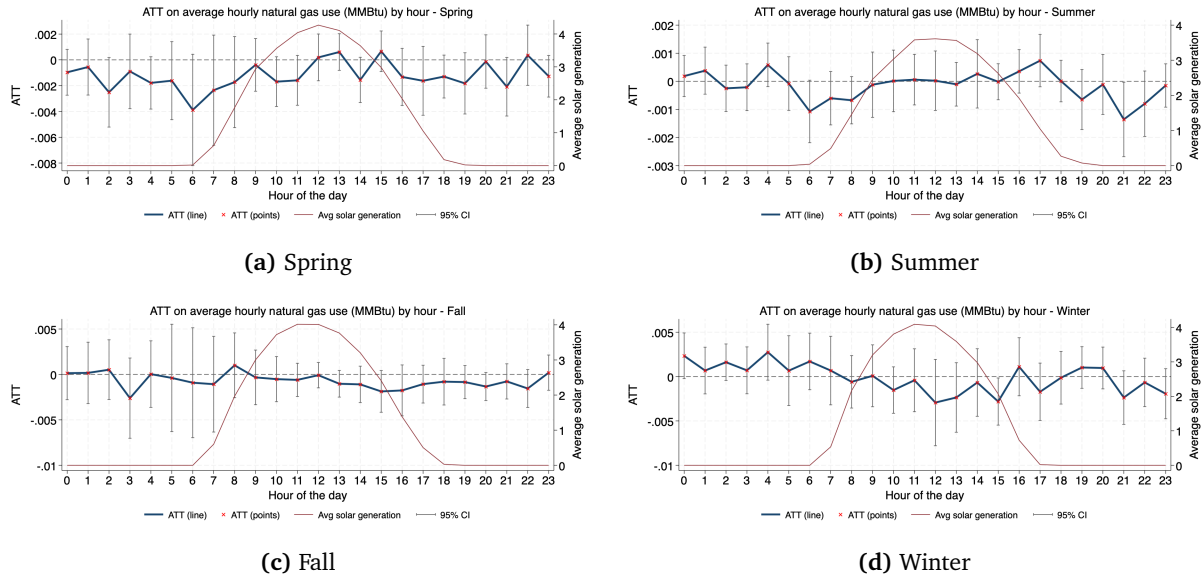


Figure C.11: ATT on hourly natural gas use (MMBtu) by season

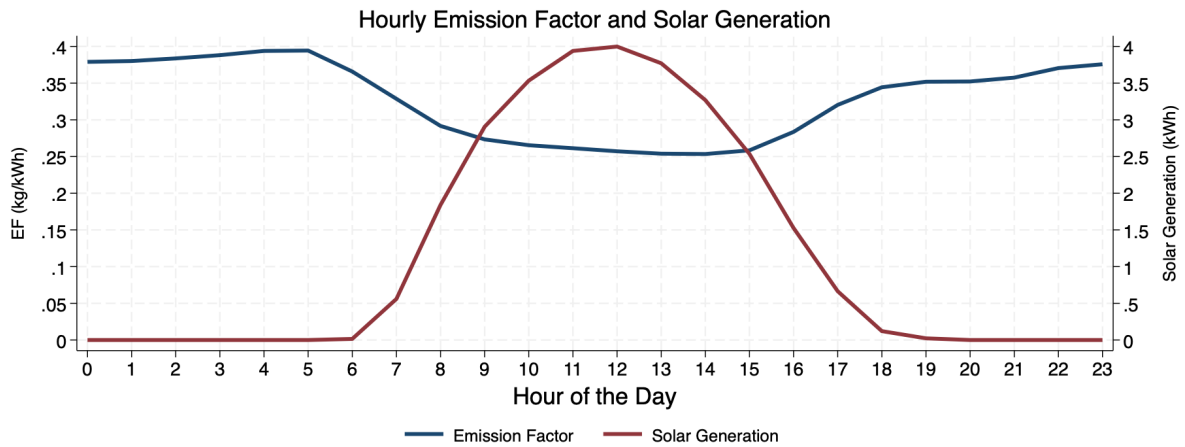


Figure C.12: Hourly solar generation and emission factor

C.7 Supplementary Tables

This subsection collects supporting tables for the solar-rebound analysis. Table C.3 reports the staggered-adoption data structure for the restricted sample. Tables C.5 and C.6 report the seasonal ATT for the restricted sample in native units and in MMBtu. The grid- and gas-channel CO₂ reductions by hour and season are reported in Tables C.9 and C.12. Tables C.13, C.14, C.15, and C.16 compare natural-gas and electricity consumption across surveyed versus non-surveyed and solar versus non-solar households, and Table C.17 reports Kolmogorov–Smirnov tests of the

corresponding distributions.

Table C.2: Number of households in each solar adoption group (Full sample)

Never treated	Always treated	Treated within the period	Total
1,729	249	198	2,176

Table C.3: Number of households in each solar adoption group (Restricted sample)

Never treated	Always treated	Treated within the period	Total
1,729	0	110	1,839

Table C.4: Summary Statistics

	Full Sample (N = 2,176)			
	Mean	S.D.	Min	Max
Solar adoption	0.21	0.40	0	1
Solar capacity (kW)	5.52	2.09	1.23	10.00
Hourly solar generation (kWh) - all hours	1.16	0.44	0.26	2.10
Hourly solar generation (kWh) - with positive generation	2.28	0.87	0.5	4.19
Hourly grid electricity consumption (kWh)	0.96	0.57	0	5.79
Hourly electricity consumption (kWh)	1.05	0.62	0	5.79
Hourly gas consumption (MMBtu)	0.01	0.01	0	0.16
Hourly total energy consumption (MMBtu)	0.01	0.01	0	0.16

Notes: This table reports summary statistics based on household-level averages. We first average hourly consumption and generation outcomes within each household over the study period, and then summarize the distribution of these household-level means across households. This approach gives each household equal weight in the summary statistics and avoids giving more weight to households with more observed hourly records. Average solar generation is reported both over all observed hours and conditional on positive generation hours.

Table C.5: Rebound effect heterogeneity: ATT by season - Restricted sample

		(1) Full sample	(2) Spring	(3) Summer	(4) Fall	(5) Winter
Panel A: Total electricity (kWh)	ATT	238.697***	247.946***	94.208	39.093	458.526***
	Std. Err	(56.8526)	(80.7660)	(105.4202)	(77.7122)	(142.6081)
	Pre-treatment mean	631.0236	564.4052	692.6547	558.9326	705.9960
	% change	+37.827%	+43.930%	-	-	+64.947%
Panel B: Grid electricity (kWh)	ATT	-50.368***	-41.627	-130.836	-155.584**	79.500
	Std. Err	(53.0038)	(77.6366)	(88.8329)	(71.7170)	(145.7907)
	Pre-treatment mean	631.0119	564.4052	692.6547	558.9326	705.9516
	% change	-7.982%	-	-	-27.836%	-
Panel C: Natural gas (MMBtu)	ATT	-0.266	-0.500	-0.125	-0.401	0.830*
	Std. Err	(0.2907)	(0.3517)	(0.2150)	(0.3813)	(0.4327)
	Pre-treatment mean	6.55737	6.1827	1.5424	5.3487	12.4711
	% change	-	-	-	-	+6.658%
	N	77,622	21,382	17,804	15,958	19,706
	Sample period	All	Mar. - May.	Jun. - Aug.	Sept. - Nov.	Dec. - Feb

Note: This table reports the ATT of solar adoption on household energy consumption. Treatment timing is defined by the year-month of solar installation, and we use households that never adopt solar as the control group. Standard errors, reported in parentheses, are clustered at the household level. Pre-treatment means are calculated using observations prior to solar adoption for treated households. Percentage changes are computed relative to pre-treatment means and are not reported when the ATT estimate is statistically insignificant. Significance levels are denoted as *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

Table C.6: Rebound effect heterogeneity: ATT by season (in MMBtu) - Restricted sample

		(1) Full sample	(2) Spring	(3) Summer	(4) Fall	(5) Winter
Panel A: Total electricity (MMBtu)	ATT	0.814***	0.845***	0.321	0.133	1.564***
	Std. Err	(0.1940)	(0.2756)	(0.3597)	(0.2652)	(0.4866)
	Pre-treatment mean	2.1531	1.9258	2.3633	1.9071	2.4089
	% change	+37.826%	+43.929%	-	-	+64.946%
Panel B: Grid electricity (MMBtu)	ATT	-0.172	-0.142	-0.446	-0.531**	0.271
	Std. Err	(0.1808)	(0.2649)	(0.3031)	(0.2447)	(0.4974)
	Pre-treatment mean	2.1530	1.9258	2.3633	1.9071	2.4087
	% change	-7.982%	-	-	-27.836%	-
Panel C: Natural gas (MMBtu)	ATT	-0.266	-0.500	-0.125	-0.401	0.830*
	Std. Err	(0.2907)	(0.3517)	(0.2150)	(0.3813)	(0.4327)
	Pre-treatment mean	6.55737	6.1827	1.5424	5.3487	12.4711
	% change	-	-	-	-	+6.658%
Panel D: Total energy (MMBtu)	ATT	1.307***	0.346	1.201***	1.027**	3.083***
	Std. Err	(0.3508)	(0.4592)	(0.4497)	(0.4862)	(0.7328)
	Pre-treatment mean	8.7118	8.1096	3.9073	7.2573	14.8816
	% change	+15.008%	-	+30.738%	+14.154%	+20.719%
	N	77,622	21,382	17,804	15,958	19,706
	Sample period	All	Mar. - May.	Jun. - Aug.	Sept. - Nov.	Dec. - Feb

Note: This table reports the ATT of solar adoption on household energy consumption. Treatment timing is defined by the year-month of solar installation, and we use households that never adopt solar as the control group. Standard errors, reported in parentheses, are clustered at the household level. Pre-treatment means are calculated using observations prior to solar adoption for treated households. Percentage changes are computed relative to pre-treatment means and are not reported when the ATT estimate is statistically insignificant. Significance levels are denoted as *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

Table C.7: CO₂ Reduction from Grid Electricity with Rebound (Seasonal Aggregation)

Season	Marginal EF (kg/kWh)	ATT	Reduction (kg)
Spring	0.465	-102.309*	-47.574
Summer	0.441	-252.238***	-111.346
Fall	0.442	-333.309***	-147.196
Winter	0.443	insignificant	-
Spring total			-142.723
Summer total			-334.039
Fall total			-441.588
Winter total			-
Annual total			-918.351

Table C.8: CO₂ Reduction from Grid Electricity with Rebound: Hourly ATT Estimates

Hour	Marginal EF (kg/kWh)	ATT_fmt	Hourly effect (kg)
0	0.445	0.175**	0.078
1	0.445	0.211***	0.094
2	0.445	0.216***	0.096
3	0.445	0.232***	0.103
4	0.445	0.230***	0.102
5	0.444	0.233***	0.104
6	0.445	0.222***	0.099
7	0.453	0.167**	0.076
8	0.456	-0.065	0.000
9	0.456	-0.504***	-0.230
10	0.455	-0.820***	-0.373
11	0.454	-1.000***	-0.454
12	0.454	-1.134***	-0.515
13	0.455	-1.133***	-0.515
14	0.455	-1.093***	-0.497
15	0.454	-0.983***	-0.446
16	0.453	-0.824***	-0.373
17	0.449	-0.524***	-0.235
18	0.443	-0.193**	-0.086
19	0.443	0.161**	0.071
20	0.443	0.357***	0.158
21	0.444	0.312***	0.138
22	0.444	0.232***	0.103
23	0.445	0.176**	0.078
Daily reduction			-2.423
Annual reduction			-884.296

Table C.9: CO₂ Reduction from Grid Electricity with Rebound: Hour–Season ATT Estimates

Season	Hr	EF(kg/kWh)	ATT	Reduction(kg)
Spring	0	0.451	0.092	0.000
Spring	1	0.452	0.205**	0.093
Spring	2	0.451	0.195**	0.088
Spring	3	0.451	0.131	0.000
Spring	4	0.451	0.221***	0.100
Spring	5	0.450	0.208**	0.094
Spring	6	0.452	0.187	0.000
Spring	7	0.481	0.037	0.000
Spring	8	0.487	-0.184	0.000
Spring	9	0.487	-0.462***	-0.225
Spring	10	0.486	-0.699***	-0.340
Spring	11	0.485	-0.946***	-0.458
Spring	12	0.485	-1.084***	-0.525
Spring	13	0.486	-1.108***	-0.539
Spring	14	0.487	-1.127***	-0.548
Spring	15	0.483	-1.063***	-0.514
Spring	16	0.480	-0.925***	-0.444
Spring	17	0.467	-0.671***	-0.313
Spring	18	0.447	-0.368***	-0.165
Spring	19	0.447	0.002	0.000
Spring	20	0.447	0.197*	0.088
Spring	21	0.449	0.123	0.000
Spring	22	0.449	0.026	0.000
Spring	23	0.451	0	0.000
Summer	0	0.442	0.229**	0.101
Summer	1	0.442	0.221**	0.098
Summer	2	0.442	0.244**	0.108
Summer	3	0.442	0.313***	0.138
Summer	4	0.442	0.256***	0.113
Summer	5	0.442	0.208***	0.092
Summer	6	0.442	0.139**	0.061
Summer	7	0.442	-0.025	0.000
Summer	8	0.442	-0.328***	-0.145
Summer	9	0.441	-0.712***	-0.314
Summer	10	0.441	-0.965***	-0.426
Summer	11	0.441	-1.161***	-0.512
Summer	12	0.441	-1.295***	-0.571
Summer	13	0.441	-1.327***	-0.585
Summer	14	0.441	-1.286***	-0.567
Summer	15	0.440	-1.241***	-0.547
Summer	16	0.440	-1.179***	-0.519
Summer	17	0.441	-0.997***	-0.439
Summer	18	0.441	-0.751***	-0.331
Summer	19	0.441	-0.194	0.000
Summer	20	0.441	0.366***	0.161
Summer	21	0.441	0.477***	0.211
Summer	22	0.442	0.374***	0.165
Summer	23	0.442	0.285***	0.126
Spring daily reduction: 3.610kg				
Summer daily reduction: 3.580kg				

Season	Hr	EF(kg/kWh)	ATT	Reduction(kg)
Fall	0	0.442	0.083	0.000
Fall	1	0.442	0.07	0.000
Fall	2	0.442	0.078	0.000
Fall	3	0.442	0.11	0.000
Fall	4	0.442	0.057	0.000
Fall	5	0.442	0.093	0.000
Fall	6	0.442	0.142	0.000
Fall	7	0.441	0.183	0.000
Fall	8	0.441	-0.07	0.000
Fall	9	0.442	-0.399***	-0.176
Fall	10	0.442	-0.757***	-0.334
Fall	11	0.442	-0.839***	-0.370
Fall	12	0.442	-0.965***	-0.426
Fall	13	0.442	-0.947***	-0.418
Fall	14	0.442	-0.888***	-0.392
Fall	15	0.441	-0.786***	-0.347
Fall	16	0.441	-0.664***	-0.293
Fall	17	0.441	-0.435***	-0.192
Fall	18	0.441	-0.017	0.000
Fall	19	0.441	0.332*	0.147
Fall	20	0.441	0.372**	0.164
Fall	21	0.441	0.199	0.000
Fall	22	0.442	0.086	0.000
Fall	23	0.442	0.063	0.000
Winter	0	0.444	0.297*	0.132
Winter	1	0.443	0.305**	0.135
Winter	2	0.443	0.283**	0.125
Winter	3	0.443	0.385***	0.171
Winter	4	0.443	0.344**	0.152
Winter	5	0.443	0.379**	0.168
Winter	6	0.444	0.376**	0.167
Winter	7	0.444	0.409**	0.181
Winter	8	0.445	0.243	0.000
Winter	9	0.445	-0.370*	-0.165
Winter	10	0.444	-0.713***	-0.316
Winter	11	0.442	-0.804***	-0.356
Winter	12	0.443	-0.955***	-0.423
Winter	13	0.443	-0.906***	-0.401
Winter	14	0.443	-0.796***	-0.353
Winter	15	0.443	-0.602***	-0.267
Winter	16	0.443	-0.377***	-0.167
Winter	17	0.443	0.147	0.000
Winter	18	0.443	0.457**	0.202
Winter	19	0.443	0.591***	0.262
Winter	20	0.442	0.575***	0.254
Winter	21	0.442	0.432**	0.191
Winter	22	0.442	0.363**	0.161
Winter	23	0.443	0.373**	0.165
Fall daily reduction: 2.639kg				
Winter daily reduction: -0.018kg				

Table C.10: CO₂ Reduction from Natural Gas with Rebound (Seasonal Aggregation)

Season	Emissions Coefficients (kg/MMBtu)	ATT	Reduction (kg)
Spring	52.91	-0.948***	-50.183
Summer	52.91	insignificant	-
Fall	52.91	insignificant	-
Winter	52.91	insignificant	-
Spring total			-150.550
Summer total			-
Fall total			-
Winter total			-
Annual total			-150.550

Table C.11: CO₂ Reduction from Natural Gas with Rebound: Hourly ATT Estimates

Hour	Emissions Coefficients (kg/MMBtu)	ATT_fmt	Hourly effect (kg)
0	52.91	0.001	0.000
1	52.91	0	0.000
2	52.91	0	0.000
3	52.91	0	0.000
4	52.91	0.001*	0.053
5	52.91	0.001	0.000
6	52.91	0	0.000
7	52.91	0	0.000
8	52.91	0	0.000
9	52.91	0	0.000
10	52.91	-0.001	0.000
11	52.91	-0.001	0.000
12	52.91	-0.001	0.000
13	52.91	0	0.000
14	52.91	-0.001	0.000
15	52.91	0	0.000
16	52.91	0	0.000
17	52.91	-0.001	0.000
18	52.91	-0.001	0.000
19	52.91	0	0.000
20	52.91	0	0.000
21	52.91	-0.002**	-0.106
22	52.91	-0.001	0.000
23	52.91	0	0.000
Daily total			-0.053
Annual total			-19.312

Table C.12: CO₂ Reduction from Natural Gas with Rebound: Hour–Season ATT Estimates

Season	Hr	EC (kg/MMBtu))	ATT	Reduction(kg)	Season	Hr	EC (kg/MMBtu))	ATT	Reduction(kg)
Spring	0	52.91	-0.001	0.000	Fall	0	52.91	0	0.000
Spring	1	52.91	-0.001	0.000	Fall	1	52.91	0	0.000
Spring	2	52.91	-0.003*	-0.159	Fall	2	52.91	0.001	0.000
Spring	3	52.91	-0.001	0.000	Fall	3	52.91	-0.003	0.000
Spring	4	52.91	-0.002*	-0.106	Fall	4	52.91	0	0.000
Spring	5	52.91	-0.002	0.000	Fall	5	52.91	0	0.000
Spring	6	52.91	-0.004*	-0.212	Fall	6	52.91	-0.001	0.000
Spring	7	52.91	-0.002	0.000	Fall	7	52.91	-0.001	0.000
Spring	8	52.91	-0.002	0.000	Fall	8	52.91	0.001	0.000
Spring	9	52.91	0	0.000	Fall	9	52.91	0	0.000
Spring	10	52.91	-0.002*	-0.106	Fall	10	52.91	-0.001	0.000
Spring	11	52.91	-0.002	0.000	Fall	11	52.91	-0.001	0.000
Spring	12	52.91	0	0.000	Fall	12	52.91	0	0.000
Spring	13	52.91	0.001	0.000	Fall	13	52.91	-0.001	0.000
Spring	14	52.91	-0.002*	-0.106	Fall	14	52.91	-0.001	0.000
Spring	15	52.91	0.001	0.000	Fall	15	52.91	-0.002	0.000
Spring	16	52.91	-0.001	0.000	Fall	16	52.91	-0.002	0.000
Spring	17	52.91	-0.002	0.000	Fall	17	52.91	-0.001	0.000
Spring	18	52.91	-0.001	0.000	Fall	18	52.91	-0.001	0.000
Spring	19	52.91	-0.002	0.000	Fall	19	52.91	-0.001	0.000
Spring	20	52.91	0	0.000	Fall	20	52.91	-0.001*	-0.053
Spring	21	52.91	-0.002*	-0.106	Fall	21	52.91	-0.001	0.000
Spring	22	52.91	0	0.000	Fall	22	52.91	-0.002	0.000
Spring	23	52.91	-0.001	0.000	Fall	23	52.91	0	0.000
Summer	0	52.91	0	0.000	Winter	0	52.91	0.002*	0.106
Summer	1	52.91	0	0.000	Winter	1	52.91	0.001	0.000
Summer	2	52.91	0	0.000	Winter	2	52.91	0.002	0.000
Summer	3	52.91	0	0.000	Winter	3	52.91	0.001	0.000
Summer	4	52.91	0.001	0.000	Winter	4	52.91	0.003*	0.159
Summer	5	52.91	0	0.000	Winter	5	52.91	0.001	0.000
Summer	6	52.91	-0.001*	-0.053	Winter	6	52.91	0.002	0.000
Summer	7	52.91	-0.001	0.000	Winter	7	52.91	0.001	0.000
Summer	8	52.91	-0.001	0.000	Winter	8	52.91	-0.001	0.000
Summer	9	52.91	0	0.000	Winter	9	52.91	0	0.000
Summer	10	52.91	0	0.000	Winter	10	52.91	-0.002	0.000
Summer	11	52.91	0	0.000	Winter	11	52.91	0	0.000
Summer	12	52.91	0	0.000	Winter	12	52.91	-0.003	0.000
Summer	13	52.91	0	0.000	Winter	13	52.91	-0.002	0.000
Summer	14	52.91	0	0.000	Winter	14	52.91	-0.001	0.000
Summer	15	52.91	0	0.000	Winter	15	52.91	-0.003**	-0.159
Summer	16	52.91	0	0.000	Winter	16	52.91	0.001	0.000
Summer	17	52.91	0.001	0.000	Winter	17	52.91	-0.002	0.000
Summer	18	52.91	0	0.000	Winter	18	52.91	0	0.000
Summer	19	52.91	-0.001	0.000	Winter	19	52.91	0.001	0.000
Summer	20	52.91	0	0.000	Winter	20	52.91	0.001	0.000
Summer	21	52.91	-0.001**	-0.053	Winter	21	52.91	-0.002	0.000
Summer	22	52.91	-0.001	0.000	Winter	22	52.91	-0.001	0.000
Summer	23	52.91	0	0.000	Winter	23	52.91	-0.002	0.000
Spring daily reduction: 0.794kg					Fall daily reduction: 0.053kg				
Summer daily reduction: 0.106kg					Winter daily reduction: -0.106kg				

Table C.13: Gas Consumption: Survey (N=588) vs. Non-Survey (N=7,268)

	Survey (N=588)		Non-Survey (N=7,268)		T-Test
	Consumption (CCF)	S.D.	Consumption (CCF)	S.D.	
Year					
2023	913.68	1092.19	990.54	1906.66	0.97
2024	955.37	1231.62	1058.91	2265.43	1.11
2025 (Incomplete)	555.45	746.6	626.98	1485.43	1.16
Month					
1	198.61	210.61	215.33	372.69	1.09
2	135.17	150.15	147.9	263.22	1.17
3	132.59	155.09	149.38	308.83	1.32
4	71.68	92.58	82.36	211.47	1.23
5	37.67	56.1	45.66	171.59	1.14
6	20.45	37.5	25.34	123.29	0.97
7	22.06	56.33	23.37	118.76	0.26
8	20.37	40.46	24.03	120.14	0.73
9	22.15	39.63	26.03	110.08	0.84
10	50.83	65.17	57.38	155.42	1.00
11	124.52	139.23	135.55	236.69	1.09
12	156.09	166.72	170.32	316.3	1.06
Day of Week					
Sunday	3.17	3.6	3.57	8.16	1.2
Monday	3.19	3.61	3.6	8.02	1.25
Tuesday	3.22	3.66	3.62	7.92	1.24
Wednesday	3.12	3.54	3.52	7.73	1.24
Thursday	3.02	3.44	3.41	7.51	1.27
Friday	3.3	3.8	3.66	8.13	1.05
Saturday	3.27	3.79	3.64	8.16	1.1

Notes: A t-value with an absolute magnitude greater than 1.96 indicates statistical significance at the 5% level.

Table C.14: Electricity Consumption: Survey (N=536) vs. Non-Survey (N=7,746)

	Survey (N=536)		Non-Survey (N=7,746)		T-Test
	Consumption (KWH)	S.D.	Consumption (KWH)	S.D.	
Year					
2023	6267.3	3791.82	6547.96	4622.61	-1.39
2024	7296.39	4621.66	7925.67	5618.25	-2.55
2025 (Incomplete)	3532.71	2319.47	3901.11	2798.9	-2.98
Month					
1	727.04	623.08	758.78	492.62	-1.17
2	559.92	468.52	587.15	367.01	-1.34
3	608.63	491.89	646.36	384.41	-1.77
4	490.41	381.66	527.66	302.74	-2.25
5	445.92	342.77	489.5	287.08	-2.92
6	533.05	412.48	585.64	372.94	-2.92
7	741.57	576.2	799.08	542.43	-2.27
8	705.66	553.56	755.11	504.65	-2.04
9	481.91	374.94	513.4	328.31	-1.92
10	482.92	370.03	517.51	296.51	-2.14
11	557.07	458.75	605.37	371.11	-2.41
12	621.03	530.18	668.89	434.62	-2.06
Day of Week					
Sunday	20.45	15.06	22.1	12.73	-2.52
Monday	19.74	15.01	21.28	12.28	-2.36
Tuesday	19.69	20.1	21.38	12.38	-1.95
Wednesday	19.56	14.77	21.15	12.22	-2.48
Thursday	19.89	14.86	21.52	12.28	-2.53
Friday	20.8	15.16	22.54	12.7	-2.65
Saturday	22.43	15.98	24.2	13.52	-2.54

Notes: A t-value with an absolute magnitude greater than 1.96 indicates statistical significance at the 5% level.

Table C.15: Gas Consumption: Solar (N=74) vs. Non-Solar (N=588)

	Solar (N=74)		Non-Solar (N=588)		T-Test
	Consumption (CCF)	S.D.	Consumption (CCF)	S.D.	
Year					
2023	894.91	739.4	770.33	428.27	1.41
2024	937.18	829.71	774.12	497.82	1.65
2025 (Incomplete)	544.83	525.32	447.79	320.05	1.54
Month					
1	195.25	142.44	169.74	95.18	1.49
2	132.97	103.2	113.56	64.39	1.57
3	130.24	108.22	111.28	66.74	1.47
4	70.58	66.44	57.13	31.45	1.71
5	37.21	42.56	28	16.06	1.84
6	19.86	24.54	14.88	9.49	1.71
7	21.6	49.99	15	11.07	1.12
8	19.6	24.4	14.7	10.76	1.68
9	21.77	26.67	14.55	9.95	2.26
10	50.58	49.37	37.07	22.88	2.24
11	122.3	92.43	103.78	64.58	1.61
12	153.92	112.41	128.22	76.63	1.84
Day of Week					
Sunday	3.14	2.61	2.59	1.38	1.78
Monday	3.14	2.51	2.61	1.4	1.77
Tuesday	3.17	2.52	2.67	1.48	1.65
Wednesday	3.08	2.44	2.56	1.44	1.77
Thursday	2.97	2.36	2.48	1.32	1.75
Friday	3.26	2.61	2.71	1.47	1.77
Saturday	3.22	2.62	2.67	1.44	1.78

Notes: A t-value with an absolute magnitude greater than 1.96 indicates statistical significance at the 5% level.

Table C.16: Electricity Consumption: Solar (N=82) vs. Non-Solar (N=536)

	Solar (N=82)		Non-Solar (N=536)		T-Test
	Consumption (KWH)	S.D.	Consumption (KWH)	S.D.	
Year					
2023	6547.96	3791.82	9461.36	5333	-5.74
2024	7925.67	4621.66	10745.14	5861.21	-4.93
2025 (Incomplete)	3901.11	2319.48	6100.99	3240.91	-7.54
Month					
1	758.78	492.62	1034.18	697.41	-4.43
2	587.15	367.01	885.37	502.79	-6.51
3	646.36	384.41	891.11	456.98	-5.24
4	527.66	302.74	962.92	467.64	-11.2
5	489.5	287.08	937.02	436.93	-12.19
6	585.64	372.94	953.03	451.9	-8.13
7	799.08	542.43	1037.08	477.65	-3.63
8	755.11	504.65	888.67	404.39	-2.22
9	513.4	328.31	922.3	448.24	-9.88
10	517.51	296.51	862.07	418.68	-9.15
11	605.37	371.11	918.23	540.15	-6.62
12	668.89	434.62	962.86	609.92	-5.36
Day of Week					
Sunday	22.1	12.73	35.8	17.57	-8.7
Monday	21.28	12.28	36.44	17.77	-9.82
Tuesday	21.38	12.38	36.6	17.81	-9.79
Wednesday	21.15	12.22	37.33	18.42	-10.43
Thursday	21.52	12.28	37.38	19.22	-10.12
Friday	22.54	12.7	36.05	17.32	-8.61
Saturday	24.2	13.52	36.74	17.71	-7.58

Notes: A t-value with an absolute magnitude greater than 1.96 indicates statistical significance at the 5% level.

Table C.17: KS Test P-Values for Electricity and Gas Comparisons

	Electricity		Gas	
	Survey vs. Non-Survey	Solar vs. Non-Solar	Survey vs. Non-Survey	Solar vs. Non-Solar
Year				
2023	0.004	<0.0001	0.199	0.124
2024	<0.0001	<0.0001	0.466	0.267
2025 (Incomplete)	<0.0001	<0.0001	0.803	0.197
Month				
1	<0.0001	0.001	0.132	0.162
2	<0.0001	<0.0001	0.154	0.093
3	<0.0001	<0.0001	0.436	0.208
4	<0.0001	<0.0001	0.475	0.147
5	<0.0001	<0.0001	0.307	0.088
6	<0.0001	<0.0001	0.634	0.255
7	0.008	<0.0001	0.418	0.198
8	0.014	<0.0001	0.217	0.223
9	0.001	<0.0001	0.26	0.016
10	<0.0001	<0.0001	0.539	0.109
11	<0.0001	<0.0001	0.148	0.254
12	<0.0001	<0.0001	0.07	0.089
Day of Week				
Sunday	<0.0001	<0.0001	0.058	0.172
Monday	<0.0001	<0.0001	0.177	0.153
Tuesday	<0.0001	<0.0001	0.161	0.188
Wednesday	<0.0001	<0.0001	0.117	0.152
Thursday	<0.0001	<0.0001	0.148	0.129
Friday	<0.0001	<0.0001	0.096	0.074
Saturday	<0.0001	<0.0001	0.13	0.168

Notes: Kolmogorov–Smirnov (KS) test p-values comparing electricity and gas consumption distributions across household groups. A p-value below 0.05 indicates a statistically significant difference between the two distributions.

C.8 Supplementary Solar-Rebound Results

This subsection collects the detailed tables, the carbon-accounting method, and the robustness analyses summarized in Part III.

Consumption summary and treatment effects. Table C.18 compares consumption across solar and non-solar households before and after adoption. The seasonal ATT is reported in native units (Table C.19) and in MMBtu (Table C.20), the day-of-week ATT in Table C.21, and the Spring/Winter mechanism decomposition in Table C.22. These underlie Figures 11 and 12.

Table C.18: Summary Statistics: Solar households vs. Non-solar households

		Non-Solar		Non-Solar		Solar				Diff
		Mean	S.D.	Min	Max	Mean	S.D.	Min	Max	
Pre-solar periods	Grid consumption (kWh)	0.97	0.59	0	5.79	1.07	0.51	0.18	3.03	-0.1**
	Total electricity consumption (kWh)	0.97	0.59	0	5.79	1.38	0.61	0.36	3.89	-0.41***
	Gas consumption (MMBtu)	0.01	0.01	0	0.16	0.01	0.01	0	0.03	0
	Total energy consumption (MMBtu)	0.01	0.01	0	0.16	0.01	0.00	0	0.04	0.002***
Post-solar periods	Grid consumption (kWh)	0.97	0.59	0	5.79	0.82	0.45	0.04	2.82	0.15***
	Total electricity consumption (kWh)	0.97	0.59	0	5.79	1.37	0.66	0.31	3.62	-0.4***
	Gas consumption (MMBtu)	0.01	0.01	0	0.16	0.01	0.00	0	0.03	0.003***
	Total energy consumption (MMBtu)	0.01	0.01	0	0.16	0.01	0.00	0	0.03	0.003***
All periods	Grid consumption (kWh)	0.97	0.59	0	5.79	0.93	0.49	0.04	3.03	0.04
	Total electricity consumption (kWh)	0.97	0.59	0	5.79	1.37	0.64	0.31	3.89	-0.4***
	Gas consumption (MMBtu)	0.01	0.01	0	0.16	0.01	0.00	0	0.03	0.003***
	Total energy consumption (MMBtu)	0.01	0.01	0	0.16	0.01	0.00	0	0.04	0.003***

Notes: Significance levels are denoted as *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

Table C.19: Rebound effect heterogeneity: ATT by season

		(1)	(2)	(3)	(4)	(5)
		Full sample	Spring	Summer	Fall	Winter
Panel A: Total electricity (kWh)	ATT	118.696***	175.249***	-44.947	-129.493	458.764***
	Std. Err	44.088	58.842	70.957	88.464	135.764
	Pre-treatment mean	631.794	565.872	694.249	560.092	704.418
	% change	+18.78%	+30.97%	-	-	+65.13%
Panel B: Grid electricity (kWh)	ATT	-131.117***	-102.309*	-252.238***	-333.309***	152.401
	Std. Err	(41.573)	(54.608)	(63.669)	(97.907)	(133.837)
	Pre-treatment mean	631.782	565.872	694.249	560.092	704.375
	% change	-20.76%	-18.08%	-36.33%	-59.51%	-
Panel C: Natural gas (MMBtu)	ATT	-0.345	-0.948***	-0.115	-0.696	0.052
	Std. Err	(0.266)	(0.338)	(0.113)	(0.598)	(0.579)
	Pre-treatment mean	6.542	6.847	1.538	5.343	12.395
	% change	-	-13.85%	-	-	-
N		82,219	21,997	18,485	16,408	20,435
Sample period		All	Mar. - May.	Jun. - Aug.	Sept. - Nov.	Dec. - Feb

Note: This table reports the ATT of solar adoption on household energy consumption. Treatment timing is defined by the year-month of solar installation, and we use households that never adopt solar as the control group. Standard errors, reported in parentheses, are clustered at the household level. Pre-treatment means are calculated using observations prior to solar adoption for treated households. Percentage changes are computed relative to pre-treatment means and are not reported when the ATT estimate is statistically insignificant. Significance levels are denoted as *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

Table C.20: Rebound effect heterogeneity: ATT by season (in standard units)

		(1)	(2)	(3)	(4)	(5)
		Full sample	Spring	Summer	Fall	Winter
Panel A: Total electricity (MMBtu)	ATT	0.405***	0.598***	-0.153	-0.442	1.565***
	Std. Err	(0.150)	(0.201)	(0.242)	(0.302)	(0.463)
	Pre-treatment mean	2.156	1.931	2.369	1.911	2.404
	% change	+18.79%	+30.97%	-	-	+65.13%
Panel B: Grid electricity (MMBtu)	ATT	-0.447***	-0.349*	-0.861***	-1.137***	0.520
	Std. Err	(0.142)	(0.186)	(0.217)	(0.334)	(0.457)
	Pre-treatment mean	2.156	1.931	2.369	1.911	2.403
	% change	-20.75%	-18.08%	-36.33%	-59.51%	-
Panel C: Natural gas (MMBtu)	ATT	-0.345	-0.948***	-0.115	-0.696	0.052
	Std. Err	(0.266)	(0.338)	(0.113)	(0.598)	(0.579)
	Pre-treatment mean	6.542	6.847	1.538	5.343	12.395
	% change	-	-13.85%	-	-	-
Panel D: Total energy (MMBtu)	ATT	0.634**	-0.351	0.675**	0.156	1.606**
	Std. Err	(0.300)	(0.402)	(0.298)	(0.550)	(0.727)
	Pre-treatment mean	8.699	8.104	3.908	7.256	14.800
	% change	+7.29%	-	+17.27%	-	+10.86%
	N	82,219	21,997	18,485	16,408	20,435
	Sample period	All	Mar. - May	Jun. - Aug.	Sept. - Nov.	Dec. - Feb

Note: This table reports the ATT of solar adoption on household energy consumption. Treatment timing is defined by the year-month of solar installation, and we use households that never adopt solar as the control group. Standard errors, reported in parentheses, are clustered at the household level. Pre-treatment means are calculated using observations prior to solar adoption for treated households. Percentage changes are computed relative to pre-treatment means and are not reported when the ATT estimate is statistically insignificant. Significance levels are denoted as *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

Table C.21: Rebound effect heterogeneity: ATT on daily average consumption by day of the week

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Panel A: Total electricity (kWh)	ATT	0.343***	0.293***	0.266***	0.343***	0.311***	0.388***	0.302***
	Std. Err	(0.063)	(0.063)	(0.061)	(0.061)	(0.063)	(0.065)	(0.061)
	Pre-treatment mean	1.011	0.961	0.962	0.948	0.969	1.006	1.084
	% change	33.93%	+30.49%	+27.65%	+36.18%	+32.09%	+38.57%	+27.86%
Panel B: Grid electricity (kWh)	ATT	-0.211***	-0.225***	-0.254***	-0.187***	-0.223***	-0.189***	-0.239***
	Std. Err	(0.062)	(0.062)	(0.061)	(0.062)	(0.065)	(0.064)	(0.060)
	Pre-treatment mean	1.011	0.961	0.962	0.948	0.969	1.006	1.084
	% change	-20.87%	-23.41%	-26.40%	-19.73%	-23.01%	-18.79%	-22.05%
Panel C: Natural gas (MMBtu)	ATT	-0.000	-0.000	0.000	0.000	-0.000	-0.001	0.000
	Std. Err	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
	Pre-treatment mean	0.011	0.011	0.011	0.011	0.01	0.011	0.011
	% change	-	-	-	-	-	-	-
Panel D: Total energy (MMBtu)	ATT	0.000	0.000	0.000	0.000	0.001	0.000	0.000
	Std. Err	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
	Pre-treatment mean	0.014	0.014	0.014	0.014	0.014	0.015	0.014
	% change	-	-	-	-	-	-	-
	N	70,325	70,328	70,328	70,291	70,327	70,325	70,327

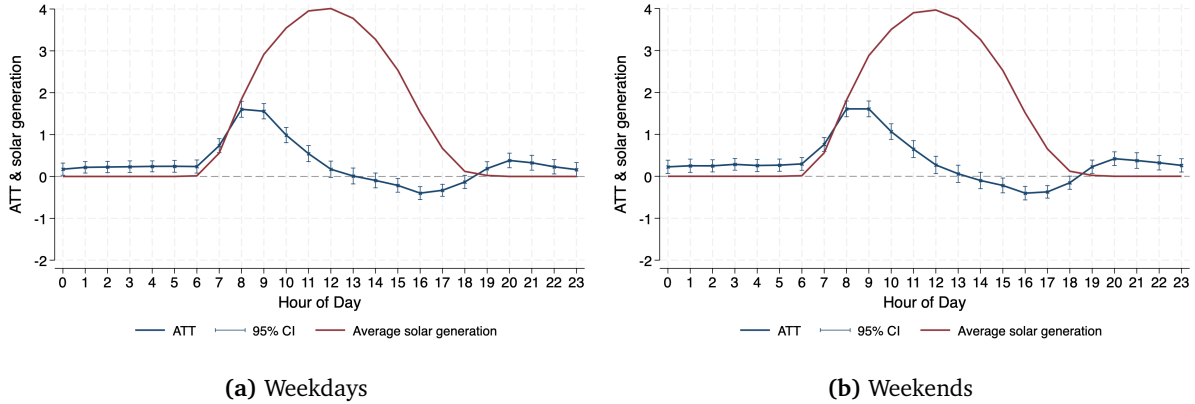
Note: This table reports the ATT of solar adoption on household average daily energy consumption. Treatment timing is defined by the year-month of solar installation, and we use households that never adopt solar as the control group. Standard errors, reported in parentheses, are clustered at the household level. Pre-treatment means are calculated using observations prior to solar adoption for treated households. Percentage changes are computed relative to pre-treatment means and are not reported when the ATT estimate is statistically insignificant. Significance levels are denoted as *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

Table C.22: Heterogeneous rebound effects in spring and winter

	Spring	Winter
Total electricity consumption	+31%	+65%
Grid electricity consumption	-18%	–
Natural gas consumption	-13%	–
When is the rebound	Solar hours	Throughout the day
Possible drivers	Solar generation, substitution	Solar generation, income effects

Note: This table summarizes the key results from Table C.19 and Figure ??, reporting seasonal and within-day patterns in rebound effects.

The within-day mechanism is shown by the hourly ATT estimates, which track solar-generation hours. The main text (Figure 13) reports electricity use by hour for Spring and Winter. The weekday–weekend split is shown below (Figure C.13), and the remaining seasons together with the grid-electricity and natural-gas analogues appear among the supplementary figures (Figures C.9, C.10, and C.11).

**Figure C.13:** ATT on hourly electricity use (kWh) by day type

Carbon-accounting method. The grid marginal emission factor (MEF) is the emission intensity of the marginal generator under a merit-order dispatch (solar, wind, hydro, nuclear, coal, natural gas, petroleum):

$$\text{MEF}_t = e_{i^*(t)}, \quad \text{where } i^*(t) = \min \left\{ i : D_t \leq \sum_{j=1}^i K_j \right\}, \quad (\text{C.4})$$

where i indexes technologies ordered by increasing marginal cost, K_j is generated capacity by technology j , and D_t is total demand at time t . The CO_2 reduction from reduced grid purchases is the sum over time of the hourly grid-electricity ATT times the MEF, and the reduction from

reduced natural gas use applies the gas emission coefficient (52.91 kg CO₂ per MMBtu):

$$\Delta\text{CO}_2^{\text{grid}} = \sum_t \text{ATT}_t^{\text{grid}} \times \text{MEF}_t, \quad \Delta\text{CO}_2^{\text{gas}} = \sum_t \text{ATT}_t^{\text{gas}} \times \text{EC}_t. \quad (\text{C.5})$$

Tables C.23 and C.24 report the CO₂ reductions by hour and season for the grid and gas channels, and Table C.25 compares the observed reduction with the no-rebound counterfactual across alternative emission-factor specifications.

Table C.23: CO₂ Reduction from Grid Electricity with Rebound: Hour–Season ATT Estimates

Season	Number of days	Daily reduction	Seasonal reduction	Total reduction
Spring	92	3.610	332.09	899.87 kg
Summer	92	3.580	329.32	
Fall	91	1.544	240.11	
Winter	90	-0.018	-1.64	

Table C.24: CO₂ Reduction from Natural Gas with Rebound: Hour–Season ATT Estimates

Season	Number of days	Daily reduction	Seasonal reduction	Total effect
Spring	92	0.794	73.016	78.042 kg
Summer	92	0.106	9.735	
Fall	91	0.053	4.815	
Winter	90	-0.106	-9.524	

Table C.25: Comparison of Theoretical and Estimated CO₂ Reductions

Theoretical reduction	Estimated reduction by ATT and emission factors				
	(1)	(2)	(3)	(4)	(5)
3915.17	CO ₂ reduction.Electricity (kg)	705.99	918.35	884.30	899.87
	CO ₂ reduction.NG (kg)	-	150.55	19.31	78.04
	Total CO ₂ reduction (kg)	705.99	1,068.90	903.61	977.91
	Offset	81.97%	72.70%	76.92%	75.02%
	Seasonal variation in EF	×	✓	×	✓
	Within-day variation in EF	×	×	✓	✓
	Detailed calculation in	×	Table C.7, C.10	Table C.8, C.11	Table C.23, C.24

Notes: This table compares the theoretical CO₂ reduction with estimated reductions based on the ATT on grid electricity consumption. When no variation in emission factors (EF) is incorporated, the estimated reduction is computed using the ATT on average monthly grid electricity consumption multiplied by the average EF over the study period and scaled to an annual basis. Specifically, the estimate is given by
 $-131.117 \text{ kWh/month} \times 0.4487 \text{ kg/kWh} \times 12 \text{ months} = 705.99 \text{ kg}.$

The deviation across specifications reflects the temporal alignment between grid-use reductions and emission factors: reductions are larger in mid-summer to fall months when emission factors are high (Figure C.14), but concentrated in solar-generation hours when emission factors are low.

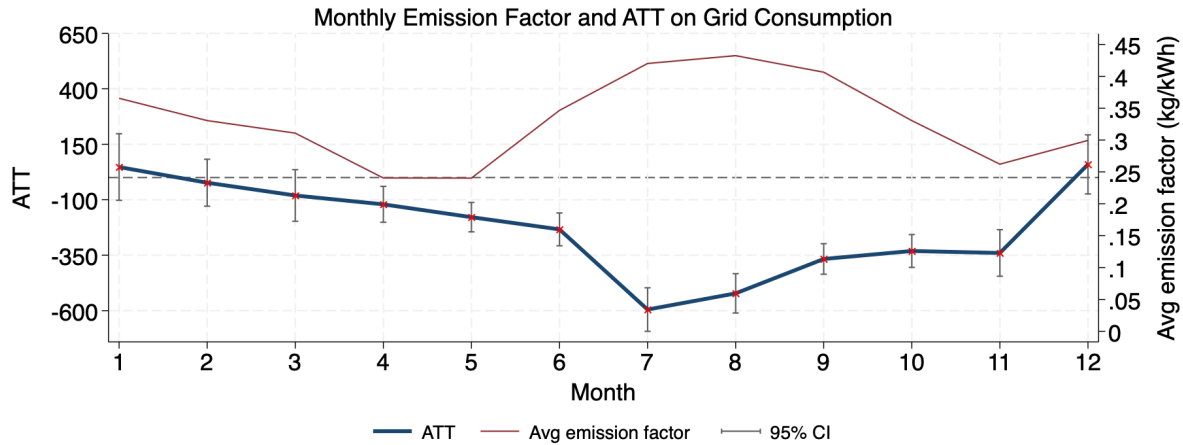


Figure C.14: Monthly ATT and emission factor

SUTVA and placebo test. Identification relies on the Stable Unit Treatment Value Assumption (SUTVA), under which each household's potential consumption depends only on its own adoption status and timing, not on others' adoption. To probe spillovers, we assign each solar household's adoption timing to one randomly chosen nearby non-solar household (the placebo treatment), removing actual adopters from the sample. The placebo ATT estimates are statistically insignificant throughout the event window (Figure C.15), providing no evidence of strong local spillovers. Two caveats remain. We cannot rule out small or indirect interference outside geographic proximity, and residential solar is not a uniform treatment (systems differ in capacity, orientation, tilt, shading, and compensation), so the estimates are the average effect of adoption under the observed system characteristics.

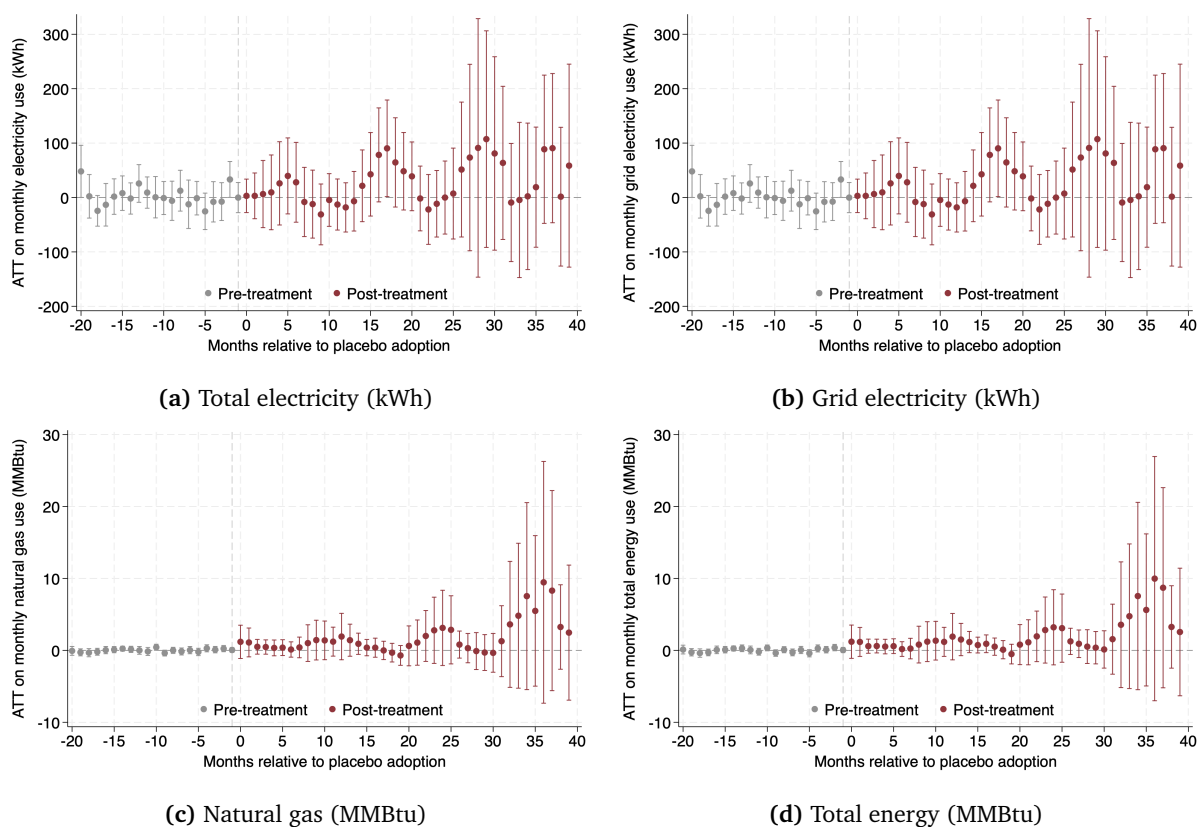


Figure C.15: Event-study estimates for monthly energy consumption (placebo treatment sample)

Finally, the full-sample event study (Figure C.4) shows an inverted-U pattern. The monthly electricity rebound rises after adoption and then attenuates beyond about two years, consistent with households learning over time to balance self-consumption, grid exports, and overall use rather than with rising consumption among nearby non-adopters.

D Appendix to Part IV: Household Factors and Consumption

This appendix collects the background, data, and methodological detail relocated from the Part IV body, followed by the supplementary tables and figures that complement the main results.

D.1 Background and Motivation

Decomposing persistent consumption by fuel matters for policy because efficiency programs deliver value only when they reach the households where savings are largest, and because the answer shapes electrification planning. The gap between projected and realized savings is well

documented, and one source is misallocation. Programs do not consistently reach the homes where reductions would be greatest (Allcott and Greenstone, 2012; Burlig et al., 2020; Fowlie et al., 2018). When a household switches from gas to electric heating, its heating load moves from a fuel governed mainly by the building envelope to one that also reflects appliances and occupant behavior, so the new electricity load a switch adds depends on which household switches. A utility that knows which characteristics drive each fuel can direct envelope measures, appliance programs, or behavioral tools to the households where each will do the most.

D.2 Data

This part draws on five linked data sources for Los Alamos County, New Mexico, spanning January 2022 through June 2025.

D.2.1 Smart Meter Consumption Data

The Los Alamos Department of Public Utilities (LADPU) provided household-level daily electricity and natural gas consumption records for about 8,500 residential accounts. Observations that violate physical limits are dropped: daily electricity readings above 200 kWh or 35 kWh per thousand square feet of home size, and daily gas readings above 25 therms¹³ or 4 therms per thousand square feet. Negative reads, which indicate meter errors or manual adjustments, are also dropped. After trimming, the estimation panel contains approximately 695,000 household-days. Figure D.1 plots the post-trimming distribution of daily consumption for both fuels.

¹³Natural gas consumption is reported in therms throughout. One therm equals one CCF multiplied by an elevation factor (0.78 for Los Alamos, 0.81 for White Rock) and a monthly heat-content value from the LADPU cost-of-gas schedule. The mean conversion factor is approximately 0.81.

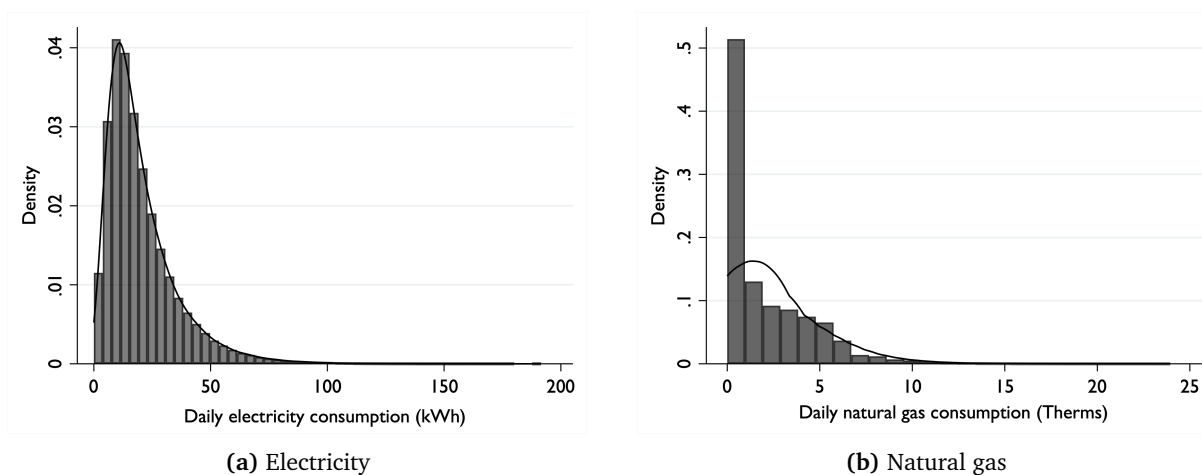


Figure D.1: Distribution of daily household consumption

Notes: Post-trimming distribution. Electricity consumption (kWh/day) is right-skewed with a mode near 10–15 kWh/day and a long upper tail. Natural gas consumption (therms/day) is mainly concentrated near zero with a heavy right tail. Most household-days fall below 2 therms/day, but cold winter days exceed 10 therms/day.

D.2.2 Household Survey

LADPU fielded a discrete choice experiment (DCE) survey to its residential customers via mail and email. The survey collected appliance portfolios, demographics, self-reported housing characteristics, behavioral measures, and perceptions about electrification from 631 households. Data collection ran from July to September 2025. The survey collects information about the primary fuels used for space heating, water heating, cooking, and clothes drying. It also records heating equipment type and age, rooftop solar ownership, and standard demographics including income, education, retirement status, work-from-home arrangements, ethnicity, and respondent age. Some data recoding is applied to a set of ordinal variables to make them suitable for regression analysis. The recoding details are documented in the notes to Table D.2.

D.2.3 Property Characteristics

Property records were manually collected from online real estate platforms and linked to survey respondents via street-address matching. We replace survey-stated square footage, house age, and bedroom counts with scraped values. Figure D.2 plots survey-reported home size against scraped values. The close alignment along the 45-degree line, with no systematic over- or under-reporting, speaks to the quality of the survey responses more broadly.¹⁴ Residence type is consolidated into three categories: single-family detached, mobile or manufactured homes, and multi-family structures.

¹⁴Table D.9 in the appendix confirms that gaps between survey-reported and scraped measures are not systematically related to household demographics.

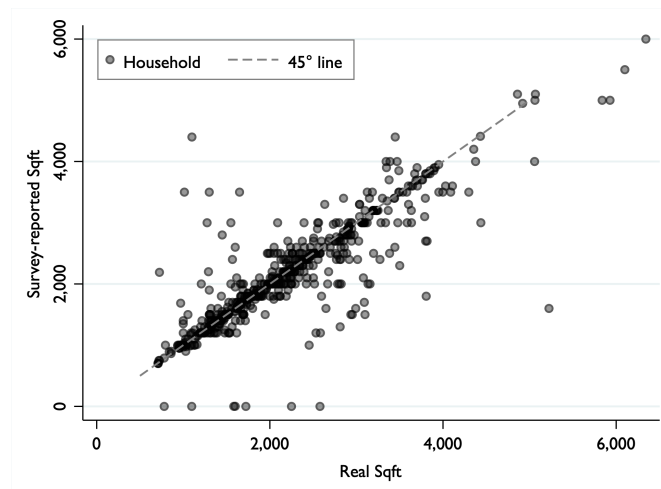


Figure D.2: Survey-reported versus scraped home size

Notes: The 45-degree line indicates perfect agreement. The close alignment, with no evidence of systematic misreporting, supports the reliability of the survey data.

D.2.4 Weather Data

We collect weather variables from the PRISM Climate Group's 800 m daily gridded product, extracted at the centroids of Los Alamos and White Rock. The variables include daily mean temperature, dewpoint temperature, vapor pressure deficit, diurnal temperature range, and total precipitation. Table D.1 summarizes the weather characteristics of the estimation window. The high-desert environment at about 7,300 feet elevation produces large diurnal temperature swings and low humidity. The mean daily temperature is 11.0°C, ranging from −13.4°C to 30.7°C, and precipitation falls on about a quarter of the year. Typical-weather profiles, used to construct the baseline expected loads, are computed from day-of-year PRISM averages weighted by the observed calendar composition of each energy carrier's Step 2 sample.

Table D.1: PRISM Weather Summary (Jan 2023– Dec 2025)

	Mean	SD	Min	Max
Daily mean temperature (°C)	10.97	9.02	−13.40	30.70
Dewpoint temperature (°C)	−3.01	7.98	−24.20	16.00
Vapor pressure deficit (hPa)	11.04	7.42	0.40	40.10
Diurnal temperature range (°C)	13.77	3.72	1.90	27.10
Daily precipitation (mm)	1.03	2.88	0.00	39.40

Notes: Data for the daily panel across the estimation window (2023–2025; $N = 695,244$ household-days). Dewpoint and vapor pressure deficit capture the high-desert environment. The diurnal range reflects the large day–night temperature swings at 7,300 ft elevation. Rain falls on 26.0% of days.

D.2.5 Additional Data Sources

Electric vehicle registrations were matched to survey respondents using address-level records from the New Mexico Motor Vehicle Division. Active battery-electric and plug-in hybrid registrations in Los Alamos and White Rock were linked to survey street addresses, yielding 15 matched households out of 214 active registrations. The matched share, 2.4% of survey households (15 of 631), aligns closely with the county-wide EV/PHEV ownership rate of 2.6% (214 of 8,247 occupied housing units from the ACS).

The American Community Survey (ACS) 2024 five-year estimates for Los Alamos County report 8,247 occupied housing units, of which 81.6% use natural gas as the primary heating fuel and 15.0% use electricity. These proportions align closely with the survey sample (90.0% using natural gas and 8.0% using electricity), supporting its representativeness on heating-fuel composition.

Table D.2: Descriptive Statistics: Step 2 Model Variables

	Mean	SD	N
Panel A: Housing Structure			
Home size (1,000 Sqft)	2.17	0.89	566
Stories	1.51	0.61	569
Residence age (decades)	3.99	0.82	573
<i>Residence type</i>			
Single-family detached	0.82	—	625
Mobile / manufactured	0.13	—	625
Multi-family	0.03	—	625
Has garage	0.77	—	571
Panel B: Appliance Portfolio			
<i>Primary heating fuel</i>			
Electric	0.08	—	610
Natural gas	0.90	—	610
<i>Cooking fuel</i>			
Electric	0.37	—	607
Natural gas	0.61	—	607
<i>Water heating fuel</i>			
Electric	0.09	—	510
Natural gas	0.90	—	510
<i>Dryer fuel</i>			
Electric	0.75	—	600
Natural gas	0.25	—	600
Has rooftop solar	0.13	—	631
Has EV or PHEV	0.02	—	631
Panel C: Demographics			
High income (\$100k+)	0.78	—	565
Graduate degree	0.60	—	582
Works from home	0.28	—	572
Respondent age (years)	57.97	16.74	581
Hispanic	0.08	—	560
Renter	0.04	—	575
Retired	0.39	—	572
Panel D: Usage & Equipment			
Dryer: Uses ≥ 2 times/week (share)	0.70	—	602
Heating equipment ≥ 10 years old (share)	0.59	—	595

Notes: Statistics use one observation per survey respondent household. Proportions are reported for binary and categorical indicators (SD omitted as fully determined by the mean). Dryer use and heating equipment age are self-reported on ordinal scales and recoded to continuous measures for the regression analysis: dryer use is mapped to approximate times per week (1→0, 2→0.5, 3→1, 4→2.5, 5→5), and heating equipment age is mapped to year midpoints (1→1, 2→3, 3→7, 4→12, 5→17, 6→22). The shares reported in Panel D use the recoded continuous measures. *N* reports non-missing household observations for each variable. The complete descriptive table (reporting raw survey scales) is in Appendix Table D.4.

D.3 Empirical Strategy

A household's daily electricity and natural gas consumption depends not only on housing structure, appliances, and demographics, but also on factors that vary frequently, namely weather and calendar effects (Hor et al., 2005; Kang and Reiner, 2022; Zhang and Zhou, 2019). On cold winter days, households use more electricity or natural gas, depending on their appliances, to heat their home. Electricity consumption likewise increases on hot summer days to cool homes. On weekends, people are more likely to stay at home and consume more energy.

We use the fixed-effects filtered (FEF) estimator of Pesaran and Zhou (2018) to recover how time-invariant household characteristics relate to energy use. The challenge this estimator addresses is that the characteristics of interest (home structure, appliances, and demographics) are stable over time. A standard two-way fixed effects (TWFE) regression cannot identify the relationship between time-invariant covariates and energy use, because the fixed-effect term absorbs everything constant within a household that weather and calendar cannot explain statistically. FEF instead proceeds in two steps. A first step uses the daily panel to estimate the common weather and calendar response and filters it from consumption. The remaining component bundles households' time-invariant traits, observed and unobserved. A second step then takes this household-specific component and regresses it on the observed characteristics using ordinary least squares (OLS).

The estimation panels comprise 580 surveyed households for electricity, of which 562 also have a natural gas smart meter. Each household is observed daily from January 2022 through June 2025. Each household has an average of 1,080 daily observations for electricity and 1,073 for natural gas, with a minimum of six months. Both steps are estimated separately for each energy carrier.

D.3.1 Step 1: Time-Varying Demand Filter

Daily consumption is dominated by two components that are unrelated to persistent household differences. The first component is weather, which includes ambient air temperature, humidity, and precipitation. Temperature is the primary driver behind daily fluctuations because it determines both heating and cooling usage. Humidity adds to the cooling load by making air feel hotter and by forcing air conditioners to work harder at a given temperature. Precipitation matters indirectly by keeping people indoors.

Figure D.3 plots mean daily consumption against daily mean temperature in 1°C bins, separated by each household's primary heating appliance fuel. The figure shows electricity consumption following a U-shape. It rises with cooling load in summer for all households and rises again with heating in winter. The cold-side response is steeper among households that heat primarily with electricity than among those that heat with natural gas. The figure shows that natural gas

consumption declines monotonically with temperature for both heating groups. Consumption does not rise on the warm range since natural gas serves no cooling load. Both groups consume more natural gas as temperature falls, but homes that are primarily gas-heated sit consistently above electrically-heated homes throughout the cold range. The temperature response differs by heating fuel, which motivates interacting primary heating fuel with temperature in Step 1.

The second component is the calendar. Energy consumption behavior depends on the month of the year (seasons) and on the day of the week. The former factor captures changes related to holidays, school breaks, and day length which shift consumption independently of weather patterns. Similarly, the latter factor mainly captures the effect of people spending more time at home during weekends than during weekdays. Our sample displays expected behavior. Electricity consumption peaks during winter months that are both colder and coincide with the holiday season spanning November and January. It peaks again during summer months, which are both hotter and coincide with the school break (see Appendix Figure D.7). Natural gas consumption mostly peaks during fall and winter and falls to the baseline level during the rest of the year. This pattern can be mostly explained by space heating being the heaviest use for natural gas.

Temperature and calendar effects are entangled, so we include both in the Step 1 filtering specification. Step 1 removes these two components from each household's daily consumption so that the remaining part can be interpreted as a household-level baseload.

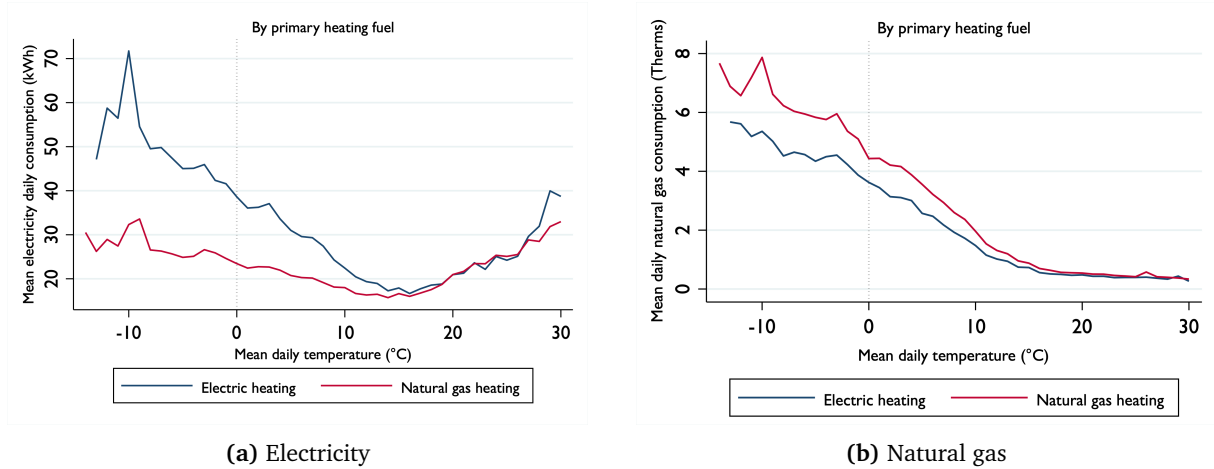


Figure D.3: Mean daily consumption versus daily mean temperature, by primary heating fuel

Notes: Mean daily consumption by 1°C temperature bin, separated by primary heating fuel. Bins with fewer than five household-day observations are excluded.

For each energy carrier we estimate a household fixed-effects regression of the form

$$y_{it} = f(T_{it}; \theta) + \mathbf{W}'_{it} \psi + \delta_t + \alpha_i + \varepsilon_{it}, \quad (\text{D.1})$$

where y_{it} is daily consumption for household i on date t . The temperature-response function

$f(T_{it}; \theta)$ captures how daily mean temperature ($^{\circ}\text{C}$) maps to consumption. The vector $\mathbf{W}_{it}$ contains the remaining weather covariates. Humidity enters through dewpoint temperature ($^{\circ}\text{C}$) and vapor pressure deficit (hPa). The weather vector also includes total daily precipitation (mm) and a rainy-day indicator. Within-day temperature variation is captured through the diurnal range ($^{\circ}\text{C}$). The term δ_t collects the calendar controls, namely day-of-week, month-of-year, and year indicators. The household fixed effect α_i absorbs every time-invariant household characteristic (during the study period), including those captured in our data (housing structure, appliance portfolios, and demographics).

The main specification models $f(T_{it}; \theta)$ semiparametrically. Daily mean temperature is divided into 5°C bins, with a separate coefficient estimated for each:

$$f(T_{it}; \theta) = \sum_{b=1}^B \theta_b \cdot \mathbf{1}[T_{it} \in \text{bin}_b] + \sum_{b=1}^B \tau_b \cdot \mathbf{1}[T_{it} \in \text{bin}_b] \cdot h_i, \quad (\text{D.2})$$

where the $15\text{--}20^{\circ}\text{C}$ bin serves as the omitted reference category and h_i is a binary indicator for primary heating fuel (i.e., electricity or natural gas). The semiparametric form does not restrict the temperature response to any given shape, making it the most flexible option to absorb the time-varying signal among the specifications we consider. A disadvantage is that it produces parameters that are less interpretable than a polynomial or HDD/CDD parameterization.¹⁵

Binned temperature specifications originate with Schlenker and Roberts (2006) and Schlenker and Roberts (2009) in the climate-yield literature and have since become common for estimating weather effects across environmental and energy economics applications (Aroonruengsawat and Auffhammer, 2011; Auffhammer, 2022; Auffhammer et al., 2017; L. W. Davis and Gertler, 2015; Deschênes and Greenstone, 2011).

Electric and natural gas heating systems have fundamentally different thermal response mechanisms. Therefore, equation (D.2) includes the heating-fuel interaction τ_b . This is the only household-level interaction with temperature we allow in Step 1. Adding further interactions (e.g., home size, residence age, or appliance ownership) would risk absorbing baseload household signal that belongs in Step 2 estimation.

D.3.2 Step 2: Baseload Decomposition

Step 2 explains the household baseload component $\tilde{u}_i \equiv T_i^{-1} \sum_{t=1}^{T_i} \hat{u}_{it}$, the within-household time average of the Step 1 residual $\hat{u}_{it} = y_{it} - \hat{f}(T_{it}) - \mathbf{W}_{it}' \hat{\psi} - \hat{\delta}_t$. Following Pesaran and Zhou (2018), this residual subtracts only the time-varying components of equation (D.1), so it retains the

¹⁵Appendix Table D.5 compares this specification against four parametric families (polynomials, restricted cubic splines, heating- and cooling-degree days, and piecewise linear splines) on within- R^2 and holdout RMSE. All considered specifications perform similarly, so the semiparametric choice carries no fit cost.

household-specific level that the fixed effect α_i absorbs in Step 1. It is therefore on the scale of the household's typical daily consumption.

The following progressive sequence of cross-sectional regressions is estimated:

$$\bar{u}_i = \beta_0 + \mathbf{Z}_i^{\text{housing}} \beta_1 + \mathbf{Z}_i^{\text{appliance}} \beta_2 + \mathbf{Z}_i^{\text{demo}} \beta_3 + \eta_i, \quad (\text{D.3})$$

This paper estimates three specifications, each nesting the previous one and adding a group of characteristics.

The first model (M1) captures the home's physical capacity to consume energy. This includes house size (SqFt) and age, number of stories, and residence type (single-family, multi-family, mobile). These characteristics capture the home's geometry and proxy for its thermal envelope. Larger and older homes require more energy to heat in winter and to cool in summer. This model also conditions on whether the house has a solar rooftop system, which offsets metered electricity use.

The second model (M2) adds the appliance and technology stock, which converts energy into services. The type of appliance a household uses determines which carrier they use for a given service (electricity or natural gas). For instance, a household with electric water heating is expected to draw more persistent electricity and less natural gas than one with gas water heating. Observing consumption in both energy carriers allows us to study the cross-fuel tradeoff of using different types of appliances.

The third model (M3) adds household demographic characteristics such as income, education, ethnicity, and retirement status. Income and education proxy for both the quality and quantity of appliances and devices used at home. Higher-earning households are more likely to own more devices and therefore use more electricity. They are also more likely to purchase costly but efficient appliances and devices. Retirement and working from home proxy for more time spent at home using energy.

Los Alamos county is a high-income, highly educated national laboratory community. Therefore, income and education enter the model as indicators rather than continuous measures. We use a high-income indicator for households earning over \$100,000 and a graduate-degree indicator. The models progress from the house's structure, to the equipment within it, to the characteristics of its occupants.

Each coefficient gives the change in the household-level persistent component $\bar{u}_i$ associated with a unit change in the corresponding characteristic, conditional on other covariates in the model. The coefficients for electricity and natural gas are in kWh/day and therms/day, respectively.

The dual energy carrier feature of our data allows us to compare how each characteristic relates to electricity and to natural gas for the same households. This can reveal whether a

factor shifts demand between the two carriers or relates to only one.

D.4 Step 1 Estimates: Temperature Response and Model Fit

Figures [D.4a](#) and [D.4b](#) plot the semi-parametric Step 1 temperature-response estimates for each energy carrier, with households grouped by primary heating fuel. Each point is a bin-level coefficient relative to the 15–20°C reference comfort bin.

For electricity, both heating-fuel groups consume more than their reference level as temperature falls (Figure [D.4a](#)). On the cold side, the response splits by heating fuel: in the –5 to 0°C level, homes that are primarily electrically heated consume about 13.2 kWh per day above their reference level, twice the 6.5 kWh response of primarily gas-heated homes. This gap persists through colder temperature levels. On the warm side, the two groups' responses are statistically indistinguishable. Consumption rises with temperature, but more modestly compared to the sharp response to cold weather. The cold side splits by heating fuel and the warm side does not because the two sides activate different end uses. Cold weather activates space heating, whose primary fuel differs across households, while warm weather activates cooling, which is delivered by electric air conditioning regardless of how a home is heated.

The natural gas response mirrors that of electricity, except that it is the primarily gas-heated homes whose consumption rises most sharply as temperature falls (Figure [D.4b](#)). On the cold side, the response again splits by heating fuel. At the –5 to 0°C level, gas-heated homes consume 2.2 therms per day above their reference level, twice the response of primarily electrically heated homes (1.1 therms). Unlike the electricity gap that persists at a stable size, this gap widens as temperature falls. It reaches about 2.8 therms at the –10 to –5°C level. Primarily electrically heated homes respond on the gas meter as well, although more weakly. This is because not all of them are fully electric in heating. 64.7% of them have gas water heaters which draw more gas on colder days. Some may also operate secondary gas heating. On the warm side, both groups show a nearly flat response.

For both carriers, estimates show wider 95% confidence intervals closer to the end tails of the temperature range where the panel contains fewer days with such levels (see Appendix [D.6](#)). The 95% C.I. band for primarily electrically heated homes is wider at every temperature level, since the group makes up only 8% of the sample. Nonetheless, the heating-fuel interaction remains statistically significant at the 95% level.

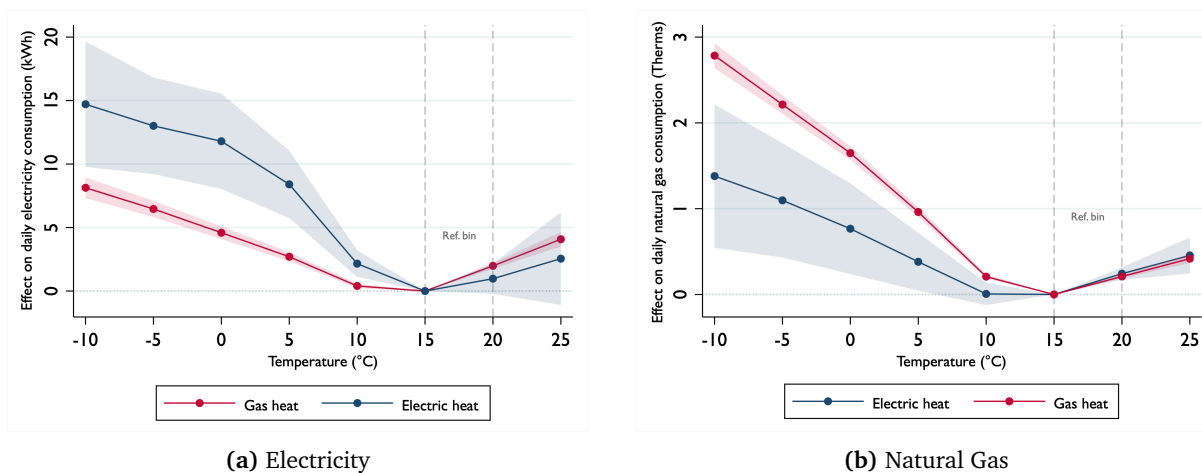


Figure D.4: Semiparametric Step 1 temperature-response estimates

Notes: Each point is a bin-level coefficient relative to the 15–20°C reference bin (vertical dashed lines). Shaded ribbons give 95% confidence intervals. Household fixed effects and calendar controls are included. Bins with fewer than five observations are omitted.

Table D.3 reports the remaining weather covariates and calendar blocks from the preferred specification. Households consume more of both electricity and natural gas on days with precipitation. Relative to average daily use (20.03 kWh/d for electricity, 2.09 therms/d for gas), a rainy day is associated with 10.6% higher natural gas use, against only a 2.0% effect for electricity use. This is expected considering people are more likely to stay indoors. A wider diurnal temperature range is associated with lower consumption of both carriers (-0.13% per °C for electricity and -0.33% per °C for natural gas). Large temperature swings allow for natural night cooling, which reduces the need for air conditioning during the day. Similarly, sunnier days deliver solar gain, which offsets the need for heating. For calendar effects, results show that month-of-year and day-of-week coefficients are jointly significant ($p < 0.0001$). This confirms that calendar variation also explains day-to-day consumption beyond the variation in weather that is controlled for.

The most important Step 1 result is the contrast in the regression’s explanatory power across carriers. Weather and calendar variables account for 63.5% of the daily variation in a household’s daily consumption in natural gas, but only 9.3% for electricity. Daily natural gas use is therefore tightly governed by thermal conditions and seasonal timing. Electricity use contains a larger non-weather component, which likely reflects appliance use, occupancy, and the number and type of electric devices used in the home. Step 2 investigates this contrast even further using the cross-sectional household (survey) and housing characteristics.¹⁶

¹⁶The lower electricity within- R^2 does not undermine the second step. The purpose of Step 1 is to remove time-varying variation before explaining the remaining household-level component.

Table D.3: Step 1 Weather and Calendar Controls (Semiparametric 5°C Bin Specification)

Dep. variable: daily consumption	Electricity		Natural Gas	
	kWh/day		therms/day	
	Coef.	<i>t</i>	Coef.	<i>t</i>
Weather covariates				
Precipitation (mm)	0.063***	11.37	0.004***	6.14
Dewpoint (°C)	0.021**	2.12	-0.035***	-21.73
Vapor pressure deficit (hPa)	0.145***	9.28	-0.038***	-20.87
Diurnal temperature range (°C)	-0.026***	-2.93	-0.007***	-6.25
Rainy day (0/1)	0.405***	9.56	0.222***	27.90
Calendar fixed effects (joint <i>F</i>-test)				
Day-of-week (6)	$F(6, 592) = 60.78$		$F(6, 576) = 95.34$	
Month-of-year (11)	$F(11, 592) = 78.54$		$F(11, 576) = 189.19$	
Year (3)	$F(3, 592) = 46.48$		$F(3, 576) = 40.51$	
Households	580		562	
Household-days	626,536		602,918	
Within- R^2	0.093		0.635	

Notes: Standard errors clustered by household. All specifications include household fixed effects and 5°C temperature bins interacted with primary heating fuel. Temperature-response coefficients are shown in Figure D.4. Calendar coefficients are not reported for brevity. Joint *F*-tests against zero are reported instead. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure D.5 shows the cross-household distribution of the persistent component for electricity and natural gas. The figure shows that substantial household heterogeneity remains after the Step 1 filter. The remaining variation further motivates the Step 2 decomposition.

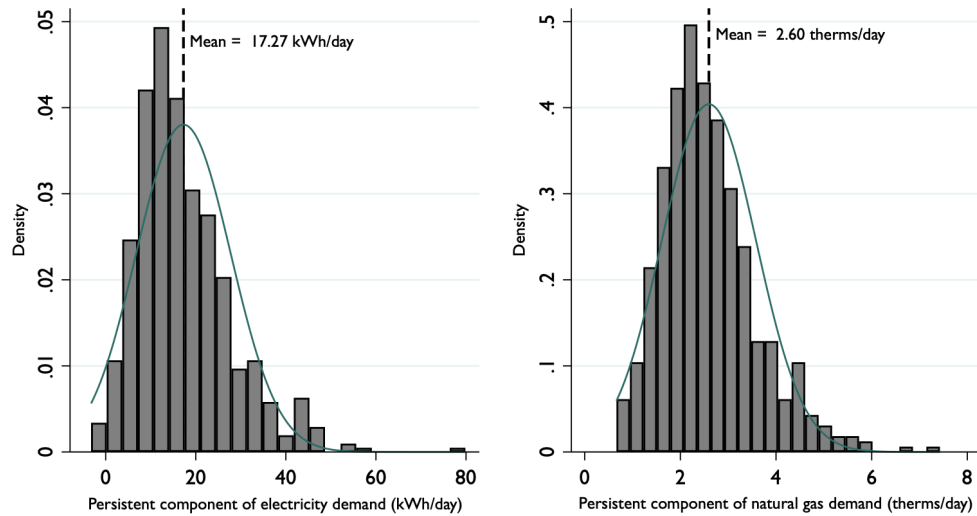


Figure D.5: Distribution of the household persistent component, by energy carrier.

Notes: The persistent component of energy demand $\bar{u}_i$ is the household-level average of the Step 1 residual $\hat{u}_{it}$. Vertical lines mark sample means.

D.5 Expanded Descriptive Statistics

Table D.4: Expanded Survey Respondent Descriptive Statistics

	Mean/share	SD	Range	N
Panel A: Housing Structure				
Home size (1,000 Sqft)	2.17	0.89	[0.00, 6.00]	566
Bedrooms	3.34	0.81	[1.00, 5.00]	567
Stories	1.51	0.61	[1.00, 3.00]	569
Residence age (decades)	3.99	0.82	[1.00, 5.00]	573
<i>Residence type</i>				
Single-family detached	0.82	—	—	625
Mobile/manufactured	0.13	—	—	625
Multi-family	0.03	—	—	625
Renter	0.04	—	—	575
Has garage	0.77	—	—	571
<i>Conditional on having a garage</i>				
Garage heated	0.14	—	—	438
Garage insulated	0.85	—	—	60
Panel B: Primary Space Heating				

Continued on next page

D APPENDIX TO PART IV: HOUSEHOLD FACTORS AND CONSUMPTION

Table D.4 – continued

	Mean/share	SD	Range	N
<i>Equipment type</i>				
Central furnace	0.58	—	—	613
Steam/hot water	0.32	—	—	613
Heat pump (central or ductless)	0.06	—	—	613
Other (built-in elec/gas, wood, fireplace, etc.)	0.05	—	—	613
<i>Primary heating fuel</i>				
Electric	0.08	—	—	610
Natural gas	0.90	—	—	610
Propane (bottled gas)	0.00	—	—	610
Wood or pellets	0.01	—	—	610
Other (fuel oil, other)	0.01	—	—	610
Heating equipment age (1–6)	4.01	1.76	[1.00, 6.00]	595
Has secondary heating system	0.68	—	—	610
Main heating use frequency (1–5)	1.17	0.63	[1.00, 4.00]	610
Panel C: Appliance Portfolio				
<i>Cooking appliance ownership</i>				
Has range	0.77	—	—	631
Has cooktop	0.35	—	—	631
Has wall oven	0.29	—	—	631
<i>Range fuel (conditional on having range)</i>				
Electric	0.34	—	—	486
Natural gas	0.63	—	—	486
Other (propane, dual-fuel)	0.03	—	—	486
<i>Cooktop fuel (conditional on having cooktop)</i>				
Electric	0.42	—	—	219
Natural gas	0.57	—	—	219
Propane	0.01	—	—	219
<i>Wall oven fuel (conditional on having wall oven)</i>				
Electric	0.83	—	—	183
Natural gas	0.17	—	—	183
Has outdoor grill	0.58	—	—	611
<i>Water heating fuel</i>				
Electric	0.09	—	—	510
Natural gas	0.90	—	—	510
Has second water heater	0.11	—	—	606
Water heater age (1–6)	3.53	1.61	[1.00, 6.00]	499
<i>Dryer</i>				
Has dryer	0.99	—	—	610
Dryer fuel: Electric	0.75	—	—	600
Dryer fuel: Natural gas	0.25	—	—	600
Dryer age (1–6)	3.06	1.48	[1.00, 6.00]	594

Continued on next page

D APPENDIX TO PART IV: HOUSEHOLD FACTORS AND CONSUMPTION

Table D.4 – continued

	Mean/share	SD	Range	N
Has pool heater	0.03	—	—	610
Has rooftop solar	0.13	—	—	631
<i>EV / PHEV ownership</i>				
Has EV or PHEV	0.02	—	—	631
Has more than one EV	0.00	—	—	631
Panel D: Demographics				
Household size	2.52	1.50	[0.00, 15.00]	317
Respondent age	57.97	16.74	[18.00, 120.00]	581
Female	0.37	—	—	574
Hispanic	0.08	—	—	560
Graduate degree	0.60	—	—	582
High income (100k+)	0.78	—	—	565
Respondent is retired	0.39	—	—	572
Works from home	0.28	—	—	572
Panel E: Usage & Behavior				
Dryer use frequency (1–5)	3.89	0.98	[1.00, 5.00]	602
Cooktop use frequency (1–5)	2.17	0.82	[1.00, 5.00]	485
Oven use frequency (1–6)	3.58	1.03	[1.00, 6.00]	484
Indoor temperature, day (°F)	68.74	3.09	[58.00, 78.00]	420
Indoor temperature, evening (°F)	65.14	4.77	[45.00, 76.00]	411
Indoor temperature, night (°F)	65.13	4.62	[45.00, 78.00]	417
Gas appliance satisfaction (1–5)	1.52	0.87	[1.00, 5.00]	578
<i>Equipment age (1–6 scale)</i>				
Main heating	4.01	1.76	[1.00, 6.00]	595
Water heater	3.53	1.61	[1.00, 6.00]	499
Dryer	3.06	1.48	[1.00, 6.00]	594
Panel F: Billing, Engagement & Attitudes				
Has usage dashboard	0.48	—	—	629
Tracks usage regularly	0.77	—	—	301
Receives energy assistance	0.01	—	—	623
Utilities included in rent	0.04	—	—	25
Perceived need for panel upgrade	0.74	—	—	419

Supports 2070 carbon-free goal	0.28	—	—	419
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Notes: Statistics are computed using one observation per survey respondent household. For binary variables and mutually exclusive categories, the Mean/share column reports the proportion equal to one; SD and range are omitted (—) because the support is {0, 1}. Range is shown as [minimum, maximum] for non-binary variables. N reports non-missing household observations for each row. Fuel shares may not sum exactly to one due to small other-fuel categories and item nonresponse. Table reports raw survey scales. For the regression analysis, heating equipment age and dryer use frequency are recoded to continuous measures (see main-text Table D.2 notes for the mapping). Water heater age, dryer age, cooktop/oven use frequency, and heating use frequency remain on their original ordinal scales. Shared-row variables are computed on the conditional sample (e.g., garage characteristics on garage-owning households).

D.6 Step 1 Model Comparison

Table D.5 reports Step 1 comparison metrics across candidate temperature specifications for both energy carriers. We report within- R^2 (filtering quality) and holdout RMSE from a 20% random validation split. The semiparametric 5°C bin model is the main specification. All other entries are robustness checks. RMSE is reported on the original scale and is not comparable across energy carriers.

Table D.5: Step 1 Model Comparison

Model	Electricity			Natural Gas		
	d.f.	R_w^2	RMSE _{out}	d.f.	R_w^2	RMSE _{out}
Semiparametric						
5°C bins (main)	18	0.095	10.14	18	0.632	1.503
Restricted cubic splines						
RCS (4 knots)	6	0.098	10.11	6	0.636	1.493
Polynomials						
Cubic	6	0.097	10.12	6	0.635	1.495
Quadratic	4	0.092	10.14	4	0.633	1.497
Heating / cooling degree days						
Quadratic HDD/CDD	8	0.096	10.13	8	0.636	1.493
Piecewise linear						
Knots at 0°C, 18°C	6	0.097	10.12	6	0.635	1.495

Notes: R_w^2 = within- R^2 from the household fixed-effects regression. RMSE_{out} = root mean squared error on a 20% holdout split. d.f. = degrees of freedom consumed by the temperature specification. All models share the same calendar controls.

D.7 Progressive Step 2 Decomposition

Tables D.6 and D.7 report the specifications' progression M1 through M3, namely housing structure alone (M1), adding appliance portfolios (M2), and the full specification with demographics

and behavioral controls (M3).

Table D.6: Progressive Step 2 Decomposition: Electricity

	M1: Housing	M2: + Appliances	M3: + Demo + Beh
Electric cooking		1.841** (0.931)	1.471 (0.893)
Electric water heating		3.539** (1.595)	4.278** (1.718)
Electric dryer		0.627 (1.008)	1.428 (0.969)
Rooftop solar		-3.444** (1.585)	-3.723** (1.489)
Home size (1,000 sq ft)	4.439*** (0.646)	5.460*** (0.673)	4.897*** (0.736)
Mobile/manufactured	-1.760 (1.080)	-2.324** (1.179)	-2.115* (1.089)
Multi-family	-1.765 (1.711)	-2.778* (1.589)	-2.013 (1.659)
Residence age (decades)	-0.189 (0.245)	0.166 (0.249)	0.280 (0.258)
Stories	-0.073 (0.748)	-0.309 (0.765)	0.386 (0.829)
Renter	-3.574*** (1.329)	-3.589** (1.484)	-4.587*** (1.539)
High income (\$100k+)			1.709 (1.056)
Graduate degree			-1.098 (0.860)
Works from home			0.970 (1.037)
Respondent age			-0.068* (0.038)
Retired			3.306*** (1.261)

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D APPENDIX TO PART IV: HOUSEHOLD FACTORS AND CONSUMPTION

Table D.6 continued

	M1: Housing	M2: +Appliances	M3: +Demo+Beh
Dryer use (times/week)			1.587*** (0.282)
Main heating age (yrs)			0.007 (0.057)
Observations	533	438	418
R ²	0.197	0.250	0.328
Adjusted R ²	0.188	0.233	0.300
Mean persistent component (kWh/day)	17.080	17.159	17.215
Predicted persistent baseline	.	16.091	15.660

Notes: Standard errors in parentheses. Residence-type coefficients are relative to single-family detached homes, is unobserved in the electricity M3 sample and omitted. * pi0.10, ** pi0.05, *** pi0.01.

Table D.7: Progressive Step 2 Decomposition: Natural Gas

	M1: Housing	M2: +Appliances	M3: +Demo+Beh
Electric cooking		-0.089 (0.080)	-0.061 (0.082)
Electric water heating		-0.300** (0.141)	-0.249 (0.155)
Electric dryer		-0.182* (0.093)	-0.157* (0.089)
Rooftop solar		-0.367*** (0.117)	-0.219* (0.122)
Home size (1,000 sq ft)	0.664*** (0.059)	0.677*** (0.067)	0.683*** (0.073)
Mobile/manufactured	-0.081 (0.112)	-0.114 (0.117)	-0.099 (0.118)
Multi-family	-0.175 (0.135)	-0.114 (0.139)	-0.043 (0.154)
Residence age (decades)	0.033	0.039*	0.048**

Continued on next page

Table D.7 continued

	M1: Housing	M2: +Appliances	M3: +Demo+Beh
	(0.022)	(0.023)	(0.023)
Stories	-0.096	-0.097	-0.157*
	(0.077)	(0.082)	(0.085)
Renter	-0.282	-0.280	-0.417*
	(0.185)	(0.213)	(0.246)
High income (\$100k+)			0.123
			(0.106)
Graduate degree			-0.019
			(0.077)
Works from home			-0.131
			(0.090)
Respondent age			0.003
			(0.004)
Retired			-0.027
			(0.124)
Dryer use (times/week)			0.065***
			(0.024)
Main heating age (yrs)			0.015***
			(0.005)
Observations	520	427	406
R ²	0.366	0.396	0.440
Adjusted R ²	0.358	0.381	0.415
Mean persistent component (therms/day)	2.605	2.586	2.592
Predicted persistent baseline	.	2.826	2.778

Notes: Standard errors in parentheses. Residence-type coefficients are relative to single-family detached homes. * pi0.10, ** pi0.05, *** pi0.01.

D.8 Typical-Weather Expected-Load Decomposition

Table D.8 reports the expected-load decomposition that translates the Step 2 persistent-component coefficients into shares of typical daily consumption, evaluated under day-of-year PRISM averages for Los Alamos and White Rock. Total expected daily load is the sum of the household

persistent component and the Step 1 weather component. These totals serve as the denominators for the % of typical calculations in the main results table.

Table D.8: Expected Daily Load Under Typical Weather

	Electricity (kWh/day)	Natural Gas (therms/day)
Step 1 typical-weather component	2.523	-0.899
Step 2 persistent baseline ($\hat{\alpha}_0$)	17.397	2.597
Total expected daily load	19.920	1.698
Observed mean daily load	19.920	2.096
Typical vs actual weather effect	-0.000	-0.398
Model fit gap (actual weather)	0.030	0.015
Weather variation (typical – actual)	-0.030	-0.413

Notes: The persistent baseline $\hat{\alpha}_0$ is $\hat{\alpha}_0 \equiv \bar{y} - \bar{\mathbf{X}}' \hat{\beta}$, the sample average of the household fixed effect recovered from the Step 1 semiparametric bins specification (the intercept of the Pesaran–Zhou cross-sectional regression). It represents expected consumption at the Step 1 reference category (January, Sunday, 15–20°C, no precipitation). The Step 1 weather component is the average deviation from this reference under PRISM day-of-year typical weather, evaluated with a 365-day unweighted grid at the sample-average household. The gap decomposition isolates model fit error (near zero by OLS identity) from the effect of replacing realized 2023–2025 weather with long-run PRISM climatology. The negative weather gap for gas indicates that 2023–2025 weather was, on net, more conducive to gas heating demand than the PRISM climatology. The observed mean daily load (19.920 kWh/d for electricity, 2.096 therms/d for gas) serves as the denominator for all % of mean calculations in Table 7.

D.9 Survey Misreporting Diagnostics

Some housing controls used in Step 2 are self-reported. Table D.9 examines whether the gap between survey-reported and scraped property measures is systematically related to demographics by regressing the signed error in square footage and bedroom count on household characteristics. The coefficients are uniformly small and mostly imprecise. Survey-scraped gaps are not systematically related to demographics, supporting the use of scraped values when available.

Table D.9: Survey-Scraped Misreporting: OLS Diagnostics

	Square footage error (%)	Bedroom count error
High income (\$100k+)	-0.154** (0.062)	-0.119 (0.108)
Graduate degree	-0.018 (0.034)	0.002 (0.079)
Household size	0.012 (0.010)	0.014 (0.027)
Single-family detached	0.010 (0.034)	0.176* (0.093)
Renter	-0.099 (0.136)	0.071 (0.197)
Works from home	0.009 (0.031)	-0.006 (0.077)
Constant	0.112** (0.056)	-0.035 (0.121)
Observations	306	306
R ²	0.053	0.013

Notes: Signed error between survey-reported and scraped property characteristics. Square footage error (%) = $100 \times (\text{survey} - \text{scraped}) / \text{scraped}$; bedroom count error = survey – scraped. Positive values indicate survey over-reporting. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.10 Temperature Distribution

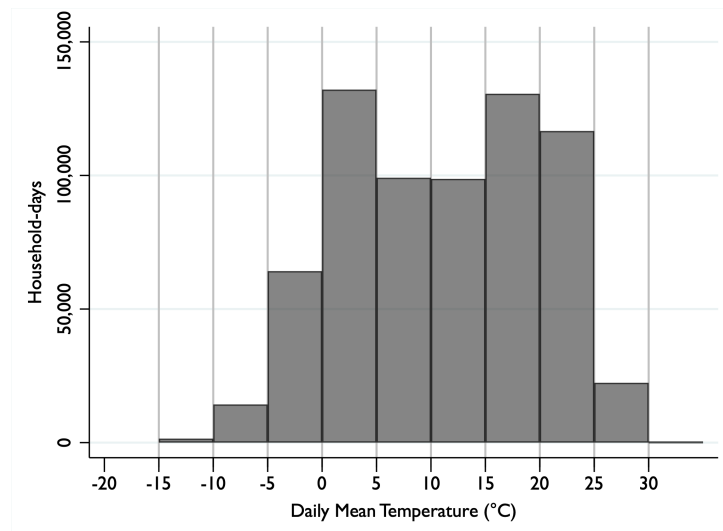
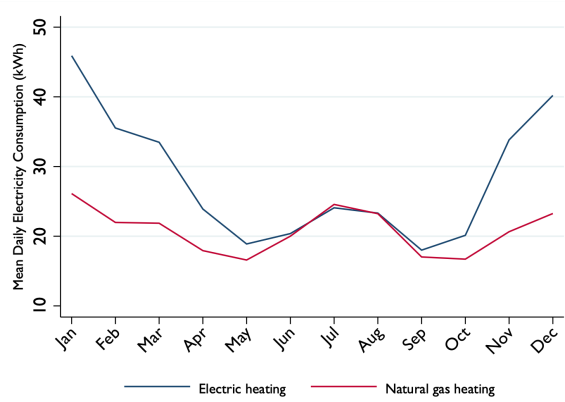


Figure D.6: Distribution of daily mean temperature

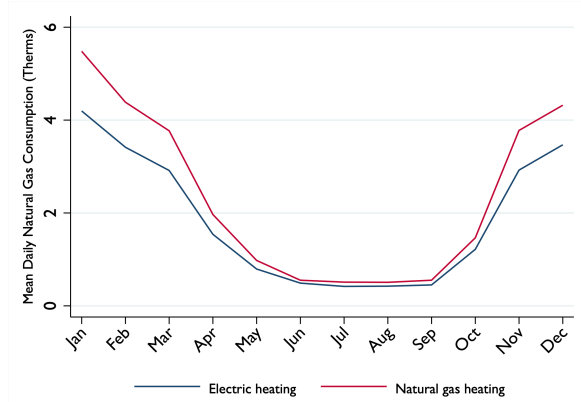
Notes: Estimation window covers January 2022 through June 2025.

D.11 Seasonal Consumption Patterns

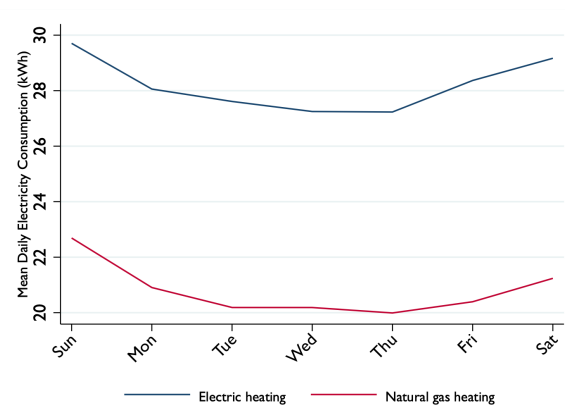
Figure D.7 reports mean daily consumption by month for each carrier, separated by primary heating fuel. Electricity displays two seasonal peaks, a summer peak driven by cooling load (common to both heating-fuel groups) and a winter peak driven by heating load (concentrated in households whose primary heating fuel is electric). Natural gas shows the expected winter-bowl shape, with the strongest winter rise among households whose primary heating fuel is gas. The calendar fixed effects in Step 1 (month-of-sample, day-of-week, and holiday indicators) absorb this systematic seasonal cycle so that the recovered household persistent component is not contaminated by the timing of when each household happened to be observed.



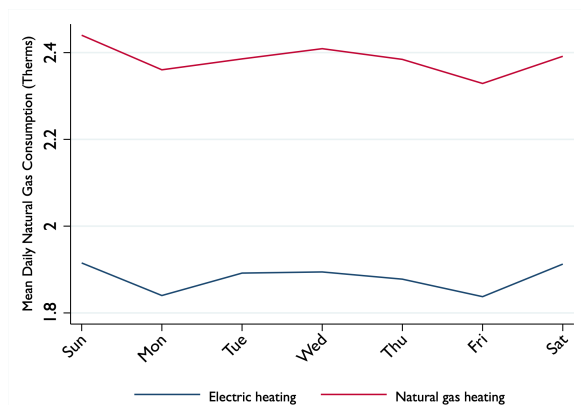
(a) Electricity, by month



(b) Natural gas, by month



(c) Electricity, by day of week



(d) Natural gas, by day of week

Figure D.7: Mean daily consumption by calendar cycle, by primary heating fuel

D.12 Step 2 (FEF) versus OLS on Mean Daily Consumption

This subsection compares the two-step FEF estimates with OLS on mean daily consumption. Figure D.8 shows the cross-sectional dispersion of daily mean temperature across households on a given day, which is small relative to the seasonal swing that Step 1 removes. Tables D.10 and D.11 report the natural-gas and electricity coefficients under both estimators.

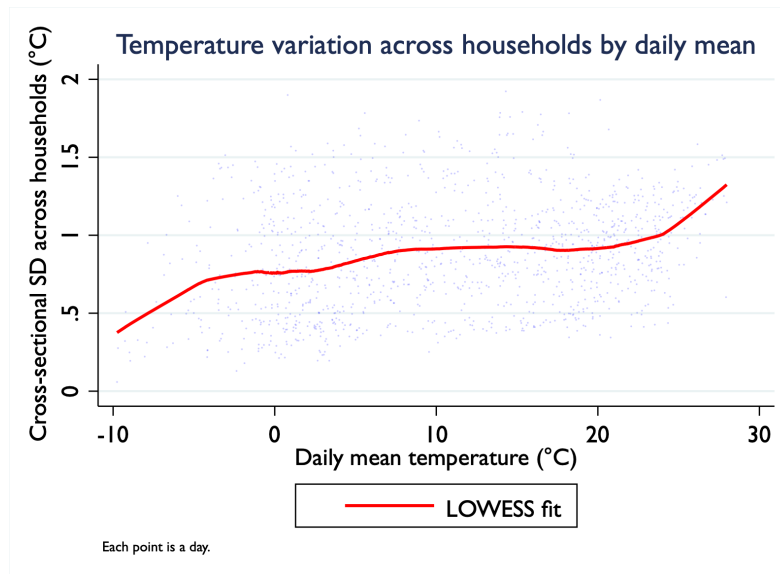


Figure D.8: Cross-sectional temperature variation across households by daily mean temperature

Notes: Each point is a day. The vertical axis reports the cross-sectional standard deviation of daily mean temperature across all households on that day.

Table D.10: Step 2 (FEF) versus OLS on mean daily consumption: Natural Gas

	FEF (persistent)		OLS (mean)	
	Coef.	SE	Coef.	SE
Housing structure				
Home size (1,000 sqft)	0.683***	(0.073)	0.683***	(0.068)
Residence type (ref: single-family detached)				
Mobile/manufactured	−0.099	(0.118)	−0.105	(0.119)
Multi-family	−0.043	(0.154)	−0.037	(0.155)
Residence age (decades)	0.048**	(0.023)	0.049**	(0.022)
Stories	−0.157*	(0.085)	−0.149*	(0.086)
Renter	−0.417*	(0.246)	−0.422*	(0.244)
Appliance portfolio				
Electric cooking	−0.061	(0.082)	−0.059	(0.076)
Electric water heating	−0.249	(0.155)	−0.262*	(0.142)
Electric dryer	−0.157*	(0.089)	−0.155*	(0.082)
Rooftop solar	−0.219*	(0.122)	−0.210*	(0.111)

Table D.10 – continued

	FEF (persistent)		OLS (mean)	
	Coef.	SE	Coef.	SE
Demographics & occupancy				
High income (\$100k+)	0.123	(0.106)	0.095	(0.101)
Graduate degree	−0.019	(0.077)	−0.016	(0.071)
Works from home	−0.131	(0.090)	−0.117	(0.084)
Respondent age	0.003	(0.004)	0.002	(0.004)
Retired	−0.027	(0.124)	−0.011	(0.116)
Dryer use (times/week)	0.065***	(0.024)	0.064***	(0.023)
Heating equip. age (yrs)	0.015***	(0.005)	0.015***	(0.005)
Observations	406		406	
R ²	0.440		0.511	

Notes: Robust standard errors in parentheses. Both columns estimate the same M3 specification. The FEF dependent variable is the household persistent component. The OLS dependent variable is mean daily consumption. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.11: Step 2 (FEF) versus OLS on mean daily consumption: Electricity

	FEF (persistent)		OLS (mean)	
	Coef.	SE	Coef.	SE
Housing structure				
Home size (1,000 sqft)	4.897***	(0.736)	4.897***	(0.735)
Residence type (ref: single-family detached)				
Mobile/manufactured	−2.115*	(1.089)	−2.214**	(1.065)
Multi-family	−2.013	(1.659)	−2.086	(1.641)
Residence age (decades)	0.280	(0.258)	0.270	(0.256)
Stories	0.386	(0.829)	0.361	(0.831)
Renter	−4.587***	(1.539)	−4.364***	(1.512)
Appliance portfolio				
Electric cooking	1.471*	(0.893)	1.422	(0.893)
Electric water heating	4.278**	(1.718)	4.302**	(1.716)
Electric dryer	1.428	(0.969)	1.455	(0.965)
Rooftop solar	−3.723**	(1.489)	−3.557**	(1.474)
Demographics & occupancy				
High income (\$100k+)	1.709*	(1.056)	1.738*	(1.052)
Graduate degree	−1.098	(0.860)	−1.051	(0.857)
Works from home	0.970	(1.037)	1.044	(1.035)
Respondent age	−0.068*	(0.038)	−0.071*	(0.038)
Retired	3.306***	(1.261)	3.345***	(1.255)
Dryer use (times/week)	1.587***	(0.282)	1.558***	(0.281)
Heating equip. age (yrs)	0.007	(0.057)	0.009	(0.056)
Observations	418		418	
R ²	0.328		0.331	

Notes: Robust standard errors in parentheses. Both columns estimate the same M3 specification. The FEF dependent variable is the household persistent component. The OLS dependent variable is mean daily consumption. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.13 Robustness

The main findings rest on two modeling choices, the Step 1 weather filter and the Step 2 specification sequence. This section documents that neither drives the cross-carrier asymmetry.

D.13.1 Step 1 Filter Sensitivity

The Step 2 baseload estimates could in principle depend on which weather model is used to strip time-varying variation in Step 1. Table D.12 re-estimates a common five-predictor Step 2 specification under each of the six Step 1 filters. The home-size coefficient varies by less than 5% across all specifications for either energy carrier. The cross-carrier asymmetry is not an artifact of filter choice.

Table D.12: Step 2 Coefficient Stability Across Step 1 Filters

Step 1 filter	Home size	Rooftop solar	Renter	Retired	Dryer use
Electricity (kWh/day)					
5°C bins (main)	5.043	-3.561	-4.705	3.371	1.548
RCS (4 knots)	4.960	-3.126	-4.528	3.737	1.587
Cubic polynomial	4.957	-3.100	-4.518	3.757	1.589
Quadratic polynomial	4.956	-3.142	-4.507	3.734	1.586
Quadratic HDD/CDD	5.062	-3.608	-4.735	3.319	1.544
Piecewise linear (0, 18°C)	4.944	-3.063	-4.493	3.793	1.592
Natural Gas (therms/day)					
5°C bins (main)	0.640	-0.224	-0.390	0.001	0.067
RCS (4 knots)	0.655	-0.310	-0.429	-0.047	0.062
Cubic polynomial	0.655	-0.310	-0.429	-0.046	0.062
Quadratic polynomial	0.653	-0.309	-0.429	-0.045	0.062
Quadratic HDD/CDD	0.640	-0.218	-0.389	0.006	0.067
Piecewise linear (0, 18°C)	0.654	-0.308	-0.428	-0.045	0.062

Notes: Five-predictor Step 2 specification (home size, rooftop solar, renter, retired, dryer use) re-estimated under each Step 1 filter; differences across rows reflect filter choice only. Home size per 1,000 Sqft; dryer use in times per week.

The natural gas heating coefficient in Step 2 provides the clearest illustration of why the filter matters. Under the semiparametric bins, that coefficient is near zero, because the filter absorbs the differential cold-weather response of gas-heated homes into Step 1. Under every smooth parametric alternative, the same coefficient is large and precisely estimated. The smooth models, with only four to six temperature parameters, cannot fully separate the heating-fuel level shift from its weather response. The unabsorbed load enters Step 2 as a spurious baseload effect. The quadratic HDD/CDD model, which includes a dedicated heating-degree-day term, is intermediate, consistent with partial but incomplete absorption. This pattern is not evidence of fragility in the semiparametric filter. It is the expected signature of a filter flexible enough to do its job.

D.13.2 Step 2 Specification Stability

The progressive M1 through M3 sequence in Appendix Tables [D.6](#) and [D.7](#) shows that the key structural coefficients are stable as thematic tiers are added. For natural gas, the home-size coefficient is nearly flat across all three specifications, confirming that it is orthogonal to the appliance portfolio and occupant characteristics added in M2 and M3. For electricity, the home-size path is non-monotonic. Adding appliance controls initially increases the gradient before demographics pull it back toward the M1 value, consistent with a negative correlation between home size and electric appliance holdings. M1 and M2 retain more households than M3 and serve as larger-sample structural robustness checks. The cross-carrier asymmetry is present and similarly sized in all three specifications.

D.13.3 Multicollinearity

Table [D.13](#) reports the largest variable-level VIFs by fuel and specification. All specifications show uniformly low VIFs, confirming that multicollinearity does not inflate the standard errors of the focal housing and appliance regressors.

Table D.13: Variance Inflation Factors, Step 2 M3 Specification

Variable	VIF
Housing structure	
Home size	1.60
Stories	1.57
Has garage	1.51
Residence age	1.50
Multi-family (vs. single-family detached)	1.44
Mobile/manufactured (vs. single-family detached)	1.44
Renter	1.13
Appliance portfolio	
Electric heating	1.84
Electric water heating	1.30
Electric dryer	1.17
Electric cooking	1.14
Rooftop solar	1.13
Demographics & behavior	
Dryer use (times/week)	4.33
Retired	2.27
Respondent age	2.18
Heating equipment age (years)	1.28
High income	1.25
Works from home	1.22
Graduate degree	1.11
Hispanic	1.10
EV/PHEV ownership	1.08

Notes: VIFs from the M3 main specification ($N = 430$).
All values are well below the conventional threshold of 10. Interaction terms are omitted, and their component VIFs are listed individually.

D.14 Load-Projection Methodology

This appendix documents the household-anchored load projection summarized in Section 20. The projection is a microsimulation. It begins from each residential meter’s actual 2024 monthly consumption and layers regression-based fuel switching on top, so the baseline requires no representativeness assumption and is exact by construction. The model is implemented in Python (which generates the figures and table in the body) and delivered to LADPU as a standalone, formula-driven spreadsheet (`LADPU_load_projection_tool.xlsx`) that reproduces the same numbers from editable inputs.

(1) Actual-2024 per-home baseline. We aggregate the LADPU monthly meter file to one row per electric meter for calendar year 2024, linked to its natural-gas meter where present. We retain meters with at least ten months of electricity coverage and trim physically implausible reads (negative or extreme meter-months, and the top and bottom 0.5% of annual electricity). Metered gas is converted from hundred-cubic-feet (CCF) to therms as $\text{therms} = \text{CCF} \times \phi_\ell \times h_m$, where ϕ_ℓ is the location elevation factor (0.78 for the Los Alamos townsite, 0.81 for White Rock, assigned from the meter’s service city) and $h_m \in [1.02, 1.05]$ is the month-specific heat content from the utility’s gas-rate schedule. The resulting baseline comprises 8,646 residential meters with about 62,400 MWh of electricity and 5.76 million therms of gas in 2024. Of these homes, 6,906 heat with gas. Forward years scale this baseline by the 0.4% annual housing-stock growth. Because the baseline is the literal 2024 system load, no calibration or re-basing factor is applied.

(2) Appliance-fuel inference. Switching must be applied to the homes that actually own each gas appliance, which is observed only for the roughly 470 survey-matched homes. We tested whether each meter’s appliance fuels can be inferred from its consumption pattern (a fuel-type non-intrusive load-disaggregation problem), training gradient-boosted classifiers (`HistGradientBoosting`, five-fold stratified cross-validation) on the labeled homes using electricity winter/summer and baseload ratios and gas seasonality features. Space heating carries a strong, near-deterministic signature and is identified per home directly from gas seasonality (see step 3). The data-driven flag classifies 79.9% of homes as gas-heated, closely matching the ACS estimate of 81.6%. The minor gas appliances, however, do not separate from consumption alone. Cross-validated AUCs of 0.68 (water), 0.57 (cooking), and 0.54 (dryer) do not beat the majority-class baseline. We therefore assign water heating, cooking, and drying by their survey ownership shares (0.903, 0.634, and 0.251 of gas customers, respectively) applied as expected fractions, rather than per home. This is the source of the minor-appliance caveat in the body.

(3) Gas seasonality split and apportionment. Each home’s annual gas is split into a non-space component (its summer baseload, taken as twelve times the mean of June–August gas)

and a space-heating component (the winter excess above that baseload). Summed over gas-heated homes, the space component is 4.29 million therms and the non-space component 1.47 million therms, together reconciling to the 5.76 million-therm metered total. The non-space pool is divided across water heating, cooking, and drying in proportion to each end-use's ownership count times its electricity switching effect. Removing an end-use from a home eliminates exactly its share of that home's actual gas, so a fully converted home reaches zero gas and the aggregate gas removed reconciles to the metered total at full electrification. This avoids the bias of using the small estimated gas coefficients directly, which would leave a large gas residual even at 100% conversion.

(4) Conversion arithmetic. Electrifying end-use k in a converting home adds the Part-IV per-home electricity effect and removes the apportioned gas. For the minor appliances the added electricity is the Step-2 (M3) coefficient applied flat across months (+4.278, +1.471, and +1.428 kWh/day for water heating, cooking, and drying). For space heating it is the Step-1 temperature response evaluated against each month's temperature distribution, so the added electric-heating load is concentrated in the cold months. This is what drives the winter-peak growth. Aggregate added load in year y is $\sum_k p_k(y) N_k \Delta E_k$, where $p_k(y)$ is the scenario's cumulative conversion share for end-use k , N_k the gas-appliance count, and ΔE_k the per-home monthly increment. This quantity is added to the growth-scaled baseline.

(5) Scenario pace and targeting. Scenarios differ only in $p_k(y)$. S1 sets p_k equal across end-uses to the whole-home milestone schedule (10/30/50/75/100% by 2030/40/50/60/70). S2a fills only the willing pool, with $p_k(y) = c_k f(t)$, where c_k is the survey "very likely" ceiling and $f(t)$ the stated-timing curve (saturating about a decade out), so adoption plateaus at c_k . S2b adds replace-on-burnout turnover for the reluctant remainder, $p_k(y) = c_k f(t) + (1 - c_k)[1 - e^{-t/L_k}]$, with L_k the appliance lifetime, so conversion approaches one as the stock turns over. Within a pace, the highest-gas (oldest-equipment) homes are taken first.

(6) Solar overlay and confidence intervals. Rooftop solar grows from the installed base (about 500 homes) to 40% of meters by 2050. Each adopting home reduces grid load by the Part-III grid-electricity ATT (−131 kWh per month per home, which already nets out the rebound). Confidence intervals propagate the regression standard errors. An effect with standard error s_k applied to N_k homes at pace p_k contributes variance $(p_k N_k s_k)^2$, summed across independent end-uses and months, with the 95% band at ± 1.96 times the resulting standard error. The bands therefore capture estimation uncertainty in the switching coefficients, not uncertainty in the adoption pace, which the three scenarios are designed to bracket.

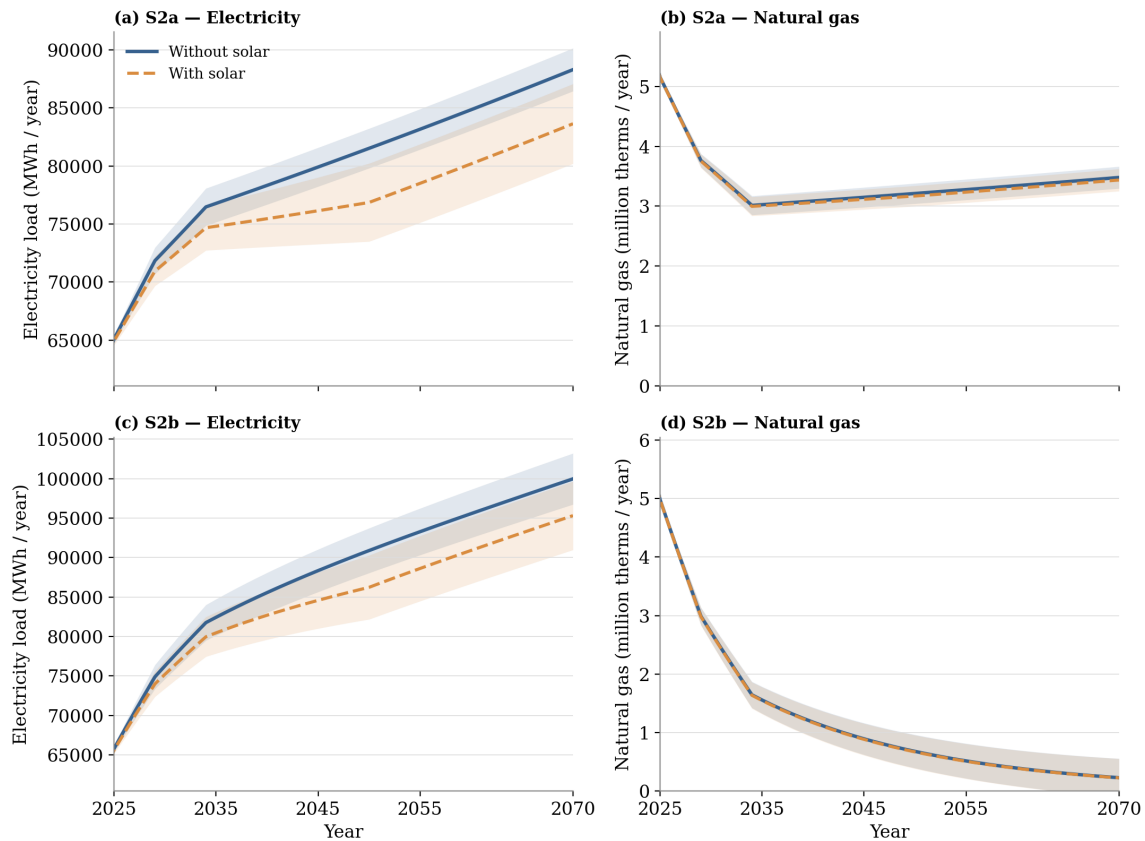


Figure D.9: Rooftop solar's effect on projected electricity and gas under the bottom-up scenarios

Notes: The bottom-up scenarios S2a (stated-only; panels a, b) and S2b (replace-on-burnout; panels c, d), each shown with and without the rooftop-solar overlay (40% of homes by 2050), with 95% confidence intervals on both paths. The electricity panels show the grid offset from the Part-III grid ATT. The gas panels show the smaller spring gas reduction, which is visible here, unlike the top-down path of Figure 18, because these scenarios leave natural gas in service.

E Related Literature

E.1 Tariff design, incentives and the economics of electrification

Work in energy-economics journals shows that price signals (i.e., volumetric tariffs and up-front subsidies) remain the dominant levers for appliance switching. In Colombia, McRae and Wolak (2021) demonstrate that a two-part tariff calibrated to income elasticities can recover network costs while shielding low-income users, a design later encouraged for Chicago by Spiller, Esparza, et al. (2023), who find time-differentiated prices cut peak demand and improve the private payback of rooftop PV and batteries. Complementary techno-economic simulations confirm that tariff structure often matters more than equipment efficiency, because under high volumetric rates a heat-pump retrofit can raise winter bills (Borenstein et al., 2022). Studies in emerging markets underline the same point from the opposite angle. Subsidizing Liquefied Petroleum Gas (LPG) or grid electricity crowds out clean-burn cookstoves when tariffs fail to internalize health costs (Behnia et al., 2024; Bouaguel and Alsulimani, 2022). The literature converges on tariff reform plus targeted incentives as the cost-effective path to large-scale electrification, but it also warns that bill outcomes would depend on local load shapes that few papers measure with smart-meter data.

E.2 Household fuel choice and appliance adoption

Socio-economic status, infrastructure access and cultural practice together shape which fuels households use and when they switch. Panel data from Ethiopia (Alem et al., 2016) and rural China (Hou et al., 2017) show evidence for an “energy ladder” in which higher income and education raise the probability of adopting LPG or electricity, yet later studies complicate that ladder. Beauchamp and Walsh (2021) introduce the idea of energy citizenship, showing that pro-environmental norms can override economic constraints, while Goswami et al. (2023) demonstrate that caste and gender roles override income in rural India. In high-income contexts the frontier issue is whole-home electrification. Edwards et al. (2024) map the United States’ (US) heat-pump uptake and reveal stark climate-zone and racial disparities, and Brockway et al. (2021) link those disparities to feeder-level hosting limits. Lane et al. (2024) add qualitative depth to the switching decision, finding that New York City renters perceive upfront hassle and reliability concerns as larger obstacles than equipment cost. One major implication of this literature is that policies that ignore local infrastructure and social context will hinder switching and adoption even where tariffs are favorable.

E.3 Equity and distributional outcomes

Distributional analyses cut across the previous themes by asking who pays during and after the transition. Using customer-level billing data, L. Davis and C. Hausman (2022) project that if richer households electrify first, legacy gas costs could triple for the lowest-income decile. Similar dynamics appear in California feeder-studies (Waite and Modi, 2020) and in a national model of appliance mandates (Hill, 2025), both concluding that uncoordinated roll-outs risk regressive bill impacts that swamp climate benefits. Equity research also flags infrastructure barriers. Montañés et al. (2025) show that past blackout experience depresses electric-appliance adoption in vulnerable neighborhoods, while Das et al. (2021) document how high first costs of improved cook-stoves exclude the poorest quintile in Bangladesh even when lifetime savings are positive. This literature shows why electrification programs must retire gas infrastructure in tandem with low-income conversions and pair rebates with low-interest finance.

E.4 Consumer preferences, willingness-to-pay (WTP) and information interventions

Stated-preference studies improve our understanding of how much value households place on cleaner energy services. Meta-evidence across Europe and Asia finds average WTP premiums of 5 to 15 % for green electricity (Hojnik et al., 2021) and for high-efficiency appliances (Galarraga et al., 2011), but only when respondents trust the label. Risk and loss-aversion experiments with Chinese farmers reveal that higher risk tolerance reduces uptake of energy-efficient fridges and lamps (He et al., 2019). Information interventions amplify or mute those premiums, and carefully framed environmental messages elevate WTP for efficient appliances by up to one-third (Li et al., 2024; Wang et al., 2021).

E.5 System-level environmental and health effects

Finally, engineering and public-health research connect household choices to aggregate emissions and exposure. Stoner et al. (2021) trace global cooking-fuel trends and show that the drop in biomass reliance since 1990 cut population-weighted $PM_{2.5}$ exposure approximately by one-fifth, although rural biomass use remains stubbornly high. Applied Energy simulations for California indicate that space-heating electrification can lower state residential CO_2 by more than 60 % if accompanied by a 75 % renewable grid (Tarroja et al., 2018), but it could shift the system peak to winter (Elmallah et al., 2022). Health-oriented work underlines that partial ‘fuel stacking’ leaves most of the indoor-air benefit unrealized (Tumwesige et al., 2017). The consensus is clear on direction, in that electrification cuts emissions and health burdens. The size of those benefits depends on grid cleanliness and the pace at which households fully abandon polluting fuels.

E.6 Solar rebound and distributed generation

Residential solar adoption turns households into prosumers who both consume and export electricity (Boccard and Gautier, 2021; Gautier, Jacqmin, and Poudou, 2018; Green and Staffell, 2017), creating scope for a rebound effect through the lower effective cost of self-generated power (Matthew E Oliver et al., 2025), moral licensing (Beppler et al., 2023), and pro-environmental spillovers (Truelove et al., 2014). The rebound idea originates in the energy-efficiency literature, where cheaper energy services induce additional consumption that offsets part of the intended savings (Binswanger, 2001; Gillingham et al., 2014; Liang et al., 2018; Sorrell and Dimitropoulos, 2008). Classic examples include vehicle fuel economy (D. L. Greene et al., 1999) and home heating (Haas and Biermayr, 2000). Applied to rooftop PV, households shift or increase use during solar-generation hours when self-consumption is more valuable than export under net metering (Gautier, Hoet, et al., 2019), and recent quasi-experimental studies estimate residential solar rebound effects of roughly 8 to 18% (Aydin et al., 2023; Bigler, 2025; Havas et al., 2015; Qiu et al., 2019; Spiller, Sopher, et al., 2017). Because the additional demand may be met by carbon-intensive grid generation, the rebound can erode solar's emissions benefits (D'Agosti and Danza, 2025; Deng and Newton, 2017; Toroghi and Matthew E. Oliver, 2019). A related literature shows that household electricity and natural gas use are jointly determined, so cross-fuel substitution shapes the net energy and emissions impact (Alberini et al., 2011; Bernard et al., 2011; Dubin and McFadden, 1984; Mansur et al., 2008).

E.7 Discrete choice experiments for heating and fuel choice

A substantial discrete-choice-experiment (DCE) literature examines household heating-system and fuel choices. In Germany, Achtnicht (2011) finds that investment cost dominates heating-system replacement, with households paying modest premiums for carbon reductions but requiring large subsidies to leave natural gas. Michelsen and Madlener (2012) and Michelsen and Madlener (2016) reach similar conclusions, with operating-cost savings and energy independence outweighing environmental motives. Zemo et al. (2019) integrate environmental attitudes into a fuel-switching DCE, Park and Kwon (2011) show that subsidy design interacts with household characteristics to determine adoption, and Bersisa et al. (2021) model scale and preference heterogeneity in rural energy choices. The recurring finding that private economic benefits outweigh environmental ones motivates the cost- and efficiency-led framing of our choice experiment.

E.8 Environmental attitudes and willingness to pay

The New Ecological Paradigm (NEP) scale (Dunlap and Van Liere, 1978; Dunlap, Van Liere, et al., 2000) is the standard measure of pro-environmental worldview in environmental valua-

tion. Kotchen and Reiling (2000) show that NEP scores predict stated valuations, and Hoyos et al. (2015) find that environmental attitudes explain substantial preference heterogeneity in DCEs and that omitting them inflates random-parameter variances. Mamkhezri (2025), Mamkhezri (2026), and Mamkhezri et al. (2020) and Scarpa and Willis (2010) document attitude–willingness-to-pay links for renewable energy, while Faccioli et al. (2020) and Mariel et al. (2021) discuss capturing such heterogeneity through observable covariates. A parallel literature emphasizes that the attitude–behavior gap is context-dependent (Diekmann and Preisendörfer, 2003; Whitmarsh, 2009). This is consistent with our finding that attitudes predict stated willingness more strongly than metered behavior.

E.9 Hypothetical bias, stated–revealed preference consistency, and WTP-space estimation

Because choice-experiment estimates are hypothetical, a long literature asks how well they track real behavior (J. Hausman, 2012; Kling et al., 2012; Penn and Hu, 2018). Meta-analyses document systematic hypothetical–real divergence (List and Gallet, 2001; Murphy et al., 2005), while within-subject stated–revealed preference comparisons (Bishop and Heberlein, 1979; Johnston et al., 2017; Loomis, 2011) show that the gap varies by context and elicitation format. Best-practice guidance stresses consequentiality and careful design (Carson, Flores, and Meade, 2001; Carson and Groves, 2007; Vossler et al., 2012), attention to protest responses (Meyershoff and Liebe, 2006), and attribute non-attendance (Scarpa, Gilbride, et al., 2009). We estimate the model directly in willingness-to-pay space (K. E. Train and Weeks, 2005) and recover individual-level posterior estimates (Revelt and K. Train, 2000), linking stated values to metered consumption.

E.10 Household factors and persistent energy consumption

A growing literature uses household smart-meter data to ask what drives residential energy demand, linking the two fuels’ records or comparing their load shapes, but rarely asks, for each fuel separately, which household and housing characteristics explain persistent (weather- and calendar-adjusted) consumption (Matsumoto, 2022; McKenna et al., 2022; Pullinger et al., 2024). The question matters for policy because efficiency and electrification programs deliver value only when they reach the homes where savings are largest, and a well-documented gap between projected and realized savings is partly one of misallocation, because programs do not consistently reach those homes (Allcott and Greenstone, 2012; Burlig et al., 2020; Fowlie et al., 2018). Identifying the cross-fuel asymmetry in persistent consumption tells a utility where to aim envelope measures versus appliance and behavioral tools, and which households will add the most electric load when they switch. Methodologically, recovering the association be-

tween time-invariant household characteristics and consumption is not possible with a standard household fixed-effects regression, because the fixed effect absorbs everything constant within a household. We use the two-step fixed-effects-filtered estimator of Pesaran and Zhou (2018), which first removes the common weather and calendar response and then explains the residual household component. Zhang and Zhou (2019) develop a related two-step estimator of time-invariant effects in dynamic panels. The first step follows the energy-demand tradition of controlling flexibly for weather and the calendar (Hor et al., 2005; Kang and Reiner, 2022) and of modeling the temperature response with binned indicators, an approach that originates in the climate-yield literature (Schlenker and Roberts, 2006; Schlenker and Roberts, 2009) and is now standard across environmental and energy economics (Aroonruengsawat and Auffhammer, 2011; Auffhammer, 2022; Auffhammer et al., 2017; L. W. Davis and Gertler, 2015; Deschênes and Greenstone, 2011).

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Pathway to Zero Natural Gas

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Prepared for the Los Alamos Department of Public Utilities

The goal: no natural gas service by 2070

Los Alamos County has committed to eliminating natural gas service by 2070. For homes, that means replacing gas furnaces, water heaters, and stoves with electric alternatives, mostly through **voluntary decisions** made over decades.

- **Will households switch?** How willing are customers to move away from gas, and what would change their minds?
- **What will it take?** What barriers and costs do households actually face?
- **What happens to the grid?** How much new electricity demand will the transition create for the utility?

This study answers those three questions with evidence from Los Alamos.

Resident survey

912 responses from LADPU customers (July–September 2025): appliance stock, bills, and attitudes toward switching.

Choice experiment

403 households repeatedly chose among realistic electrification packages. Their choices reveal what they value in dollar terms.

Meter data

Hourly electricity and gas readings for the county's ~8,500 homes, January 2022 – June 2025, linked to solar installations.

Main findings

1. Households are open to switching away from natural gas, but they are **cost-sensitive**, and **three-quarters have no plan to switch**.
2. Households value **efficiency and bill savings over emissions**. The **electrical-panel upgrade** is the single largest barrier.
3. Rooftop solar cuts grid purchases but **raises total energy use**, a “rebound” that erodes much of solar’s carbon benefit.
4. Gas use is driven by **building characteristics**, and electricity use by **household characteristics**. Different fuels need different policies.
5. Meeting the 2070 goal means **~61% more electricity demand** with a much sharper **winter peak**.

Resident survey findings

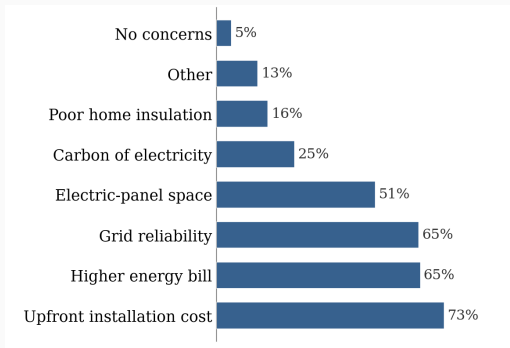
Gas use, satisfaction, and affordability

- 96% use gas, and 88% are satisfied with their gas appliances.
- 74% have no plan to switch. Most see electric appliances as less reliable.
- Affordability line: hardship sets in at bill increases of \$25–\$50 per month.

Households face practical barriers, not a lack of willingness

- Upfront cost and electric panel capacity are key switching barriers.
- Cost savings and efficiency, not environmental benefits, would change minds.
- A third of heating systems are 20+ years old. A wave of replace-or-switch decisions is coming.

Key barriers for switching



Share citing each concern ($N = 675$, multiple answers).

- **Upfront cost (73%):** offset by federal and state rebates and low-interest financing.
- **Higher bills (65%):** met by heat-pump efficiency and rate design.
- **Grid reliability (65%):** largely a perception of older equipment. Information and grid investment can address it.
- **Panel capacity (51%):** a one-time \$2,000–\$5,000 upgrade that incentives and permitting can cover.

Willingness to pay: the choice experiment

Measuring willingness to pay for electrification

Each of the 403 households made six choices among electrification packages that varied in:

- carbon footprint reduction
- appliance **efficiency**
- upfront **rebate**
- net **monthly cost**

The trade-offs they made reveal how much each feature is worth to them, in dollars per month.

	Option A	Option B
Financial Incentives (Rebates/Subsidies) 	0% rebate	75% rebate
Energy Efficiency of Electric Appliances 	25% more efficient	10% more efficient
Annual Reduction in Household Carbon Footprint 	↓ 33% (1.5 metric tons of CO2e)	↓ 0% (0 metric tons of CO2e)
Net Monthly Out-of-Pocket Cost (First 10 Years) 	↓ \$50/month	↑ \$200/month

Images from Freepik.com

Efficiency first, climate second, rebates third

What households value	Worth per month
Appliance efficiency (per %-point of improvement)	\$2.31
Carbon reduction (per %-point of reduction)	\$1.49
Upfront rebate (per %-point of cost covered)	\$1.10

- Households value electrification mainly for its **private benefits** (performance and operating-cost savings), not its climate benefits.
- Environmental values matter for *who* switches. Environmentally minded households value carbon cuts several times more than other households do.
- Stated values likely overstate real-world payments. The *ordering* is the robust message.

The electrical panel is the single largest barrier

- Much of the housing stock dates to the 1940s–1970s, built with 100- or 150-amp panels.
- ~3 in 4 homes would need a 200-amp panel upgrade to go all-electric.
- Typical upgrade cost: \$2,000–\$5,000, plus permit and electrician fees.

What it does to willingness

Households facing a panel upgrade need about \$800 per year in extra savings or incentives before they will choose to electrify, on top of the appliance costs themselves.

Implication: panel subsidies, financing, and streamlined permitting address the single largest barrier, and the one affecting the most homes.

Information alone did not move choices

We randomly assigned some respondents to read a detailed message about the climate and indoor-health effects of gas before making their choices.

- The message had **no measurable effect** on willingness to pay once environmental attitudes were accounted for.
- The message resonates with people who already care. It does not create new demand.

Implication for outreach

Lead with **bill savings, comfort, and performance** (modern heat pumps are 2–3× as efficient as a gas furnace and add summer cooling). Use climate and health benefits as support, not as the headline.

Rooftop solar and the rebound effect

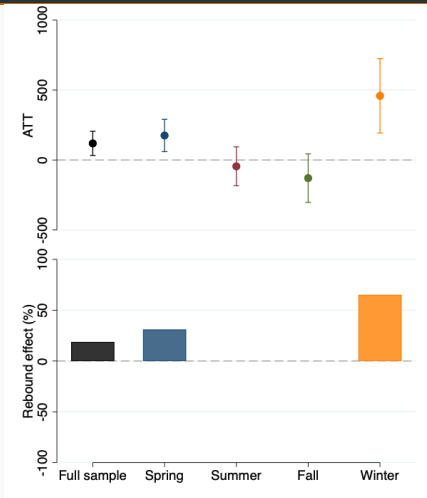
Does rooftop solar reduce energy use?

We compared 198 households that added solar during 2022–2025 with 1,729 matched neighboring homes, before and after installation.

After installing solar. . .	Change
Electricity bought from the grid	–21%
Total electricity used (including own solar power)	+19%
Natural gas use	roughly unchanged
Total household energy use	+7%

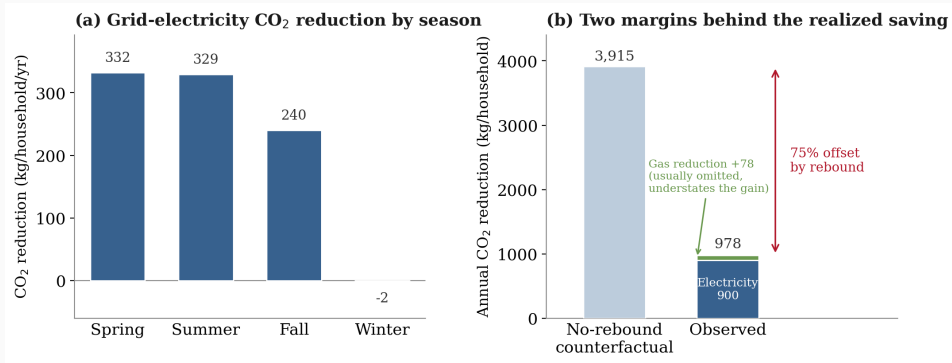
Solar households do more than replace grid power with their own generation. They consume more energy overall. This is the “rebound effect.”

The rebound is a winter phenomenon



- **Winter:** electricity use rises **65%** across the whole day, including evenings and nights when panels produce nothing, consistent with extra heating and comfort funded by bill savings.
- **Spring:** use rises 31% in solar-generation hours while **gas falls 14%**, a shift from gas toward the household's own solar power.
- **Summer/Fall:** little change in total use. Grid purchases fall sharply.

The rebound offsets most of solar's carbon benefit



- Absent behavior change, each solar home would avoid **~3.9 tonnes** of CO₂ per year. With the rebound, the realized saving is **~1 tonne**, so **~75% of the potential is forgone**.
- Solar still helps, but far less than its generation suggests, and least in winter, when electrification adds the most load.

The road to 2070: what the transition means for the grid

Different fuels, different levers

Using meter data for ~580 surveyed homes, we separated what drives each fuel's persistent use:

Natural gas = the building

Weather explains 64% of day-to-day gas use. What remains is set by home size, age, and structure. Gas is a building-envelope outcome.

Electricity = the household

Weather explains only 9%. Electricity use reflects appliances, occupancy, and household characteristics on top of the building.

Implication: the biggest gas reductions come from large, older, high-gas homes (identifiable from meter and property records) and from weatherizing them before electrifying them.

Electricity added by each appliance conversion

Going electric on. . .	Adds per day	vs. typical home (~ 20 kWh/day)
Water heating	~ 4.3 kWh	+21%
Cooking	~ 1.5 kWh	+7%
Clothes drying	~ 1.4 kWh	+7%
Space heating	the largest addition , weather-driven and concentrated in winter	

- Space and water heating dominate the new load and are the end uses to plan around. Cooking and drying are minor.
- The same switches *reduce* gas use. This is substitution across fuels, not pure addition.
- Larger homes use more of both fuels. Each additional 1,000 sq ft adds ~ 4.9 kWh/day of electricity (+25%).

Three scenarios for residential demand

S1: The 2070 goal

Homes convert on a schedule that ends gas by 2070. This is the planning benchmark for the load LADPU must be ready to serve.

S2a: Stated intentions

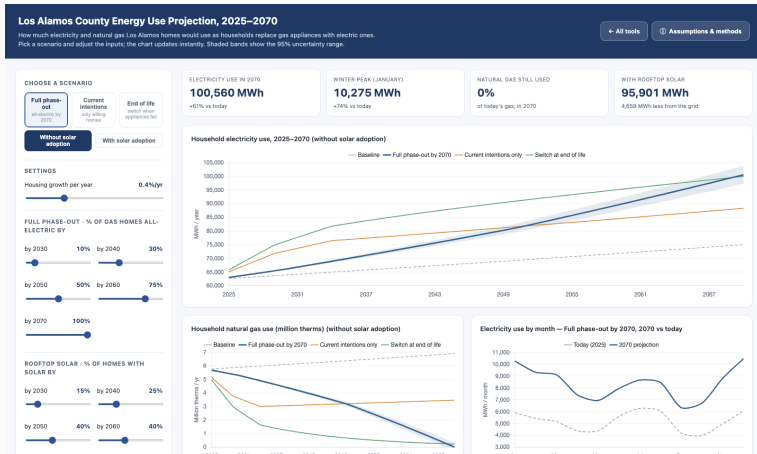
Only the households that say they are “very likely” to switch actually do. The 74% with no plan never switch.

S2b: Replace-on-burnout

Willing households switch as stated. All others go electric *when their gas equipment fails* (12–18-year lifetimes).

All three scenarios are anchored to actual 2024 metered consumption from the county’s 8,646 residential meters. The projections are delivered as an editable planning workbook *and* an interactive online tool (next slide).

Interactive scenario tool



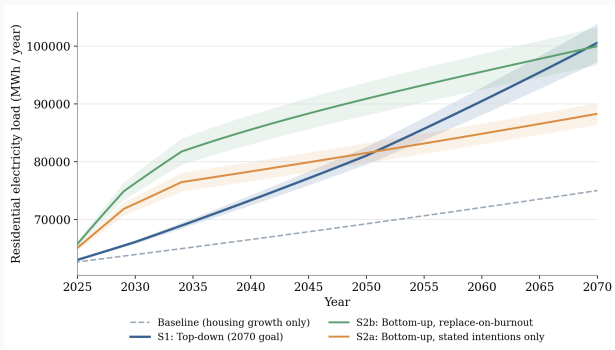
Pick a scenario, adjust the milestones and solar path, and the charts update instantly.

203

unm-eel.github.io/ladpu: projection, willingness-to-pay, solar-rebound, and home tools

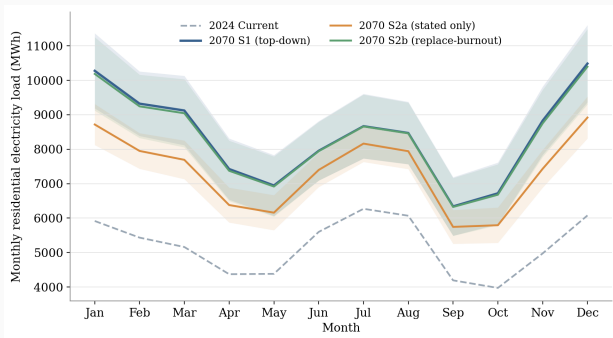
16/24

Meeting the goal: electricity demand rises about 61% by 2070



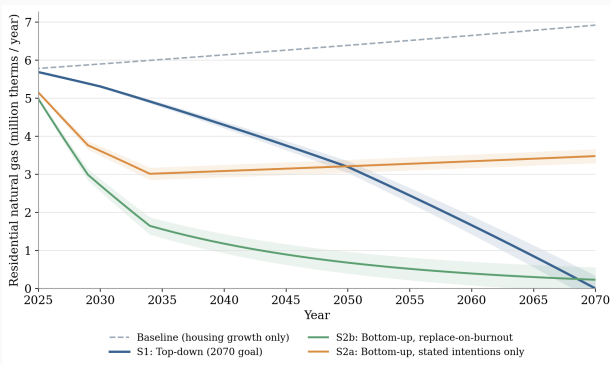
- Meeting the goal would raise residential load from $\sim 62,400$ MWh (2024) to $\sim 100,600$ MWh (2070).
- About a third of the growth is new housing. The rest is electrification.
- Under stated intentions alone (S2a), load would plateau at $\sim 88,300$ MWh, well short of the goal.

Winter becomes the binding constraint



- Electric heating concentrates the new load in winter.
- January load would grow $\sim 74\%$, faster than annual energy ($\sim 61\%$).
- Today's mild seasonal profile would give way to a pronounced **winter peak**.
- **Size the system to the winter peak, not to annual energy.**

The willingness gap and what closes it



- On stated intentions alone, **~60% of today's gas would still be burning in 2070.**
- But if electric simply becomes the **default at equipment replacement**, turnover alone would electrify **~96% of gas homes by 2070.**
- The goal is reachable on a natural-replacement timeline, *not* on stated intentions.

Rooftop solar helps, but only modestly

- Even if solar reaches 40% of homes by 2050, it would trim the 2070 grid load by only ~4,700 MWh, roughly 5%.
- Two reasons: solar reaches a minority of homes, and the rebound converts part of each system's output into higher consumption.
- The new electric load peaks on winter evenings, when panels produce nothing.

Implication

Solar is a useful hedge, not a solution. Compensation that rewards self-consumption, load-shifting, and storage (moving midday solar toward the winter evening peak) would raise solar's value to the grid.

What LADPU can do

Near term: lower the cost and friction of switching

- **Lead with savings and performance, not climate.** Efficiency, comfort, and bill savings are what move the majority. The environmental case works as support.
- **Address the panel barrier.** Streamline permitting for panel upgrades. The choice experiment prices this barrier at ~\$800–\$1,000 per home per year.
- **Help households stack incentives and finance the switch.** Point customers to federal and state rebates and offer financing for the one-time upgrade costs.
- **Reach households when equipment fails.** Switching is cheapest at equipment failure, and a third of heating systems are already 20+ years old. Have the electric option and incentives ready *at that moment*.

Medium term: target and sequence conversions

- **Go where the gas is.** Large, older, multi-story homes burn the most gas and can be identified from meter and property records.
- **Weatherize before electrifying.** Envelope improvements cut today's gas use *and* shrink tomorrow's electric heating load. Coordinate with county and state programs.
- **Prioritize space and water heating.** They account for nearly all remaining gas use and are the end uses households are most willing to convert. Cooking can come last.
- **Redesign solar compensation.** Reward self-consumption and shifting toward the winter evening peak rather than maximizing exports.

Long term: plan for the load, protect affordability

- **Plan capacity to the winter peak** (+74% by 2070), not annual energy (+61%), and revisit with the scenario workbook as adoption unfolds.
- **Carry the rebound into forecasts.** Solar generation is not a one-for-one reduction in grid load.
- **Build equity in from the start.** A \$50–\$100 per month bill increase means hardship for most households. If wealthier homes electrify first, gas-system fixed costs fall on fewer, lower-income customers.
- **Aim subsidies at the binding constraint for lower-income homes** (the one-time panel and wiring cost), e.g., income-qualified support through New Mexico's Home Energy Rebates.

1. The 2070 goal is **feasible** on a natural-replacement timeline, not on stated intentions. Make electric the **default at equipment failure**.
2. The binding barriers are **cost and friction** (above all the electrical panel), not awareness or attitudes.
3. Lead with **savings and performance**; target **large, older, high-gas homes**; sequence **weatherization before electrification**.
4. Plan the grid for a **winter peak $\sim 74\%$ higher** than today, carry the **solar rebound** into load forecasts, and build **affordability** into the design.

Thank you

Yang, Mamkhezri, Jawhari, Zhao & Cornelius (2026)

Pathway to Zero Natural Gas, white paper prepared for LADPU

Interactive tools: unm-eel.github.io/ladpu



County of Los Alamos

Los Alamos, NM 87544
www.losalamosnm.us

Staff Report

August 05, 2026

Agenda No.:	5.a.
Index (Council Goals):	Quality Excellence - Effective, Efficient, and Reliable Services; Quality Governance - Fiscal Stewardship; DPU FY26 - 1.0 Provide Safe and Reliable Utility Services; DPU FY26 - 2.0 Achieve and Maintain Excellence in Financial Performance
Presenters:	Joann Gentry, Deputy Utility Manager-Finance & Admin.
Legislative File:	CO0768-26.3

Title

Introduction of Incorporated County of Los Alamos Code Ordinance No. 02-387; An Ordinance Amending the Department of Public Utilities' Water Service Rate Schedules, Chapter 40, Article III, Sections 40-171, 40-173 and 40-175, and adding new Sections 40-176, 40-177, and 40-178 to the Incorporated County of Los Alamos Code

Recommended Action

I introduce without prejudice Incorporated County of Los Alamos Code Ordinance No.02-387; An Ordinance Amending the Department of Public Utilities' Water Service Rate Schedules, Chapter 40, Article III, Sections 40-171, 40-173 and 40-175, and adding new Sections 40-176, 40-177, and 40-178 to the Incorporated County of Los Alamos Code, with revisions to the effective dates of the last service charge period to “after September 30, 2027” in Sections 40-171(b) and (c) and “after June 30, 2027” in all other sections.

..Utility Manager's Recommendation

The Utility Manager recommends that the Board of Public Utilities (BPU) introduce this ordinance.

Body

The ordinance presented on April 15, 2026 to BPU, was the correct version; however, all subsequent approvals of the ordinance were based on an inadvertently presented a version that was materially different from the ordinance introduced at BPU. Accordingly, the water rate ordinance adopted by the Council on June 30, 2026, is void.

Based on the review of the ordinance presented on April 15, 2026, the recommendations below are being submitted for consideration-

Section 40-171(b) and (c): Change dates listed as “From 10/1/2027 through 9/30/2028” or “10/1/2027-9/30/2028” to “After 9/30/2027.”

Section 40-173(b) and (c): Change dates listed as “From 7/1/2027 through 6/30/2028” or “July 1, 2027 through June 30, 2028” to “After 6/30/2027.”

Section 40-175(b) and (c): Change dates listed as “July 1, 2027 through June 30, 2028” to “After 6/30/2027.”

Section 40-176(b) and (c): Change dates listed as “From 7/1/2027 through 6/30/2028” or “July 1,

2027 through June 30, 2028” to “After 6/30/2027.”

Section 40-177(b) and (c): Change dates listed as “July 1, 2027 through June 30, 2028” to “After 6/30/2027.”

Section 40-178: Change dates listed as “July 1, 2027 through June 30, 2028” to “After 6/30/2027.”

Citizens are welcome to attend and provide public comment regarding the proposed Water Service Rates at these scheduled meetings:

BPU Public Hearing: August 19, 2026

Council Introduction: August 25, 2026

Council Public Hearing: September 29, 2026

Alternatives

Without taking action, DPU would be forced to curtail maintenance and replacement activities, which would ultimately impact system reliability.

Fiscal and Staff Impact/Planned Item

The proposed increases are expected to restore the water fund to a positive cash flow in FY2029 as well as begin funding our long-term cash reserves in FY2034.

Attachments

A - Incorporated County of Los Alamos Code Ordinance No. 02-387

B - Water Rate Presentation

C - Water Rate FAQ

INCORPORATED COUNTY OF LOS ALAMOS CODE ORDINANCE NO. 02-387

AN ORDINANCE AMENDING THE DEPARTMENT OF PUBLIC UTILITIES' WATER SERVICE RATE SCHEDULES, CHAPTER 40, ARTICLE III, SECTIONS 40-171, 40-173, AND 40-175, AND ADDING NEW SECTIONS 40-176, 40-177, AND 40-178 TO THE INCORPORATED COUNTY OF LOS ALAMOS CODE

WHEREAS, the Incorporated County of Los Alamos ("County") is an incorporated county of the State of New Mexico as provided in Section 5, Article 10 of the New Mexico Constitution, and is granted all powers of a municipality; and

WHEREAS, pursuant to Article V of the County Charter, the Department of Public Utilities ("Department") is charged with the duty to operate County owned electric, gas, water and sewer systems; and

WHEREAS, Section 504 of the County Charter requires that the Department be operated on a compensatory basis, with rates being just, reasonable, and comparable to those in neighboring communities; and

WHEREAS, the Department and Utilities Manager have identified the need to increase water rates to meet the projected revenue requirements of the Department; and

WHEREAS, Ordinance No. 02-380, An Ordinance Amending the Department of Public Utilities' Water Service Rate Schedules, Chapter 40, Article III, Sections 40-171, 40-173, and 40-175, and Adding New Sections 40-176, 40-177, and 40-178 to the Incorporated County of Los Alamos Code, which was adopted by County Council on June 30, 2026, is void due to an inadvertent procedural defect in its adoption; and

WHEREAS, pursuant to Charter Section 203.1.d. any change in County utility rates shall be done by ordinance; and

WHEREAS, pursuant to Section 4.6.a. of the *Board of Public Utilities Procedural Rules* (ed 8/20/25), the Utilities Manager is responsible for preparing and presenting proposed utility rate ordinances to the Board of Public Utilities ("BPU"); and

WHEREAS, pursuant to Charter Section 504 the rates to be paid for utility services shall then be proposed by the BPU to the County Council and shall become effective on the date of adoption by Council; and

WHEREAS, the Utilities Manager initially presented this proposed increased water rate ordinance to BPU on August 5, 2026; and

WHEREAS, the Utilities Manager, after receiving comments from the BPU, then presented this final proposed increased water rate ordinance to the BPU on August 19, 2026; and

WHEREAS, on August 19, 2026, the BPU approved this final proposed water rate ordinance and recommended forwarding it to the County Council; and

WHEREAS, on August 25, 2026, the County Council, pursuant to County Charter, Section 203.2.1 introduced this proposed increased water rate ordinance; and

WHEREAS, on September 29, 2026, the County Council, pursuant to County Charter, Section 203.2.2 held a public hearing on this proposed increased water rate ordinance; and

WHEREAS, the water service rate schedule shall be amended, with strike through-text indicating deletions and underline-text indicating added text.

NOW, THEREFORE, BE IT ORDAINED BY THE GOVERNING BODY OF THE INCORPORATED COUNTY OF LOS ALAMOS, as follows:

Section 1. Section 40-171 of the Code of the Incorporated County of Los Alamos is amended to read, as follows:

Sec. 40-171. Potable water rate schedule 8-A.

- (a) *Applicability.* Potable water rate schedule 8-A is applicable to all classes of retail customers whether commercial, residential, or otherwise. The rate shall consist of a service charge plus a water consumption charge.
- (b) *Service charge.*

Service Charge Per Meter Per Month							
Water Meter Size	[Through 10/31/2022]	[From 11/1/2022 through 09/30/2023]	[From 10/01/2023 through 09/30/2024]	[From 10/01/2024 through 09/30/2025]	[After 9/30/2025] <u>Through 9/30/2026</u>	<u>From 10/1/2026 through 9/30/2027</u>	<u>After 9/30/2027</u>
1-inch and under	[\$11.40]	[\$12.54]	[\$13.79]	[\$15.17]	\$16.69	<u>\$18.03</u>	<u>\$19.47</u>
1½-inch	[\$36.10]	[\$39.71]	[\$43.68]	[\$48.05]	\$52.86	<u>\$40.57</u>	<u>\$43.81</u>
2-inch	[\$53.88]	[\$59.27]	[\$65.20]	[\$71.72]	\$78.89	<u>\$72.12</u>	<u>\$77.88</u>
3-inch	[\$106.33]	[\$116.96]	[\$128.66]	[\$141.53]	\$155.68	<u>\$162.27</u>	<u>\$175.23</u>
4-inch	[\$181.06]	[\$199.17]	[\$219.09]	[\$241.00]	\$265.10	<u>\$288.48</u>	<u>\$311.52</u>
6-inch	[\$382.23]	[\$420.45]	[\$462.50]	[\$508.75]	\$559.63	<u>\$649.08</u>	<u>\$700.92</u>
8-inch	[\$631.54]	[\$694.69]	[\$764.16]	[\$840.58]	\$924.64	<u>\$1,153.92</u>	<u>\$1,246.08</u>
<u>10-inch</u>						<u>\$1,803.00</u>	<u>\$1,947.00</u>

<u>12-inch</u>						<u>\$2,596.32</u>	<u>\$2,803.68</u>
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- (c) *Water consumption charge.* The water consumption charge shall be charged to each customer billed under rate schedule 8-A according to the following schedules:

	<i>Consumption October 1 through April 30 (Non-Peak Season)</i>			
	<i>Commodity Rate per 1,000 Gallons</i>			
	<i>Monthly Consumption</i>	<i>9,000 gal or less</i>	<i>over 9,000 gal to 15,000 gal</i>	<i>over 15,000 gal</i>
Single family residential	[Through 10/31/2022]	[\$6.02]	[\$6.02]	[\$6.02]
	[11/1/2022 to 09/30/2023]	[\$6.50]	[\$6.50]	[\$6.50]
	[10/01/2023 to 09/30/2024]	[\$6.83]	[\$6.83]	[\$6.83]
	[10/01/2024 to 09/30/2025]	[\$7.17]	[\$7.17]	[\$7.17]
	Through [After] 09/30/2026[5]	\$7.53	\$7.53	\$7.53
	<u>10/1/2026-09/30/2027</u>	<u>\$8.13</u>	<u>\$8.13</u>	<u>\$8.13</u>
	<u>After 09/30/2027</u>	<u>\$8.78</u>	<u>\$8.78</u>	<u>\$8.78</u>
Multi-family residential	[Through 10/31/2022]	[\$6.02]	[\$6.02]	[\$6.02]
	[11/1/2022 to 09/30/2023]	[\$6.50]	[\$6.50]	[\$6.50]
	[10/01/2023 to 09/30/2024]	[\$6.83]	[\$6.83]	[\$6.83]
	[10/01/2024 to 09/30/2025]	[\$7.17]	[\$7.17]	[\$7.17]
	Through [After] 09/30/2026[5]	\$7.53	\$7.53	\$7.53
	<u>10/1/2026-09/30/2027</u>	<u>\$8.13</u>	<u>\$8.13</u>	<u>\$8.13</u>
	<u>After 09/30/2027</u>	<u>\$8.78</u>	<u>\$8.78</u>	<u>\$8.78</u>
Commercial	[Through 10/31/2022]	[\$6.02]	[\$6.02]	[\$6.02]
	[11/1/2022 to 09/30/2024 2023]	[\$6.50]	[\$6.50]	[\$6.50]
	[10/01/2023 to 09/30/2024]	[\$6.83]	[\$6.83]	[\$6.83]

	[10/01/2024 to 09/30/2025]	[\$7.17]	[\$7.17]	[\$7.17]
	Through [After] 09/30/2026[5]	\$7.53	\$7.53	\$7.53
	10/1/2026-09/30/2027	<u>\$8.13</u>	<u>\$8.13</u>	<u>\$8.13</u>
	After 09/30/2027	<u>\$8.78</u>	<u>\$8.78</u>	<u>\$8.78</u>
County/schools	[Through 10/31/ 2022]	[\$6.02]	[\$6.02]	[\$6.02]
	[11/1/2022 to 09/30/ 2023]	[\$6.50]	[\$6.50]	[\$6.50]
	[10/01/2023 to 09/30/ 2024]	[\$6.83]	[\$6.83]	[\$6.83]
	[10/01/2024 to 09/30/2025]	[\$7.17]	[\$7.17]	[\$7.17]
	Through [After] 09/30/2026[5]	\$7.53	\$7.53	\$7.53
	10/1/2026-09/30/2027	<u>\$8.13</u>	<u>\$8.13</u>	<u>\$8.13</u>
	After 09/30/2027	<u>\$8.78</u>	<u>\$8.78</u>	<u>\$8.78</u>

	Consumption May 1 through September 30 (Peak Season)			
	Commodity Rate per 1,000 Gallons			
	Monthly Consumption	9,000 gal or less	over 9,000 gal to 15,000 gal	over 15,000 gal
Single family residential	[Through 10/31/ 2022]	[\$6.02]	[\$6.40]	[\$7.65]
	[11/1/2022 to 09/30/ 2023]	[\$6.50]	[\$7.15]	[\$7.87]
	[10/01/2023 to 09/30/ 2024]	[\$6.83]	[\$7.51]	[\$8.26]
	[10/01/2024 to 09/30/2025]	[\$7.17]	[\$7.89]	[\$8.67]
	Through [After] 09/30/2026[5]	\$7.53	\$8.28	\$9.10
	10/1/2026-09/30/2027	<u>\$8.13</u>	<u>\$8.94</u>	<u>\$9.84</u>
	After 09/30/2027	<u>\$8.78</u>	<u>\$9.66</u>	<u>\$10.62</u>
Multi-family residential	[Through 10/31/ 2022]	[\$6.02]	[\$6.33]	[\$6.47]
	[11/1/2022 to 09/30/ 2023]	[\$6.50]	[\$6.50]	[\$6.50]
	[10/01/2023 to 09/30/ 2024]	[\$6.83]	[\$6.83]	[\$6.83]

	[10/01/2024 to 09/30/2025]	[\$7.17]	[\$7.17]	[\$7.17]
	Through [After] 09/30/2026[5]	\$7.53	\$7.53	\$7.53
	10/1/2026-09/30/2027	<u>\$8.13</u>	<u>\$8.13</u>	<u>\$8.13</u>
	After 09/30/2027	<u>\$8.78</u>	<u>\$8.78</u>	<u>\$8.78</u>
Commercial	[Through 10/31/ 2022]	[\$6.02]	[\$6.02]	[\$6.02]
	[11/1/2022 to 09/30/ 2023]	[\$6.50]	[\$6.50]	[\$6.50]
	[09/30/ 2024]	[\$6.83]	[\$6.83]	[\$6.83]
	[10/01/2024 to 09/30/2025]	[\$7.17]	[\$7.17]	[\$7.17]
	Through [After] 09/30/2026[5]	\$7.53	\$7.53	\$7.53
	10/1/2026-09/30/2027	<u>\$8.13</u>	<u>\$8.13</u>	<u>\$8.13</u>
	After 09/30/2027	<u>\$8.78</u>	<u>\$8.78</u>	<u>\$8.78</u>
County/schools	[Through 10/31/ 2022]	[\$6.02]	[\$6.02]	[\$6.02]
	[11/1/2022 to 09/30/ 2023]	[\$6.50]	[\$6.50]	[\$6.50]
	[10/01/2023 to 09/30/ 2024]	[\$6.83]	[\$6.83]	[\$6.83]
	[10/01/2024 to 09/30/2025]	[\$7.17]	[\$7.17]	[\$7.17]
	Through [After] 09/30/2026[5]	\$7.53	\$7.53	\$7.53
	10/1/2026-09/30/2027	<u>\$8.13</u>	<u>\$8.13</u>	<u>\$8.13</u>
	After 09/30/2027	<u>\$8.78</u>	<u>\$8.78</u>	<u>\$8.78</u>

Note: Multi-family residential includes multiple dwelling units (duplexes, triplexes, quads ...) and apartments as defined in Code section 40-201.

Section 2. Section 40-173 of the Code of the Incorporated County of Los Alamos is amended to read, as follows:

Sec. 40-173. Non-potable water rate charge.

- (a) The non-potable water rate sold and delivered to points of delivery. The rate shall consist of a service charge, plus a non-potable water consumption charge.

(b) Service Charge.

<u>Service Charge Per Meter Per Month</u>		
<u>Water Meter Size</u>	<u>From 10/1/2026 through 6/30/2027</u>	<u>After 6/30/2027</u>
<u>1-inch and under</u>	<u>\$9.02</u>	<u>\$9.74</u>
<u>1½-inch</u>	<u>\$20.29</u>	<u>\$21.91</u>
<u>2-inch</u>	<u>\$36.06</u>	<u>\$38.94</u>
<u>3-inch</u>	<u>\$81.14</u>	<u>\$87.62</u>
<u>4-inch</u>	<u>\$144.24</u>	<u>\$155.76</u>
<u>6-inch</u>	<u>\$324.54</u>	<u>\$350.46</u>
<u>8-inch</u>	<u>\$576.96</u>	<u>\$623.04</u>
<u>10-inch</u>	<u>\$901.50</u>	<u>\$973.50</u>
<u>12-inch</u>	<u>\$1,298.16</u>	<u>\$1,401.84</u>

(c) The water consumption rate for non-potable water, including effluent reuse water, shall be ~~[\$3.03 per 1,000 gallons for consumption through October 31, 2022, \$3.18 per 1,000 gallons for consumption November 1, 2022 through September 30, 2023, \$3.34 per 1,000 gallons for consumption October 1, 2023 through September 30, 2024, \$3.51 per 1,000 gallons for consumption October 1, 2024 through September 30, 2025, and] \$3.69 per 1,000 gallons for consumption through September 30, 2026, \$3.99 per 1,000 gallons for consumption October 1, 2026 through June 30, 2027, and \$4.30 per 1,000 gallons for consumption after June 30, 2027.~~

Section 3. Section 40-175 of the Code of the Incorporated County of Los Alamos is amended to read, as follows:

Sec. 40-175. Bulk delivery rate schedule 8-D.

(a) Applicability. Schedule 8-D is applicable to all bulk water sold and delivered to bulk points of delivery. The rate shall consist of a service charge, plus a water consumption charge.

- (b) The bulk delivery rate for water sold and delivered to bulk points of delivery shall be [~~\$4.13 per 1,000 gallons for consumption through October 31, 2022, \$4.83 per 1,000 gallons for consumption November 1, 2022 through September 30, 2023, \$5.07 per 1,000 gallons for consumption October 1, 2023 through September 30, 2024, \$5.32 per 1,000 gallons for consumption October 1, 2024 through September 30, 2025, and~~ \$5.59 per 1,000 gallons for consumption through September 30, 2026, \$6.04 per 1,000 gallons for consumption for October 1, 2026 through June 30, 2027, and \$6.52 per 1,00 gallons for consumption after June 30, 2027.
- (c) The customer service charge for water sold and delivered to bulk points of delivery shall be [~~\$778.84 per month per customer for service through October 31, 2022; \$817.78 per month per customer for service November 1, 2022 through September 30, 2023; \$858.67 per month per customer for service October 1, 2023 through September 30, 2024; \$901.60 per month per customer for service October 1, 2024 through September 30, 2025; and~~ \$946.68 per month per customer for service through September 30, 2026, \$1,022.41 per month per customer for service October 1, 2026 through June 30, 2027, and \$1,104.21 per month per customer for service after June 30, 2027.

Section 4. Three new sections are added to the Code of Ordinances, Chapter 40 Utilities, Water Rates, Sections; 40-176 Irrigation Meters, 40-177 Bulk Water Sales to Los Alamos National Laboratory, and 40-178 Pajarito Mountain Service Area, as follows:

Sec 40-176. – Irrigation Meters

Definition: An irrigation meter is a dedicated water meter that exclusively meters water used for outdoor watering, irrigation and snowmaking. None of the water used is returned to the sewer system, and sewer charges do not apply to irrigation meter usage.

- (a) The potable water rate is applicable to water sold and delivered for irrigation meters. The rate shall consist of a service charge, plus a potable water consumption charge.
- (b) Service Charge.

<u>Service Charge Per Meter Per Month for Snow Making and Irrigation</u>		
<u>Water Meter Size</u>	<u>From 10/1/2026 through 6/30/2027</u>	<u>After 6/30/2027</u>
<u>1-inch and under</u>	<u>\$9.02</u>	<u>\$9.74</u>
<u>1½-inch</u>	<u>\$20.29</u>	<u>\$21.91</u>
<u>2-inch</u>	<u>\$36.06</u>	<u>\$38.94</u>
<u>3-inch</u>	<u>\$81.14</u>	<u>\$87.62</u>

<u>4-inch</u>	<u>\$144.24</u>	<u>\$155.76</u>
<u>6-inch</u>	<u>\$324.54</u>	<u>\$350.46</u>
<u>8-inch</u>	<u>\$576.96</u>	<u>\$623.04</u>
<u>10-inch</u>	<u>\$901.50</u>	<u>\$973.50</u>
<u>12-inch</u>	<u>\$1,298.16</u>	<u>\$1,401.84</u>

- (c) The water consumption rate for potable water, for irrigation use, shall be \$8.13 per 1,000 gallons for consumption October 1, 2026 through June 30, 2027, and \$8.78 per 1,000 gallons for consumption after June 30, 2027.

Sec. 40-177. Bulk Water Sales to Los Alamos National Laboratory

- (a) The water consumption rate for water sales to Los Alamos National Laboratory, for potable water sold and delivered to Los Alamos National Laboratory points of delivery shall consist of a service charge, plus a water consumption charge.
- (b) The customer service charge for water sold and delivered to bulk points of delivery shall be \$946.68 per month per customer for service through September 30, 2026, \$1,022.41 per month per customer for service October 1, 2026 through June 30, 2027, and \$1,104.21 per month per customer for service after June 30, 2027.
- (c) The water consumption rate for potable water sold and delivered to Los Alamos National Laboratory shall be \$7.45 per 1,000 gallons for consumption from October 1, 2026 through June 30, 2027, and \$7.80 per 1,000 gallons for consumption after June 30, 2027.

Sec. 40-178. Pajarito Mountain Service Area

The water consumption rate for the Pajarito Mountain “Service Area”, including the Jemez Mountains’ wildfire protection area, for potable water sold and delivered to points of delivery above 8,000 feet in elevation, shall consist of an applicable potable water service charge or irrigation meter charge, and a commercial water consumption charge plus an energy charge. The energy charge rate is \$1.50 per 1,000 gallons of water sold from October 1, 2026 through June 30, 2027, and \$1.50 per 1,000 gallons of water sold after June 30, 2027.

Section 5. Effective Date. This ordinance shall become effective upon adoption with the amended water rates being applied for all billings on or after September 30, 2026.

Section 6. Severability. Should any section, paragraph, clause or provision of this ordinance, for any reason, be held to be invalid or unenforceable, the invalidity or unenforceability of such section, paragraph, clause or provision shall not affect any of the remaining provisions of this ordinance.

Section 7. **Repealer.** All ordinance or resolutions, or parts thereof, inconsistent herewith are hereby repealed only to the extent of such inconsistency. This repealer shall not be construed to revive any ordinance or resolution, or part thereof, heretofore repealed.

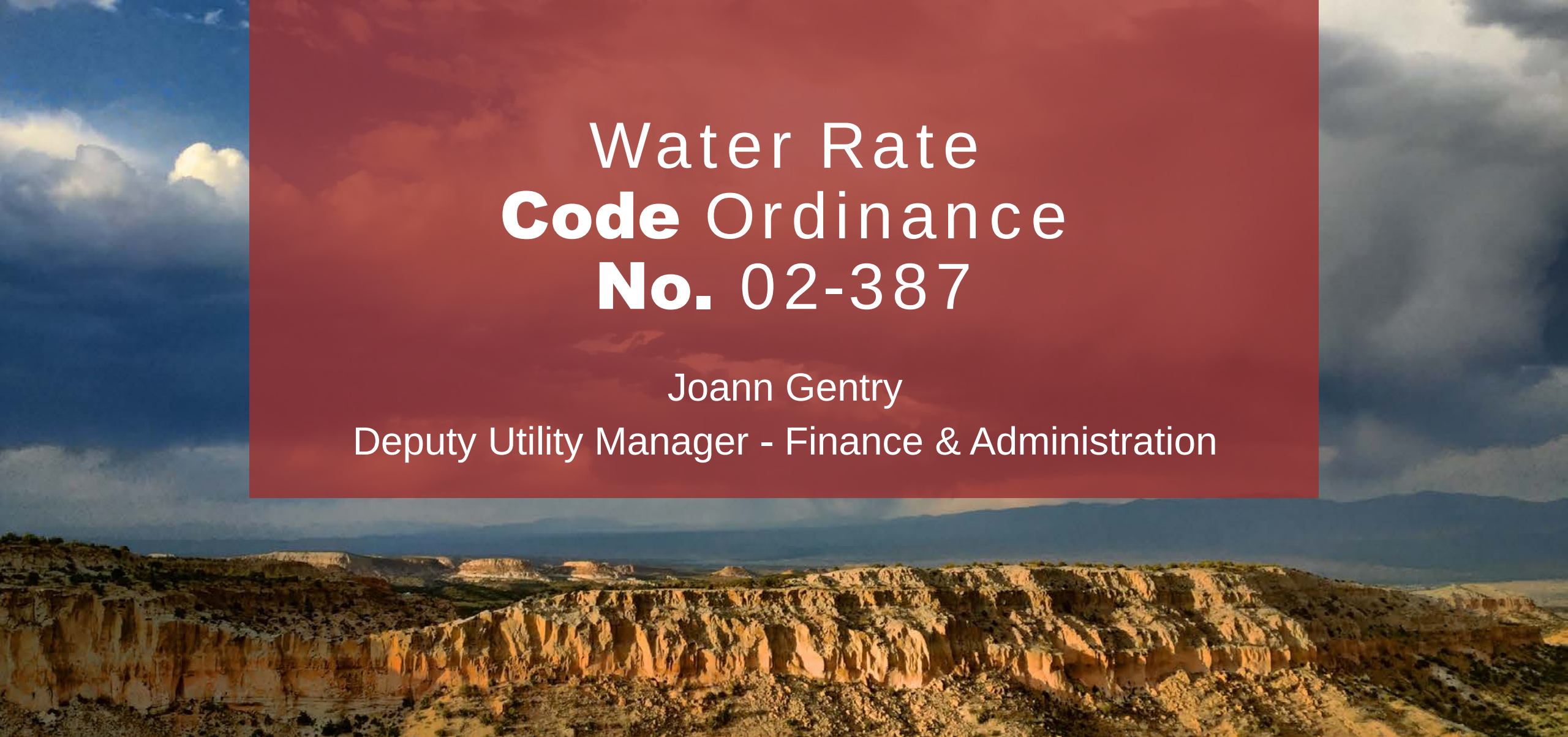
ADOPTED this 29th day of September 2026.

**COUNCIL OF THE INCORPORATED
COUNTY OF LOS ALAMOS**

**Randall T. Ryti,
Council Chair**

ATTEST: (SEAL)

**Michael D. Redondo,
Los Alamos County Clerk**



Water Rate **Code** Ordinance **No.** 02-387

Joann Gentry
Deputy Utility Manager - Finance & Administration

Overview

2



Water Rate Ordinance 02-380 provided to BPU on April 15, 2026, was the correct version; however, an incorrect version was subsequently provided on May 20, 2026



Water Rate Ordinance 02-380 provided to the County Council on June 9, 2026, and June 30, 2026 was not the correct version



Water Rate Ordinance 02-387 replaces the incorrect version previously presented to BPU and County Council

Recommended Revisions

Recommendations:

- Section 40-171(b) and (c) revise where dates, which are listed as “From 10/1/2027 through 9/30/2028” or “10/1/2027-9/30/2028” to “After 9/30/2027” • Section 40-173 (b) and (c) revise where dates, which are listed as “From 7/1/2027 through 6/30/ 2028” or “July 1, 2027 through June 30, 2028” to “After 6/30/2027”
- Section 40-175 (b) and (c) revise where dates, which are listed as “July 1, 2027 through June 30, 2028” to “After 6/30/2027”
- Section 40-176 (b) and (c) revise where dates, which are listed as “From 7/ 1/ 2027 through 6/30/2028” or “July 1, 2027 through June 30, 2028” to “After 6/ 30/2027”

Recommended Revisions

- Recommendations:
 - Section 40-177 (b) and (c) revise where dates, which are listed as “July 1, 2027 through June 30, 2028” to “After 6/30/2027”
 - Section 40-178 revise where dates, which are listed as “July 1, 2027 through June 30, 2028” to “After 6/30/2027”

Thank you!

Questions?

Joann Gentry

Deputy Utility Manager -
Finance & Administration

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Frequently Asked Questions

Water Rate Ordinance

How much are water rates increasing?

The Department of Public Utilities (DPU) is proposing water rate increases covering a two-year period to be approved by the Board of Public Utilities and adopted by the County Council.

Additional revenue is needed to support current operations and build cash reserves required for future infrastructure needs. During the FY2027 and FY2028 budget cycle, it was determined that revenues generated would need to increase by 8% each year to maintain adequate fund balances per the DPU financial policies.

This results in the following rate adjustments:

Proposed service charge per month

Residential, Multifamily, Commercial, County & Schools

Water Meter Size	Current	After 9/30/2026	After 9/30/2027
1-inch & under	\$16.69	\$18.03	\$19.47
1.5 inch	\$52.86	\$40.57	\$43.81
2 inch	\$78.89	\$72.12	\$77.88
3 inch	\$155.68	\$162.27	\$175.23
4 inch	\$265.10	\$288.48	\$311.52
6 inch	\$559.63	\$649.08	\$700.92
8 inch	\$924.64	\$1,153.92	\$1,246.08
10 inch	-	\$1,803.00	\$1,947.00
12 inch	-	\$2,596.32	\$2,803.68

Administrative Office

1000 Central Avenue, Suite 130

Los Alamos, NM 87544

P 505.662.8333 F 505.662.8005

customercare@lacnm.us

ladpu.com/dpu

Proposed consumption charge per 1,000 gallons

Customer class	Consumption date	Non-peak season (Oct-Apr)	Peak season (May-Sept)		
		all consumption	<= 9,000 gal	9,001 -15,000 gal	> 15,000 gal
Single-family residential	Current	\$7.53	\$7.53	\$8.28	\$9.10
	After 9/30/2026	\$8.13	\$8.13	\$8.94	\$9.84
	After 9/30/2027	\$8.78	\$8.78	\$9.66	\$10.62
Multi-family residential	Current	\$7.53	\$7.53	\$7.53	\$7.53
	After 9/30/2026	\$8.13	\$8.13	\$8.13	\$8.13
	After 9/30/2027	\$8.78	\$8.78	\$8.78	\$8.78
Commercial	Current	\$7.53	\$7.53	\$7.53	\$7.53
	After 9/30/2026	\$8.13	\$8.13	\$8.13	\$8.13
	After 9/30/2027	\$8.78	\$8.78	\$8.78	\$8.78
County & Schools	Current	\$7.53	\$7.53	\$7.53	\$7.53
	After 9/30/2026	\$8.13	\$8.13	\$8.13	\$8.13
	After 9/30/2027	\$8.78	\$8.78	\$8.78	\$8.78

Why do we need these water increases and what do they cover?

To keep DPU's water pumping and delivery system resilient and sound, DPU has planned future capital projects. These projects are essential to ensure:

- A sufficient water supply to meet customer demand, including increased needs at LANL and new housing in both White Rock and Los Alamos townsite.
- Infrastructure that supports fire suppression,
- Repair and replacement of aging infrastructure to reduce leaks and water main breaks,
- Continued delivery of safe, high-quality drinking water that meets all federal and state health standards.

In addition, in 2016 the Board of Public Utilities adopted financial policies requiring each utility fund to maintain healthy cash reserves. These reserves help ensure DPU can meet daily operational needs, cover system retirement obligations, manage debt service, and respond to unexpected equipment failures or external disruptions.

Where can I find the draft ordinance?

The draft ordinance, along with additional information, is available on the DPU website at

<https://ladpu.com/rates>

What is the process for raising the water rates?

The BPU will hold a public hearing on August 19 at 5:30 pm in the Council Chambers at 1000 Central Ave., Los Alamos, NM, and via Zoom. If the BPU approves the ordinance, it will be introduced at the August 25 County Council meeting. The Council will then hold a public hearing to consider adoption at the September 29 council meeting in Council Chambers. The following link will allow public access to both meetings: <https://ladpu.com/ratehearing>

When will these rates take effect?

The proposed ordinance states that the increases will go into effect after each “peak” season. The peak season for Los Alamos and White Rock runs from May through September of each year. Therefore, these rates will take effect on October 1st of each proposed year.

There were several recent breaks to waterlines, has the DPU neglected the water infrastructure?

Over the past 3 years, DPU has invested in operations, maintenance and capital improvements, comprising \$4,205,098 in the water distribution system and \$23,380,819 in the water production system. However, maintaining our infrastructure is an ongoing process. DPU has carefully prioritized the water capital improvement projects by identifying areas with the greatest need that impact the most customers. This includes replacement needs for waterlines that experience frequent breaks. For the next 5 years, DPU plans to reinvest \$19,330,00 in water production infrastructure and \$4,355,000 in water distribution infrastructure.

Should we abandon water conservation programs and education since the result is less revenue for DPU, therefore causing rates to go up?

Water conservation efforts in every community naturally reduce the amount of revenue water providers receive. However, many of DPU's costs are fixed. Regardless of how much water is sold, DPU must maintain and operate wells, pump stations, and pipelines, and ensure we have the staff needed to keep the system functioning safely and reliably. If water consumption drops to the point where revenue no longer covers these fixed costs, DPU—like other water utilities—must raise rates to continue providing service.

Because water conservation is essential, we continue to encourage everyone to be good stewards of our natural resources. The Office of the State Engineer has allocated 5,541.3 acre-feet of water rights per year to Los Alamos County and the Department of Energy. If the County wishes to support new housing and economic development, we must all use water wisely to stay within this limit.

DPU also has a conservation goal of reducing water consumption by 12% by 2030. Additionally, the department has benefited from low-interest loans and grant programs that require conservation plans and rate structures—such as the County's current tiered water rates—that promote efficient water use.

What if these increases are not approved?

If the rate increases are not approved, DPU will need to reduce expenses, which would likely include delaying critical capital projects. Postponing this work will accelerate the deterioration of system infrastructure and ultimately result in a less reliable water utility.

How do these rates compare with other communities?

The following is an example of a residential customer (single-family home) with a 1-inch water meter. Cells in orange represent the proposed rate increases.

Community	Gallons Consumed Non-Peak Season	Monthly Bill
Los Alamos Current Rate	6,000	\$61.87
Los Alamos Proposed Rate FY27	6,000	\$66.81
Los Alamos Proposed Rate FY28	6,000	\$72.15
Santa Fe County	6,000	\$82.06
City of Santa Fe	6,000	\$60.47
Espanola	6,000	\$49.74

Community	Gallons Consumed Peak Season*	Monthly Bill
Los Alamos** Current Rate	14,000	\$125.86
Los Alamos** Proposed Rate FY27	14,000	\$135.90
Los Alamos** Proposed Rate FY28	14,000	\$146.79
Santa Fe County**	14,000	\$177.18
City of Santa Fe**	14,000	\$171.59
Espanola	14,000	\$84.78

*Month of August was used for the peak season comparison.

** Tiered or seasonal rates apply for this jurisdiction

Is there any assistance for individuals on fixed incomes?

DPU maintains a Utility Assistance Program to aid qualified low-income residential families. More information and the application are available at <https://ladpu.com/assist>.

DPU recognizes that even a small increase in a utility bill can significantly affect customers who are facing unexpected hardships, living on fixed incomes, or struggling financially to meet basic expenses. If you are having difficulty paying your utility bill, we'd like to help! Thanks to the voluntary contributions of our generous community and customers, we offer financial assistance to eligible households through our Utilities Assistance Program (UAP).

Customers may contact the Customer Care Center with questions about the application or to donate to the program by calling 505-662-8333 or emailing CustomerCare@lacnm.us.

Other programs available to assist customers' utility bills are:

- LA Cares, 505 661 8105
- Self-help, Inc, 505 662 4666.
- NM Low Income Energy Assistance Program (LIHEAP) (assists with energy bills), 505-753-2271.



County of Los Alamos

Staff Report

August 05, 2026

Los Alamos, NM 87544
www.losalamosnm.us

Agenda No.: 6.a.

Index (Council Goals): DPU FY26 - 1.0 Provide Safe and Reliable Utility Services; DPU FY26 - 3.0 Be a Customer Service Oriented Organization that is Approachable, Communicative, Efficient, and Transparent; DPU FY26 - 6.0 Develop and Strengthen Partnerships

Presenters: Ben Olbrich, Deputy Utility Manager-Power Supply

Legislative File: 21995-26a

Title

Discussion on the Electric Coordination Agreement (ECA)

Body

This item is for discussion only. Mr. Ben Olbrich, Deputy Utility Manager - Power Supply will be present to address any follow on questions or concerns from the Board. He may be able to provide a verbal update on the status of BPU's requested changes to the ECA.



County of Los Alamos

Staff Report

August 05, 2026

Los Alamos, NM 87544
www.losalamosnm.us

Agenda No.: 6.b.

Index (Council Goals): DPU FY26 - 1.0 Provide Safe and Reliable Utility Services; DPU FY26 - 3.0 Be a Customer Service Oriented Organization that is Approachable, Communicative, Efficient, and Transparent

Presenters: Ben Olbrich, Deputy Utility Manager-Power Supply

Legislative File: 21693-26

Title

A Presentation on Future Department of Public Utilities Plug-in Solar Policy

Utilities Manager's Recommendation

Request BPU guidance for next steps.

Body

As a follow-on to the overview of plug-in solar presented to BPU on April 1, 2026, this presentation:

- Explains why DPU needs to prepare for Plug-in Solar, hereafter called PIPV (Plug-In PhotoVoltaic)

- Evaluates safety, Distribution System impacts, and rogue PIPV systems

- Describes what choices DPU can pick from

- Considers ways for DPU to help inform customers

- Identifies staff's recommended choices

Attachments

A - Plug-In Solar Presentation

Preparing for Plug-in Solar

August 5, 2026

Purpose of Presentation

2

- As a follow-on to the overview of plug-in solar presented to BPU on April 1, 2026, this presentation:
 - Explains why DPU needs to prepare for Plug-in Solar, hereafter called PIPV (Plug-In PhotoVoltaic)
 - Evaluates safety, Distribution System impacts, and rogue PIPV systems
 - Describes what choices DPU can pick from
 - Considers ways for DPU to help inform customers
 - Identifies staff's recommended choices

Why Does DPU Need to Prepare?

3

- Because DPU's customers are going to be using PIPV systems! They can be:
 - Inexpensive; 30% to 50% lower per-watt installed cost than rooftop solar
 - Easy to install by a customer, just find a sunny spot for the PV panels and plug the cord in to an outlet
 - Portable, just unplug it and move it
- Already popular in Europe with 4+ millions in use, and interest is growing across the United States
- **DPU's decisions now will support the safe adoption of PIPV and formalize the associated DPU rules**

Evaluate the Safety

- Line worker and customer safety is addressed by UL 1741, UL 3700, and line worker engineering controls
- UL 1741 covers automatic shutdown of grid-tied inverters to prevent back feed during power outages, supplements engineering controls for line workers
- Currently there are no UL 3700 certified systems available for sale in the US
- Obstacles are being overcome - state and local regulations and policies are changing, and safety issues are being mitigated
- It's a "Buyer Beware" market, meaning that buyers (not DPU) assume the risks of PIPV

UL 3700 Requirements are Tough

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- Has requirements for specialized plug/receptacle combo and dedicated branch circuit
 - Should only be permitted, and installed by a licensed electrician or homeowner, with state inspection
 - UL 3700-compliant systems cannot be easily plugged in to an existing receptacle
- “Guerilla” installs of non-compliant systems likely, and will probably be safe, if not “super safe”. Again, buyer beware
- DPU can stay out of this issue if we don’t require interconnection agreements, or we could decide that the safety issues are significant enough to merit an interconnection agreement

Evaluate Distribution System Impacts

6

- Expected to be minor for PIPV systems below the average DPU residential load of 900 watts
- Occasional power exports are to be expected as customer loads vary hourly
- Meters for customers without interconnection agreements are not set up to monitor exported power
 - DPU does not currently monitor for exported power on non-interconnection agreement customers
 - Potential issue if no interconnection study is performed

Handling Rogue PIPV Systems

7

- Potential for customers putting in many or unusually large PIPV systems that export potentially concerning levels of power
- Potential for customers with existing rooftop PV and interconnection agreements to put in PIPV thus expanding beyond the agreement capacity
 - Would be compensated for exported PIPV energy since it is indistinguishable from rooftop PV
 - May be able to detect these PIPV systems, when the exported power exceeds the interconnection agreement or a baseline production measurement
 - Consider capping compensation for exports at each customer's baseline measurement

Background on the Customer-Owned Generation Process

8

- DPU's *Application for Operation of Customer-Owned Generation* and *Standard Interconnection Agreement* define the process for connecting customer-owned generation
- Grid-tied PV systems can export energy, sending power from the PV system to the distribution system
- DPU customers ***with interconnection agreements*** get credit for exported energy under Rule E-5.05

Credit for energy supplied to the Utility. The credit to the Customer for energy supplied to the Utility will be based on the wholesale cost. The wholesale cost is the Utility's Electric Coordination Agreement (ECA) total capacity and energy costs, for a twelve-month rolling average, calculated from the Los Alamos County Resource Pool invoices.

Pick a PIPV Interconnection Approach

9

Here are Four approaches for PIPV interconnection

1. Require all PIPV systems to use a Customer-Owned Generation interconnection process
2. Require only PIPV systems (or multiple systems) that exceed a power threshold, say 800 or 1200 watts, to use a Customer-Owned Generation interconnection process

For Options 1 & 2:

- \$500 net meter installation fee would apply unless changed; may not apply to customers who already have an interconnection agreement
- Can allow for energy export credit, the same as for rooftop PV or under a different method
- Lets DPU communicate guidance, and indemnification and liability clauses
- Can choose whether DPU would indirectly enforce requirements under UL 3700 and partially address rogue systems
- Can provide metrics
- Requires PIPV modifications to the process documents

Pick a PIPV Interconnection

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3. Create a new PIPV registration process
 - Like options 1&2 but separating the process from the existing process could make it easier for customers to understand and easier for staff to manage
 - Requires the creation of new process documents
4. No interconnection agreement required
 - No burden on staff and customers but no DPU control or knowledge of installations
 - No net meter or installation fee and no metrics
 - No export energy credit
 - No enforcement or review by DPU of requirements under UL 3700
 - Relies on public communications for safety messaging

Pick a PIPV Export Approach

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Here are three approaches for PIPV export credits

1. Provide credit for exported energy under Rule E-5.05
2. Provide credit for exported energy under a new PIPV-specific rule
3. No credit for PIPV exports

Important Point: the PIPV Interconnection and the PIPV Export choices are independent of each other!

Share Info With Customers

12

- Regardless of the selected approaches for handling rogue PIPV systems, PIPV interconnections and the PIPV export approach, DPU must share PIPV info
 - Pros and cons
 - Safety considerations
 - Places to get PIPV information
 - No assumption of risk by DPU
- DPU is not responsible or liable for any harm from the use of PIPV systems
- DPU is not reviewing or approving the safety of PIPV systems
- Customers using PIPV systems assume all risks

Staff Recommendations

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- Respond to rogue PIPV systems if it becomes an issue
- Staff recommends no PIPV interconnection agreements, because it lowers the barrier to entry for distributed solar
- Staff recommends no credit for exported energy because it follows from choosing to have no PIPV interconnections, eliminates associated staff time, and fits with the PIPV ethos of self-reliance and anti-bureaucracy
- Share information with customers

Summary

- PIPV is an emerging technology that DPU can manage now to prevent future issues
- There are several reasonable paths that DPU can take, staff recommends
 - No PIPV interconnection agreement or registration
 - No compensation for exported PIPV energy
 - Share information with customers

Next Steps

15

- BPU to identify its preferred choices
- Staff to draft plans, documents and customer resources
- BPU to review drafts

Thank you! Questions?

Ben Olbrich

**Deputy Utility Manager -
Power Supply**

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County of Los Alamos

Los Alamos, NM 87544

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Staff Report

August 05, 2026

Agenda No.:	6.c.
Index (Council Goals):	Quality Excellence - Effective, Efficient, and Reliable Services; DPU FY26 - 1.0 Provide Safe and Reliable Utility Services; DPU FY26 - 3.0 Be a Customer Service Oriented Organization that is Approachable, Communicative, Efficient, and Transparent; Quality Governance - Communication and Engagement
Presenters:	Clay Moseley, Deputy Utility Manager-GWS Services
Legislative File:	21386-26

Title

Annual Update on Wastewater Systems

Body

The board has requested a system assessment on a different utility each quarter. This quarter, Clay Moseley, Deputy Utilities Manager for GWS Operations, will present an update on the wastewater systems: wastewater collections and wastewater treatment. Discussion includes both the physical condition and operational challenges of the wastewater sub-systems: Wastewater Collections (WC) and Wastewater Treatment (WT). Also included are recent AMT (Asset Management Team - Engineering and Operations) achievements and challenges and planned near-term future O&M Goals, Action Items and Major Projects.

The physical condition of each sub-system (WC = FAIR, WT=GOOD) has seen some upward improvements from last year's report. This is the result of AMT goals moving into their project phase, with several of the projects being successfully completed. Project completion from both CIP and in-house Operations contribute to improvements. Large systems require multiple years of CIP and O&M improvement projects before the entire system's condition can be revised to a significantly improved status. The AMT program focuses on prioritizing the most critical issues from most impactful to less impactful.

The new White Rock WRRF is now fully functional after being put into operation two years ago. It truly is a source of pride for the DPU and the WT staff enjoy operating it. It has had a few startup issues, most of which have been mitigated by the project team, but one large issue with the sludge basin mixing pumps is still being worked on. There is an aggressive corrosion problem, the source of which is not fully understood and requires further investigation.

The Los Alamos WWTP has seen several major upgrades and replacements this past year, which has resulted in a significant improvement in its overall condition assessment. The original solids dewatering belt press has been replaced with a more modern, resource efficient screw press. The headworks fine screen was completely overhauled with new components, completed by WT in-house operations staff. This saved a tremendous amount of money that will be put toward other upcoming projects. Many of the electrical motor control modules (MCC "buckets") have been overhauled with new components by the Water Systems Electrical Technicians

(in-house), providing much more reliable operation of the various electrical motors driving pumps and process equipment. This was also originally planned to be outsourced to electrical contractors as a CIP project. The LA-WWTP will be seeing several more repair and upgrading projects over this next year through a mix of in-house projects and CIP.

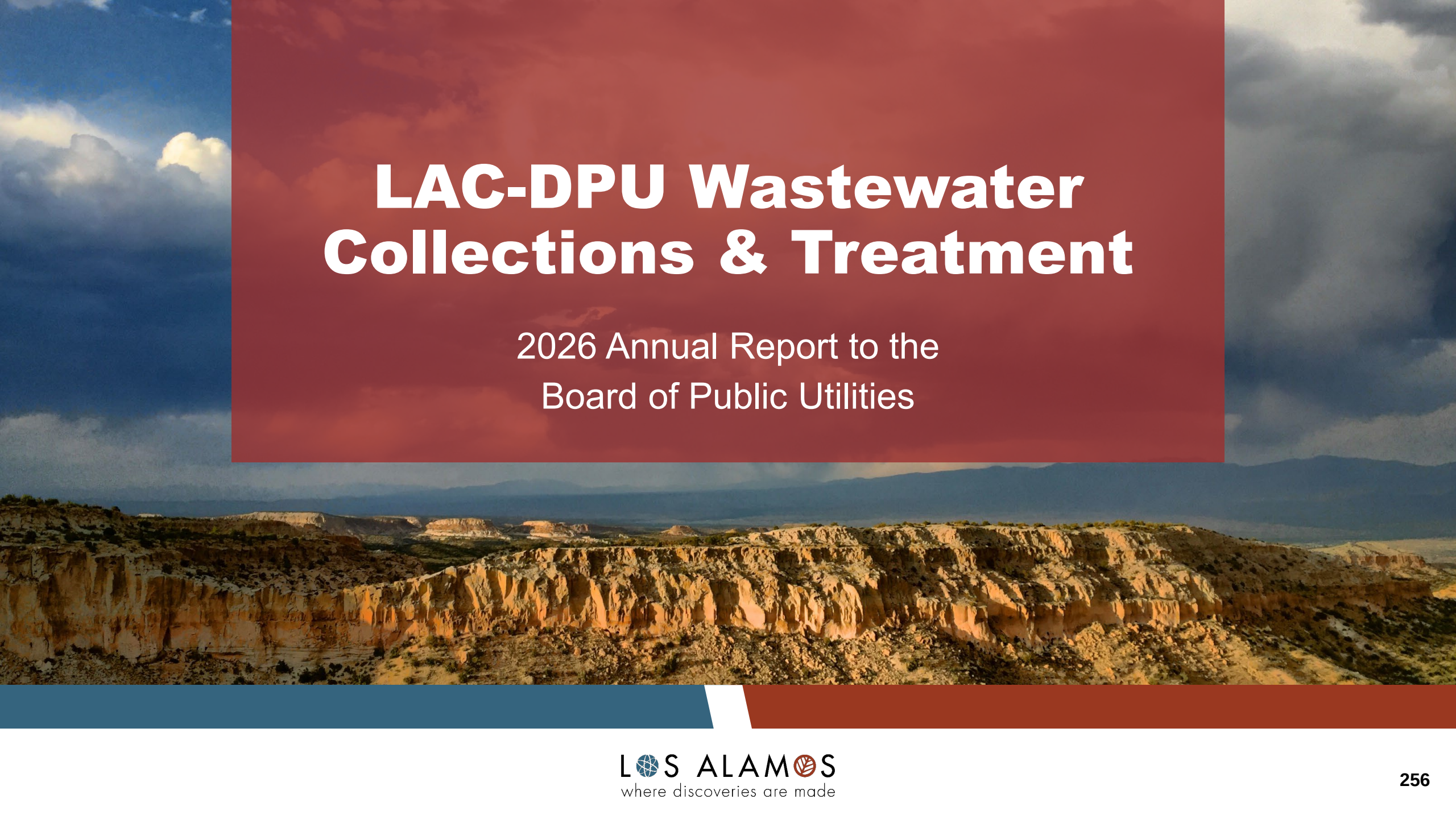
The wastewater collections (WC) system continues to be the focus of aggressive O&M work and CIP upgrades and replacements. O&M work includes inspections, mainline flushing, root removal, chemical treatment, and lift station service. The CIP projects will see a shift from replacement and upgrades of the lift stations to pipeline replacements and reconfigurations. Much of the original vitrified clay pipe sewer mains are seeing condition issues that now require replacement. Additionally, the AMT has identified sewer mains that are located under homes, putting them in a higher risk category for failure that necessitates reconfiguration.

The sewer system is a mix of older original VCP (vitrified clay pipe) where the BAR (Burn Area Replacement) project did not replace the mains: North Community, Western Area, upper Barranca Mesa, Downtown and Eastern Area neighborhoods, plus older sections of White Rock; and newer PVC and PE pipe where the BAR project replaced the original sewer system, along with locations where projects have already replaced the original sewer lines, and in newer parts of town: Quemazon, Hawks Landing, lower North Mesa, lower Barranca Mesa, various areas in White Rock (anything from sometime in the early 1970s to present-day). The more modern parts of the system that are constructed from PVC and PE pipe rarely present problems in the main line, usually only where poorly constructed connections were made. VCP pipe is subject to shifting joints, cracking, root intrusion, and cave-ins. The various types of problems with VCP are difficult to predict when they will occur, but it is predictable that it will eventually occur at some point, requiring a prioritized replacement program.

The AMT will continuously need to analyze, predict, and plan for replacement and upgrade projects in both the WT and WC systems. With all wastewater systems, O&M is extremely vital and critical at every level; therefore, recruiting, training and maintaining an expert Operations staff is the most important aspect of the wastewater systems.

Attachments

A - 2026 Wastewater Systems Annual Update



LAC-DPU Wastewater Collections & Treatment

2026 Annual Report to the
Board of Public Utilities

Purpose of Presentation

2



Provide a summary of the operational status of both the wastewater collections system (sewer) and the two LAC wastewater/water reclamation plants



Describe the challenges of operating and maintaining both systems and programs



Analyze the physical condition of the assets



Provide an overview of the future operational needs and capital project plans

Wastewater Collections – a tale of two systems

3

- The LAC wastewater collections system is complex
- Terrain and topography
- Challenges posed by original construction layout – i.e. backyard sewer mains, mains running through drainages, off the mesa cliffs, etc.
- Maintenance access is extremely challenging in many areas
- Abundance of vitrified clay pipe – approximately 32,000 ft. between TS and WR
- 25 sewer pump/lift stations – a mix of old and new; any lift station installed before 2000 has seen at least one rebuild or upgrade. Even the original Quemazon-1 lift station is scheduled for a complete rebuild this year.
- New sewer systems present very few problems – i.e. PVC and PE pipe, proper grading, layout in streets for better access, updated rules & regulations
- Implementation of modern technology in lift stations
- O&M of the WC system requires a very experienced team utilizing a heuristic approach

Older Infrastructure = O&M Challenges

4

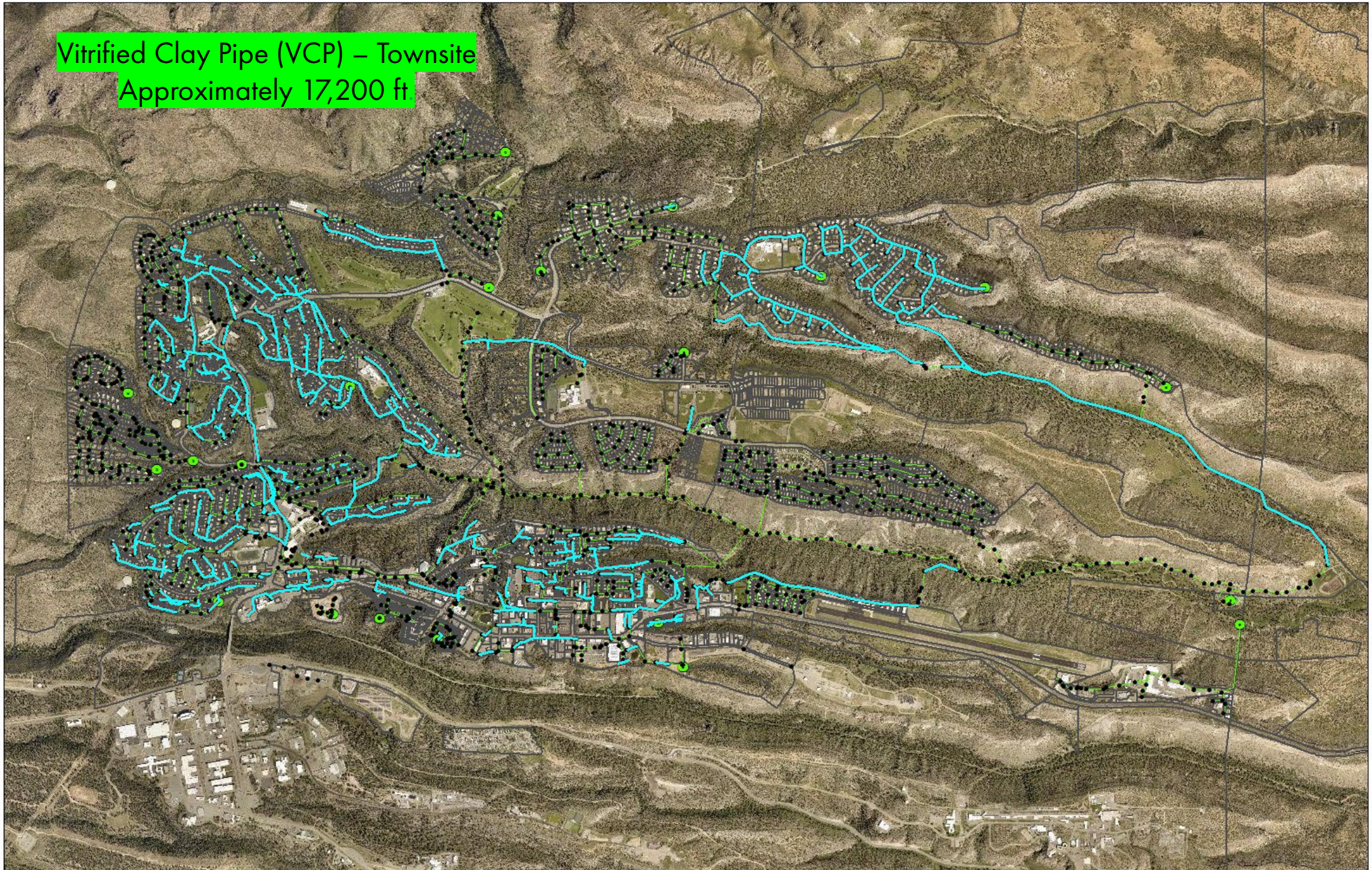


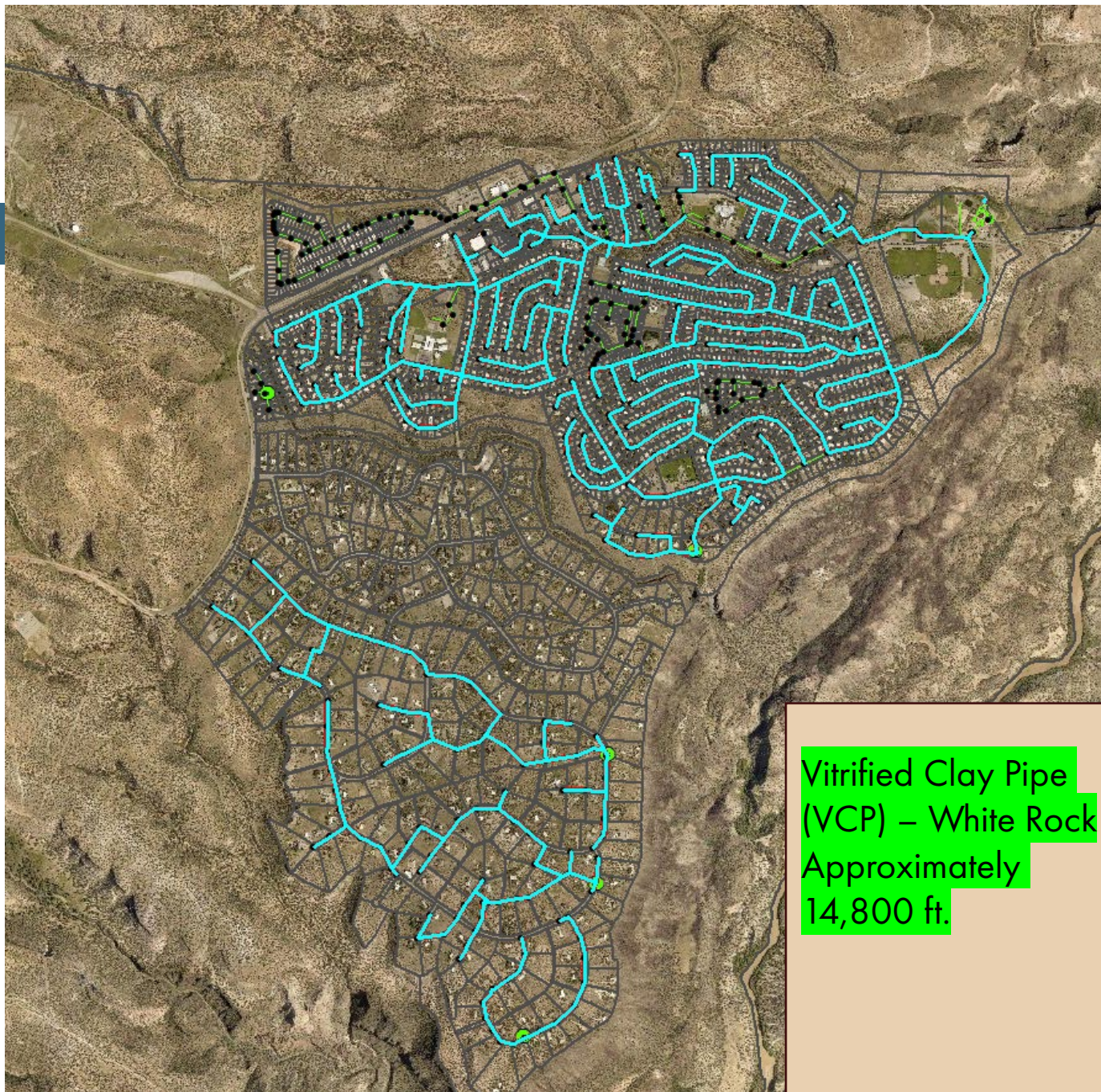
O&M Challenges

5

- Unpredictable nature of sewer blockages
- Bad consumer habits – discharges of:
 - Non-dissolvable wipes (only toilet paper can be flushed)
 - Fats, oils, grease – large residential discharges create problems in lift stations and in the sewer network pipes
 - Rags, mops, other large items – crews find these items very frequently
- Sheer magnitude of network mileage to maintain with only four crew members (on average)
- Roots – very prevalent in older areas with VCP
- Grade problems – shifting soils move VCP pipe joints, creating flow problems
- Infiltration of stormwater – storm water carries soil/sediments that settle out and create earth dams inside pipes and manholes
- Sewer mains running under homes
- Non-permitted residential taps – home additions that created a 2nd service line without inspections or permits
- Numerous original above-ground steel cliff-drop sewer lines – e.g. North Mesa

Vitrified Clay Pipe (VCP) – Townsite
Approximately 17,200 ft





FY27 CIP

WASTEWATER TREATMENT AND SEWER COLLECTION TOTAL

2,185,000

SEWER COLLECTION	1,885,000
Denver Steels Phase III (Public Works Road Project)	150,000
Sewer Line Rehabilitation (RIP Loan)	
Fairway Street	800,000
Sycamore Street	600,000
North Community/Western Area Sewer Mains & Services R&R - Phase 2	300,000
DP Road Staging Area	35,000
WASTEWATER TREATMENT	300,000
Convert Effluent Washwater to Gravity System (RIP Loan)	300,000

FY28 CIP

WASTEWATER TREATMENT AND SEWER COLLECTION TOTAL

4,150,000

SEWER COLLECTION

4,150,000

Old Pueblo Plant Canyon Drop Replacement (WTB \$640 / CIP \$160k)

800,000

Cooper Road Sewer Canyon Drop Repl. (WTB \$1,080,000 /CIP \$270k)

1,350,000

Sewer Line Rehabilitation (RIP Loan)

Refurbish or Eliminate Pueblo Canyon Pipe Bridge

1,100,000

Aspen School Area Pipeline - Phase 2 (Public Works Project)

200,000

Sandia Drive

700,000

WASTEWATER TREATMENT

0

FY29 CIP

10

WASTEWATER TREATMENT AND SEWER COLLECTION TOTAL

1,700,000

SEWER COLLECTION

1,700,000

Sewer Line Rehabilitation (RIP Loan)

Eastern Area Phase 1 Renewal & Replacement

1,000,000

Aspen School Area Pipeline - Phase 3 (Public Works Project)

300,000

Kimberly Sewer Lift Station & Wet Well

400,000

WASTEWATER TREATMENT

0

FY30 CIP

WASTEWATER TREATMENT AND SEWER COLLECTION TOTAL

2,000,000

SEWER COLLECTION

2,000,000

Sewer Line Rehabilitation (RIP Loan)

Airport Canyon Sewer Drop Replacement

1,000,000

Eastern Area Phase 2 Renewal & Replacement

750,000

Orange and Nickel Streets (Public Works Project)

250,000

WASTEWATER TREATMENT

0

FY31 CIP

12

2,000,000

SEWER COLLECTION

2,000,000

Sewer Line Rehabilitation (RIP Loan)

Laguna Sewer Canyon Drop Replacement

1,400,000

Range Road Lift Station Refurbishment

350,000

40th, 41st & 42nd South of Urban (Public Works Project)

250,000

WASTEWATER TREATMENT

0

Focal Points for the Future

13



Aggressive capital project plan to modernize infrastructure – i.e. replace VCP with PVC according to modern standards, upgrade lift stations



Analyze & respond to operational needs to improve efficiency – i.e. purchase of new/modern vector unit to expedite maintenance workflows



Maintain highly engaged and expert staff through apprentice program



Analyze crew workflows and equipment allocation to maximize O&M progress

Wastewater Collections - Staff Recommendations

14

- Maintain and build a strong GWS apprentice program to ensure O&M workflows keep pace with needs; consider staff additions as work volume increases
- Continuously analyze needs toward acquisition and maintenance of the tools and equipment necessary to run an efficient operation
- Constantly evaluate problem areas that require additional maintenance work throughout the year
- Prioritize asset management team collaboration between Engineering and GWS Operations to develop near- and long-term CIP plans to replace aging/failing infrastructure
- Factor in the need to be flexible with projects and respond to newly developing situations as they arise
- Emphasize public engagement – sewer discharges are a consumer issue that have health and economic impacts

Wastewater Treatment & Reclamation

15

- DPU owns and operates two treatment plants for Los Alamos & White Rock
- Both plants produce Class 1 A effluent water suitable for reclamation and reuse
- Los Alamos Plant (2007):
 - Designed for 1.5 MGD, processes on average ~0.8 MGD
 - BNR (biological nutrient removal) process utilizing aerated biological reactor basins with forced air
 - LA WWTP is now seeing age/condition related replacements and upgrades
- White Rock WRRF (2024):
 - Designed for 0.5 to 0.7 MGD, processes on average ~0.28 MGD
 - BNR process utilizing an aerated oxidation ditch through mixing
 - The WR WRRF is still seeing some “new facility” start-up troubleshooting issues, but is generally a very good plant to own and operate

Los Alamos WWTP

16

- Originally constructed and in operation since 2007, much of the plant process equipment is now seeing its “end of life” need for replacement or complete overhaul
- Fine filtration process added in 2025 – promoted effluent/reclaim water quality to Class-1A
- Upgrades/Replacements completed as of 2026:
 - Replaced 2 older “Hoffman” blowers with modern VFD Aerzen blowers
 - Replaced original outmoded plant SCADA from proprietary Allen Bradley “FactoryTalk” to open source “Ignition” system – CIP and SCADA staff project
 - Replacement of dewatering process belt press with more modern screw press - CIP
 - Replaced original reuse water system pumps with improved pumps more suited to the application – WT staff project
 - Replaced VFDs on reuse water pumps – WT staff project
 - Replaced 50% of RAS/WAS pumps – WT staff project
 - Rebuilt 50% of the process MCC buckets (motor starters) – WT/Electric staff project
 - Fabricated and installed grit chamber decking to protect headworks HVAC – WT staff project
 - Complete rebuild and overhaul of the headworks fine screen – WT staff project

Los Alamos WWTP (continued)

17

Pending replacement/upgrade projects:

- Replacement of UV disinfection system – WT/Electric staff project
- Blower room heat dissipation & HVAC – planned CIP
- Repair and waterproofing of aeration basin walls – planned CIP
- Elimination of onsite reuse water pumping system – planned CIP
- Replacement of sodium & mercury ballast lighting – in process by WT/Electrical staff
- Continue MCC bucket rebuilds – in process by WT/Electrical staff

In-House Overhaul of the Fine Screen

A cost savings of \$200k to \$400k!







White Rock WRRF

21

- New facility – very popular for public tours! Produces very clean effluent
- Very modern technology that the operators enjoy
- Has had a few startup problems requiring warranty work from both the Engineer and Contractor (BHI & RMCI):
 - Grit chamber vortex system
 - RAS/WAS pumps
 - Chlorinator and sensors
 - Several minor SCADA/controls issues
 - Sludge basin mixing pumps – unresolved major corrosion problem

White Rock Effluent Discharge Permit

Operating Conditions

#	Terms and Conditions																		
6.	The Permittee shall ensure that Class 1A reclaimed domestic wastewater discharged from the reuse storage impoundment to the reuse areas does not exceed the following discharge limits. <table><tr><th>Test</th><th>30-day Average</th><th>Maximum</th></tr><tr><td>Total Nitrogen</td><td>N/A</td><td>10 mg/L</td></tr><tr><td>E. coli bacteria</td><td>3 MPN/100 mL</td><td>15 MPN/100 mL</td></tr><tr><td>BOD₅</td><td>10 mg/L</td><td>15 mg/L</td></tr><tr><td>Turbidity</td><td>3 NTU</td><td>5 NTU</td></tr><tr><td>TRC or UV Transmissivity</td><td>Monitor Only</td><td>Monitor Only</td></tr></table> [Subsections B and C of 20.6.2.3109 NMAC, NMSA 1978, § 74-6-5.D]	Test	30-day Average	Maximum	Total Nitrogen	N/A	10 mg/L	E. coli bacteria	3 MPN/100 mL	15 MPN/100 mL	BOD ₅	10 mg/L	15 mg/L	Turbidity	3 NTU	5 NTU	TRC or UV Transmissivity	Monitor Only	Monitor Only
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BOD ₅	10 mg/L	15 mg/L																	
Turbidity	3 NTU	5 NTU																	
TRC or UV Transmissivity	Monitor Only	Monitor Only																	
7.	The Permittee shall ensure adherence to the following general requirements for above-ground use of reclaimed domestic wastewater. a) The Permittee shall install and maintain signs in English and Spanish at all reuse areas such that they are visible and legible for the term of this Discharge Permit. The Permittee shall post signs at the entrance to the reuse areas and at other locations where public exposure to reclaimed domestic wastewater may occur. The signs shall state: NOTICE: THIS AREA IS IRRIGATED WITH RECLAIMED WASTEWATER - DO NOT DRINK. AVISO: ESTA ÁREA ESTÁ REGADA CON AGUAS NEGRAS RECOBRADAS - NO TOMAR. The Permittee may submit alternate wording and/or graphics to NMED for approval. b) Reclaimed domestic wastewater systems shall have no direct or indirect cross connections with public water systems or irrigation wells pursuant to the latest revision of the New Mexico Plumbing Code (14.8.2 NMAC) and New Mexico Mechanical Code (14.9.2 NMAC). c) Above-ground use of reclaimed domestic wastewater shall not result in excessive ponding of wastewater and shall not exceed the water consumptive needs of the																		



22

Huge improvement!

WT & WP CIP plans include covering the old WR plant secondary clarifiers through a grant for protecting the quality of the effluent water and increasing storage capacity

Focal Points for the Future

23



Maintain current level and mix of CIP and WT staff-run projects developed by asset management team program



Analyze & respond to operational needs to improve efficiency



Maintain highly engaged and expert staff through apprentice & training program



Current WT staff level is sufficient

Thank you!

Questions?

T. Clay Moseley

Deputy Utility Manager –
GWS Services

Office: 505-662-8271

Cell: 505-500-0523

clay.moseley@losalamosnm.gov





County of Los Alamos

Staff Report

August 05, 2026

Los Alamos, NM 87544
www.losalamosnm.us

Agenda No.:	6.d.
Index (Council Goals):	DPU FY26 - 3.0 Be a Customer Service Oriented Organization that is Approachable, Communicative, Efficient, and Transparent
Presenters:	Abbey Hayward, Public Relations Manager
Legislative File:	21574-26

Title

Transactional Survey Report: January - June 2026

Body

DPU's Transactional Survey report covers the first half of calendar 2026. Conducted by Great Blue Research, the survey investigates: 1) reasons for contacting DPU; 2) methods of interaction with DPU; 3) the number of times customers must contact DPU to resolve their issue; 4) how DPU's staff is rated by customers; and 5) demographic profiles of those responding to the survey. It has a 95% confidence level and with 111 people responding, it has a margin of error of +/- 9.19%.

As is typical with this survey, the vast majority of respondents were residential customers. Only six were commercial customers, making commercial responses meaningless as a stand-alone category. Nearly half the customers who responded have been DPU customers for at least 20 years, with 57% residing on the Hill and 32% residing in White Rock.

This report compares the previous two 6-month periods of 2025 as well as the second 6-month period of 2024. More than 78% of the respondents rated interactions with Customer Care staff and the remaining interactions were between interactions in the field (14%) and interactions with other DPU employees (8%). During this survey period, the Customer Care interactions over the phone increased to 65%, from 55%. Visits to the Customer Care Center dropped to 16%, from 29%, and email interactions have declined as well.

Customers are invited to complete this survey through a number of methods, including invitation links in email signatures, and signs at the Customer Care Center (CCC). However, the greatest number of responses come from text messages sent to individuals who have reached out to the CCC by phone.

Payment arrangement remains the leading response as to why customers are reaching out to DPU. More customers reached out to DPU regarding a water service problem in this first half of 2026 than in the second half of 2025; however, this trend is reflected in the first half of 2025 to the second half of 2024 as well.

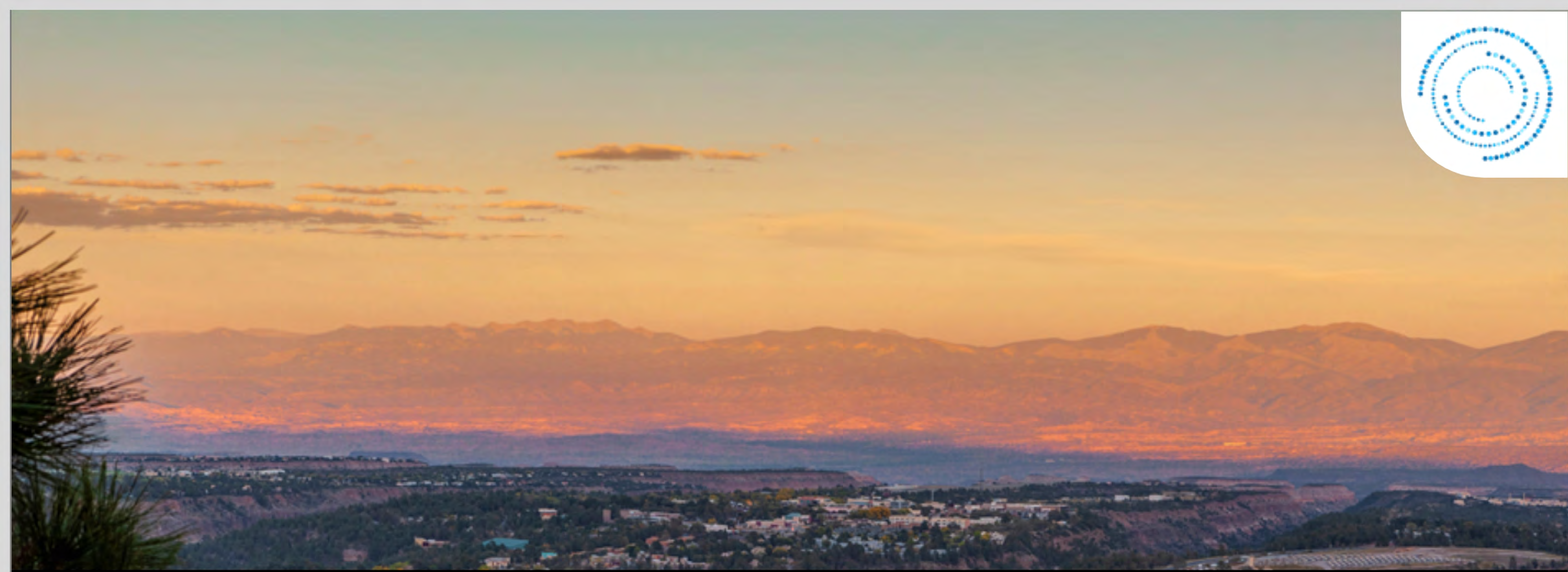
Per the report, "over eight-out-of-ten respondents (86%) had their issue or question resolved to

their satisfaction during their first contact with the DPU, which was an increase compared to the second half of 2025.”

The results for DPU representative characteristics were lower than in the second half of 2025, but notably improved when compared to the first half of 2025. The Customer Care staff could have been fielding questions about time-of-use or any number of water or electric outages, which are highly sensitive topics to a lot of customers. Customer Service received high positive ratings for clear communication, courtesy and professionalism, and being knowledgeable.

Attachments

A - Los Alamos Transactional Report CY2026 H1



Report of Findings

1st Half 2026 Transactional Study

Table of Contents

Section One

Project Overview

Section Two

Key Study Findings

Section Three

About GreatBlue

Section Four

Aggregate Data

(Provided Separately)

Project Overview



Research Objectives

- GreatBlue Research was commissioned by the Los Alamos County Department of Public Utilities (hereinafter “DPU”) to conduct market research to understand the nature of customers' most recent transactions with DPU employees.
- The primary goals of this research study were to assess reasons for contacting the DPU, track methods of interacting with the DPU, and understand how well DPU employees are servicing customers' needs.
- The outcome of this research will enable the DPU to a) more clearly understand the nature of transactions with DPU employees, b) act on near-term opportunities for improvement, and c) create a strategic roadmap to improve interactions with customers moving forward.

Areas of Investigation

The Los Alamos County Department of Public Utilities Transactional Survey leveraged a quantitative research methodology to address the following areas of investigation:

- Reasons for contacting the DPU
- Methods of interacting with the DPU
- Number of points of contact with the DPU needed to resolve issues
- Rating DPU representatives on a series of characteristics
- Demographic profiles of respondents



Research Methodology Snapshot

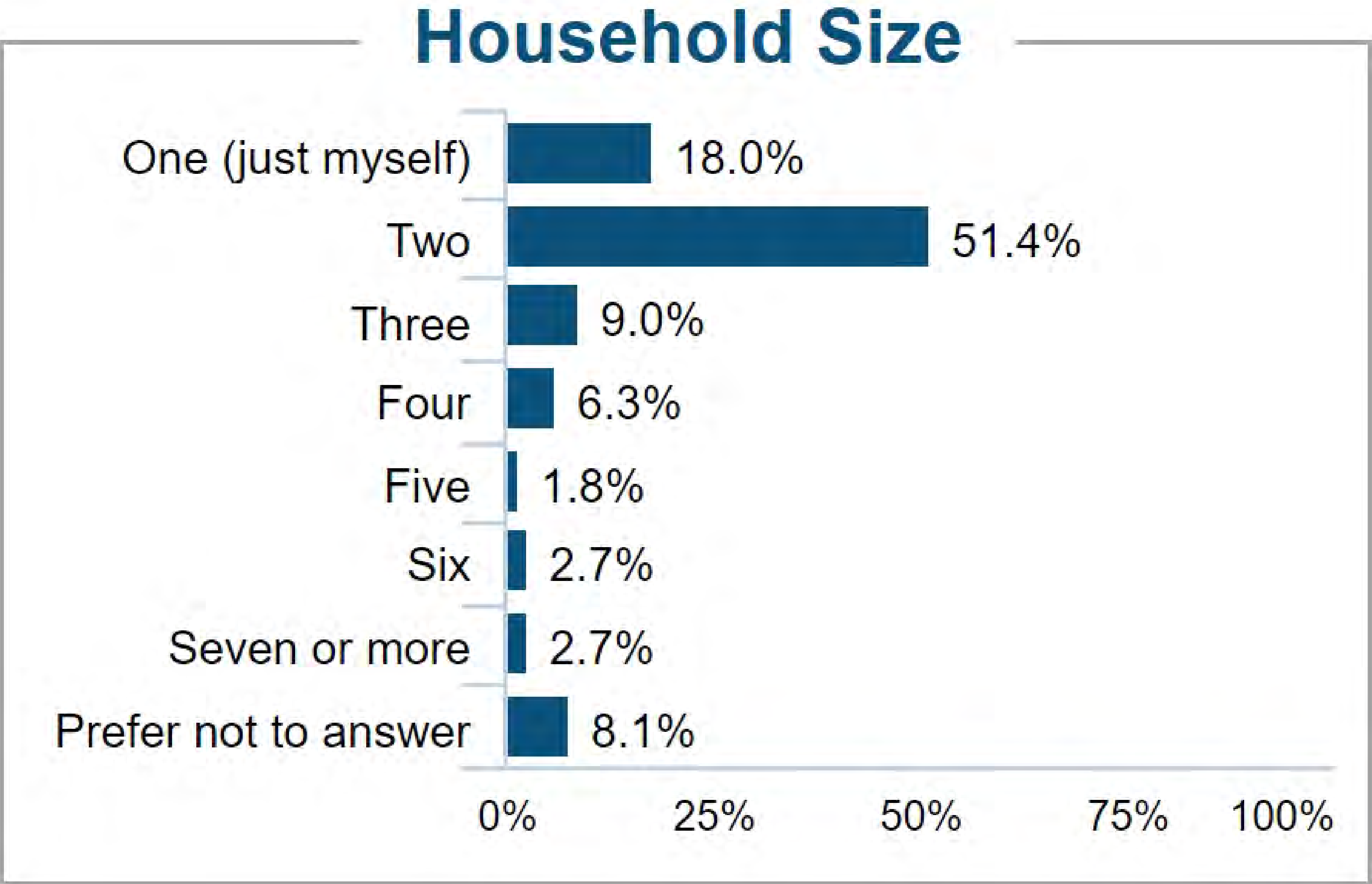
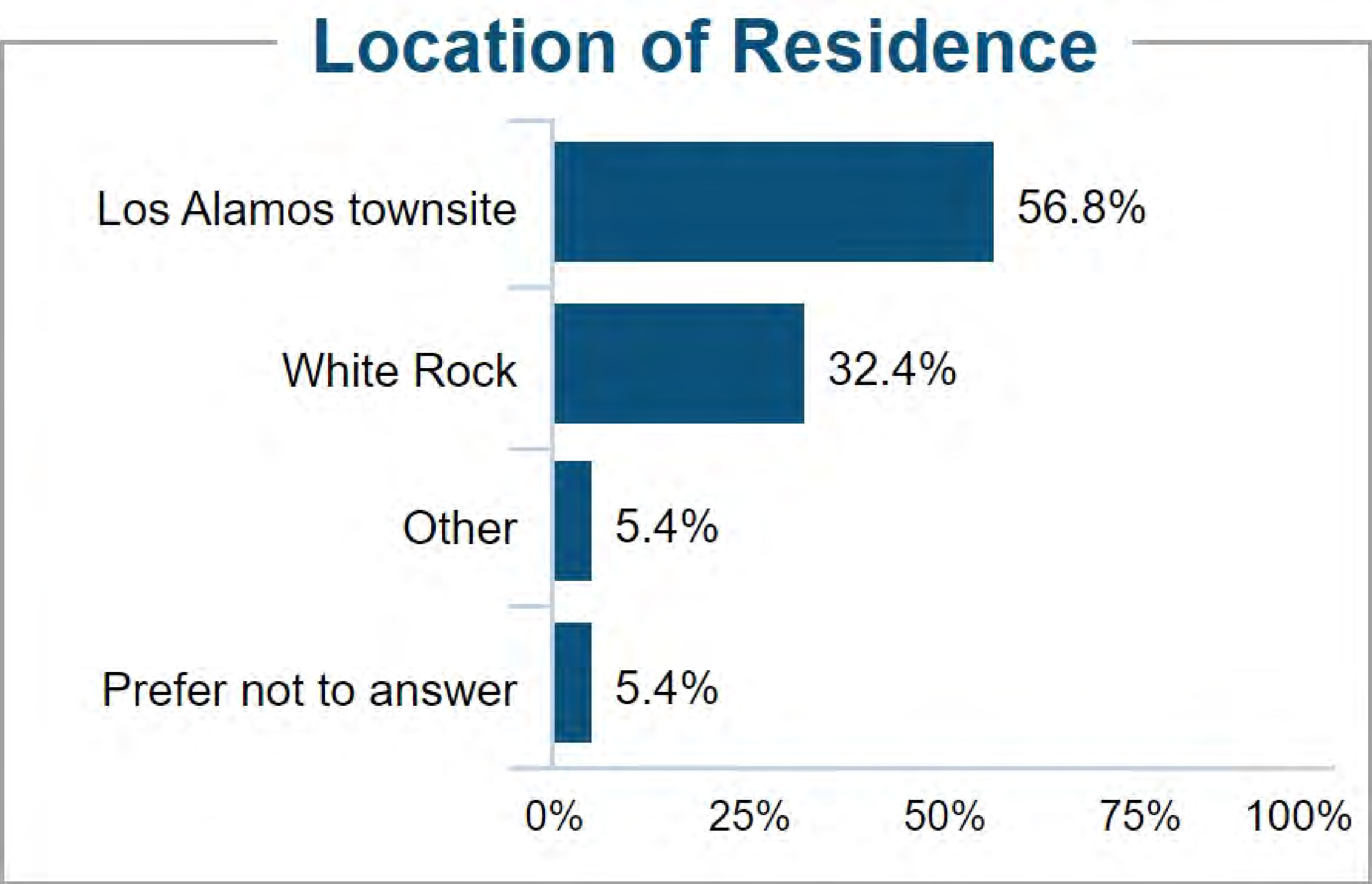
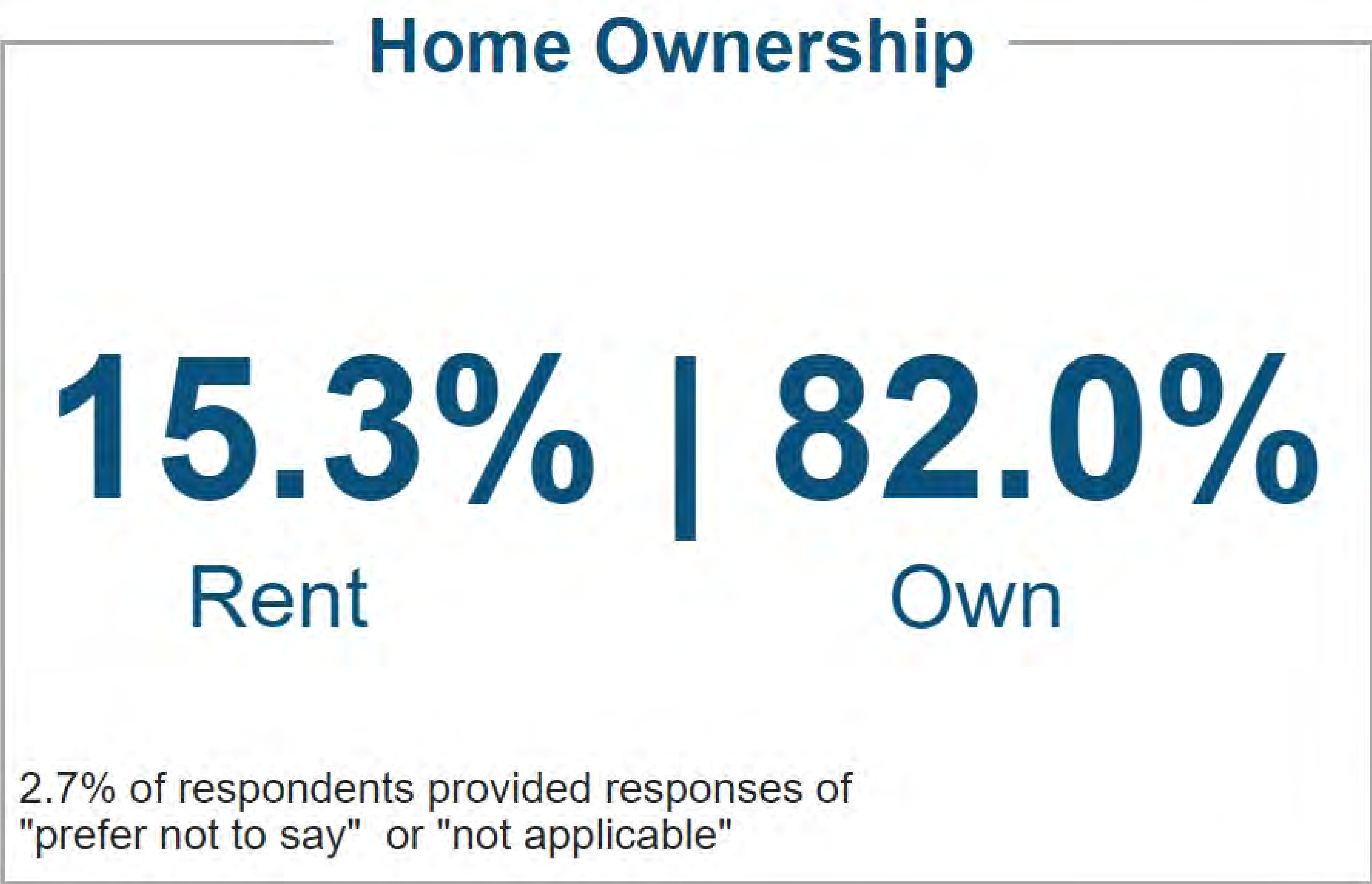
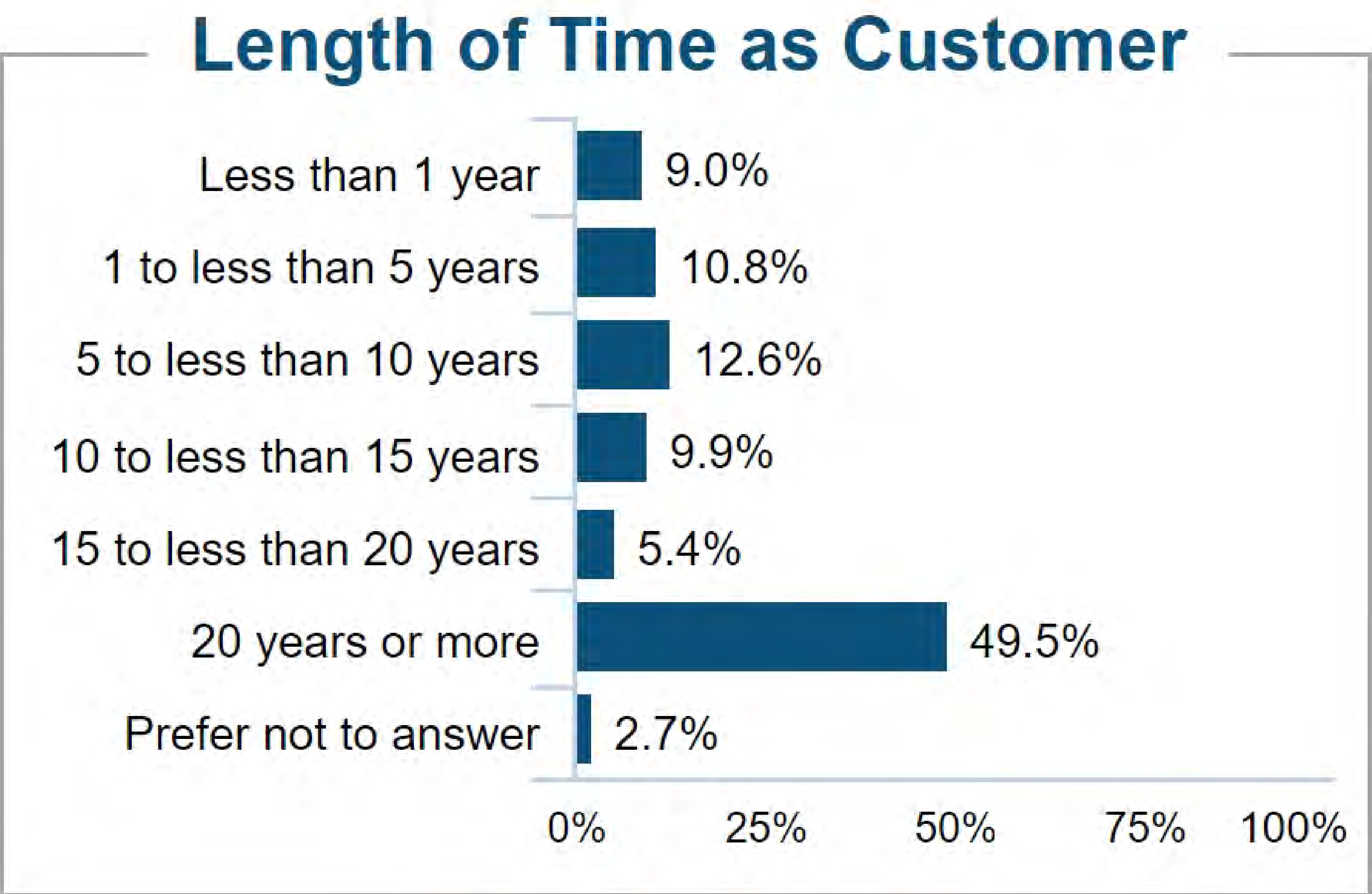
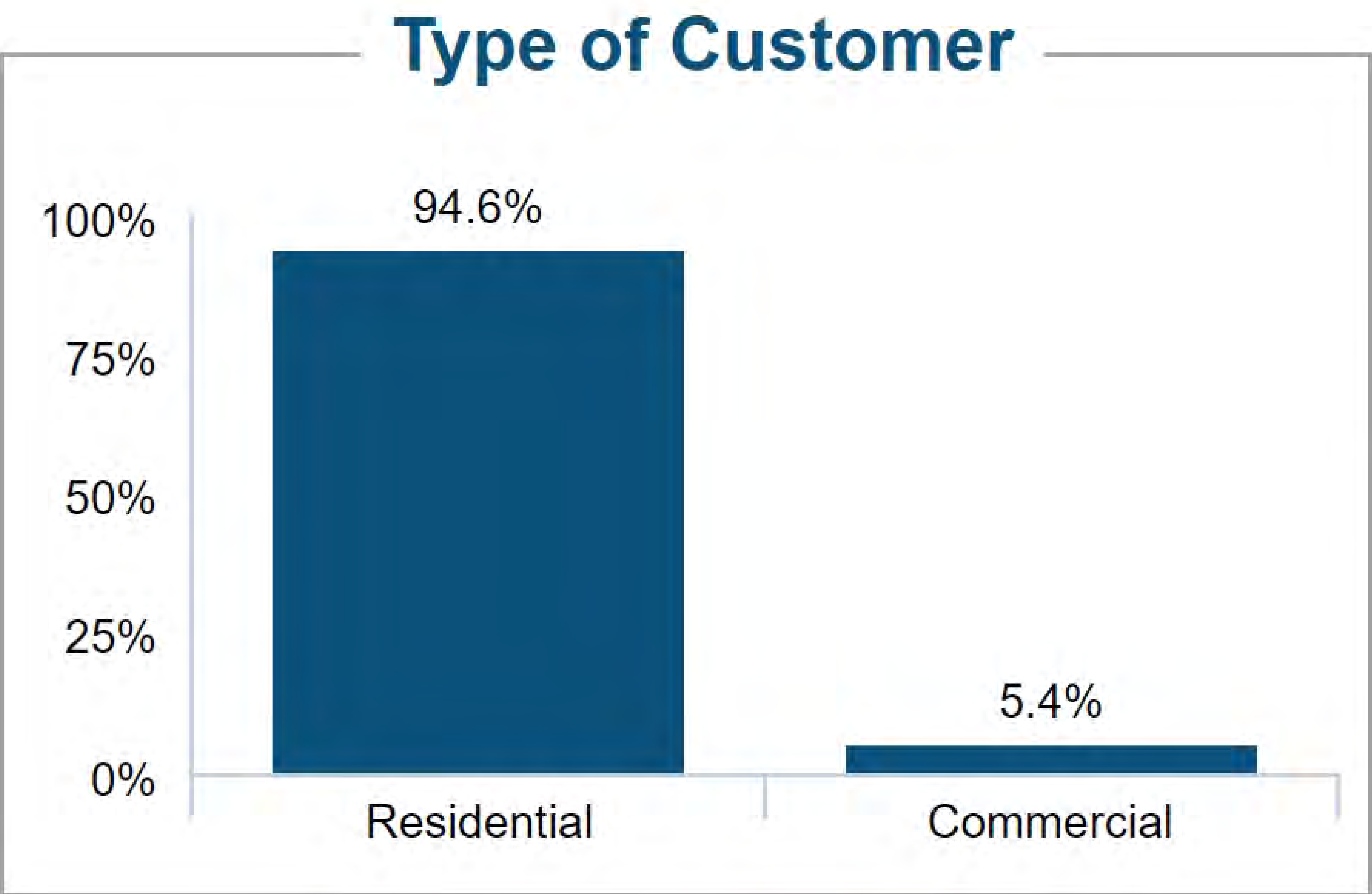
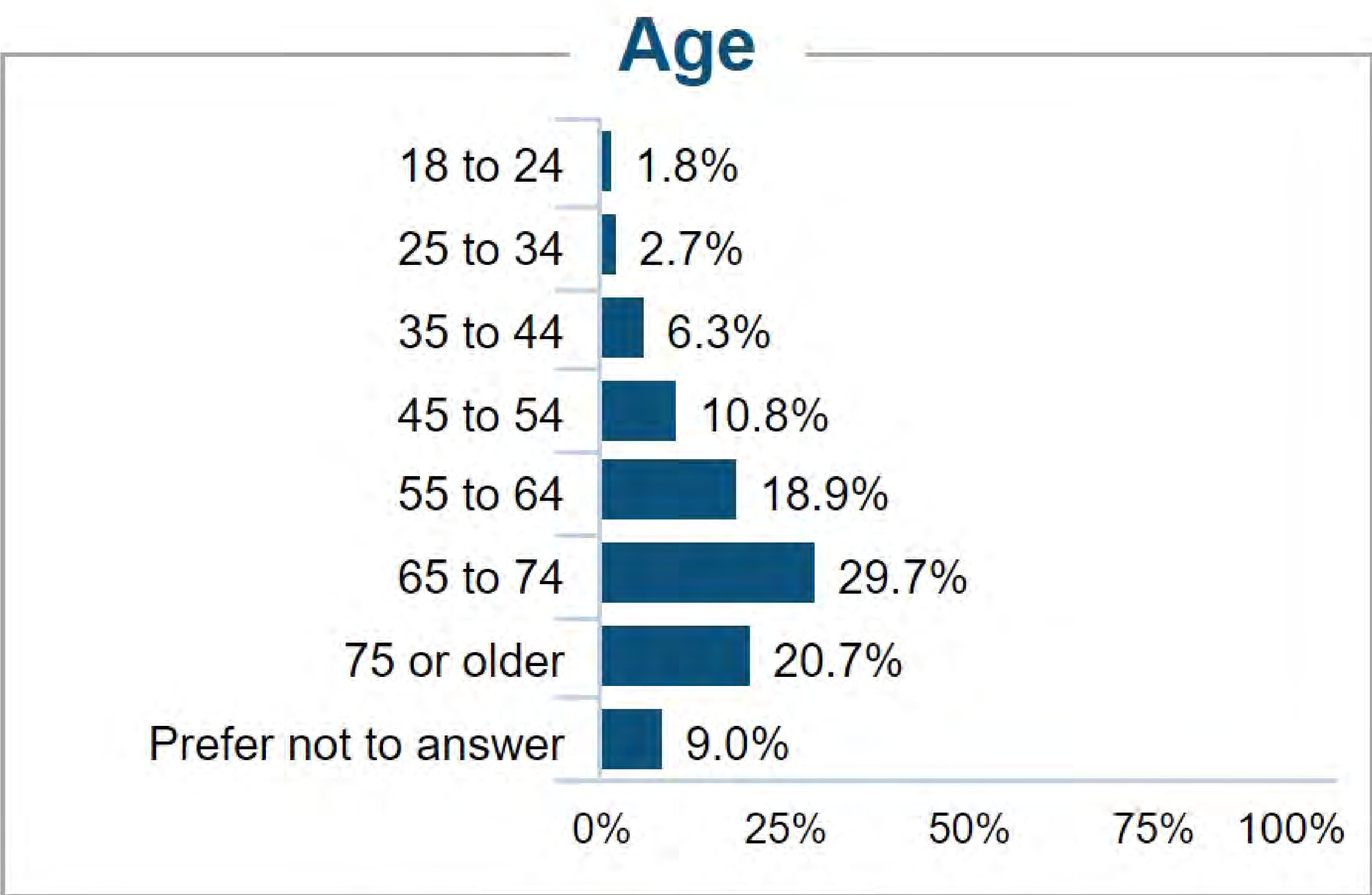


Methodology Digital	No. of Completes 111	No. of Questions 19*	Incentive None	Sample Distributed by the DPU
Target Customers who have had a recent transaction with the DPU	Quality Assurance Dual-level**	Margin of Error +/- 9.19%	Confidence Level 95%	Research Dates January 1, 2026 - June 30, 2026

* This represents the total possible number of questions; not all respondents will answer all questions based on skip patterns and other instrument bias.

** Supervisory personnel, in addition to a computer-aided interviewing platform, ensure the integrity of the data is accurate.

Respondent Profile | Demographics

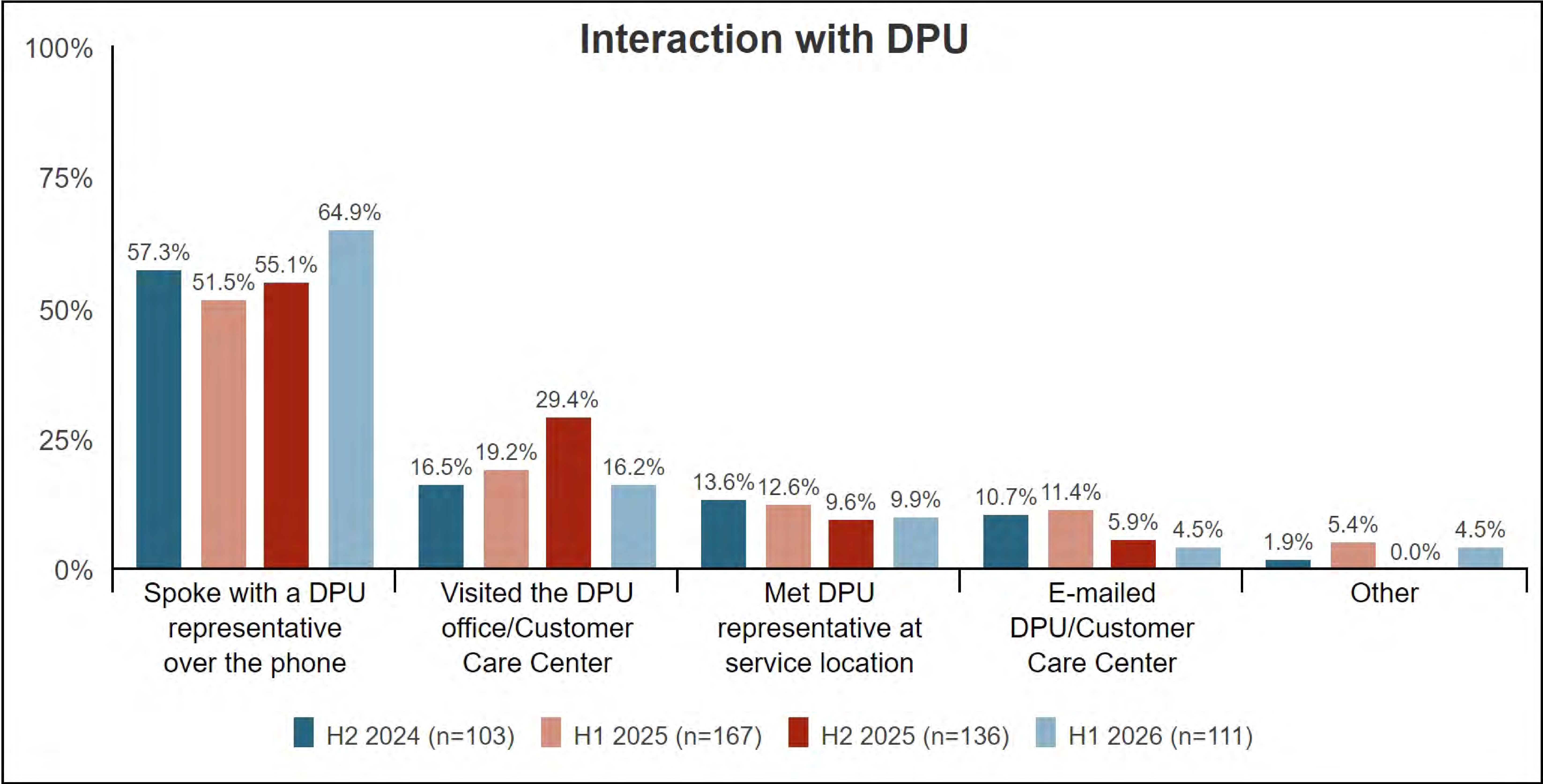
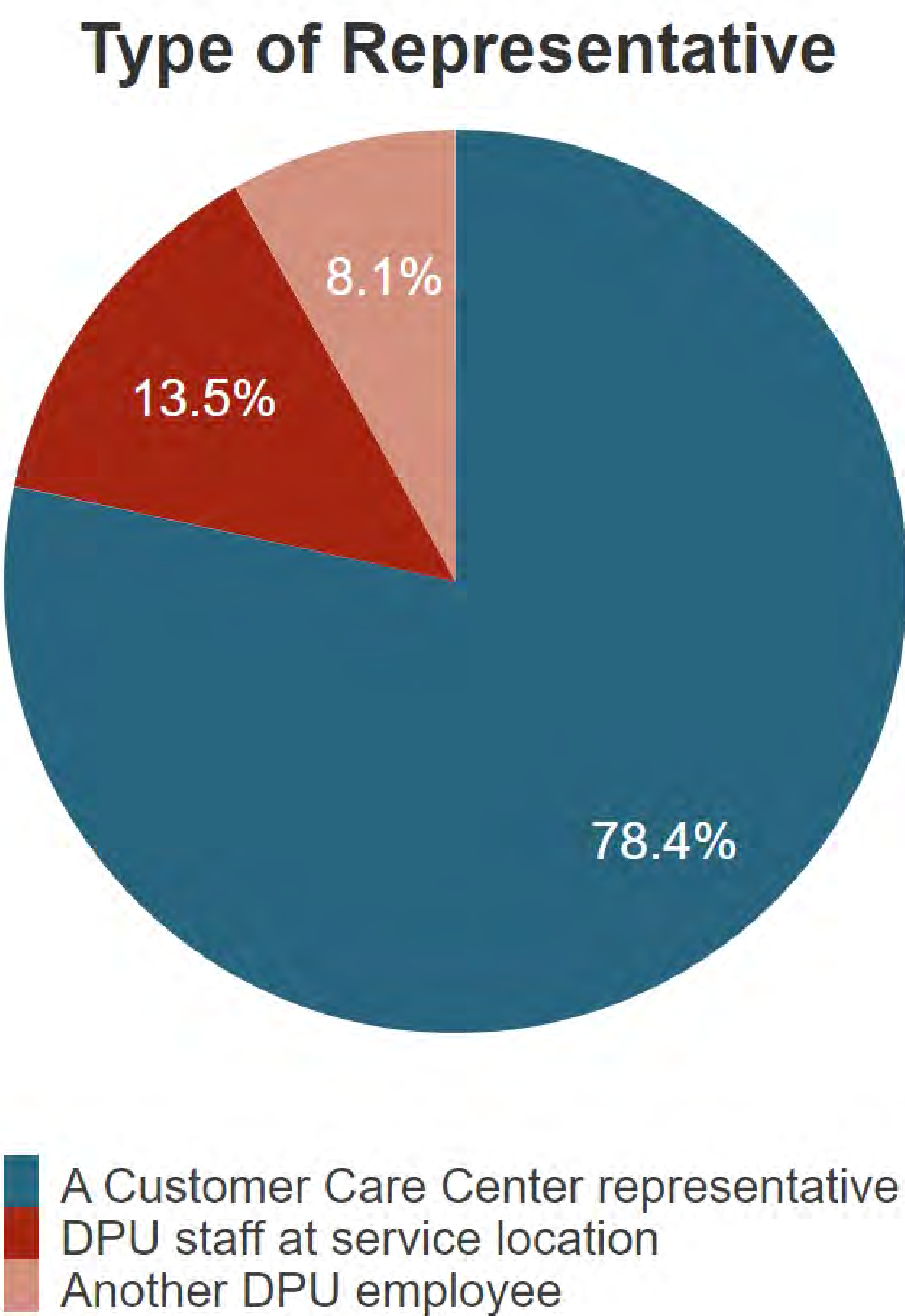


Key Study Findings



Customer Service | Interaction with DPU

Over three-quarters of respondents had a Customer Care Center representative assist them during their most recent interaction with the DPU. Additionally, nearly two-thirds of respondents spoke with a DPU representative over the phone during their most recent transaction, which was an increase compared to the second half of 2025 (+9.8 percentage points). Of note, fewer respondents visited the DPU office / Customer Care Center in the first half of 2026 in comparison to the second half of 2025 (-13.2 percentage points).



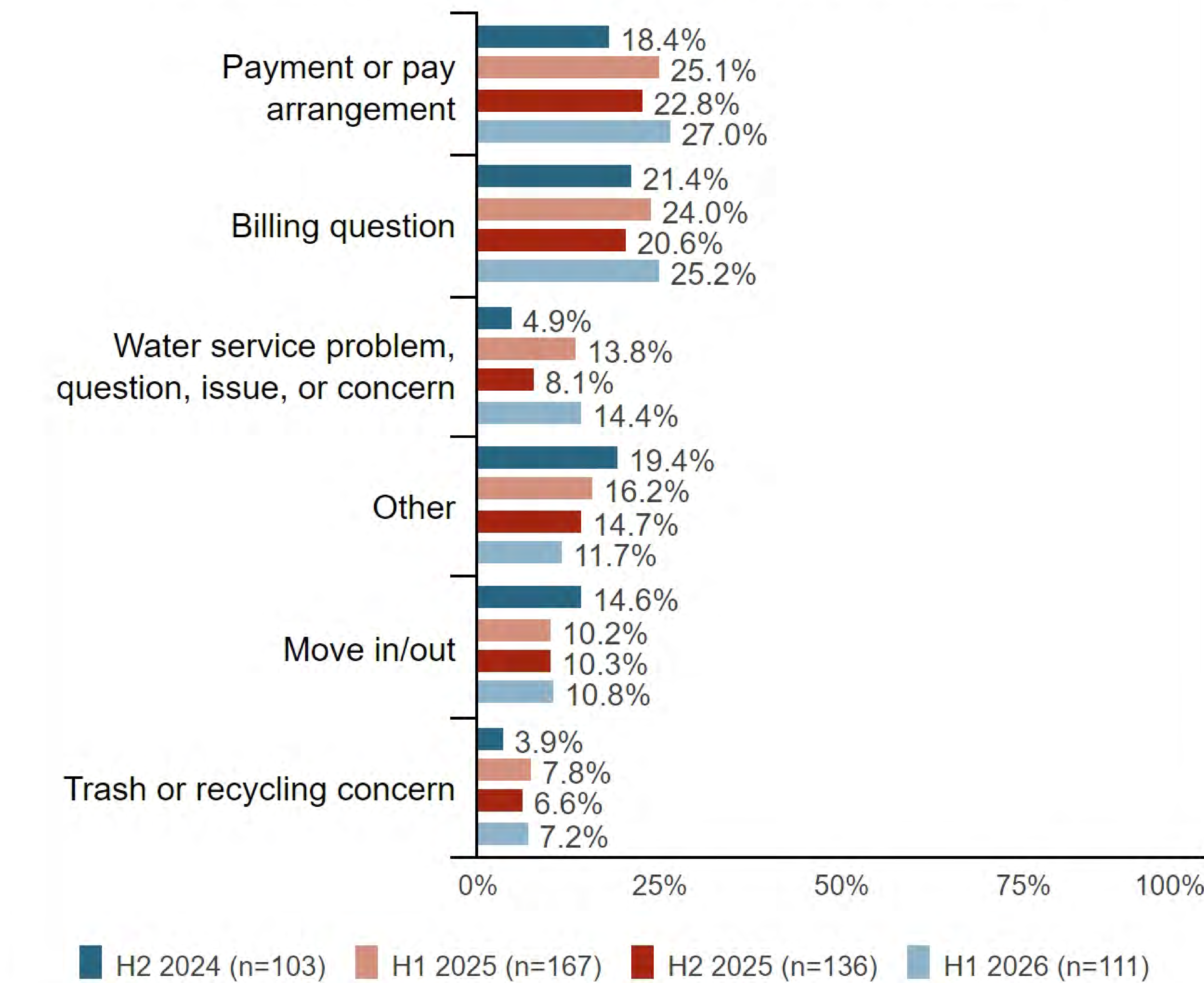
Q: Who assisted you in your most recent transaction with DPU?
Q: How did you interact with DPU?

Customer Service | Reason for Contact

"Payment or pay arrangement" was the top reason customers contacted the DPU in the first half of 2026, with more customers reporting this as their reason for contact compared to the second half of 2025 (+4.2 percentage points). "Billing question" remained the second most common reason for contact in the first half of 2026.

Of note, more customers contacted the DPU regarding a "water service problem, question, issue, or concern" compared to the second half of 2025 (+6.3 percentage points).

Reason for Most Recent Contact with DPU



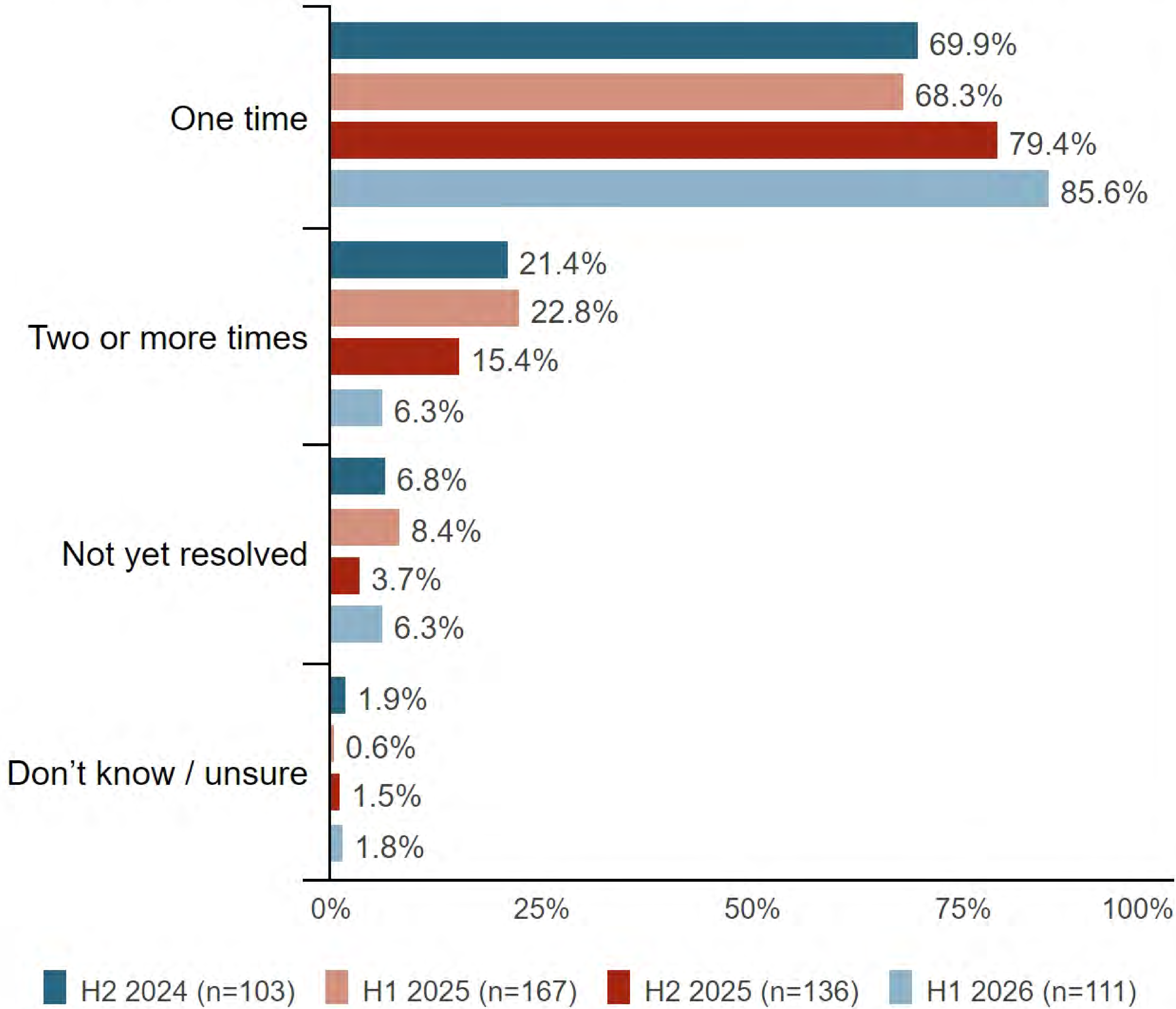
Top 6 responses shown

Q: What was the reason for your most recent contact with DPU? (Select all that apply)

Over eight-out-of-ten respondents had their issue or question resolved to their satisfaction during their first contact with the DPU, which was an increase compared to the second half of 2025 (+6.2 percentage points).

Furthermore, less than one-out-of-ten of respondents contacted the DPU more than once before their issue was resolved, which was a decrease compared to the second half of 2025 (-9.1 percentage points).

Number of Times Contacted Before Issue Was Resolved



Q: Regarding your reason for contacting DPU, how many times did you need to contact DPU before your issue or question was resolved to your satisfaction?

Customer Service | Representative Characteristics

Overall, DPU representatives achieved an average positive rating of 91.3% in the first half of 2026, which was a slight decrease compared to the second half of 2025 (-2.0 percentage points), while representing a notable improvement compared to the first half of 2025 (+6.9 percentage points). This was driven by over nine-out-of-ten respondents providing positive ratings across nearly all representative characteristics evaluated. Respondents provided the highest positive ratings for the representative's clear communication, courtesy and professionalism, wait time or punctuality, and being knowledgeable.

Positive Ratings of DPU Representative Characteristics

	H2 2024	H1 2025	H2 2025	H1 2026
Clear communication	93.0%	83.8%	94.8%	93.5%
Courtesy and professionalism	93.1%	88.0%	94.7%	92.7%
Wait time or punctuality	90.2%	86.1%	93.9%	91.0%
Knowledgeable	93.0%	84.3%	92.4%	91.0%
Overall quality of service	90.1%	81.9%	94.6%	90.9%
Issue resolution	90.0%	82.4%	89.5%	89.0%
Average	91.6%	84.4%	93.3%	91.3%

Responses 7-10 shown, excluding "don't know" responses

H2 2024: n=103, H1 2025: n=167, H2 2025: n=136, H1 2026: n=111
Q: Please rate the DPU representative you most recently interacted with on the following characteristics, using a 10-point scale where one (1) is “very poor” and ten (10) is “very good.”

About GreatBlue





Harnessing the Power of Data

...to help clients achieve organizational goals.



Data supporting strategic decisions to improve products and services. Since 1979, our experience with study and instrument design, data collection, analysis, and formal presentation assists our clients in identifying the “why” and “what’s next.”



Talent with a knowledge base in a wide range of industries and methodologies ensures a 360° view of the challenges faced and the expertise to address them.



Solutions that are customized to provide a personalized approach to understanding organizational, employee, and customer needs, allowing for more informed decisions.

Methodologies:



Digital Surveys



Focus Groups



In-Depth Interviews

Studies:



Awareness and Perception Studies



Customer and Employee Satisfaction Studies



Journey Mapping



Creative and New Concept Testing

Michael Vigeant CEO

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Chris Biggs SVP, Research & Strategy

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WHAT'S NEXT.



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GreatBlue Research



County of Los Alamos

Staff Report

August 05, 2026

Los Alamos, NM 87544
www.losalamosnm.us

Agenda No.: 6.e.
Index (Council Goals):
Presenters: Cristella Valdez, Assistant County Attorney
Legislative File: 21575-26a

Title

Annual Review of the Board of Public Utilities Procedural Rules

Recommended Action

Review the Procedural Rules and request any updates or changes to them that will be incorporated for adoption by the BPU at the regular meeting on August 19, 2026.

Body

The Board of Public Utilities (BPU) shall begin its annual review of the BPU Procedural Rules (PR) in Attachment A. In August 2024, Council updated the Boards and Commissions' Orientation Manual and Procedural Rules (See Attachment B).

DPU staff has recommended a revision to clarify a process for bringing minor amendments or corrections to rate ordinances for public hearing before BPU. A proposed revision can be found at Section 4.6(B) to provide that a "rate ordinance presented to BPU for a minor correction or amendment regarding a clerical error within thirty (30) days of presentation for public hearing before or adoption by County Council need not be submitted in advance of the public hearing but may be acted upon by the BPU when submitted." (See Attachment C).

Additionally, Section 1.9 of the PR states that each year during the August BPU regular session, each board member will affirm that he/she has received, read, understands, and agrees to abide by the PR and the applicable documents referenced in its Appendix. Appendix A is the reaffirmation signature sheet, which will be routed for signature after the August 19, 2026, regular meeting.

Attachments

- A - BPU Procedural Rules
- B - B&C Orientation Manual & Procedural Rules
- C - Draft Revised BPU Procedural Rules



Electric, Gas, Water, and Wastewater Services

Board of Public Utilities

Procedural Rules

May 21, 2014
Revision 1: May 20, 2015
Revision 2: July 15, 2015
Revision 3: December 16, 2015
Revision 4: March 16, 2016
Revision 5: August 18, 2016
Revision 6: January 18, 2017
Revision 7: August 16, 2017
Revision 8: January 15, 2020
Revision 9: February 19, 2020
Revision 10: July 20, 2022
Revision 11: August 16, 2023
Revision 12: September 18, 2024
Revision 13: August 20, 2025

This manual contains the current procedures adopted by the Los Alamos County Board of Public Utilities (BPU) to exercise jurisdiction and control of the Los Alamos Department of Public Utilities (DPU) in accordance with Los Alamos County Charter, Article V - Utilities.

https://library.municode.com/nm/los_amos_county/codes/code_of_ordinances?nodeId=PTICH_ARTVUT

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Part 1: Introduction and Administration

1.1. Purpose

These Procedural Rules (PR) contain the current rules adopted by the Incorporated County of Los Alamos (County), Board of Public Utilities (BPU) to fulfill its responsibility to exercise jurisdiction and control of the Los Alamos Department of Public Utilities (DPU) in accordance with the Los Alamos County Charter, Article V –Utilities and the County Code of Ordinances. Section 501.3, Organization of the Board of Public Utilities; The Board of Public Utilities shall adopt and shall file with the Council procedural rules and regulations not inconsistent with this Charter. This PR was initially adopted by the BPU on May 21, 2014.

1.2. Reasons for Adoption

- a. To realize the efficiency of having all on-going BPU general and meeting procedures in one place.
- b. To quickly orient new BPU members to current BPU procedures.
- c. To eliminate redundant or conflicting BPU procedures over time.
- d. To ease the reviewing of current procedures and processes when considering new issues.
- e. To support continuity and consistency of BPU processes and procedures.
- f. To provide clear, proactive guidance to the DPU and Utilities Manager.
- g. To comply with Article V of the Los Alamos County Charter and County Code of Ordinances.

1.3. Consistency

Each process or procedure in this PR is expected to be consistent with State and Federal law, the County of Los Alamos Charter, the Los Alamos County Code of Ordinances, and other County ordinances and resolutions, all of which have precedence over these BPU procedures. These PRs are specific to the Board of Public Utilities and if any differences exist with the broader *Los Alamos County Orientation Manual and Procedural Rules for Members of Boards and Commissions (B&Cs)*, this PR has precedence over the B&Cs procedures and rules. Except for time-limited or procedural-only BPU decisions (approving minutes, electing an officer, etc.), which are recorded in regular BPU minutes, all on-going BPU procedures shall be included or referenced in this document. The Utilities Manager is responsible for developing and implementing department processes and procedures that are consistent with this PR and the decisions of the Council and BPU.

1.4. Transition

As soon as some version of the PR is voted on by at least four of the five voting members of the BPU, those procedures are deemed to supersede any past procedure that might be found in old minutes unless a prior BPU resolution or contract obligates the BPU or DPU to a specific matter. If any actual or apparent conflict arises between the PR and other adopted policies or BPU resolutions, the matter shall be resolved by a majority vote of the entire BPU.

1.5. Changes

These rules will be reviewed and revised as necessary or at least annually at the regular July BPU meeting. The Utilities Manager will help the BPU formulate new language in the PR by distributing proposed changes in advance using software that shows all changes for BPU members to review. Any change to this PR must be approved by a vote of at least four of the five voting members of the BPU. Any BPU member as well as the Utilities Manager may submit proposed changes. Whenever changes are adopted, the updated document should be quickly made available to the BPU and to those staff who assist the BPU in its work. The previous version should be stored separately for future reference if needed.

1.6. Specificity

Each new rule will be drafted to fit in the appropriate place within the PR. Conceptually, procedures should be drafted from the “outside in,” i.e., the broadest procedure statement should be stated first, then the next broadest, etc. down to the level of detail that the BPU finds appropriate for BPU action and below which management is afforded discretion as to how it implements the procedures.

1.7. Maintenance of the Procedural Rules

- a. The Utilities Manager shall update the PR after the BPU makes any changes and shall post that version on the BPU website within 30 days of the approved changes.
- b. On at least a biennial basis the BPU shall request the County Attorney’s review the PR to ensure compliance with current State, federal, and local law.
- c. The full PR and all the appendices, as may be amended from time to time as provided herein, will be maintained and available to the public on the DPU’s website.

1.8. Context of Other Laws, Rules, and Policies

This PR fits into this hierarchy as provided below:

- a. Laws and Applicable Regulations and Los Alamos County Charter
- b. Los Alamos County Code of Ordinances

- c. Los Alamos County Council Resolutions
- d. Los Alamos County administrative policies
- e. These BPU Procedural Rules
- f. Utilities Manager-Approved Departmental Procedures
- g. Processes or procedures set by Deputy Managers Under the Utilities Manager

1.9. Annual Reaffirmation

Each year during the August BPU meeting each Board member will affirm that he/she has received, read, understands, and agrees to abide by this Board of Public Utilities Procedures Rules and the applicable documents referenced in the Appendix. See [Appendix A](#) for the re-affirmation signature sheet.

Part 2: Organization Essentials

2.1. Mission Statement

(approved by the BPU 9/17/2025)

To provide safe, reliable, economical, and environmentally responsible utility services.

2.2. Vision Statement

(approved by the BPU 9/17/2025)

Continually earn community trust through exceptional utility services.

2.3. Values Statement

(approved by the BPU 9/17/2025)

We value Community, Employees, Partners and the Environment through:

- Safety
- Trust
- Professionalism
- Customer Service
- Fiscal Responsibility
- Ethical Behavior
- Communication
- Collaboration
- Innovation
- Fairness

2.4. Accountability

The BPU and DPU are accountable to (1) the customers of the Los Alamos County Department of Public Utilities and (2) the Citizens of the County of Los Alamos represented by the County Council.

2.5. Strategic Planning

The following are the strategic planning goals of the Board:

- a. The BPU is expected to always think strategically.
- b. The Utilities Manager is expected to annually develop (1) Strategic Objectives, (2) Long-Term Goals, and (3) Short-Term Goals for the DPU based on the procedures in this PR and to present the Strategic Objectives and Long-Term Goals to the BPU for approval. See [Appendix B](#) for the current DPU Strategic Objectives and Long-Term Goals.
- c. The BPU will ensure alignment of the DPU's Strategic Objectives with those of the County and then forward the approved Strategic Objectives document to the County Council for their information.

2.6. Climate of Compliance

It is the fundamental rule of the BPU that all BPU and DPU business and other practices be conducted in compliance with all applicable laws and regulations of the United States, the State of New Mexico, and the County of Los Alamos, specifically:

- a. The Los Alamos County Charter, Article V – Utilities (See [Appendix C.](#))
- b. The Los Alamos County Code of Ordinances, Chapter 40 – Utilities (See [Appendix D.](#))
- c. Other adopted ordinances, resolutions, policy, or rule by the County Council

2.7. Code of Conduct

Members of the BPU will comply with the State and Los Alamos County Code of Conduct Ordinance. See [Appendix E.](#)

2.8. Guiding Principles

In addition to the Los Alamos County Code of Conduct, the BPU will follow these Guiding Principles:

- a. The safety of the public and DPU employees is the BPU's priority, outweighing all other considerations. The BPU will work with the Utilities Manager to foster a culture of safety in the DPU. Refer to [Appendix N](#) for the DPU's Culture of Safety Vision Statement.
- b. The BPU has responsibilities to the DPU customers to preserve and increase the value of DPU assets and to ensure the long-term viability of all DPU utilities.
- c. The BPU will strive to establish and maintain fair and just utility rates for each utility service that fully cover the costs for operation, maintenance, future replacement and upgrades, and debt service for each utility. Rate structures should reflect the fixed and variable costs associated with each utility.
- d. The BPU will adjust and propose rates for each utility service in a timely manner to address changes in the costs associated with that utility service.
- e. The BPU will promote policies, procedures, and processes to improve the performance and reliability of each utility, as measured against national standards at a reasonable cost to the DPU customers.
- f. The BPU will recommend policies, procedures, and processes that will improve the environmental sustainability of DPU operations at a reasonable cost to the DPU customers.
- g. The BPU will promote the development and maintenance of documented, comprehensive plans for operation of the DPU during emergency conditions.

- h. The BPU will promote programs such as education, energy surveys, and irrigation analysis that will enable DPU customers to use our water, sewer, gas, and electrical utility services in a manner that will protect the environment, conserve resources, and be cost-effective to the DPU customers.

2.9. Standards of BPU Member Public Behavior

- a. The extent of a BPU member's authority is one vote in BPU meetings.
- b. BPU members shall not interfere with the Utilities Manager in the operation of the DPU.
- c. BPU members shall not direct DPU employees.
- d. BPU members shall maintain civil decorum at meetings, treating each other with courtesy and respect; remembering that *"Every difference of opinion is not a difference of principle."* – Thomas Jefferson.
- e. BPU members' interaction with the public, each other, and staff will be open, transparent, and professional.
- f. BPU members must maintain the confidentiality of closed sessions and information gained from their position on the BPU. Release and disclosure of confidential information must be approved by a majority of the BPU and County Council.
- g. Representing the Board to Council:
 - The Chair of the BPU (or designee) is the official spokesperson for the Board when communicating Board activities to and with Council. The Chair shall be recognized as the head of Board for the purposes of intergovernmental relations, ceremonial purposes and calling BPU emergency meetings.
 - Each BPU member is free to communicate with the County Council as a private citizen; when doing so, the BPU member should clearly state that the Board Member is not speaking for the BPU unless specifically appointed by the BPU to be the spokesperson for the BPU on a particular issue.
 - Issues discussed and decisions made during open BPU meetings should be accurately communicated to the County Council.
- h. The rules contained in the current edition of these Procedural Rules, the Council's Annual Meeting Resolution, any applicable adopted Council Board and Commission Procedural Rules, and the current version of **Roberts Rules of Order** shall govern the BPU in all cases to which they are applicable and in which they are not inconsistent with any special rules of order the BPU may adopt.
- i. BPU members, if acting within the scope of their duty, are subject to the immunities and limitations of the New Mexico Tort Claims Act, Sections 41-4-1, *et seq.*, NMSA 1978, as amended.

2.10. Whistleblowers

Members of the BPU will abide by the New Mexico “Whistleblower Protection Act,” NMSA 1978, Chapter 10, Article 16C. See [Appendix F](#) for additional information.

2.11. Documents Retention/Destruction

- a. The BPU shall preserve all information relating to litigation, audits, and investigations.
- b. From time to time, due to pending, threatened, or otherwise reasonably foreseeable litigation, audits, government investigations, or similar proceedings, the County Attorney or the Utilities Manager may issue BPU members a notice to suspend the destruction of specific records. No records so specified may be destroyed by BPU members until the notice is withdrawn in writing by County Attorney or the Utilities Manager.
- c. The County of Los Alamos, BPU, and its departments are subject to State Inspection of Public Records requirements and have a records and information management governance policy. Contact the Utilities Manager or the DPU Executive Assistant for more detailed information.

2.12. Open Meetings

- a. All meetings of a quorum of BPU members held for the purpose of formulating public policy, discussing public business, or for taking any action within the authority of the BPU, are public meetings. Meetings or portions of BPU meetings can only be closed when the matter to be considered falls within one of the exceptions defined in the New Mexico Open Meetings Act (NMSA 1978, §§ 10-15-1 through 10-15-4); any questions regarding BPU meetings and/or closed sessions should be directed to the County Attorney.
- b. As required by the County Council, BPU meetings will be broadcast to the public using the County's on-line streaming capabilities; to the extent possible, BPU meetings will be held in meeting rooms with audio-video capabilities.
- c. Each January the County Council passes and the BPU will affirm a resolution establishing minimum standards of reasonable notice to the public for all meetings of the Council and of all County boards, commissions, and policy-making bodies.
 - 1) The resolution sets the requirements for public notice and agenda publication for regular meetings, special meetings, emergency meetings, and closed sessions.

- 2) Refer to [Appendix G](#), for the current County Open Meetings Resolution.
- d. BPU shall issue a notice of potential quorum no later than 72 hours prior to a potential quorum.
- e. Board members should avoid exchanging e-mails, phone calls, or other communication in which a quorum of BPU members may be included to discuss a policy issue, upcoming agenda item, or related matter; such communications may violate the State's Open Meetings Act, however sending correspondence to the DPU Executive Assistant or Utilities Manager is acceptable. This issue is commonly known as a "rolling quorum."
- f. Refer to [Appendix H](#), State of New Mexico Attorney General's "Open Meetings Act Compliance Guide," which may be amended from time to time.

2.13. Media Relations

- a. The BPU promotes transparency in its decision-making process. As such public and media representatives are welcome to participate in all open Board meetings and shall receive meeting agendas and agenda packets upon request.
- b. Each BPU member is free to interact with the media as a private citizen; when doing so, the BPU member should clearly state that he/she is not speaking for the BPU unless specifically appointed by a majority of the BPU members as spokesperson for the BPU on a particular issue. The Chair of the BPU shall usually act as spokesperson for the BPU with regard to media queries, or if a majority of the BPU has delegated such authority to the Chair on a particular media issue of public interest and importance.
- c. Issues discussed during closed BPU meetings should not be revealed to the media.
- d. Issues discussed and decisions made during open BPU meetings should be accurately communicated to the media.
- e. BPU members may consider referring media queries to the DPU public relations staff on certain issues or may request assistance from DPU public relations staff in responding to media requests.
- f. BPU members shall be professional in their manner and conduct at all meetings. Even though media representatives may not be present at an open BPU meeting, meeting minutes, audio recordings, and/or video recordings are public record and will be made available to the public and media representatives upon request.

2.14. Education and Development

- a. BPU applicants shall be provided with an online link to this PR document so they can better understand the roles and responsibilities of BPU membership.
- b. Within two months of being appointed, each new BPU member will be provided with an orientation to the DPU, including its mission, policies, procedures, and programs, as well as his or her roles and responsibilities as a board member. This orientation will be provided or coordinated by the BPU Chair. Newly appointed BPU members will also receive a copy of the *APPA Handbook for Public Power Policymakers*, the County's *Public Involvement Guide for Boards and Commissions*, and the County's *Orientation Manual for Members of Boards and Commissions*. (The *Orientation Manual for Members of Boards and Commissions* includes several provisions that differ from the County Charter provisions for the BPU; nevertheless, the document may provide useful general guidance for BPU members and officers.)
- c. Each BPU member is expected to seek continuing education that will enhance his or her ability to effectively fulfill the duties of a BPU member and is encouraged to obtain a relevant certification within two years of appointment to the BPU. An example is the Public Power Governance Essentials On-demand Training. Refer to the APPA information in [Appendix I](#).

Part 3: Board Structure and Processes

3.1. Governing Style

The BPU will approach its task with a style that emphasizes outward vision rather than an internal preoccupation, that encourages diversity in viewpoints, that underlines strategic leadership more than administrative detail, that is cognizant of the clear distinction between Board and staff roles, and that promotes pro-active rather than reactive approaches. In this spirit, the BPU will:

- a. Comply with this PR and discuss variances in open session.
- b. Be accountable to the DPU customers and the citizens of Los Alamos County for competent, conscientious, and effective accomplishment of its obligations as a body. It will allow no officer or individual of the BPU to usurp this role or hinder this commitment.
- c. Monitor and regularly discuss the BPU's own process and performance.
- d. Seek to ensure the continuity of its governance functions by identifying capable County citizens, encouraging them to apply for County Council appointment to the BPU, then adequately orienting and training new BPU members.
- e. Be an initiator of policy and not just react to DPU staff initiatives.

3.2. BPU Job Descriptions

The job of the BPU is to exercise jurisdiction and control over the DPU. In this role, the BPU must lead the DPU toward desired operational and financial performance objectives and ensure that these objectives are met. The BPU's specific contributions are unique to its role of trusteeship and necessary for proper governance and management.

- a. To perform its job, the **BPU** shall:
 - 1) Work with the Utilities Manager to define and refine the DPU's mission, vision, values, strategies, and major goals/outcomes and hold the Utilities Manager accountable for developing strategic objectives and long-term goals based on these procedures.
 - 2) Develop an annual performance plan with priorities for the Utilities Manager. The performance plan should align with the DPU's strategic objectives and long-term goals already approved by the BPU and should identify the performance standards by which the Utilities Manager is expected to achieve those objectives/goals/outcomes.
 - 3) Monitor the performance of the DPU relative to the achievement of the objectives/goals/outcomes.
 - 4) Select, nurture, evaluate annually, recommend fair compensation for and, if necessary, recommend termination of the Utilities Manager, who functions as the Board's sole agent.

- 5) Ensure financial solvency and integrity of the DPU through its processes and actions.
- 6) Require periodic financial and management audits to ensure compliance with the law and good practices in accordance with Article V of the Los Alamos County Charter.
- 7) Participate in the annual DPU Strategic Planning Process as described elsewhere in this PR.
- 8) Review, approve, and recommend an annual DPU budget, including the Schedule of Funds, to the County Council.
- 9) Review, approve, and recommend utility rate ordinances to the County Council.
- 10) Review and approve utility contracts greater than or equal to \$100,000, and review, approve and recommend utility contracts greater than \$300,000 to the County Council. (Refer to Los Alamos County Code of Ordinances, Sec. 31-74. "Authority to execute contracts.")
- 11) Maintain and constantly improve all on-going procedures of the BPU in this PR.
- 12) Support the Utilities Manager in strategic, operational, and human resources issues before county staff and/or County Council.
- 13) Evaluate and strive to improve the BPU's performance as a governing board.
- 14) Actively work with DPU staff to communicate the value of the DPU to its partners. Possible activities may include:
 - Accompanying the Utilities Manager and participating in presentations to civic organizations.
 - Attending County Council meetings where DPU topics will be presented or discussed.
- 15) Seek input and involve DPU partners in BPU policy considerations and decisions using methods such as:
 - Exploring ways to get more partner input while policies are being formed.
 - Using DPU bill inserts to distribute information and solicit public input on issues.
 - Utilizing the Los Alamos County On-Line Forum.
 - Use the bi-annual DPU customer survey to gather public input on issues.
 - Forming ad-hoc citizen's panels to address strategic questions and make recommendations to the BPU.
- 16) Work with the County Council to get citizens with diverse backgrounds appointed to the BPU to ensure that the BPU represents the community it serves.

- b. For the BPU to function effectively, **each BPU member** must:
- 1) Regularly attend BPU meetings.
 - 2) Review the agenda packet for each meeting and come to the meeting prepared to discuss the items on the agenda.
 - 3) Participate in BPU discussions at meetings.
 - 4) If possible before a BPU meeting, prepare any lengthy reports and/or comments in writing and provide to the DPU Executive Assistant at or before the meeting.
 - 5) Adhere to these PRs.
 - 6) Represent interests of DPU customers.
 - 7) Rotate attendance at boards and commissions lunches.
 - 8) Accept and fulfill duties assigned by the BPU Chair.
 - 9) In BPU meeting discussions, focus on policy consideration and direction versus operational issues; discuss technical details of DPU operations with DPU staff prior to the BPU meeting if possible.
 - 10) Actively endeavor to understand and balance the varied concerns of DPU customers.
- c. The **BPU Chair** has the following additional responsibilities:
- 1) Meet with Utilities Manager approximately two weeks before each regular BPU meeting to review and approve the agenda items for the meeting.
 - 2) Conduct all BPU meetings.
 - 3) Obtain BPU member volunteers, or if necessary, appoint BPU members for committees and Board projects.
 - 4) Review meeting minutes after each BPU meeting.
 - 5) Review and approve the Utilities Manager's travel pre-approvals and reimbursements.
 - 6) To the extent possible, attend weekly "Leadership Council" meetings to be aware of County Council agenda and to provide information about BPU issues to County leadership; if necessary, ask the BPU Vice-Chair to attend.
 - 7) Represent the BPU at County Council meetings, particularly those where DPU issues will be discussed.
 - 8) Provide an annual oral report to County Council to keep them aware of issues facing the BPU which may significantly impact the operations of other County departments.
 - 9) Help the BPU spend appropriate time on policy considerations, processes, and direction versus operational issues; guide BPU meeting discussions away from operational details and toward policy issues.

- d. In the absence of the Chair, the **BPU Vice Chair** shall assume the duties of the Chair.
- e. The **BPU immediate past Chair** is encouraged to serve as mentor for the current BPU Chair.
- f. The **Utilities Manager** is an ex-officio non-voting member of the BPU: Refer to Part 4 of this PR for a description of the Utilities Manager's Responsibilities.
- g. The **County Manager** will be an ex-officio non-voting member of the BPU and is encouraged to:
 - 1) Attend the meetings of the BPU or send a designated alternate Deputy County Manager.
 - 2) Serve as a liaison between the Board and County Administration to ensure that (a) the Council is aware in advance of actions by the DPU which may significantly impact County operations, and (b) that DPU is aware in advance of actions by the County which may significantly impact DPU operations.
- h. The **County Council Liaison** is encouraged to:
 - 1) Attend the meetings of the BPU or send a designated alternate County Council member.
 - 2) Provide an annual briefing to the BPU on the strategic objectives of the County.
 - 3) Keep the County Council informed on BPU and DPU issues that may have a major impact on the County.
 - 4) Keep the BPU informed on County Council issues that may have a major impact on the BPU or the DPU.
 - 5) Sit at the dais or with members of the BPU at Council Liaison discretion, at which time, the Council Liaison name-placard shall be displayed.
 - 6) Participate in DPU discussion when the Council Liaison has clarifying points pertinent to the discussion.
 - 7) Refrain from interjecting opinion into discussion, unless speaking as a member of the public during periods reserved for public comment.

3.3. Annual Calendar of BPU Activities

The BPU will generally follow the calendar of activities outlined below, although, circumstances may dictate that the timing of some of these activities be adjusted. Additional BPU activities such as consideration of utility rate ordinances

and utility contracts will occur from time to time. The calendar for the current year is included as [Appendix J](#).

January

- Affirmation of the Incorporated County of Los Alamos Open Meeting Resolution for the Current Calendar Year
- Election of BPU Chair & Vice Chair for the Current Calendar Year
- Introduction of Council Liaison to the BPU for the Current Calendar Year
- Appointment of BPU Member to the County Audit Committee for the Current Calendar Year

February

- DPU Annual Report for the Previous Fiscal Year
- Budget Presentation for the Next Fiscal Year
- Biannual Update: Transactional Survey Report for July-December of the previous calendar year

March

- Annual Update: Water System
- Annual Update: LANL Presentation on Environmental Goals
- Approval of the DPU Budget for the Next Fiscal Year
- DPU Quarter 2 Report for the CURRENT Fiscal Year (October - December)

April

- Begin Utilities Manager's Performance Evaluation Process (*Closed Session*)
- UAMPS Presentation by CEO/General Manager
- Annual Update: Results of the Voice of the Customer Survey
- Annual Update: Electric Reliability Plan (ERP) for the Current Fiscal Year
- Begin Advertising Annual BPU Vacancy

May

- BPU Conducts Annual Utilities Manager's Performance Review (*Closed Session*)
- Approval of Year-End Budget Revisions
- Overview of the ECA Budget Process & Approval of the DOE/LAC Resource Pool Budget for the Next Two Fiscal Years
- Council Approves DOE/LAC Resource Pool Budget for the Next Two Fiscal Years
- Council/BPU Working Group Interviews BPU Candidates
- Council Appoints New BPU Member (Five-Year Term)

June

- Utilities Manager – Annual Performance Planning (*Closed Session*)
- Planning for the Annual BPU Presentation to Council (Work Session)
- Final Review of the BPU Annual Presentation to Council (Regular Session)
- Annual Update: Wastewater System
- Annual Review: Utilities Assistance Program (UAP)
- DPU Quarter 3 Report for the CURRENT Fiscal Year (January - March)

- Recognition of Departing Board Member

July

- Introduction of New BPU Member
- Orientation for New BPU Member
- Annual Open Meetings Act & Code of Conduct Training by Attorney
- Annual Review of the BPU Procedural Rules
- Presentation to Council by the BPU Chair (Council Work Session)

August

- Annual Update: Electric Production – Hydroelectric Facilities
- Biannual Update: Transactional Survey Report for January – June of the Current Calendar Year
- Approval & Reaffirmation of the BPU Procedural Rules
- Annual Strategic Planning for the DPU (Special Meeting)
- Approval of Resolution to Remove 5-Year-Old Uncollectable Utility Accounts from A/R List

September

- Approval of the DPU Mission, Vision & Values and the Strategic Goals & Objectives
- Approval of Budget Carryovers from the Previous FY to the Current FY
- DPU Quarter 4 Report for the PREVIOUS Fiscal Year (April - June)

October

- Annual Update: Integrated Resource Plan (IRP)
- Annual Update: Gas Distribution System

November

- Annual BPU Self-Evaluation
- Approval of the BPU Meeting Calendar for the Next Calendar Year

December

- Approval of the Annual BPU Self-Evaluation
- DPU Quarter 1 Report for the CURRENT Fiscal Year (July - September)

3.4. BPU Meetings

- a. Regular Meetings – Regular meetings will generally be held on the third Wednesday of each month at 5:30 p.m. These meetings will be set under the requirements of the annual Open Meetings Resolution adopted by Council. Public comment will be taken at the beginning and end of the meeting, on any subject. Public comment on action items will be taken at the time the action is considered. Public comment will generally be limited to three (3) minutes or otherwise as announced by the Chair. Public comment will also be accepted by available written methods, including by email.
- b. Work Sessions – work sessions will generally be held on the first Wednesday of each month at 5:30 p.m. The Board may schedule work sessions on a regular basis under the requirements of the annual Open Meetings Resolution. Board meetings designated as work sessions will be held for the primary purpose of discussing issues at length with staff in an informal setting without taking formal action, except for required procedural actions such as adopting a statement for inclusion in the minutes regarding a previously held closed meeting. Public comment will be taken at the beginning and end of the session, and by available written methods, including email.
- c. Closed Meetings - The Chair, a majority of the Board, or the Utilities Manager may call for a closed meeting to discuss issues (such as pending litigation, personnel matters, collective bargaining strategy) pursuant to NMSA 1978, 10-15- 1 (H) (2,5 etc.). Following the closed meeting, at the next Board meeting during which action may be taken, the Chair will call for a motion that is substantially similar to the following: *"I move that the Board approve the following statement for inclusion in the minutes: 'The matters discussed in the closed meeting held on (MONTH)(DAY)(YEAR) that began at (TIME) were limited only to those topics specified in the (NOTICE) (MOTION) of the closed meeting.'"* This motion is a procedural motion, therefore only a show of hands is required rather than a roll call vote.
- d. Special Meetings – A special meeting may be called by the Chair or, in the Chair's absence, by the Utilities Manager, or by such other officers that may be designated by the Board or by any two Board members upon written request, for the purpose of conducting Board business. Notice of a special meeting will follow the requirements of the annual Open Meetings Resolution.
- e. Emergency Meetings - The Chair, a majority of the Board, or the Utilities Manager may call an emergency meeting in accordance with the Open Meetings Act.

3.5. BPU Meeting Agenda Templates

The following templates describe the items that will be addressed and the order of business at a typical BPU meeting; not every meeting will include every item in the template. Agenda documentation will be substantially complete at least 72 hours before each meeting.

a. Regular Meeting

1. Call to Order
2. Public Comment *(on any subject)*
3. Approval of Agenda
4. Consent Agenda
 - a) Approval of Minutes
5. Presentations
6. Public Hearings *(Ordinances & Resolutions)*
7. Department Business
8. Board Business
 - a) Chair's Report
 - b) Board Member Reports
 - c) Utilities Manager's Report
 - d) County Manager's Report
 - e) Council Liaison's Report
 - f) Environmental Sustainability Board Liaison's Report
 - g) General Board Business
 - h) Board Expenses
9. Status Reports
 - a) Electric Reliability Report
 - b) Accounts Receivables Report
 - c) Risk & Safety Report
10. Request/Review - Upcoming Agenda Items
 - a) Tickler File
11. Public Comment *(on any subject)*
12. Adjournment

b. Work Sessions & Special Meetings

1. Call to Order
2. Public Comment *(on any subject)*
3. Approval of Agenda
4. Presentations
5. Business *(if any)*
6. Public Comment *(on any subject)*
7. Adjournment

3.6. Public Comment

The following is the BPU's general rule concerning public comment during BPU meetings:

- a. Regular Meeting agendas will include a standing public comment period at the beginning and end of each meeting, on any subject. The public comment period is an opportunity for the Board to listen to members of the public on any subject. BPU members should not correct, rebut, or engage in dialogue with a member of the public during or after the public comment period.
- b. Work Session & Special Meeting agendas will include standing public comment periods at the beginning and end of the meeting, on any subject.
- c. Oral public comment should be limited to three (3) minutes per person. Requests to make comments exceeding three (3) minutes should be submitted to the Board in writing prior to the meeting. The text of lengthy comments should be submitted to the Board prior to the meeting, if possible, but may also be submitted during or after the meeting. The name of the citizen providing public comment will be included in the minutes and whether they are a resident of Los Alamos County.
- d. Individuals representing or making a combined statement for a large group present at a meeting may be allowed additional time for comment at the discretion of the Board. The Board may agree to this by consent (no motion necessary).
- e. Public Hearings – After the presenter has given his or her presentation, the Chair will provide an opportunity for Board questions and then public comment on the particular topic. Any formal BPU action on the item will occur in the Public Hearings section of the BPU meeting agenda after public comments are finished.
- f. Business Items - After the presenter has given his or her presentation and there is initial Board discussion, and prior to accepting a main motion on an item, the Chair will formally open the floor for public comment specific to the agenda item. If a public hearing has been held on the topic during the meeting, the Chair may request that comments not be repeated. The Board may continue to have additional discussion on the item after the public comment period.
- g. BPU members may, at any time, ask the Chair to allow a presenter, member of the public, or staff member to speak to provide clarification or additional information about an agenda item. This is not considered to be part of the public comment period.
- h. Procedures regarding public comment will be included on agendas so that interested citizens know how to submit written comments prior to the meeting for Board consideration.

- i. Written public comment, including email to the BPU and identified in the subject line as “public comment,” submitted prior to or during the meeting will be provided to the DPU Executive Assistant to attach to the minutes.
- j. Additional useful guidance and suggestions for public hearings and other ways and means of sharing information with or gathering input from DPU customers can be found in the Los Alamos County *Public Involvement Guide for Boards and Commissions*.

3.7. Meeting Agendas

- a. BPU meeting agendas shall comply with the State of New Mexico “Open Meetings Act.” Refer to [Appendix G](#), State of New Mexico Attorney General’s “Open Meetings Act Compliance Guide” and the County’s annual Open Meeting resolution.
- b. All documentation regarding upcoming public hearings, consent, and business items shall be substantially complete at least 72 hours prior to action being taken.
- c. The agenda must contain a list of specific items of business to be discussed or transacted at the meeting, but there is no requirement for any additional description of what the Board may do with a specific item of business on the agenda.

3.8. Meetings Minutes

- a. Meeting minutes should be a succinct record of what was done at the meeting, not a transcript of what was said during the meeting.
- b. In substance, but not necessarily format, BPU meeting minutes will comply with Roberts Rules of Order, the County Boards and Commissions Manual, the New Mexico “Open Meetings Act” and County Council procedures.
- c. Board members should carefully review draft meeting minutes before approval and request that additional discussion details be included if needed to provide further explanation of a topic.
- d. During the meeting, the board members may request that portions of discussions be recorded in the minutes if they believe the details to be of great importance to the overall record.
- e. Any items requiring further action by the Board or follow-up by Staff should be captured in the minutes.
- f. Approved minutes of BPU meetings are the official record of BPU meetings; recordings of BPU meetings will be retained for at least one year for reference purposes.

3.9. Removal/Replacement of a BPU Member

- a. Article V of the County Charter states circumstances that would warrant removal of a BPU member by the County Council.
- b. A BPU member may resign by submitting written notice to the Chair of the BPU and the Chair of the County Council; except for such circumstances that warrant an earlier departure, the resigning member should continue to serve on the BPU until a replacement is appointed by the County Council.
- c. If a Board member resigns or is removed, the BPU will work with the County Council to get a replacement appointed within 60 days. The BPU will identify capable Los Alamos County citizens and encourage them to apply for County Council appointment to the BPU.

3.10. BPU Self-Evaluation

- a. Beginning in October, the BPU will perform an annual self-evaluation of its own performance. The BPU may invite major partners (e.g., DPU staff, County Council, County Manager) to participate in specific aspects of the evaluation.
- b. The purposes and reasons for the BPU self-evaluation are intended to:
 - 1) Promote understanding of roles and responsibilities
 - 2) Provide orientation for new members
 - 3) Address, and perhaps help resolve, Board conflicts
 - 4) Clarify what members expect from the group and self
 - 5) Identify priorities for the BPU's future efforts
 - 6) Identify BPU strengths and weaknesses
 - 7) Identify opportunities for improvement in BPU performance
 - 8) Help identify needed changes to this PR
 - 9) Ensure that self-evaluation aligns with at least three of the Baldrige "Criteria for Performance Excellence."
- c. Refer to [Appendix K](#) for a BPU self-evaluation template adapted from the *APPA Handbook for Public Power Policymakers*. The BPU will change the self-evaluation topics over time to fit the changing business climate, relations with the Utilities Manager, relations with the County Council, and to include lessons learned from previous self-evaluations.
- d. In its self-evaluation the BPU will address open-ended questions such as:
 - 1) What did the BPU accomplish during the past year?
 - 2) What did the BPU fail to accomplish during the past year?
 - 3) What did the BPU do well during the past year?
 - 4) What did the BPU do poorly during the past year?
 - 5) What were the key issues of the past year? Did the BPU address them adequately?"
- e. The BPU will seek broad participation in the self-evaluation process by:

- 1) Soliciting suggestions for self-evaluation questions from DPU staff, County staff, County Council, and the public.
 - 2) Inviting the immediate past BPU member(s) to participate in the self-evaluation.
 - 3) Inviting the County Council Liaison, County Manager, and County Attorney to participate in the self-evaluation.
- f. The BPU will explore ways to make the BPU self-evaluation honest and candid.
 - g. The BPU will explore ways to collect questions, complaints, and compliments to be addressed in the annual self-evaluation process.

3.11. Dispute Resolution Process

- a. From time to time the County Council may not adopt a BPU approved utility rate ordinance or may not approve a budget, personnel action, or utility contract recommended by the BPU.
- b. In this situation the BPU will reconsider its recommendation and may submit either a revised or a reinforced recommendation to the County Council.
- c. If the BPU does not develop a recommendation that is approved by the County Council in a timely manner, it will request the Council to appoint an appropriate number of councilors to a joint County Council/BPU working group that is charged to reach an agreement within a specified time.

Part 4: Utilities Manager Responsibilities

4.1. Essential Duties and Responsibilities

- a. The Utilities Manager's essential duties and responsibilities are described in the Los Alamos County Job Description and Classification for the Utilities Manager, Job Code 7001; refer to [Appendix M](#).
- b. The following sections address some of the Utilities Manager's responsibilities that particularly relate to the BPU.

4.2. Strategic Planning

- a. The Utilities Manager should implement a systematic, cyclical strategic planning process to develop (1) Strategic Objectives, (2) Long-Term Goals, and (3) Short-Term Goals for the DPU and present the Strategic Objectives and Long-Term Goals to the BPU for approval.
- b. The DPU strategic planning processes should be based on the current *Baldrige Criteria for Performance Excellence* or an equivalent standard that is acceptable to the BPU.
- c. Refer to [Appendix L](#) for a description of the DPU Strategic Planning Process.

4.3. Operations and Management

- a. The Utilities Manager is responsible for the day-to-day operations of the department and management of its personnel.
- b. The Utilities Manager's operation of the department and management of its employees, in general, shall be subject to the personnel code and the procurement code. In general, other administrative County-wide policies shall be followed to the extent they do not conflict with the BPU's jurisdiction.
- c. Special processes and procedures necessary for the operation of the DPU shall be proposed by the Utilities Manager, approved by the BPU, and put in place with the assistance of the County Manager.

4.4. Annual Budget

- a. The Utilities Manager is responsible for preparing and presenting a preliminary and a final annual DPU budget to the BPU.
- b. The proposed annual DPU budget intended for BPU approval should address each of the utilities individually and include 10-year forecasts that project changes in sales, revenue and expenses, and the rates and borrowing necessary to sustain each utility.

- c. The proposed DPU budget intended for County Council approval should be based on the BPU approved budget and shall address the DPU on a bi-annual basis.
- d. The Utilities Manager should present the preliminary annual budget at the February BPU meeting and the final annual budget at the March BPU meeting

4.5. Annual and Quarterly Financial Reports

- a. The Utilities Manager shall prepare and provide the BPU with an audited annual financial report as of the end of the previous fiscal year for each utility and for the DPU.
 - 1) The annual financial report shall adhere to generally accepted accounting principles as promulgated by the Governmental Accounting Standards Board and the Financial Accounting Standards Board as applicable.
 - 2) The annual financial report may be included as part of the audit of the County's Annual Comprehensive Financial Report.
 - 3) The annual report shall be provided for BPU information at the March BPU meeting.
 - 4) The accepted annual report (if separate from the general County) should be suitably summarized and formatted then provided to the County Council and made available to the public on the DPU website.
- b. The Utilities Manager shall prepare quarterly DPU performance reports.
 - 1) Each quarterly report should include information about capital projects, operational and financial performance, and DPU highlights during the previous quarter. The operational and financial performance reports should include data for the previous quarters of the fiscal year plus cumulative totals.
 - 2) Quarterly reports shall be provided to the BPU and the County Council and made available to the public on the DPU website.

4.6. Rate Ordinances

- a. The Utilities Manager is responsible for preparing and presenting proposed utility rate ordinances to the BPU.
- b. At the BPU meeting prior to the public hearing on a final proposed utility rate ordinance before the BPU, the Utilities Manager shall introduce the draft ordinance and present the budget and operational reasons for the proposed rate ordinance. A revised rate ordinance presented to the BPU after rejection of the original rate ordinance by the County Council need not be submitted in advance of the public hearing but may be acted upon by the BPU when submitted.

- c. When the final proposed utility rate ordinance is presented to the BPU for approval, the Utilities Manager shall make a presentation to the BPU that approximates that which will be made to the County Council to obtain their acceptance of the ordinance.

4.7. BPU Membership

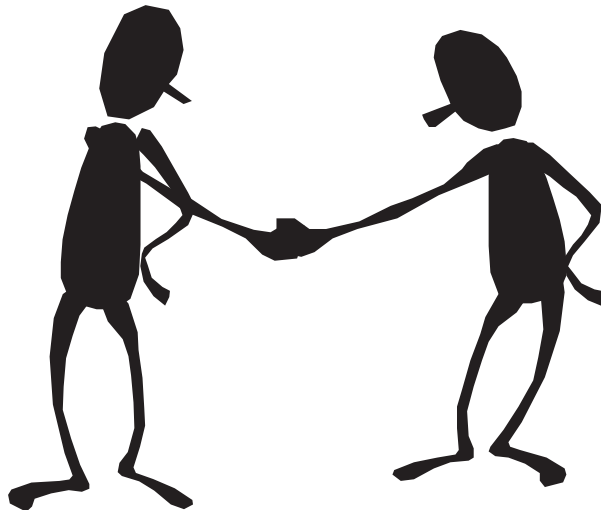
The Utilities Manager and the County Manager shall both be ex officio non-voting members of the BPU.

Appendices

The full PR and links to all appendices listed below are available on the DPU pages of the County's website at <https://ladpu.com/bpu>. Click on **"Guiding Documents."**

- A. Annual Reaffirmation of the Procedural Rules
- B. DPU Strategic Objectives, Long-Term Goals, and Short-Term Goals for the Current Fiscal Year
- C. Los Alamos County Charter, Article V – Utilities
- D. Los Alamos Code of Ordinances, Chapter 40 – Utilities
- E. Los Alamos County Code of Conduct (Code Ordinance No. 02-240):
- F. New Mexico "Whistleblower Protection Act," NMSA 1978, Section 10-16C-1 to 6
- G. Los Alamos County Council's Annual Resolution for Open Meeting Compliance
- H. State of New Mexico Attorney General's "Open Meetings Act Compliance Guide"
- I. American Public Power Association Governance Resources
- J. BPU Calendar for the Current Year
- K. BPU Self-Evaluation Template
- L. Strategic Planning Process – Key Process Steps (KPS)
- M. Los Alamos County Job Description and Classification for the Utilities Manager
- N. DPU Culture of Safety Vision Statement

LOS ALAMOS COUNTY ORIENTATION MANUAL and PROCEDURAL RULES FOR MEMBERS OF BOARDS AND COMMISSIONS (B&Cs)



August 2024
Updated

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INTRODUCTION

As a new member appointed to a Board or Commission (B&C), you will be provided an opportunity to participate in an orientation session conducted by County staff from the department most closely linked to your B&C. This orientation session will include, but not be limited to, a review of the B&C's responsibilities as assigned by the County Council or as specified by state law and a review of the procedures of the B&C.

For the purpose of these guidelines, a B&C is defined as one of the County's standing Boards appointed by Council. Most B&Cs are advisory to Council; however, some may have statutory responsibilities. All of the current B&Cs were created by County ordinance and a description of their responsibilities and duties can be found in Chapter 8 of the Los Alamos County Code. The Code can be accessed electronically through the County's web site at www.losalamosnm.us. The staff liaison or the clerical support person assigned to your B&C can also provide a copy of your B&C's enabling legislation.

As provided for in Section 8-15 of the County Code, unless otherwise provided by law, all boards and commissions shall follow the Procedural Rules adopted by the County Council which are contained in Part II of this Handbook.

ORIENTATION OBJECTIVES:

After attending the orientation session and reviewing this handbook, you should be able to agree with the following statements:

- ☐ I understand the role and responsibilities of my B&C.
- ☐ I've read the relevant sections of Chapter 8 of the County Code.
- ☐ I know what my fellow B&C members and I are expected to do.
- ☐ I know the professional staff liaison who is assigned to my B&C and/or the department director and I understand their roles.
- ☐ I understand the working relationship between the county staff and my B&C.
- ☐ I know the sources of information that assist my B&C with decision making.
- ☐ I know which types of community issues are of concern to my B&C.
- ☐ I understand the local government activity for which my B&C is expected to make policy recommendations.
- ☐ I understand the difference between making policy and making policy recommendations as an advisory B&C.

- ❑ I understand the distinction between operations and policy.
- ❑ I understand that unless otherwise provided by law, all boards and commissions shall follow the Procedural Rules adopted by the County Council and contained in Part II of this Handbook.
- ❑ I have read and understand the Procedural Rules contained in Part II of this Handbook.
- ❑ I have read the current Work Plan for my B&C.

THE ROLE OF BOARDS AND COMMISSIONS: UNDERSTANDING THEIR MISSION

Volunteer citizen B&Cs serve an important role in democratic local government. B&Cs are an excellent mechanism for gathering constructive citizen input, putting to use the talents of individual citizens, and bringing a citizen perspective to local government activities and projects.

Service on a B&C familiarizes you with your community and develops potential community leaders, and it gives you the chance to help address community needs and make recommendations for possible solutions. Finally, B&Cs provide a way to practice the spirit of giving and philanthropy, a way to serve your fellow citizens.

As a volunteer member of a B&C, you have the opportunity to influence important decisions about government policies, about the distribution of community resources, and about the provision of services to residents. The quality and effectiveness of your input can affect the whole community.

Occasionally, members of a B&C may have a poor understanding of the B&C's role and responsibilities. If this occurs, the B&C is likely to be ineffective or may be disruptive of staff activities and no longer contributes positively to the democratic process. Ineffective B&Cs may cause citizens to become disillusioned - to feel that the local government is rigid, does not accomplish its goals, or does not respond to citizens' voices. Citizens initially motivated by a spirit of giving may become disenchanted and may decline to participate further in civic activities. The County will try to prevent this from happening. For this reason, it is essential that B&C members be properly oriented to understand their duties and carry them out effectively.

A B&C's job, generally, is to make informed citizen recommendations to the County Council and to assist the Council in making good decisions for the community. Each B&C has a specific scope of assigned responsibilities identified in their enabling ordinance.

The County Council, not the B&C, is ultimately responsible to the citizens. The B&C must understand that its role is generally to advise, as opposed to the County Council's role to make policy and the staff's operational/administrative role. The B&C must also

understand that the decision to implement the B&C's recommendations will be made by staff or by the County Council. Also important, though, the B&C members need to understand that their role as an advisory group is important to the well-being of the community. In other words, even though the B&C's job is different from staff's job and the County Council's job, it is a very important part of a democratic local government.

B&C members should also recognize that the County Council's area of concern is much broader than the B&C's and, in some cases, B&C recommendations will not be implemented. B&C members should not interpret this as a rebuke, but rather as part of the process.

It is imperative that an advisory B&C's work reflects the wishes of the community as a whole and not only the opinions of the appointed members. Effective B&C work depends on the members' understanding of the general direction in which the community is headed. B&Cs can help to meet the objectives of the County Council if the overall community vision articulated by Council is allowed to guide not only the B&C's case-by-case recommendations, but also its long-range goals and annual work plan.



RELATIONSHIP WITH THE COUNTY COUNCIL

A County Councilor will be assigned to serve as liaison to each B&C. The assignments will change annually and will be made in a manner determined by the Council. The liaison to the Utilities Board is automatically the Council vice-chair.

Individual Councilors, including the liaison, cannot assign tasks to a B&C. In regard to all B&Cs, except the Board of Public Utilities, the Councilor will, after consultation with the Chair of the B&C, attend regular meetings of the B&C to participate in the B&C as agreed and should meet periodically with the Chair of the B&C to determine the level of participation desired by the B&C and issues in which the Council should be advised. The assigned Council liaison's role is to act as the primary information conduit between the B&C and the Council as a whole. It is incumbent upon that Councilor to provide guidance and advice about which B&C issues to bring to the attention of the Council for action and which should be merely information items. However, this does not prevent the B&C Chair, in accordance with an action of the B&C, from bringing a recommendation to the Council.

In regard to the Board of Public Utilities, the Council liaison will sit at the dais.

Each B&C advises the County Council on policy matters regarding its assigned powers and duties. The B&C shall develop policy recommendations by:

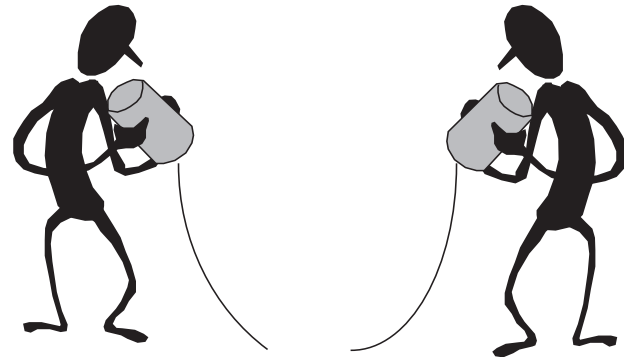
- Providing a forum for discussion and study of matters that are of interest to citizens, the County Council, and staff, and that conform to the vision for the community articulated by the County Council.
- Researching and developing plans for resolving concerns within the B&C's areas of responsibility. (Some actions of a B&C may be subject to appeal to the County Council as provided in the B&C's enabling ordinance. No action of a B&C shall relieve the County Council of its responsibilities nor usurp the authority granted to the County Council by the Charter.)

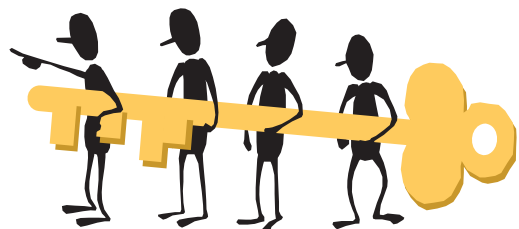
The City of Commerce, California, calls B&C members "the eyes and ears" of the community. In this type of symbiotic relationship, however, B&C members need to remember that they were not appointed to relieve the elected officials of making policy decisions. B&C members should also avoid trying to predict actions or votes of the County Council. This does not, however, preclude them from interpreting the philosophy of the County Council or trends in County Council thinking.

MEETING WITH THE COUNTY COUNCIL

Meetings between the B&C and County Council can help clarify expectations and philosophies. Traditionally, each B&C Chair will be expected to make an annual presentation during a Council work session. The monthly Council work sessions are used because they are conducted informally and usually have less crowded agendas. The schedule for these annual presentations is usually developed at the beginning of each calendar year. The Chair may use his/her presentation time to describe the B&C's accomplishments and discuss proposed work plans or any other issues that warrant Council attention. The B&C Chairperson will primarily be responsible for the B&C presentation to Council. Here are suggested steps for planning that presentation:

- If needed, devote a portion of a B&C meeting to identify and assign priorities to issues to be covered.
- Plan to list the B&C's accomplishments for the past year and describe the proposed work program for the upcoming year. List the top priorities of the B&C along with some of the challenges faced by the B&C.
- Meet with County Council liaison or the Department Director to develop and review the presentation.





B&C WORK PLANS

A work plan is the B&C's expressed effort for the year. It addresses the important problems, challenges, and opportunities identified by Council and the Department that need to be addressed by the B&C during the next year. A Council-approved and published work plan has the following benefits:

- Establishes measurable objectives
- Keeps the B&C aligned with departmental and Council strategic priorities and goals
- Assists in the allocation of departmental resources
- Promotes continuity of B&C action

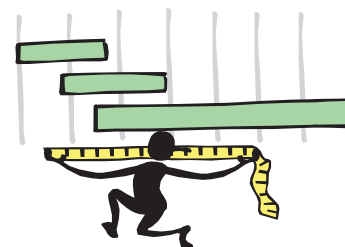
Annually, a work plan will be developed jointly between the B&C and staff. The deadline for B&C work plan development will be set and communicated to all B&C members each year. A Council working group will be appointed to review all B&C work plans. A work plan template will be provided each year to the B&C Chair and staff liaison. Each B&C shall make progress on their approved work plan until Council approves a new work plan and this new approved plan is transmitted to the B&C at their next available public meeting.

B&C Chairs are expected to meet, as needed, with their Department Director and the other Chairs of B&Cs assigned to that Department to discuss the B&C's work plans and strategies for executing those work plans. The Department Director will also review the level and allocation of departmental resources, such as staff time and support, for all B&Cs affiliated with the department.

Some B&Cs occasionally undertake initiatives that require resource allocation in one or more departments. For example, the Arts in Public Places Board (APPB) may need assistance from Community Development or Public Works with the installation or maintenance of APPB sculptures. Council must approve these appropriations as part of the regular budget process. These appropriations will be considered part of the budget of the relevant department.

Generally, the following outline will be used for the preparation of B&C work plans: (Specific dates and deadlines will be announced each year. The schedule shown below indicate the general timeframe.)

Oct	- Council determines strategic priorities - Departments begin planning for budget options in relation to their responsibilities. - B&Cs may be asked to provide input on budget options in relation to their area of responsibility.
Nov	- B&C Chairs and staff develop draft work plans.
Dec	- B&Cs/Departments review and complete work plans and submit to Department Directors and Council liaisons roughly 6 working weeks (excluding holidays) following receipt of Council budget guidance.
Jan	- A Council working group reviews, comments, and revises each B&C work plan and then makes a report including recommendations to the whole Council. The reviewed plans are presented for Council approval in a manner determined by Council.





RELATIONSHIP WITH COUNTY STAFF

Throughout their terms, B&C members will work closely with the associated department director, staff liaison and occasionally, the County Manager. A close working relationship between the B&Cs and their associated department is important for success, but it should be clear that the B&Cs work with the departments, not for the departments and vice-versa. A good partnership between staff and the B&C members has historically been an effective and productive relationship. A B&C may ask specific departments through their assigned staff liaison to provide information upon which the B&C members can make informed decisions. Department representatives designated as ex-officio members are expected to attend all B&C meetings and participate in B&C discussions, provide background information, and may advocate positions on potential B&C actions. The ex-officio staff representative(s) are non-voting members of the B&C.

County departments can provide staff reports to the County Council, through the County Manager, regarding B&C actions. Such reports may supplement, agree with, or take positions opposed to the recommendations of the B&C. If a staff report is prepared relating to a recommendation by a B&C, a copy of the report will be provided by the staff liaison to the B&C chairperson before the report is presented to the County Manager.

Each year the B&C Chairperson and the Department Director will prepare a brief description of the B&C accomplishments and plans for the future as part of their annual work plan. See previous section.

CLERICAL STAFF SUPPORT

Administrative/clerical support for B&Cs may be required as a function of the Staff Liaison, but generally the department will provide an additional clerical staff member to take B&C minutes and provide other administrative support. The clerical support staff for a B&C performs the following duties and any other duties as may be assigned by the department director:

- To cause the minutes of the B&C meetings to be taken, transcribed, prepared, and maintained in a manner best suited to provide an accurate record of all B&C proceedings;
- To give notice to the public, the media, the County Manager and the Council of all meetings of the B&C;
- To prepare and distribute agenda packets; and
- To provide other clerical support as agreed between the Department Director and the B&C Chair.

PROFESSIONAL STAFF LIAISON RESPONSIBILITIES

Here is a list of important staff liaison duties and responsibilities:

- Being informed about the latest developments in their field.
- Providing background information and making professional recommendations on important issues.
- Expressing both pro and con arguments on issues.
- Understanding the County Council's, County Manager's, and Department Director's goals and being informed of actions that have been taken.
- Alerting B&C members of possible negative reactions concerning the B&C's recommendations.
- Making sure appropriate staff action is taken after a B&C's recommendation is made.
- Developing a rapport with the chairperson and B&C members.
- Assisting with the presentation of the B&C recommendations to Council.

Unfortunately, some of these actions can create friction with B&C members. Both parties need to remember that the goal is to maintain a close working relationship and foster a partnership between B&C members and County staff.

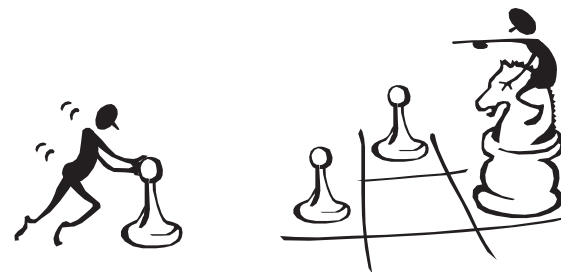
B&C MEMBER RESPONSIBILITIES

Here is a list of important B&C member duties and responsibilities:

- To meet, as necessary, to accomplish the B&C's assigned duties.
- To perform other responsibilities as required by the enabling legislation of a B&C.
- To hold public meetings and hearings, as may be required, and in conformance with the New Mexico Open Meetings Act.
- To submit an annual Work Plan to the Council documenting B&C activities during the previous year, communicating its members' perceptions of the needs of the community within its area of responsibility, and defining the B&C's plans for the future.
- To make recommendations relative to needed policies, ordinances, and programs to achieve the Council's goals. ("Minority" recommendations can be prepared when there's a difference of opinion between members of the B&C.)
- To act responsibly and professionally with respect to information obtained as a B&C member.
- If requested, to cooperate with the County's designated custodian of records to make the B&C public records open for public inspection. "Public records," as defined in NMSA 1978 Section 14-2-6, are "all documents, papers, letters, books, maps, tapes, photographs, recordings, and other materials (including e-mails) regardless of physical form or characteristics, that are used, created, received, maintained, or held by or on behalf of any public body and relate to public business, whether or not the records are required by law to be created or maintained."
- To refrain from any action which constitutes a conflict of interest. As defined in the County Charter: "Any elected official, County employee, committee member or advisory board or commission member who has a financial interest in the outcome of any policy, decision, or determination shall not vote or act on the issue in which he or she has such an interest." Each B&C member is required to complete a Disclosure Form and is expected to excuse himself/herself from any B&C discussions or actions that could be interpreted as representing a conflict of interest. However, not all interests a board member may have create a conflict of interest. Section 30-8 of the County Code addresses this as follows: "No public official shall engage in any official act directly affecting the public official's financial interest, or the financial interest of the public official's immediate family, *except that a public official shall not be disqualified from engaging in an official act if the benefit of the financial interest to the public official or the immediate family of the public official is proportionately less than or equal to the benefit of the general public.* (Emphasis Added) This exception in the County Code mirrors that of

state law, (see 10-16-4(B)) and it ensures that those chosen by the citizens via the ballot box or through the appointment by the County Council to represent the public's interest in their county government can act on measures that widely affect the general public even if a Councilor or B&C member has a financial interest in the matter on par with general public's interest in the matter. For example, to raise property taxes the County Council must take action to place the proposed measure on the ballot. Raising property taxes would directly impact the financial interests of any County Councilor (or any immediate family member) who owns real estate in the County. In the above hypothetical, it would not violate the Code of Conduct for a County Councilor to vote against or for a property tax measure because their financial interest in their real property (and any immediate family member's real property) would be directly impacted since that impact is similar to the impact the general public would experience. As this exception illustrates, navigating potential conflicts of interest can be complicated. Per the Charter the County Attorney serves as the legal advisor to County B&Cs. If any B&C member is concerned about whether a conflict of interest exists, the B&C member should contact the County Attorney's office for advice and counsel on the matter.

- To attend scheduled County meetings when such meetings relate to the work of the B&C. The B&C Chair or designee should attend the monthly B&C luncheon.
- To review all relevant background information provided in preparation for regular or special meetings or work sessions of the Council.
- To develop rapport with other Board members and staff.



PARTS OF THE WHOLE: TEAMS

It is important to understand your B&C's place in our community, that is, the B&C's relationships to local elected policy makers, citizens, other B&Cs, and the staff.

Once the B&C members understand their role and how the job will be done, the group needs to learn to communicate clearly and work together as a team. To get anything accomplished requires that each B&C member, including the B&C Chair, cooperate with other members. While seemingly simple, this can be one of the most challenging aspects of serving on an advisory B&C. Cooperation can be essential to marshalling the votes necessary to make a recommendation. This means learning to compromise, give and take, and sort out common goals.

The Council selects people with diverse backgrounds and experiences to serve on B&Cs. Moreover, the appointees may have different values and agendas. As a result, there can be built-in conflicts even before the group ever comes together.

A team represents the highest level of cooperation. B&C members are encouraged to learn to appreciate differences and discover that the power of teamwork is infinitely superior to individual contributions.

RELATIONSHIP WITH OTHER BOARDS AND COMMISSIONS

B&Cs shall, when possible, cooperate fully with other B&Cs on matters of mutual interest. If there appears to be an overlap of responsibilities involving multiple B&Cs and departments, these should be addressed as they come up. The County Manager, affected Department Directors, and B&C Chairpersons should meet to determine which B&C should take the lead on the issue(s). They will take into consideration the B&C responsibilities and the public's perception of which B&C might be the most appropriate body to collect public input.

RELATIONSHIPS WITHIN THE BOARD OR COMMISSION

The types of problems confronted by B&Cs can be very frustrating. Keep in mind that each member's ability to work together is very important to the community. As B&C members try to make the best possible decisions on issues, the following recommendations may help get over the hurdles of conflict and disagreement:

Separate the people from the problem and address issues, not personalities. You and your colleagues aren't questioning each other's good intentions or personal integrity. You are discussing options for making the best possible decisions. Don't think about what you may not like about the person sitting across the table from you. Instead think about what he or she is saying, about the points that person is trying to make. If a colleague seems to be attacking your integrity, try to get that person back on track by asking him or her to make the point.

Focus on mutual interests and shared goals. When your B&C seems to bog down,

sometimes it is helpful to step back and think about mutual goals. Remember that you are all serving the same community.

Invent options for mutual gain. Is there a compromise with which everyone will feel satisfied? Think about all that has been said throughout the debate. Can the best aspects of everybody's ideas be incorporated into a plan? Ask your colleagues why a particular approach is not satisfactory and what approaches would be acceptable.

Be open, honest, and willing to listen. Examine your own approach to dealing with conflict. Are you really listening to what your colleagues are saying? Are you thinking about the implications? Don't be afraid to state your concerns. Be honest in revealing what you see as available options and by explaining what you see as shortcomings in others' suggestions.

WHEN THE PROCESS BOGS DOWN: THE NATURE OF CONFLICT

It is a rare B&C that never experiences conflict. After all, a B&C is comprised of individuals with different experiences, educational backgrounds, jobs, expertise, and feelings. B&C members often find conflict highly frustrating; however, members should understand that part of their job is to channel conflict into good decisions. The diversity that causes conflict to arise can be the key to successful B&C work. Remember, the assigned staff liaison is also a B&C member.

B&C members are encouraged to view the conflict preceding a group decision as healthy debate. Conflict should cause you to ask questions, to seek explanations, to demand justification, to challenge, and to be challenged. It should prompt all participants to examine every angle of every argument, option, or approach.

When conflict is minimal, little effort may be required to reach a decision, but the B&C still needs to ensure that issues are fully considered. Conversely, when conflict is great, reaching consensus may be very difficult. Ultimately, conflict may result in sound, collaborative solutions comprising the best aspects of all the ideas generated. If issues are thoroughly aired, each B&C member will be committed to the solutions reached, and the cohesiveness of the group will increase.

A variety of techniques can be used to resolve conflict on citizen advisory B&Cs. The most common techniques are those used to make a decision, thus bringing closure to an issue: voting or negotiating a compromise. Problem-solving techniques are used to find a solution that each member views as the best possible. B&C members should understand the difference between making a decision and creating a solution by working together.

Decision Making. When conflict is minimal or nonexistent, B&Cs often vote to make a decision. Yet, even as simple and common an approach as voting can cause problems for

a B&C. For example, problems are likely to occur if members have strong feelings about the issue being voted on, particularly if they feel the issue was not sufficiently discussed and debated.

Further, voting produces winning and losing factions on a B&C. A member or members who frequently end up on the losing side may begin to feel less and less a part of the group. Finally, the losing members won't feel a part of the decision that was made and the B&C may begin to polarize. A chairperson who consistently uses the vote to make decisions must be prepared to deal with the feelings of those on the losing side.

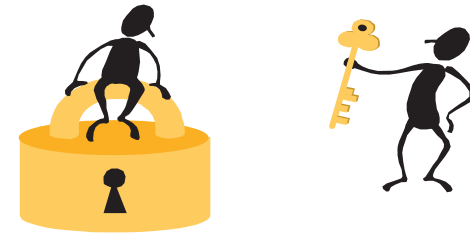
The second technique for making decisions, negotiating a compromise, often is used when B&C members have developed firm positions about an issue. Negotiating requires more time and effort than does voting. In particular, negotiating requires communication skills and cooperation among B&C members. Ideas must be presented clearly and each participant must be willing to listen to possibilities for compromise. The best compromise is one that all members can support.

Participants must realize that negotiation is a process of give and take. B&C members should be encouraged to think about their positions, set priorities, and decide which demands they are willing to exchange for something more important. In most cases, an acceptable compromise can be reached because each party will have to give up something.

Problem Solving. Solving a problem is much more involved than the above two methods for resolving conflict. When B&Cs are faced with serious conflict, they should go beyond simply reaching a decision to expending the time needed to actually solve the problem. Trying to force a decision when the level of conflict is high may produce a poor decision, sacrifice the group's cohesiveness, and exacerbate conflict on the B&C and in the community.

Problem solving requires finding a solution that satisfies every member of the group. This implies that every group member must participate in the problem-solving process. It may be necessary to schedule a special meeting to resolve a particularly difficult conflict.

There is no easy resolution of conflict that sometimes surrounds issues of importance. When conflict does arise, finding a solution is necessary to allow an advisory B&C to make sound recommendations that each member will support. The most important thing for B&C members to remember is that they are colleagues, that they are part of the same team, and that each team member has a unique contribution to make.



RELATIONSHIP WITH THE COMMUNITY

One duty of B&Cs is to provide public information for and to receive public comments from individuals or groups interested in the B&C's area of responsibility. B&Cs can use a variety of techniques to involve and inform the public. Specific guidelines on each format are provided in the County's *"Public Involvement Manual"*. Your staff liaison can provide a copy.

RELATIONSHIP WITH THE MEDIA

B&Cs must recognize that local government is a source of news for the local media. In this connection:

- Consider all public statements in light of how they would appear in the newspaper.
- Remember that you are viewed as a spokesperson for the County of Los Alamos even though it is not in an official capacity.
- Consider responding to letters to the editor very carefully. What is the potential for escalating a controversy? Will such a response resolve the problem?
- If possible, avoid saying "no comment." Indicate why you cannot comment at this time or that you will be able to comment after the meeting or at a later time. See #1 on the next page.



Working with the Media

By Julie Habiger

Being a member of a B&C can expose you to more attention from the media than you might otherwise receive as a citizen. Chances are, you already know the "logistics" part of being on a B&C and the fact that your meetings must be open to the public with a published agenda - this means the media can attend and report on your meetings. However, what happens outside the meetings if you are approached by a newspaper reporter or TV news team, wanting your comments and thoughts about an issue? Here are some tips:

1. Sometimes it's okay to say "no comment." While you should keep an open, communicative relationship with the media, or anyone in the public, you need to remember that it's tough to communicate all the facts in a conversation to someone who hasn't got the history you have in studying the issues brought forward to your B&C. Avoid off-the-cuff answers to questions that might assume the person asking the questions is knowledgeable in the subject matter.

2. Remember when you speak, you're part of a larger majority. There's a reason why B&Cs boast a certain number of members -- it allows for a diverse range of opinions and viewpoints. For that reason, it's not appropriate to speak to the media in a manner that would indicate that your personal opinion represents that of all your fellow members. Presenting a common front is important in making your B&C work as a team, so taking the extra time early on in dealing with an issue to discuss how you will present your findings and recommendations to the public is just as important as the decisions you make.

3. Be open and honest in your response, but remember it's okay to say "I don't know" or "Let me find out and get back to you" if you really don't have all the answers. Reporters work under tight deadlines and they need responses quickly. You need to appreciate their time schedules, but don't let their desire to have the whole story in a few minutes prevent you from taking an extra five minutes to check your facts. Better yet, if you don't feel comfortable, point them in the direction of someone else who might be better suited to deal with their questions; that could be the Chair of your B&C, your County staff liaison, a member of County Council, or the County Attorney's Office.

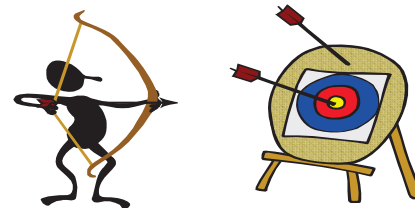
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4. What you say today to one person could be said to the world tomorrow.

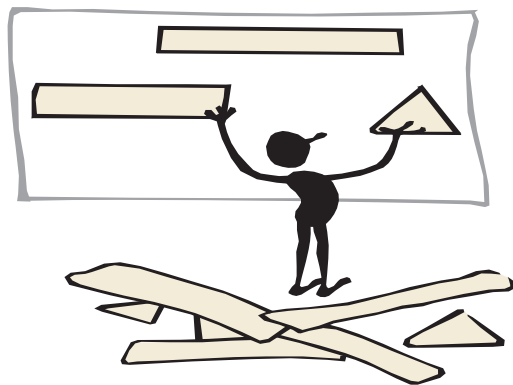
Unfortunately, when there is a volatile situation, when emotions run high or people feel they are personally being attacked, many rash statements are made in haste. If you're feeling that way, then this is not the time to talk to the media. You might say or do something you'll regret later. Reports go out on the wire all around New Mexico and the U.S., so your comments could be far-reaching and have tenfold greater "damage control" potential than another day when you might answer differently. Offer to reschedule a time when you, not the reporter, are feeling more appropriately in control of the interview.

5. Beware of leading questions. This goes back to the old adage of "look before you leap" or in this case "weigh your answers carefully before you speak." Most of the time the media has a specific angle to a story, and they are looking for you to substantiate or provide additional information relative only to that perspective. Leading questions start with phrases such as, "Would it be fair to say that...". "Is there any truth to the rumor that ...", "What have you heard about ..." followed by a specific story angle that the reporter is working on for their TV or radio station or newspaper. Other tactics are for the reporter to state their opinion and ask you to substantiate it. Here's an example: "The Wen Ho Lee case must have been very disruptive to life in Los Alamos -- how has the County dealt with this disruption?" This question leads you to answer based on the assumption that the reporter, not you or the County, has already decided that there was indeed a disruption, when in fact there might not have been any issues at all that impacted the County! Finally, it isn't uncommon for members of the media, acting on a hunch, to try to "fish" for a story by asking leading questions simply to find out what you do or don't know about a topic. The reporter will try and make their questions come across as if "surely you must know about this" (and thus you feel compelled to offer an answer rather than appear to look ignorant about the situation).

The bottom line in dealing with the media is this: be honest and do your best to be informative -- just remember to think before you speak, and weigh what you do or don't know in answering their questions.



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THE B&C SUPPORT SYSTEM

To be effective, a B&C needs a strong support system. Here are seven critical elements in this support system.

- An agenda that provides order and information.
- Staff reports that are clear, concise, and informative.
- Minutes that are timely, clear, and succinct.
- Operating procedures that help rather than hinder the group process.
- A chairperson skilled in facilitating decision making with a diverse group.
- Meetings that begin on time, adjourn at a reasonable hour, and result in clear recommendations or actions taken.
- Meetings that are scheduled to maximize B&C member and public participation.

1. THE AGENDA

The agenda is one of the most important tools of the B&C. It is defined as a list, outline or plan of things to be considered. It focuses the discussion at a meeting by specifying topics and the order in which they will be addressed. The B&C chairperson, in consultation with the staff liaison, traditionally sets the agenda for each B&C meeting. Please reference the B&C Rules (Section II of this manual) for specific guidelines related to agenda items. See also: [Exhibit A - Sample B&C Agenda](#).

As required in the County's current annual Open Meetings Resolution, all B&C's must comply with the following regulations provided in the NM Open Meetings Act (NMSA 1978 Section 10-15-1 - Revised 2013) related to B&C agendas:

"Meeting notices shall include an agenda containing a list of specific items of business to be discussed or transacted at the meeting or information on how the public may obtain such an agenda. Except in the case of an emergency or in the case of a public body that ordinarily meets more frequently than once per week, at least seventy-two (72) hours prior to the meeting, the agenda shall be available to the public and posted on the public body's web site, if one is maintained. ...Except for emergency matters, a public body shall take action only on items appearing on the agenda. For purposes of this subsection, an "emergency" refers to unforeseen circumstances that, if not addressed immediately by the public body, will likely result in injury or damage to persons or property or substantial financial loss to the public body."

2. STAFF REPORTS

Staff reports, written or oral, are an indispensable part of the B&C process. They are used to:

- Frame issues
- Provide facts and focus
- Provide chronologies
- Identify issues and alternatives
- Present the staff's position
- Make a recommendation

3. B&C MINUTES

The minutes represent an official record of the B&C's discussions and actions. A draft of the minutes must be prepared within ten working days after the meeting. Both draft and official copies of B&C minutes are open to public inspection.

Official B&C minutes:

- Record B&C actions
- Communicate background to the County Council
- Provide perspective on issues
- Provide a historic record of the proceedings
- Provide summary of items that need follow up
- Include reports and/or recommendations from respective subcommittees and working groups

The New Mexico Open Meetings Act (NMSA 1978 Section 10-15-1) requires minutes of open meetings to record at least the following information:

- a) *the date, time and place of the meeting;*
- b) *the names of all members of the body in attendance and a list of those members absent;*
- c) *the substance of the proposals considered; and*
- d) *a record of any decisions made by the body and of how each member voted.*

According to the NM Attorney General's OMA Compliance Guide, this means that minutes must contain a description of the subject of all discussions had by the body, even if no action is taken or considered. This may be a concise, but accurate, statement of the subject matter discussed and does not have to be a verbatim account of who said what. It may be useful, although it is not required, to also record the other persons invited or present and who participate in the deliberations." (Emphasis added)

4. PROCEDURAL RULES

B&Cs rely upon rules to facilitate meetings. These rules provide the process for conducting meetings in an orderly, efficient and fair manner. Rules may be formal or informal. Council-approved Rules and Procedures for all County B&Cs are provided in Part II of this Orientation Manual.

PREPARING MOTIONS

B&C meetings are usually conducted according to basic parliamentary procedure (Robert's Rules of Order.) The chairperson directs the meeting, and his/her rulings must be followed unless overruled by the body.

When a member wishes to propose an action for the B&C to consider, the member makes a motion. A motion generally goes through the following steps:

- The member asks to be recognized by the chairperson.
- After being recognized, the member makes the motion "I move that we..."
- Another member seconds the motion. "I second the motion."
- The chairperson may re-state the motion and asks for discussion.
- After the B&C has concluded its discussion, the chairperson then asks for public comment.
- When the chairperson feels that there has been enough discussion, the debate will be closed and the chairperson asks, "Are you ready for the question?" or "Is there any further discussion?"
- If no one asks for permission to speak, the chairperson then puts the question to a vote.
- After the vote, the chairperson announces the decision. "The motion is carried" or "The motion is lost".

A FEW COMMON MOTIONS:

- Introduce an Item: "I move that..."
- Delay Consideration: "I move to table the motion until..."
- Close Debate: "I call the question."
- Limit or Extend Debate: "I move to limit or extend debate to..."
- Request More Study: "I move to refer this to staff for further study."
- Amend a Motion: "I move to amend..."
- Object to Procedures: "Point of order."
- Reconsider a Vote: "I move to reconsider the vote on..."
- Adjourn Meeting: "I move to adjourn."

PHRASING AND DIVIDING MOTIONS

Phrasing a motion can be difficult and corrections may be necessary before it is acted upon. Until the chairperson states the motion, the B&C member making the motion may rephrase or withdraw it.

B&C members may wish to write out motions beforehand or ask staff to prepare a draft for difficult ones. If a motion gets too complicated, ask staff to prepare the wording.

In making a motion, avoid including more than one proposal in the same motion. This is especially important when B&C members are likely to disagree. If a B&C member prefers to see proposals divided and voted upon separately, the B&C member can ask the chairperson to divide the motion. If others do not object, the chairperson may proceed to treat each proposal as a distinct motion to be acted upon separately.

5. CHAIRPERSON RESPONSIBILITIES

The chairperson is the key to the effectiveness of the group process and can be likened to the team captain. The chairperson provides group direction and sets the tone for meetings.

The chairperson must balance being strong enough to move the meeting along and democratic enough to involve all members in the meeting. To be effective the chairperson needs the support of the members.

Trust is built by evenhandedness and fairness to all the participants. It also means that the chairperson does not use powers of the chair unfairly to win a point or argument.

THE EFFECTIVE CHAIRPERSON:

- Prevents overly dominant B&C members from having a disproportionate influence.
- Protects B&C members and staff from verbal attacks.
- Solicits opinions, feelings and positions from reticent B&C members.
- Protects new thoughts from being rejected prior to fair evaluation.
- Discourages finger pointing and blame-oriented statements or questions.
- Keeps the discussion focused on the problem.
- Knows how to run meetings utilizing, as appropriate, the principles of Robert's Rules of Order
- Encourages the generation of alternative solutions.
- Delays evaluation and analysis of alternatives until all are on the table.
- Guides the process of screening alternatives and selecting the solution.
- Attempts to obtain consensus.
- Moves the meeting along and does not let the B&C drift off the subject at hand.
- Coaches and helps B&C members develop their skills.

CHAIRPERSON MISTAKES:

- Uneven treatment of B&C members.
- Failure to maintain a balance between closing discussion in a timely manner and not cutting off discussion before members are ready.
- Allowing the meeting to become too informal or the discussion to drift.
- Losing track of amendments to motions.
- Forgetting to relinquish the gavel when the chairperson becomes enmeshed in an issue.
- Failure to recognize and deal with B&C member objections to procedure or process.
- Failure to protect B&C members and staff from verbal attacks.
- Ignoring input from disagreeing B&C members.
- Not explaining the process being followed to the audience.
- Failure to restate motions before they are voted upon.
- Forgetting to call breaks during long meetings.
- Failure to apply time limits on speakers consistently.
- Not reconvening the meeting at the specified time after a break.
- Not knowing rudimentary principles of Robert's Rules of Order

6. MEETING TIMES

Notification of B&C meetings will be made by the staff liaison or the B&C Chairperson in accordance with current Council policy regarding the length of time required for adequate public notice.

All meetings of B&Cs will be open to the public except as specified by law.

The B&C Chairperson will be responsible for beginning the meetings on time and adjourning at a reasonable hour.



7. EFFECTIVE PUBLIC PARTICIPATION

People presenting an issue to the B&C may have never appeared before a public body. The experience can be intimidating. Anxiety may be displayed through aggressiveness or forgetfulness. Imagine yourself in the position of having to address the B&C. You can help people by:

- Calming and reassuring them.
- Explaining meeting procedures.
- Paying attention and not doodling or reading.
- Actively listening to what they are saying. B&C member questions are not appropriate at the time of public comment.
- Avoiding baiting and lecturing, but don't let this stop you from expressing the reasons behind your vote.

OPEN MEETINGS ACT COMPLIANCE - ROLLING QUORUM:

The New Mexico Open Meetings Act (Chapter 10, Article 15 Section 1 (B) NMSA 1978) requires B&C business to be conducted in a properly noticed open meeting:

"All meetings of a quorum of members of any board, commission, administrative adjudicatory body or other policymaking body of any state agency, any agency or authority of any county, municipality, district or any political subdivision held for the purpose of formulating public policy, including the development of personnel policy, rules, regulations, or ordinances, discussing public business or for the purpose of taking any action within the authority of or the delegated authority of any board, commission or other policymaking body are declared to be public meetings open to the public at all times, except as otherwise provided in the constitution of New Mexico or the Open Meetings Act [Chapter 10, Article 15 NMSA 1978]. No public meeting once convened that is otherwise required to be open pursuant to the Open Meetings Act shall be closed or dissolved into small groups or committees for the purpose of permitting the closing of the meeting." (Emphasis added.)

Discussions among B&C members outside the open meeting can run afoul of this statutory provision. In such instances it may amount to what is called a "rolling quorum." A rolling quorum can be avoided by refraining from discussing B&C business outside the meeting room and avoiding e-mail correspondence and/or phone calls related to B&C business.

Compliance with the Open Meeting Act can present complicated questions and concerns. Per the Charter the County Attorney serves as the legal advisor to County B&Cs. If any B&C member has questions or concerns about Open Meetings Act compliance, the member should contact the County Attorney's office for advice and counsel on the matter.



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BEHAVIORS THE PUBLIC NOTICES

B&Cs develop a personality that is quite observable by audience members. Some B&Cs are characterized as being warm and friendly, while others are known as formal and distant. Both verbal and non-verbal actions help define this group personality. Things noticed include:

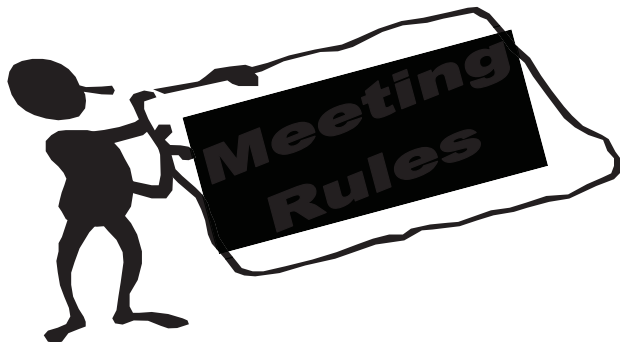
- Whether the chairperson effectively manages the meeting.
- Whether the B&C is respectful of the audience.
- Whether the individual B&C members have prepared for the meeting.
- Whether the B&C members really listen to audience concerns.
- Whether B&C members explain technical terms and jargon.
- Whether the B&C sticks to the agenda and doesn't drift.
- Whether the B&C keeps the audience informed of procedures.

MANAGING DIFFICULT MEETINGS

From time to time, B&Cs are faced with conducting highly charged controversial meetings. These meetings may involve one or more groups with conflicting views. (Please review the "Public Involvement Guide for Boards and Commissions" for more detailed information on conducting traditional public hearings.)

In a difficult meeting, the participants' demeanor may be characterized by aggressiveness and hostility. Such meetings really test the mettle of the B&C and staff. Consider the following:

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BEFORE THE MEETING

- Make agendas and back-up reports readily available to participants.
- Make sure adequate seating is available. Consider moving to larger quarters if necessary.
- Make sure sound and recording equipment is adequate and operational.
- Establish and announce rules before the meeting.
- The chairperson and staff should engage in contingency planning before the meeting.
- The chairperson should alert staff to prepare responses for anticipated questions not already answered in the agenda documentation.

DURING THE MEETING

- The Chairperson should open the meeting by explaining to all attendees the purpose of the meeting, the issues involved, the possible actions, and the procedures that will be followed at the meeting.
- Don't spend a large amount of time at the beginning of the meeting on routine items such as correcting the minutes.
- Have speakers address the B&C and not the audience. Some speakers are very adept at inciting audiences, especially if they are permitted to face the audience.
- Stop clapping and shouting early. Explain the reasons why such actions are disruptive and counterproductive.
- Don't hesitate to use recesses to help diffuse hostility or aggressiveness.
- Consider limiting speakers to a set time such as three minutes. If

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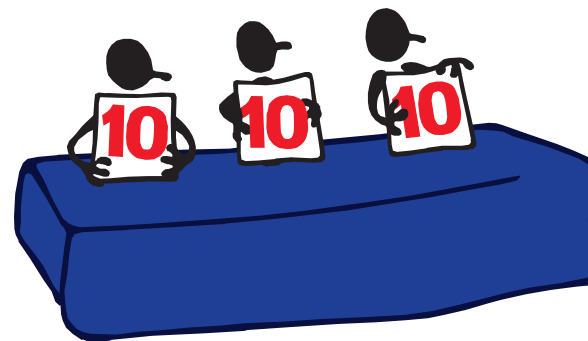
such a procedure is used, make sure it is applied fairly and consistently.

- Continue items that cannot be decided at the meeting. This should not preclude the B&C from allowing anyone who wishes to speak on the issue from doing so.

MAKING TOUGH DECISIONS

When confronted with a tough problem, here are some questions to consider to help you think through a pending decision. Not all these apply in all situations.

- Is this a matter of public safety?
- What would the impact on the budget be?
- Who will be hurt by the proposed action? Who will benefit?
- Do I have a conflict of interest in this matter?
- Do others who are involved have a conflict of interest?
- Do I have enough information to make a decision?
- Is the proposed action consistent with County Council's goals and budget guidelines?
- Are we dealing with symptoms and not the actual problem?
- What past practices relate to this issue?
- What is staff's recommendation and, if B&C action will not be consistent with staff's recommendation, why not?



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PART II
LOS ALAMOS
COUNTY BOARDS AND COMMISSIONS
PROCEDURAL RULES
Amended by Council on August 6, 2024

I. FOREWORD

These rules are referenced in the County Code Section 8.15 and adopted as a set of operating procedures for all B&Cs, unless otherwise provided by law. The rules are made to facilitate the orderly transaction of public business and discussions. Quasi-judicial hearings conducted by B&Cs shall be governed by separate rules. Where there is a conflict between these rules and the quasi-judicial hearing rules, the quasi-judicial rules shall prevail.

These rules shall remain in effect until rescinded or superseded by action of the Council or by an action of the B&C that is officially approved by Council.

II. OFFICERS AND MEMBERS

1. Election. The B&C shall annually elect a chairperson (herein after called "chair") and a vice-chair from among its members. Each B&C will set the time frame for this election. The chair and vice-chair will serve at the pleasure of the B&C and will be eligible for election to subsequent terms.
2. Chair. The chair shall preside at B&C meetings. In addition, the chair shall:
 - a. represent the B&C in public and, when authorized by the B&C, speak and act on behalf of the B&C;
 - b. communicate and follow up with Council on the activities and recommendations of the B&C;
 - c. keep B&C members informed of events, meetings or other occasions where the Chair acted or will act as the official spokesperson for the B&C;
 - d. ensure that all other B&C members are informed, as soon as practicable, of significant communications directed to the chair. This includes responses from the Council to all B&C reports or recommendations submitted to Council;
 - e. appoint a B&C member to serve as chair in the absence of the chair and vice-chair when the chair and vice-chair are on travel or otherwise unable to perform their duties;
 - f. meet regularly with the assigned Department Director;
 - g. meet regularly with the assigned Council liaison;
 - h. make appointments to subcommittees, subject to approval by the County Council ;
 - i. set the agenda for B&C meetings in consultation with the staff liaison or department director;
 - j. take responsibility for initiating action on directives from the County Council;
 - k. prepare annually the B&C work plan, in consultation with the staff liaison and department director, subject to B&C approval;
 - l. attend the regular B&C chairs' luncheon or designate another B&C member to attend;
 - m. call special meetings;
 - n. assign work to individual B&C members; and
 - o. request less than a quorum of the B&C members, and as appropriate, community members and other advisors, participate in a working group when advice on a subject or range of subjects is needed to gather information and make recommendations to the B&C.
 - p. serve on the interview panel for applicants wishing to serve on the B&C, or select a designee for this role if necessary (e.g., the chair is seeking re-appointment)
3. Vice-Chair. The vice-chair shall assist the chair in the performance of the duties of the chair, and act in the chair's place when the chair is absent from Los Alamos County or otherwise unable to perform the duties of the chair.
4. B&C members.

B&C members, including the chair and vice-chair, have equal powers and duties except as otherwise specified in the B&C enabling legislation and these procedural rules. The chair and vice-chair shall participate in discussion and voting on a basis equal to all other B&C members. In addition to the duties specified in the B&C enabling legislation, B&C members shall, to the extent possible:

 - a. stay informed of County policies;
 - b. in all public statements, make clear that they speak only for themselves unless authorized by the B&C to speak for the B&C as a whole (See Procedural Rules Section VI);
 - c. represent the official policies or positions of the County or the B&C to the best of their ability when designated as a delegate for such purpose and report to the B&C on meetings or functions to which they served as a delegate;
 - d. maintain the confidentiality of County records and other information that is made confidential by law, is privileged, or has otherwise appropriately been identified as confidential and may be withheld from public inspection;
 - e. comply with all applicable federal, state and local laws, rules and regulations applicable to public officials and the conduct of public business, including compliance with the NM Inspection of Public Records Act and county policies regarding the inspection of public records;
 - f. respect and adhere to the Council-Administrator structure of the Los Alamos County government and not interfere with the administrative functions of the county or the professional duties of the County staff; nor impair the ability of staff to implement Council policy decisions;
 - i. B&C members shall not lobby for or against County employment of any person. Providing information is permissible.

- ii. B&C members shall not give direction to any of the subordinates of the County Administrator, either publicly or privately, and shall copy the appropriate department head and County Manager on any written communication to a staff member. Nothing in these rules should be interpreted as prohibiting normal social interaction unrelated to County business between B&C members and staff.
- g. treat staff respectfully; and
- h. abide by quasi-judicial procedures when serving in a quasi-judicial capacity.

5. Ex-Officio Members

Department representatives designated as "ex-officio members" shall attend B&C meetings and participate in the discussion as a non-voting member. Staff may advocate a particular position on potential B&C actions consistent with Council policy directives, initiatives and goals.

III. REMOVAL OR RESIGNATION

1. Removal. Except as may be otherwise provided by general law, the County Charter, the County Code, or Council Procedural Rules, B&C members serve at the pleasure of the County Council and may be removed for any reason at any time by a majority vote of the Council. The Chair of the B&C, the Council liaison, or the County Administrator may recommend consideration of a member's removal to the County Council. The reasons for removal may include, but are not limited to:
 - a. Continuous absences from all regularly scheduled meetings. Members who impair the proper functioning of the B&C due to their constant inability to attend meetings or to participate in B&C activities may be removed from the B&C.
 - b. Misconduct at meetings. Members whose actions seriously interrupt the orderly process of said meetings may be removed from the B&C.
 - c. Neglect of duty. Members who intentionally disregard duly assigned tasks or repeatedly fail to carry out the responsibilities expected of a B&C member may be removed from the B&C.
 - d. Ineligible to Serve. Members who do not maintain the eligibility requirements for appointment to the B&C may be removed.
 - e. Insubordination. Members who fail to accept direction from the County Council.
2. Resignation. B&C members may resign by giving appropriate written notice of resignation. Notice of intent to resign should be provided in writing to the County Council with a copy to the B&C chair. The chair shall notify the entire B&C, the County Manager's Office, and the Department Director of the resignation within one week. A B&C member who resigns his or her position may apply for re-appointment provided the member has not served two terms in succession. (See also County Code Section 8-6 (4).)

IV. BOARD MEMBER INTERVIEWS AND RECOMMENDATIONS TO COUNCIL

Except as may be otherwise provided by general law, the County Charter, the County Code, or Council Procedural Rules, the following shall apply to interviews and appointment to the County's B&Cs:

1. Los Alamos County residents may apply to serve on one of many B&Cs. Terms for B&C members range from one to five years. Interested citizens may apply for a position on any B&C that has a vacancy.
2. After completing an application, individuals are interviewed by the B&C's Councilor Liaison, Staff Liaison, and B&C Chair or their designee ("Interview Panel").
3. The Interview Panel is responsible for making a recommendation(s) for appointment to the County Council.
4. If the Interview Panel does not have a recommendation for appointment, it shall interview more applicants until an agreed-upon recommendation of the Interview Panel can be made to County Council.
5. The Interview Panel shall document its interview process which shall include details about who it interviewed, for which positions, and who was/was not recommended for which positions. This document shall be maintained by the Staff Liaison, and made available to Council upon request.
6. The Interview Panel's agreed-upon recommendation shall be forwarded to and considered by County Council along with all of the applicants' information, including the applications and the Interview Panel's interview notes.
7. County Council may vote on the set of applicants, may remand the list to the interview committee for additional applicants, or take other action as deemed appropriate.
8. B&C Member appointments require a minimum vote of four (4) of the County Council.

V. B&C MEETINGS

1. Regular Meetings and other meetings.
 - a. Frequency of meetings. The schedule and/or frequency of the regular meetings of the B&C shall be set by its members or as designated in its enabling legislation.
 - b. Meeting notification. Notification of regular meetings shall be made by the chairperson or designee in advance of each regular meeting and in accordance with current council policy regarding the length of time required for adequate public notice. When possible, such notification shall be in the form of the B&C's agenda following the format provided below. Meeting notification shall also include a description of the accommodations that can be made for disabled individuals.
 - c. Open Meetings. The B&C shall comply with the annual Council resolution regarding open meeting requirements. The meetings of a B&C shall be open to

the public as specified in the county resolution except when the chairman, or a majority of regular members of the B&C, determines that a topic requires confidential discussion as defined in the New Mexico Open Meetings Act. The chairman, or a majority of members, may call for a closed session for the purpose of such discussion and action. This request is subject to legal review and approval by the County Attorney. All final B&C decisions must be voted upon in public.

- d. Emergency or Special Meetings. The B&C shall comply with the annual Council resolution regarding special or emergency meetings.
- e. Meeting agenda
 - i. The B&C chair, in consultation with their staff liaison is responsible for developing the B&C meeting agenda. Agendas for all B&C meetings will be posted in accordance with the Council's annual Open Meetings Resolution.
 - ii. Any B&C member may request to have an item placed on the agenda. The item will be placed on the agenda as soon as practicable. The B&C can then:
 - a) decide to take no further action;
 - b) take the requested action or a different action at that meeting; or
 - c) request that staff research the matter and return to the B&C with information and/or options or a recommendation for action.
 - iii. A typed agenda shall be prepared for each B&C meeting. The agenda shall include the following (in suggested order):
 - a) Call to Order/Roll Call
 - b) Public Comment (Limited to items not already on the agenda)
 - c) Public Hearings (if applicable)
 - d) B&C Business
 - i. Approval of B&C minutes
 - ii. Chairman's report
 - iii. (Other topics)
 - e) B&C/Staff Communications
 - i. Action Items
 - ii. Staff Reports
 - iii. Working Group or Subcommittee Reports
 - f) Public Comment
 - g) Informational Items - set date/time and agenda for next meeting (if applicable)
 - h) Adjournment

iv. Publication of agenda. In addition to the notice in the regular B&C meeting calendar prepared by the County Manager's office, it shall be the responsibility of the B&C staff liaison, or designee, to provide a copy of the agenda to the news media within the time provided under the County's annual Open Meetings Act resolution as a means of notifying the public of all B&C meetings. A B&C meeting announcement shall also be posted at the County Municipal Building.

2. Meeting Conduct.

- a. Presiding officer. The chair is the presiding officer of B&C meetings and shall conduct the meetings of the B&C and see that these procedural rules are observed. In the chair's absence, the vice-chair shall preside.
- b. Robert's Rules. Meetings of the B&C shall, in general, be conducted in accordance with Robert's Rules of Order, Newly Revised, 10th Edition, except to the extent these procedural rules require otherwise. The B&C may elect to follow an alternative procedure at any time or with regard to any matter for the purpose of facilitating the orderly transaction of public business.
- c. Civility. It is the responsibility of the presiding officer to assure that the B&C meeting is carried out in a civil manner. The chair may require that any person, including a B&C member, yield the floor in order to maintain civility. B&C members are expected to refrain from making offensive comments.
- d. Order of presentation. For each item on the agenda, other than reports provided in writing, there will usually be a presentation by the staff, committee, citizen or other person who is bringing the matter forward. B&C members will be given the opportunity to ask clarifying questions, as well as an opportunity to make statements. For all business items and public hearings, public comment will be invited on each item prior to voting on the motion with respect to that item.
- e. Motions. If a subject on the agenda will require action by the B&C, the best practice is to engage in discussion only after a motion is made and seconded. The discussion should be focused on the motion under consideration. The chair may, however, allow discussion prior to the time a motion is made to allow a full discussion of a broad topic.
- f. Recognition to speak. B&C members will speak after being recognized by the presiding officer. B&C members, other than the presiding officer, shall be recognized to speak in the order in which the members indicate an interest in speaking. Each B&C member is encouraged to speak only once with respect to the motion on the floor, but the presiding officer may recognize members to speak a second time on a topic if time allows and the B&C members wish to make additional comments. The presiding officer may, to assure the timely completion of the meeting, limit the remarks of a B&C member addressing a particular motion to three (3) minutes. The presiding officer will normally make his or her remarks after all of the other B&C members have been given an opportunity to speak at least once.

- g. Three (3) Minute rule. Any B&C member can enforce the three (3) minute rule (limiting an individual's right to speak to three minutes or less) as a point of order.

3. Voting

- a. B&Cs shall observe the following procedures in voting:

- i. Only regular members of a B&C shall have the privilege of voting on matters or questions under consideration by the B&C.
- ii. Each regular member, including the chairperson, shall have one vote.
- iii. Proxy voting is not allowed.
- iv. Members who have a financial interest in the outcome of any policy, decision, or determination shall not participate as a member in deliberations, vote, nor act on the issue in which they have an interest, as stipulated in Article 910 of the County Charter. Otherwise, every B&C member present shall vote when called upon without abstention or passing. Please refer to the above section "B&C Member Responsibilities" for further clarification and guidance on conflicts of interest. If a B&C member is concerned that a conflict of interest prohibits the member from voting on an item, they should contact the County Attorney's Office in advance of the vote to receive guidance and counsel on the potential conflict of interest.
- v. Votes shall be taken only on issues that have been clearly defined, moved and seconded.
- vi. Except as otherwise provided by law, discussion shall be encouraged after a motion has been made and seconded.
- vii. All votes, except on procedural motions, shall be conducted by roll call vote, by voice or a show of hands.
- viii. Unless otherwise provided by law, a motion shall carry upon the affirmative vote of the majority of the total number of appointed voting members of a B&C. (See County Code Section 8-6 (4).)
- ix. The results of all votes shall be announced and duly recorded in the minutes.

5. Public comment and testimony. While maintaining a business-like atmosphere, board and commission members will attempt to make citizens attending the meetings feel welcome and comfortable. Citizens or other attendees will be afforded opportunities to speak during public comment periods near the beginning and at the end of each meeting, and to provide testimony at the public hearings. Public comment opportunities will be provided during the meeting for each item on the agenda before action is taken. Public comments will be limited to three (3) minutes unless a different parameter is established by the Chair before public comment begins.. With regard to topics not on the agenda that are raised during public comment, the B&C may not take any action other than to request the topic be placed on a future agenda.

6. Minutes. The B&C shall keep written minutes of all meetings. The minutes shall include, at a minimum, the date, time and place of the meeting; the names of members in attendance and those absent; the substance of the proposals considered; and a record of all decisions and votes taken which show how each member voted. It may be useful, although not required, to also record the other persons invited or present who participate in the deliberations.

- a. Draft minutes are to be prepared within ten (10) working days after the B&C meeting. Copies of the draft minutes must be available for public inspection and should clearly indicate on the draft that they are not the official minutes and are subject to approval by the B&C. If a B&C member wishes to request a change to the draft minutes, the suggested revisions must be specifically indicated, verbally or in writing, by page and line number.
- b. The B&C must approve, amend, or disapprove draft minutes at the next meeting of a quorum, and the minutes are not official until approved by the B&C. After approval by the B&C, the B&C chair will sign the minutes.
- c. The signed copy of B&C minutes shall be maintained in accordance with the county's record retention schedule by the staff liaison. A copy of the B&C minutes will be sent to the County Manager's Office to be temporarily maintained for Council review.

7. Implementation of B&C Meeting Actions. The Chairman of the B&C shall make all B&C recommendations to the Council by memorandum, e-mail, or formal report. Copies will be sent to the Department Director and staff liaisons including requests for comments to Council on the recommendations. The Chair will report the decision/recommendation of the majority of the B&C. A significant minority position may be reported if a majority of the B&C directs its Chair to include the minority position in the report. Whenever the Council wishes, it may request a report of the B&C. Reports to the County Manager or Department Director will be in a form as requested by the Manager or Department Director.

- a. County departments may provide staff reports to the County Council, through the County Manager, regarding B&C actions. Such reports may supplement, agree with, or take positions opposed to, the recommendations of the B&C. If a staff report is prepared relating to a B&C recommendation or activity, a copy of the report shall be provided in a timely manner to the chairperson of the B&C before the report is presented to the County Council.
- b. Conflicts associated with the relationship between a B&C and staff shall be expeditiously referred in writing to the County Manager.

8. Public Records. The New Mexico Inspection of Public Records Act, NMSA 1978 Sections 14-2-1, et seq. (the Act), requires governmental agencies to make their records available to the public with limited exception. "Public records" means all documents, papers, letters, books, maps, tapes, photographs, recordings and other

materials, regardless of physical form or characteristics, that are used, created, received, maintained or held by or on behalf of any public body and relate to public business, whether or not the records are required by law to be created or maintained. B&C members should be aware that the documents, **including e-mails**, they have received or created on behalf of the County will generally be subject to disclosure pursuant to the Act.

- a. It is the general policy of the County to respond in a courteous and timely manner to all requests for public records and information made pursuant to the Act. The County has implemented an administrative policy and procedure (Administrative Procedure Guideline, Index #0280) to respond to requests for documents and information. B&C members should make themselves familiar with the policy so that they will avoid possible violation of the Inspection of Public Records Act.

VI. B&C WORKING GROUPS AND SUBCOMMITTEES

1. B&C Working Groups

- a. **Membership:** B&C working groups are relatively informal groups that are not subject to the Open Meetings Act and therefore shall be composed of less than a quorum of the B&C and may include members from the community or other advisors or experts. B&C working groups will engage in fact finding and only make non-binding recommendations to the B&C. A current list of the B&C's working groups is maintained by the County Department the B&C works with.
- b. **Establishment:** The Chair of the B&C may create a new working group or may staff an existing working group by requesting that less than a quorum of the B&C's members, and as appropriate, community members and other advisors or experts, participate when advice on a subject or range of subjects is needed to gather information and make recommendations to the B&C. The B&C Chair may appoint an alternate B&C member to the working group, but the total number of B&C members appointed (regular and alternate) must be less than a quorum of B&C members.
- c. **Non-Binding Recommendations:** Any policy recommendations made by a working group to the B&C are not binding on the County or the B&C in any legal or practical way. Any policy recommendations made by a working group are only binding on the County if adopted by the Council at a public meeting.
- d. **Participation in Working Groups:** Requests for participation in working groups will be made annually by the Chair of the B&C on a rotational basis so that other B&C members and/or community members will have the opportunity to participate, unless the Chair determines that there is good reason for the existing members to continue participating in the working group.

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- e. **B&C Members Responsibilities.** B&C members who agree to participate in a B&C working group shall make reasonable efforts to attend meetings of the working group. If the B&C member is unable to attend meetings on a regular basis, the B&C member shall notify the Chair and request that another B&C member be appointed to the working group. B&C members participating in a working group should assure the working group focuses its efforts on the matter assigned and provides recommendations to the B&C on the matter assigned. To avoid a rolling quorum, members of the B&C who have not been assigned to a given working group may not attend meetings of the working group. B&C members participating in a working group may not discuss the working group's business with other members (of the same B&C) outside of a public meeting of that B&C.

- f. **Reporting to the B&C:** When a working group is ready to report to its B&C or otherwise needs to communicate with its B&C, a member of the working group shall make a request to the Chair to be placed on the B&C's agenda. The Chair shall honor this request and place the working group on the earliest convenient agenda for the B&C. However, working groups shall be placed on the B&C's agenda to provide updates on their work to its B&C at least once a quarter.

2. Subcommittee Purpose and Council Approval

Periodically, a B&C may recommend Council establish a subordinate subcommittee to advise and make recommendations to the B&C, to perform additional research on, or to gather public input for a particular project or specific topic in the area of responsibility of the B&C. To create subcommittees that may include members not currently serving on the B&C, approval of the Department Director and County Council must be obtained prior to creation.

3. Subcommittee Creation

The motion seeking to create a subcommittee must approve a recommended charter for consideration by the County Council that, at a minimum, sets forth the following:

- a. The name of the subcommittee
- b. The purpose of the subcommittee
- c. The deliverable or product, if any, to be presented upon completion of the purpose
- d. The number of members
- e. The term of each of the members
- f. To whom the subcommittee reports
- g. The staff support and resources expected to be provided

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- h. The termination date ("Sunset Clause") for the subcommittee

Once the B&C approves a recommended charter for the subcommittee, the matter shall be placed on a Council agenda for consideration by the County Council.

4. Subcommittee Membership.

- a. Number of Members. Except under unusual circumstances, a subcommittee will consist of not less than 3 members nor more than 5 members. Requirements for subcommittee membership will be determined by the B&C and can include volunteer citizens that are not currently serving as members of the parent B&C, subject to Council approval.
- b. Residency Requirement. Preference will be given to residents of Los Alamos County in appointment to a subcommittee, but residency will not be a requirement for appointment.
- c. Open Meetings Act. As the subcommittee is created through formal action of the Council approving the subcommittee's charter, the subcommittee must comply with Council's annual Open Meetings Act resolution.
- d. B&C Membership. A subcommittee's purpose is to advise the B&C. In order to assure that advice is provided in a free and open discussion, no currently serving Council member will be appointed to serve on a B&C subcommittee. Service, even ex-officio, by a currently serving Councilor will not, except in unusual circumstances, be allowed.
- e. County Employee Membership. Charter Section 905.1 limits membership by County employees.
- f. Conflict of Interest. County Charter Section 910 sets forth the restrictions on service arising from conflicts of interest. Compliance with the Charter is required when appointing members to a B&C subcommittee. Please refer to the above section "B&C Member Responsibilities" for further clarification and guidance on conflicts of interest. If a board member is concerned that a conflict of interest exists, they should contact the County Attorney's Office to receive guidance and counsel on the potential conflict of interest.
- g. Term of Membership. The members of subcommittees can serve terms of no more than two years unless approved by Council.
- h. Voter Registration Status. Preference will be given to registered voters but registration as a voter will not be a requirement for appointment as a member of a B&C subcommittee.

5. Subcommittee Reporting Responsibility and Requirements.

- a. The motion creating the subcommittee will specify to whom the subcommittee specifically reports. All subcommittee communications, reports, or recommendations will be made to the standing B&C.
- b. The Chair of the subcommittee will make or prepare subcommittee reports to the B&C. The Chair will report the decision of the majority of the subcommittee. A significant minority position may be reported if a majority of the subcommittee directs its Chair to include the position in the report. Whenever the B&C wishes, it may request a report of the subcommittee.

6. Subcommittee Staff Support/Resources.

- a. Prior to the passage of a motion recommending the County Council create a new subcommittee or renew the term of an existing subcommittee, the B&C will identify with specificity the resources to be committed by the County in support of that subcommittee. The appropriate County Department Director shall have the authority to determine what, if any, administrative or staff support will be provided to a B&C subcommittee.

7. Subcommittee Term of Existence.

- a. Each subcommittee shall be established for a period of not more than one year; however, the subcommittee may be continued for additional one-year periods upon affirmative vote of the County Council extending the subcommittee's charter before the expiration of the subcommittee. A request by the B&C to the County Council to renew a subcommittee for an additional year period may be contained in the B&C's annual work plan approved by Council or by having the matter placed on Council agenda separately. The purpose of the one-year limited term is to encourage review for relevancy, duplication, focus, enhancement and performance. One-year terms are recognized as useful to reconfirm the need for the services of an existing subcommittee and to assure that administrative support is being supplied in an efficient manner best suited to the subcommittee's needs that does not overly-burden county resources and staff time.
- b. If the subcommittee expires prior to Council extending the subcommittee's charter, the B&C may pass a motion requesting the County Council revive and extend the subcommittee's charter. Upon passage of such a motion the matter shall be placed on a Council agenda for consideration by the County Council.

VII. CLARIFYING STATEMENT

A B&C member may attend any meeting, public or private, provided that there is not a quorum of the B&C at the meeting (if proper public notice has not been given) and

provided that, prior to speaking on a matter of the B&C business, or County business in general, the B&C member makes the Clarifying Statement below:

"What I say today is my opinion. I am not speaking on behalf of any board or commission or the County and I cannot tell you what action the County or County Council might take in the future with regard to any particular subject."

This provision is not intended to apply to ordinary conversations or other "meetings" that are not organized or called.

VIII. EXPENDITURE OF PUBLIC FUNDS

B&Cs cannot expend funds or create liabilities unless expressly authorized by law or otherwise authorized by the County Council.

DEFINITIONS

The Charter of the incorporated County of Los Alamos states that:

"The Council may create boards or commissions to advise the Council, the County Manager, or department heads, to hear appeals concerning any County operation, or to make investigations or reports the Council may designate. No B&C or Commission created by the Council shall have any authority except as granted by Council." - Article III Section 305. (Ord. 388 S4, 1994)

The following definitions shall apply to terms used in conjunction with Los Alamos County B&Cs:

Board or Commission -- A Board or Commission that is an ongoing volunteer citizen body created by ordinance or Council motion with a specified number of members who serve set terms.

Board or Commission subcommittee - a subcommittee that is subordinate to and created for the B&C by County Council approval of that subcommittee's charter. The subcommittee must be re-affirmed annually by the County Council.

Regular Member -- A voting member of a B&C by virtue of appointment by the County Council.

Ex-Officio Member -- A non-voting member of a B&C by virtue of office, the County Charter or Code, or by appointment by the County Council, County Manager, or Department Director.

Working Group -- A relatively informal group created by the Chair of a B&C requesting that less than a quorum of the B&C members, and as appropriate, community members and other advisors or experts, participate in the group on a subject or range of subjects is needed to gather information and make recommendations to the B&C that are not binding on the B&C or Council in any legal or practical way. Working Groups are not subject to the Open Meetings Act.

Exhibit A:



LOS ALAMOS

Sample Agenda
Name of B&C
Location of Meeting
Date and Time of Meeting

I. CALL TO ORDER/ROLL CALL

II. PUBLIC COMMENT

III. PUBLIC HEARINGS (if applicable)

III. B&C BUSINESS

- A. Approval of B&C Minutes
- B. Chairperson's report
- C. (List other topics)

IV. B&C/ STAFF COMMUNICATIONS

- A. Action Items
(List individual items)
- B. Staff Reports
(List individual items)
- C. Working Group and Subcommittee Reports
(List individual items)

VI. PUBLIC COMMENT

VII. INFORMATIONAL ITEMS

If applicable, set date/time for next meeting

VIII. ADJOURNMENT

If you are an individual with a disability who is in need of a reader, amplifier, qualified sign language interpreter, or any other form of auxiliary aid or service to attend or participate in the hearing or meeting, please contact the County Human Resources Department at 662-8040 at least one week prior to the meeting or as soon as possible. Public documents, including the agenda and minutes, can be provided in various accessible formats. Please contact the personnel in the Office of the County Manager at 662-8080 if a summary or other type of accessible format is needed.



Electric, Gas, Water, and Wastewater Services

Board of Public Utilities

Procedural Rules

May 21, 2014
Revision 1: May 20, 2015
Revision 2: July 15, 2015
Revision 3: December 16, 2015
Revision 4: March 16, 2016
Revision 5: August 18, 2016
Revision 6: January 18, 2017
Revision 7: August 16, 2017
Revision 8: January 15, 2020
Revision 9: February 19, 2020
Revision 10: July 20, 2022
Revision 11: August 16, 2023
Revision 12: September 18, 2024
Revision 13: August 20, 2025

This manual contains the current procedures adopted by the Los Alamos County Board of Public Utilities (BPU) to exercise jurisdiction and control of the Los Alamos Department of Public Utilities (DPU) in accordance with Los Alamos County Charter, Article V - Utilities.

https://library.municode.com/nm/los_amos_county/codes/code_of_ordinances?nodeId=PTICH_ARTVUT

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Part 1: Introduction and Administration

1.1. Purpose

These Procedural Rules (PR) contain the current rules adopted by the Incorporated County of Los Alamos (County), Board of Public Utilities (BPU) to fulfill its responsibility to exercise jurisdiction and control of the Los Alamos Department of Public Utilities (DPU) in accordance with the Los Alamos County Charter, Article V –Utilities and the County Code of Ordinances. Section 501.3, Organization of the Board of Public Utilities; The Board of Public Utilities shall adopt and shall file with the Council procedural rules and regulations not inconsistent with this Charter. This PR was initially adopted by the BPU on May 21, 2014.

1.2. Reasons for Adoption

- a. To realize the efficiency of having all on-going BPU general and meeting procedures in one place.
- b. To quickly orient new BPU members to current BPU procedures.
- c. To eliminate redundant or conflicting BPU procedures over time.
- d. To ease the reviewing of current procedures and processes when considering new issues.
- e. To support continuity and consistency of BPU processes and procedures.
- f. To provide clear, proactive guidance to the DPU and Utilities Manager.
- g. To comply with Article V of the Los Alamos County Charter and County Code of Ordinances.

1.3. Consistency

Each process or procedure in this PR is expected to be consistent with State and Federal law, the County of Los Alamos Charter, the Los Alamos County Code of Ordinances, and other County ordinances and resolutions, all of which have precedence over these BPU procedures. These PRs are specific to the Board of Public Utilities and if any differences exist with the broader *Los Alamos County Orientation Manual and Procedural Rules for Members of Boards and Commissions (B&Cs)*, this PR has precedence over the B&Cs procedures and rules. Except for time-limited or procedural-only BPU decisions (approving minutes, electing an officer, etc.), which are recorded in regular BPU minutes, all on-going BPU procedures shall be included or referenced in this document. The Utilities Manager is responsible for developing and implementing department processes and procedures that are consistent with this PR and the decisions of the Council and BPU.

1.4. Transition

As soon as some version of the PR is voted on by at least four of the five voting members of the BPU, those procedures are deemed to supersede any past procedure that might be found in old minutes unless a prior BPU resolution or contract obligates the BPU or DPU to a specific matter. If any actual or apparent conflict arises between the PR and other adopted policies or BPU resolutions, the matter shall be resolved by a majority vote of the entire BPU.

1.5. Changes

These rules will be reviewed and revised as necessary or at least annually at the regular July BPU meeting. The Utilities Manager will help the BPU formulate new language in the PR by distributing proposed changes in advance using software that shows all changes for BPU members to review. Any change to this PR must be approved by a vote of at least four of the five voting members of the BPU. Any BPU member as well as the Utilities Manager may submit proposed changes. Whenever changes are adopted, the updated document should be quickly made available to the BPU and to those staff who assist the BPU in its work. The previous version should be stored separately for future reference if needed.

1.6. Specificity

Each new rule will be drafted to fit in the appropriate place within the PR. Conceptually, procedures should be drafted from the “outside in,” i.e., the broadest procedure statement should be stated first, then the next broadest, etc. down to the level of detail that the BPU finds appropriate for BPU action and below which management is afforded discretion as to how it implements the procedures.

1.7. Maintenance of the Procedural Rules

- a. The Utilities Manager shall update the PR after the BPU makes any changes and shall post that version on the BPU website within 30 days of the approved changes.
- b. On at least a biennial basis the BPU shall request the County Attorney’s review the PR to ensure compliance with current State, federal, and local law.
- c. The full PR and all the appendices, as may be amended from time to time as provided herein, will be maintained and available to the public on the DPU’s website.

1.8. Context of Other Laws, Rules, and Policies

This PR fits into this hierarchy as provided below:

- a. Laws and Applicable Regulations and Los Alamos County Charter
- b. Los Alamos County Code of Ordinances

- c. Los Alamos County Council Resolutions
- d. Los Alamos County administrative policies
- e. These BPU Procedural Rules
- f. Utilities Manager-Approved Departmental Procedures
- g. Processes or procedures set by Deputy Managers Under the Utilities Manager

1.9. Annual Reaffirmation

Each year during the August BPU meeting each Board member will affirm that he/she has received, read, understands, and agrees to abide by this Board of Public Utilities Procedures Rules and the applicable documents referenced in the Appendix. See [Appendix A](#) for the re-affirmation signature sheet.

Part 2: Organization Essentials

2.1. Mission Statement

(approved by the BPU 9/17/2025)

To provide safe, reliable, economical, and environmentally responsible utility services.

2.2. Vision Statement

(approved by the BPU 9/17/2025)

Continually earn community trust through exceptional utility services.

2.3. Values Statement

(approved by the BPU 9/17/2025)

We value Community, Employees, Partners and the Environment through:

- Safety
- Trust
- Professionalism
- Customer Service
- Fiscal Responsibility
- Ethical Behavior
- Communication
- Collaboration
- Innovation
- Fairness

2.4. Accountability

The BPU and DPU are accountable to (1) the customers of the Los Alamos County Department of Public Utilities and (2) the Citizens of the County of Los Alamos represented by the County Council.

2.5. Strategic Planning

The following are the strategic planning goals of the Board:

- a. The BPU is expected to always think strategically.
- b. The Utilities Manager is expected to annually develop (1) Strategic Objectives, (2) Long-Term Goals, and (3) Short-Term Goals for the DPU based on the procedures in this PR and to present the Strategic Objectives and Long-Term Goals to the BPU for approval. See [Appendix B](#) for the current DPU Strategic Objectives and Long-Term Goals.
- c. The BPU will ensure alignment of the DPU's Strategic Objectives with those of the County and then forward the approved Strategic Objectives document to the County Council for their information.

2.6. Climate of Compliance

It is the fundamental rule of the BPU that all BPU and DPU business and other practices be conducted in compliance with all applicable laws and regulations of the United States, the State of New Mexico, and the County of Los Alamos, specifically:

- a. The Los Alamos County Charter, Article V – Utilities (See [Appendix C.](#))
- b. The Los Alamos County Code of Ordinances, Chapter 40 – Utilities (See [Appendix D.](#))
- c. Other adopted ordinances, resolutions, policy, or rule by the County Council

2.7. Code of Conduct

Members of the BPU will comply with the State and Los Alamos County Code of Conduct Ordinance. See [Appendix E.](#)

2.8. Guiding Principles

In addition to the Los Alamos County Code of Conduct, the BPU will follow these Guiding Principles:

- a. The safety of the public and DPU employees is the BPU's priority, outweighing all other considerations. The BPU will work with the Utilities Manager to foster a culture of safety in the DPU. Refer to [Appendix N](#) for the DPU's Culture of Safety Vision Statement.
- b. The BPU has responsibilities to the DPU customers to preserve and increase the value of DPU assets and to ensure the long-term viability of all DPU utilities.
- c. The BPU will strive to establish and maintain fair and just utility rates for each utility service that fully cover the costs for operation, maintenance, future replacement and upgrades, and debt service for each utility. Rate structures should reflect the fixed and variable costs associated with each utility.
- d. The BPU will adjust and propose rates for each utility service in a timely manner to address changes in the costs associated with that utility service.
- e. The BPU will promote policies, procedures, and processes to improve the performance and reliability of each utility, as measured against national standards at a reasonable cost to the DPU customers.
- f. The BPU will recommend policies, procedures, and processes that will improve the environmental sustainability of DPU operations at a reasonable cost to the DPU customers.
- g. The BPU will promote the development and maintenance of documented, comprehensive plans for operation of the DPU during emergency conditions.

- h. The BPU will promote programs such as education, energy surveys, and irrigation analysis that will enable DPU customers to use our water, sewer, gas, and electrical utility services in a manner that will protect the environment, conserve resources, and be cost-effective to the DPU customers.

2.9. Standards of BPU Member Public Behavior

- a. The extent of a BPU member's authority is one vote in BPU meetings.
- b. BPU members shall not interfere with the Utilities Manager in the operation of the DPU.
- c. BPU members shall not direct DPU employees.
- d. BPU members shall maintain civil decorum at meetings, treating each other with courtesy and respect; remembering that *"Every difference of opinion is not a difference of principle."* – Thomas Jefferson.
- e. BPU members' interaction with the public, each other, and staff will be open, transparent, and professional.
- f. BPU members must maintain the confidentiality of closed sessions and information gained from their position on the BPU. Release and disclosure of confidential information must be approved by a majority of the BPU and County Council.
- g. Representing the Board to Council:
 - The Chair of the BPU (or designee) is the official spokesperson for the Board when communicating Board activities to and with Council. The Chair shall be recognized as the head of Board for the purposes of intergovernmental relations, ceremonial purposes and calling BPU emergency meetings.
 - Each BPU member is free to communicate with the County Council as a private citizen; when doing so, the BPU member should clearly state that the Board Member is not speaking for the BPU unless specifically appointed by the BPU to be the spokesperson for the BPU on a particular issue.
 - Issues discussed and decisions made during open BPU meetings should be accurately communicated to the County Council.
- h. The rules contained in the current edition of these Procedural Rules, the Council's Annual Meeting Resolution, any applicable adopted Council Board and Commission Procedural Rules, and the current version of **Roberts Rules of Order** shall govern the BPU in all cases to which they are applicable and in which they are not inconsistent with any special rules of order the BPU may adopt.
- i. BPU members, if acting within the scope of their duty, are subject to the immunities and limitations of the New Mexico Tort Claims Act, Sections 41-4-1, *et seq.*, NMSA 1978, as amended.

2.10. Whistleblowers

Members of the BPU will abide by the New Mexico “Whistleblower Protection Act,” NMSA 1978, Chapter 10, Article 16C. See [Appendix F](#) for additional information.

2.11. Documents Retention/Destruction

- a. The BPU shall preserve all information relating to litigation, audits, and investigations.
- b. From time to time, due to pending, threatened, or otherwise reasonably foreseeable litigation, audits, government investigations, or similar proceedings, the County Attorney or the Utilities Manager may issue BPU members a notice to suspend the destruction of specific records. No records so specified may be destroyed by BPU members until the notice is withdrawn in writing by County Attorney or the Utilities Manager.
- c. The County of Los Alamos, BPU, and its departments are subject to State Inspection of Public Records requirements and have a records and information management governance policy. Contact the Utilities Manager or the DPU Executive Assistant for more detailed information.

2.12. Open Meetings

- a. All meetings of a quorum of BPU members held for the purpose of formulating public policy, discussing public business, or for taking any action within the authority of the BPU, are public meetings. Meetings or portions of BPU meetings can only be closed when the matter to be considered falls within one of the exceptions defined in the New Mexico Open Meetings Act (NMSA 1978, §§ 10-15-1 through 10-15-4); any questions regarding BPU meetings and/or closed sessions should be directed to the County Attorney.
- b. As required by the County Council, BPU meetings will be broadcast to the public using the County's on-line streaming capabilities; to the extent possible, BPU meetings will be held in meeting rooms with audio-video capabilities.
- c. Each January the County Council passes and the BPU will affirm a resolution establishing minimum standards of reasonable notice to the public for all meetings of the Council and of all County boards, commissions, and policy-making bodies.
 - 1) The resolution sets the requirements for public notice and agenda publication for regular meetings, special meetings, emergency meetings, and closed sessions.

- 2) Refer to [Appendix G](#), for the current County Open Meetings Resolution.
- d. BPU shall issue a notice of potential quorum no later than 72 hours prior to a potential quorum.
- e. Board members should avoid exchanging e-mails, phone calls, or other communication in which a quorum of BPU members may be included to discuss a policy issue, upcoming agenda item, or related matter; such communications may violate the State's Open Meetings Act, however sending correspondence to the DPU Executive Assistant or Utilities Manager is acceptable. This issue is commonly known as a "rolling quorum."
- f. Refer to [Appendix H](#), State of New Mexico Attorney General's "Open Meetings Act Compliance Guide," which may be amended from time to time.

2.13. Media Relations

- a. The BPU promotes transparency in its decision-making process. As such public and media representatives are welcome to participate in all open Board meetings and shall receive meeting agendas and agenda packets upon request.
- b. Each BPU member is free to interact with the media as a private citizen; when doing so, the BPU member should clearly state that he/she is not speaking for the BPU unless specifically appointed by a majority of the BPU members as spokesperson for the BPU on a particular issue. The Chair of the BPU shall usually act as spokesperson for the BPU with regard to media queries, or if a majority of the BPU has delegated such authority to the Chair on a particular media issue of public interest and importance.
- c. Issues discussed during closed BPU meetings should not be revealed to the media.
- d. Issues discussed and decisions made during open BPU meetings should be accurately communicated to the media.
- e. BPU members may consider referring media queries to the DPU public relations staff on certain issues or may request assistance from DPU public relations staff in responding to media requests.
- f. BPU members shall be professional in their manner and conduct at all meetings. Even though media representatives may not be present at an open BPU meeting, meeting minutes, audio recordings, and/or video recordings are public record and will be made available to the public and media representatives upon request.

2.14. Education and Development

- a. BPU applicants shall be provided with an online link to this PR document so they can better understand the roles and responsibilities of BPU membership.
- b. Within two months of being appointed, each new BPU member will be provided with an orientation to the DPU, including its mission, policies, procedures, and programs, as well as his or her roles and responsibilities as a board member. This orientation will be provided or coordinated by the BPU Chair. Newly appointed BPU members will also receive a copy of the *APPA Handbook for Public Power Policymakers*, the County's *Public Involvement Guide for Boards and Commissions*, and the County's *Orientation Manual for Members of Boards and Commissions*. (The *Orientation Manual for Members of Boards and Commissions* includes several provisions that differ from the County Charter provisions for the BPU; nevertheless, the document may provide useful general guidance for BPU members and officers.)
- c. Each BPU member is expected to seek continuing education that will enhance his or her ability to effectively fulfill the duties of a BPU member and is encouraged to obtain a relevant certification within two years of appointment to the BPU. An example is the Public Power Governance Essentials On-demand Training. Refer to the APPA information in [Appendix I](#).

Part 3: Board Structure and Processes

3.1. Governing Style

The BPU will approach its task with a style that emphasizes outward vision rather than an internal preoccupation, that encourages diversity in viewpoints, that underlines strategic leadership more than administrative detail, that is cognizant of the clear distinction between Board and staff roles, and that promotes pro-active rather than reactive approaches. In this spirit, the BPU will:

- a. Comply with this PR and discuss variances in open session.
- b. Be accountable to the DPU customers and the citizens of Los Alamos County for competent, conscientious, and effective accomplishment of its obligations as a body. It will allow no officer or individual of the BPU to usurp this role or hinder this commitment.
- c. Monitor and regularly discuss the BPU's own process and performance.
- d. Seek to ensure the continuity of its governance functions by identifying capable County citizens, encouraging them to apply for County Council appointment to the BPU, then adequately orienting and training new BPU members.
- e. Be an initiator of policy and not just react to DPU staff initiatives.

3.2. BPU Job Descriptions

The job of the BPU is to exercise jurisdiction and control over the DPU. In this role, the BPU must lead the DPU toward desired operational and financial performance objectives and ensure that these objectives are met. The BPU's specific contributions are unique to its role of trusteeship and necessary for proper governance and management.

- a. To perform its job, the **BPU** shall:
 - 1) Work with the Utilities Manager to define and refine the DPU's mission, vision, values, strategies, and major goals/outcomes and hold the Utilities Manager accountable for developing strategic objectives and long-term goals based on these procedures.
 - 2) Develop an annual performance plan with priorities for the Utilities Manager. The performance plan should align with the DPU's strategic objectives and long-term goals already approved by the BPU and should identify the performance standards by which the Utilities Manager is expected to achieve those objectives/goals/outcomes.
 - 3) Monitor the performance of the DPU relative to the achievement of the objectives/goals/outcomes.
 - 4) Select, nurture, evaluate annually, recommend fair compensation for and, if necessary, recommend termination of the Utilities Manager, who functions as the Board's sole agent.

- 5) Ensure financial solvency and integrity of the DPU through its processes and actions.
- 6) Require periodic financial and management audits to ensure compliance with the law and good practices in accordance with Article V of the Los Alamos County Charter.
- 7) Participate in the annual DPU Strategic Planning Process as described elsewhere in this PR.
- 8) Review, approve, and recommend an annual DPU budget, including the Schedule of Funds, to the County Council.
- 9) Review, approve, and recommend utility rate ordinances to the County Council.
- 10) Review and approve utility contracts greater than or equal to \$100,000, and review, approve and recommend utility contracts greater than \$300,000 to the County Council. (Refer to Los Alamos County Code of Ordinances, Sec. 31-74. "Authority to execute contracts.")
- 11) Maintain and constantly improve all on-going procedures of the BPU in this PR.
- 12) Support the Utilities Manager in strategic, operational, and human resources issues before county staff and/or County Council.
- 13) Evaluate and strive to improve the BPU's performance as a governing board.
- 14) Actively work with DPU staff to communicate the value of the DPU to its partners. Possible activities may include:
 - Accompanying the Utilities Manager and participating in presentations to civic organizations.
 - Attending County Council meetings where DPU topics will be presented or discussed.
- 15) Seek input and involve DPU partners in BPU policy considerations and decisions using methods such as:
 - Exploring ways to get more partner input while policies are being formed.
 - Using DPU bill inserts to distribute information and solicit public input on issues.
 - Utilizing the Los Alamos County On-Line Forum.
 - Use the bi-annual DPU customer survey to gather public input on issues.
 - Forming ad-hoc citizen's panels to address strategic questions and make recommendations to the BPU.
- 16) Work with the County Council to get citizens with diverse backgrounds appointed to the BPU to ensure that the BPU represents the community it serves.

- b. For the BPU to function effectively, **each BPU member** must:
- 1) Regularly attend BPU meetings.
 - 2) Review the agenda packet for each meeting and come to the meeting prepared to discuss the items on the agenda.
 - 3) Participate in BPU discussions at meetings.
 - 4) If possible before a BPU meeting, prepare any lengthy reports and/or comments in writing and provide to the DPU Executive Assistant at or before the meeting.
 - 5) Adhere to these PRs.
 - 6) Represent interests of DPU customers.
 - 7) Rotate attendance at boards and commissions lunches.
 - 8) Accept and fulfill duties assigned by the BPU Chair.
 - 9) In BPU meeting discussions, focus on policy consideration and direction versus operational issues; discuss technical details of DPU operations with DPU staff prior to the BPU meeting if possible.
 - 10) Actively endeavor to understand and balance the varied concerns of DPU customers.
- c. The **BPU Chair** has the following additional responsibilities:
- 1) Meet with Utilities Manager approximately two weeks before each regular BPU meeting to review and approve the agenda items for the meeting.
 - 2) Conduct all BPU meetings.
 - 3) Obtain BPU member volunteers, or if necessary, appoint BPU members for committees and Board projects.
 - 4) Review meeting minutes after each BPU meeting.
 - 5) Review and approve the Utilities Manager's travel pre-approvals and reimbursements.
 - 6) To the extent possible, attend weekly "Leadership Council" meetings to be aware of County Council agenda and to provide information about BPU issues to County leadership; if necessary, ask the BPU Vice-Chair to attend.
 - 7) Represent the BPU at County Council meetings, particularly those where DPU issues will be discussed.
 - 8) Provide an annual oral report to County Council to keep them aware of issues facing the BPU which may significantly impact the operations of other County departments.
 - 9) Help the BPU spend appropriate time on policy considerations, processes, and direction versus operational issues; guide BPU meeting discussions away from operational details and toward policy issues.

- d. In the absence of the Chair, the **BPU Vice Chair** shall assume the duties of the Chair.
- e. The **BPU immediate past Chair** is encouraged to serve as mentor for the current BPU Chair.
- f. The **Utilities Manager** is an ex-officio non-voting member of the BPU: Refer to Part 4 of this PR for a description of the Utilities Manager's Responsibilities.
- g. The **County Manager** will be an ex-officio non-voting member of the BPU and is encouraged to:
 - 1) Attend the meetings of the BPU or send a designated alternate Deputy County Manager.
 - 2) Serve as a liaison between the Board and County Administration to ensure that (a) the Council is aware in advance of actions by the DPU which may significantly impact County operations, and (b) that DPU is aware in advance of actions by the County which may significantly impact DPU operations.
- h. The **County Council Liaison** is encouraged to:
 - 1) Attend the meetings of the BPU or send a designated alternate County Council member.
 - 2) Provide an annual briefing to the BPU on the strategic objectives of the County.
 - 3) Keep the County Council informed on BPU and DPU issues that may have a major impact on the County.
 - 4) Keep the BPU informed on County Council issues that may have a major impact on the BPU or the DPU.
 - 5) Sit at the dais or with members of the BPU at Council Liaison discretion, at which time, the Council Liaison name-placard shall be displayed.
 - 6) Participate in DPU discussion when the Council Liaison has clarifying points pertinent to the discussion.
 - 7) Refrain from interjecting opinion into discussion, unless speaking as a member of the public during periods reserved for public comment.

3.3. Annual Calendar of BPU Activities

The BPU will generally follow the calendar of activities outlined below, although, circumstances may dictate that the timing of some of these activities be adjusted. Additional BPU activities such as consideration of utility rate ordinances

and utility contracts will occur from time to time. The calendar for the current year is included as [Appendix J](#).

January

- Affirmation of the Incorporated County of Los Alamos Open Meeting Resolution for the Current Calendar Year
- Election of BPU Chair & Vice Chair for the Current Calendar Year
- Introduction of Council Liaison to the BPU for the Current Calendar Year
- Appointment of BPU Member to the County Audit Committee for the Current Calendar Year

February

- DPU Annual Report for the Previous Fiscal Year
- Budget Presentation for the Next Fiscal Year
- Biannual Update: Transactional Survey Report for July-December of the previous calendar year

March

- Annual Update: Water System
- Annual Update: LANL Presentation on Environmental Goals
- Approval of the DPU Budget for the Next Fiscal Year
- DPU Quarter 2 Report for the CURRENT Fiscal Year (October - December)

April

- Begin Utilities Manager's Performance Evaluation Process (*Closed Session*)
- UAMPS Presentation by CEO/General Manager
- Annual Update: Results of the Voice of the Customer Survey
- Annual Update: Electric Reliability Plan (ERP) for the Current Fiscal Year
- Begin Advertising Annual BPU Vacancy

May

- BPU Conducts Annual Utilities Manager's Performance Review (*Closed Session*)
- Approval of Year-End Budget Revisions
- Overview of the ECA Budget Process & Approval of the DOE/LAC Resource Pool Budget for the Next Two Fiscal Years
- Council Approves DOE/LAC Resource Pool Budget for the Next Two Fiscal Years
- Council/BPU Working Group Interviews BPU Candidates
- Council Appoints New BPU Member (Five-Year Term)

June

- Utilities Manager – Annual Performance Planning (*Closed Session*)
- Planning for the Annual BPU Presentation to Council (Work Session)
- Final Review of the BPU Annual Presentation to Council (Regular Session)
- Annual Update: Wastewater System
- Annual Review: Utilities Assistance Program (UAP)
- DPU Quarter 3 Report for the CURRENT Fiscal Year (January - March)

- Recognition of Departing Board Member

July

- Introduction of New BPU Member
- Orientation for New BPU Member
- Annual Open Meetings Act & Code of Conduct Training by Attorney
- Annual Review of the BPU Procedural Rules
- Presentation to Council by the BPU Chair (Council Work Session)

August

- Annual Update: Electric Production – Hydroelectric Facilities
- Biannual Update: Transactional Survey Report for January – June of the Current Calendar Year
- Approval & Reaffirmation of the BPU Procedural Rules
- Annual Strategic Planning for the DPU (Special Meeting)
- Approval of Resolution to Remove 5-Year-Old Uncollectable Utility Accounts from A/R List

September

- Approval of the DPU Mission, Vision & Values and the Strategic Goals & Objectives
- Approval of Budget Carryovers from the Previous FY to the Current FY
- DPU Quarter 4 Report for the PREVIOUS Fiscal Year (April - June)

October

- Annual Update: Integrated Resource Plan (IRP)
- Annual Update: Gas Distribution System

November

- Annual BPU Self-Evaluation
- Approval of the BPU Meeting Calendar for the Next Calendar Year

December

- Approval of the Annual BPU Self-Evaluation
- DPU Quarter 1 Report for the CURRENT Fiscal Year (July - September)

3.4. BPU Meetings

- a. Regular Meetings – Regular meetings will generally be held on the third Wednesday of each month at 5:30 p.m. These meetings will be set under the requirements of the annual Open Meetings Resolution adopted by Council. Public comment will be taken at the beginning and end of the meeting, on any subject. Public comment on action items will be taken at the time the action is considered. Public comment will generally be limited to three (3) minutes or otherwise as announced by the Chair. Public comment will also be accepted by available written methods, including by email.
- b. Work Sessions – work sessions will generally be held on the first Wednesday of each month at 5:30 p.m. The Board may schedule work sessions on a regular basis under the requirements of the annual Open Meetings Resolution. Board meetings designated as work sessions will be held for the primary purpose of discussing issues at length with staff in an informal setting without taking formal action, except for required procedural actions such as adopting a statement for inclusion in the minutes regarding a previously held closed meeting. Public comment will be taken at the beginning and end of the session, and by available written methods, including email.
- c. Closed Meetings - The Chair, a majority of the Board, or the Utilities Manager may call for a closed meeting to discuss issues (such as pending litigation, personnel matters, collective bargaining strategy) pursuant to NMSA 1978, 10-15- 1 (H) (2,5 etc.). Following the closed meeting, at the next Board meeting during which action may be taken, the Chair will call for a motion that is substantially similar to the following: *"I move that the Board approve the following statement for inclusion in the minutes: 'The matters discussed in the closed meeting held on (MONTH)(DAY)(YEAR) that began at (TIME) were limited only to those topics specified in the (NOTICE) (MOTION) of the closed meeting.'"* This motion is a procedural motion, therefore only a show of hands is required rather than a roll call vote.
- d. Special Meetings – A special meeting may be called by the Chair or, in the Chair's absence, by the Utilities Manager, or by such other officers that may be designated by the Board or by any two Board members upon written request, for the purpose of conducting Board business. Notice of a special meeting will follow the requirements of the annual Open Meetings Resolution.
- e. Emergency Meetings - The Chair, a majority of the Board, or the Utilities Manager may call an emergency meeting in accordance with the Open Meetings Act.

3.5. BPU Meeting Agenda Templates

The following templates describe the items that will be addressed and the order of business at a typical BPU meeting; not every meeting will include every item in the template. Agenda documentation will be substantially complete at least 72 hours before each meeting.

a. Regular Meeting

1. Call to Order
2. Public Comment *(on any subject)*
3. Approval of Agenda
4. Consent Agenda
 - a) Approval of Minutes
5. Presentations
6. Public Hearings *(Ordinances & Resolutions)*
7. Department Business
8. Board Business
 - a) Chair's Report
 - b) Board Member Reports
 - c) Utilities Manager's Report
 - d) County Manager's Report
 - e) Council Liaison's Report
 - f) Environmental Sustainability Board Liaison's Report
 - g) General Board Business
 - h) Board Expenses
9. Status Reports
 - a) Electric Reliability Report
 - b) Accounts Receivables Report
 - c) Risk & Safety Report
10. Request/Review - Upcoming Agenda Items
 - a) Tickler File
11. Public Comment *(on any subject)*
12. Adjournment

b. Work Sessions & Special Meetings

1. Call to Order
2. Public Comment *(on any subject)*
3. Approval of Agenda
4. Presentations
5. Business *(if any)*
6. Public Comment *(on any subject)*
7. Adjournment

3.6. Public Comment

The following is the BPU's general rule concerning public comment during BPU meetings:

- a. Regular Meeting agendas will include a standing public comment period at the beginning and end of each meeting, on any subject. The public comment period is an opportunity for the Board to listen to members of the public on any subject. BPU members should not correct, rebut, or engage in dialogue with a member of the public during or after the public comment period.
- b. Work Session & Special Meeting agendas will include standing public comment periods at the beginning and end of the meeting, on any subject.
- c. Oral public comment should be limited to three (3) minutes per person. Requests to make comments exceeding three (3) minutes should be submitted to the Board in writing prior to the meeting. The text of lengthy comments should be submitted to the Board prior to the meeting, if possible, but may also be submitted during or after the meeting. The name of the citizen providing public comment will be included in the minutes and whether they are a resident of Los Alamos County.
- d. Individuals representing or making a combined statement for a large group present at a meeting may be allowed additional time for comment at the discretion of the Board. The Board may agree to this by consent (no motion necessary).
- e. Public Hearings – After the presenter has given his or her presentation, the Chair will provide an opportunity for Board questions and then public comment on the particular topic. Any formal BPU action on the item will occur in the Public Hearings section of the BPU meeting agenda after public comments are finished.
- f. Business Items - After the presenter has given his or her presentation and there is initial Board discussion, and prior to accepting a main motion on an item, the Chair will formally open the floor for public comment specific to the agenda item. If a public hearing has been held on the topic during the meeting, the Chair may request that comments not be repeated. The Board may continue to have additional discussion on the item after the public comment period.
- g. BPU members may, at any time, ask the Chair to allow a presenter, member of the public, or staff member to speak to provide clarification or additional information about an agenda item. This is not considered to be part of the public comment period.
- h. Procedures regarding public comment will be included on agendas so that interested citizens know how to submit written comments prior to the meeting for Board consideration.

- i. Written public comment, including email to the BPU and identified in the subject line as “public comment,” submitted prior to or during the meeting will be provided to the DPU Executive Assistant to attach to the minutes.
- j. Additional useful guidance and suggestions for public hearings and other ways and means of sharing information with or gathering input from DPU customers can be found in the Los Alamos County *Public Involvement Guide for Boards and Commissions*.

3.7. Meeting Agendas

- a. BPU meeting agendas shall comply with the State of New Mexico “Open Meetings Act.” Refer to [Appendix G](#), State of New Mexico Attorney General’s “Open Meetings Act Compliance Guide” and the County’s annual Open Meeting resolution.
- b. All documentation regarding upcoming public hearings, consent, and business items shall be substantially complete at least 72 hours prior to action being taken.
- c. The agenda must contain a list of specific items of business to be discussed or transacted at the meeting, but there is no requirement for any additional description of what the Board may do with a specific item of business on the agenda.

3.8. Meetings Minutes

- a. Meeting minutes should be a succinct record of what was done at the meeting, not a transcript of what was said during the meeting.
- b. In substance, but not necessarily format, BPU meeting minutes will comply with Roberts Rules of Order, the County Boards and Commissions Manual, the New Mexico “Open Meetings Act” and County Council procedures.
- c. Board members should carefully review draft meeting minutes before approval and request that additional discussion details be included if needed to provide further explanation of a topic.
- d. During the meeting, the board members may request that portions of discussions be recorded in the minutes if they believe the details to be of great importance to the overall record.
- e. Any items requiring further action by the Board or follow-up by Staff should be captured in the minutes.
- f. Approved minutes of BPU meetings are the official record of BPU meetings; recordings of BPU meetings will be retained for at least one year for reference purposes.

3.9. Removal/Replacement of a BPU Member

- a. Article V of the County Charter states circumstances that would warrant removal of a BPU member by the County Council.
- b. A BPU member may resign by submitting written notice to the Chair of the BPU and the Chair of the County Council; except for such circumstances that warrant an earlier departure, the resigning member should continue to serve on the BPU until a replacement is appointed by the County Council.
- c. If a Board member resigns or is removed, the BPU will work with the County Council to get a replacement appointed within 60 days. The BPU will identify capable Los Alamos County citizens and encourage them to apply for County Council appointment to the BPU.

3.10. BPU Self-Evaluation

- a. Beginning in October, the BPU will perform an annual self-evaluation of its own performance. The BPU may invite major partners (e.g., DPU staff, County Council, County Manager) to participate in specific aspects of the evaluation.
- b. The purposes and reasons for the BPU self-evaluation are intended to:
 - 1) Promote understanding of roles and responsibilities
 - 2) Provide orientation for new members
 - 3) Address, and perhaps help resolve, Board conflicts
 - 4) Clarify what members expect from the group and self
 - 5) Identify priorities for the BPU's future efforts
 - 6) Identify BPU strengths and weaknesses
 - 7) Identify opportunities for improvement in BPU performance
 - 8) Help identify needed changes to this PR
 - 9) Ensure that self-evaluation aligns with at least three of the Baldrige "Criteria for Performance Excellence."
- c. Refer to [Appendix K](#) for a BPU self-evaluation template adapted from the *APPA Handbook for Public Power Policymakers*. The BPU will change the self-evaluation topics over time to fit the changing business climate, relations with the Utilities Manager, relations with the County Council, and to include lessons learned from previous self-evaluations.
- d. In its self-evaluation the BPU will address open-ended questions such as:
 - 1) What did the BPU accomplish during the past year?
 - 2) What did the BPU fail to accomplish during the past year?
 - 3) What did the BPU do well during the past year?
 - 4) What did the BPU do poorly during the past year?
 - 5) What were the key issues of the past year? Did the BPU address them adequately?"
- e. The BPU will seek broad participation in the self-evaluation process by:

- 1) Soliciting suggestions for self-evaluation questions from DPU staff, County staff, County Council, and the public.
 - 2) Inviting the immediate past BPU member(s) to participate in the self-evaluation.
 - 3) Inviting the County Council Liaison, County Manager, and County Attorney to participate in the self-evaluation.
- f. The BPU will explore ways to make the BPU self-evaluation honest and candid.
 - g. The BPU will explore ways to collect questions, complaints, and compliments to be addressed in the annual self-evaluation process.

3.11. Dispute Resolution Process

- a. From time to time the County Council may not adopt a BPU approved utility rate ordinance or may not approve a budget, personnel action, or utility contract recommended by the BPU.
- b. In this situation the BPU will reconsider its recommendation and may submit either a revised or a reinforced recommendation to the County Council.
- c. If the BPU does not develop a recommendation that is approved by the County Council in a timely manner, it will request the Council to appoint an appropriate number of councilors to a joint County Council/BPU working group that is charged to reach an agreement within a specified time.

Part 4: Utilities Manager Responsibilities

4.1. Essential Duties and Responsibilities

- a. The Utilities Manager's essential duties and responsibilities are described in the Los Alamos County Job Description and Classification for the Utilities Manager, Job Code 7001; refer to [Appendix M](#).
- b. The following sections address some of the Utilities Manager's responsibilities that particularly relate to the BPU.

4.2. Strategic Planning

- a. The Utilities Manager should implement a systematic, cyclical strategic planning process to develop (1) Strategic Objectives, (2) Long-Term Goals, and (3) Short-Term Goals for the DPU and present the Strategic Objectives and Long-Term Goals to the BPU for approval.
- b. The DPU strategic planning processes should be based on the current *Baldrige Criteria for Performance Excellence* or an equivalent standard that is acceptable to the BPU.
- c. Refer to [Appendix L](#) for a description of the DPU Strategic Planning Process.

4.3. Operations and Management

- a. The Utilities Manager is responsible for the day-to-day operations of the department and management of its personnel.
- b. The Utilities Manager's operation of the department and management of its employees, in general, shall be subject to the personnel code and the procurement code. In general, other administrative County-wide policies shall be followed to the extent they do not conflict with the BPU's jurisdiction.
- c. Special processes and procedures necessary for the operation of the DPU shall be proposed by the Utilities Manager, approved by the BPU, and put in place with the assistance of the County Manager.

4.4. Annual Budget

- a. The Utilities Manager is responsible for preparing and presenting a preliminary and a final annual DPU budget to the BPU.
- b. The proposed annual DPU budget intended for BPU approval should address each of the utilities individually and include 10-year forecasts that project changes in sales, revenue and expenses, and the rates and borrowing necessary to sustain each utility.

- c. The proposed DPU budget intended for County Council approval should be based on the BPU approved budget and shall address the DPU on a bi-annual basis.
- d. The Utilities Manager should present the preliminary annual budget at the February BPU meeting and the final annual budget at the March BPU meeting

4.5. Annual and Quarterly Financial Reports

- a. The Utilities Manager shall prepare and provide the BPU with an audited annual financial report as of the end of the previous fiscal year for each utility and for the DPU.
 - 1) The annual financial report shall adhere to generally accepted accounting principles as promulgated by the Governmental Accounting Standards Board and the Financial Accounting Standards Board as applicable.
 - 2) The annual financial report may be included as part of the audit of the County's Annual Comprehensive Financial Report.
 - 3) The annual report shall be provided for BPU information at the March BPU meeting.
 - 4) The accepted annual report (if separate from the general County) should be suitably summarized and formatted then provided to the County Council and made available to the public on the DPU website.
- b. The Utilities Manager shall prepare quarterly DPU performance reports.
 - 1) Each quarterly report should include information about capital projects, operational and financial performance, and DPU highlights during the previous quarter. The operational and financial performance reports should include data for the previous quarters of the fiscal year plus cumulative totals.
 - 2) Quarterly reports shall be provided to the BPU and the County Council and made available to the public on the DPU website.

4.6. Rate Ordinances

- a. The Utilities Manager is responsible for preparing and presenting proposed utility rate ordinances to the BPU.
- b. At the BPU meeting prior to the public hearing on a final proposed utility rate ordinance before the BPU, the Utilities Manager shall introduce the draft ordinance and present the budget and operational reasons for the proposed rate ordinance. A revised rate ordinance presented to the BPU after rejection of the original rate ordinance by the County Council need not be submitted in advance of the public hearing but may be acted upon by the BPU when submitted. A rate ordinance presented to BPU for

a minor correction or amendment regarding a clerical error within thirty (30) days of presentation for public hearing before or adoption by County Council need not be submitted in advance of the public hearing but may be acted upon by the BPU when submitted.

- c. When the final proposed utility rate ordinance is presented to the BPU for approval, the Utilities Manager shall make a presentation to the BPU that approximates that which will be made to the County Council to obtain their acceptance of the ordinance.

4.7. BPU Membership

The Utilities Manager and the County Manager shall both be ex officio non-voting members of the BPU.

Appendices

The full PR and links to all appendices listed below are available on the DPU pages of the County's website at <https://ladpu.com/bpu>. Click on **"Guiding Documents."**

- A. Annual Reaffirmation of the Procedural Rules
- B. DPU Strategic Objectives, Long-Term Goals, and Short-Term Goals for the Current Fiscal Year
- C. Los Alamos County Charter, Article V – Utilities
- D. Los Alamos Code of Ordinances, Chapter 40 – Utilities
- E. Los Alamos County Code of Conduct (Code Ordinance No. 02-240):
- F. New Mexico "Whistleblower Protection Act," NMSA 1978, Section 10-16C-1 to 6
- G. Los Alamos County Council's Annual Resolution for Open Meeting Compliance
- H. State of New Mexico Attorney General's "Open Meetings Act Compliance Guide"
- I. American Public Power Association Governance Resources
- J. BPU Calendar for the Current Year
- K. BPU Self-Evaluation Template
- L. Strategic Planning Process – Key Process Steps (KPS)
- M. Los Alamos County Job Description and Classification for the Utilities Manager
- N. DPU Culture of Safety Vision Statement



County of Los Alamos

Staff Report

August 05, 2026

Los Alamos, NM 87544
www.losalamosnm.us

Agenda No.: 6.f.
Index (Council Goals):
Presenters: Cristella Valdez, Assistant County Attorney
Legislative File: 21572-26

Title

Open Meetings Act and Inspection of Public Records Presentation

Body

Presentation includes an overview of the New Mexico Open Meetings Act and Inspection of Public Records Act. BPU members will learn about the requirements of the Acts including: the process to properly provide meeting notices to the public, rolling quorums, and the right to inspect public records.

Attachments

- A - OMA Training Presentation
- B - Resolution No. 26-01 Open Meetings Act
- C - 2026 BPU Meeting Calendar

NMSA 1978
§§10-15-1 TO 10-15-4

AND

§§14-2-1 TO 14-2-12

NEW MEXICO OPEN MEETINGS ACT & INSPECTION OF PUBLIC RECORDS ACT

KNOWN AS THE “SUNSHINE LAWS”

- **All persons are entitled to the greatest possible information** regarding the affairs of government and the official acts of those who represent them.
- The formation of public policy or the conduct of business by vote **shall not be conducted in closed meetings.**
- **All meetings of a quorum of members** of any board or commission, held for the purpose of formulating public policy, discussing public business, or taking any action within the authority of the commission **are declared to be public meetings open to the public at all times,** except as otherwise provided by law.
See §10-15-1(B)
- Under IPRA, the law requires **open access to almost all public records** in state and local government, with few exceptions.

OMA - REQUIREMENTS FOR A PUBLIC MEETING

Quorum

- A majority of the appointed members (three of five for BPU)

Notice

- No less than ten (10) days before meeting (per LAC Resolution 25-01)
- Adoption of Calendar

Agenda

- Available at least seventy-two (72) hours prior to meeting
- Must identify the business to be discussed or transacted

Minutes

- Must be include the date, time and place of the meeting, the names of members in attendance and those absent, the substance of the proposals considered and a record of any decisions and votes taken that show how each member voted.
- All minutes are open to public inspection.
- Draft minutes shall be prepared within ten working days after the meeting and shall be approved, amended or disapproved at the next meeting where a quorum is present.



PUBLIC MEETING & PUBLIC BUSINESS

WHAT IS A “PUBLIC MEETING”?

WHEN IS BPU CONDUCTING “PUBLIC BUSINESS”?

WHAT IS AN “OPEN MEETING” ?

“All meetings of a quorum of members of any board, commission, administrative adjudicatory body or other policymaking body of any state agency or any agency or authority of any county, municipality, district or political subdivision, held for the purpose of formulating public policy, including the development of personnel policy, rules, regulations or ordinances, discussing public business or taking any action within the authority of or the delegated authority of any board, commission or other policymaking body **are declared to be public meetings open to the public at all times**, except as otherwise provided in the constitution of New Mexico or the Open Meetings Act [Chapter 10, Article 15 NMSA 1978]....”

NMSA 1978, Section 10-15-1.B.

WHAT IS PUBLIC BUSINESS ?

“All meetings of a quorum of members of any board, commission, administrative adjudicatory body or other policymaking body of any state agency or any agency or authority of any county, municipality, district or political subdivision, **held for the purpose of formulating public policy, including the development of personnel policy, rules, regulations or ordinances, discussing public business or taking any action within the authority of or the delegated authority of any board, commission or other policymaking body** are declared to be public meetings open to the public at all times, except as otherwise provided in the constitution of New Mexico or the Open Meetings Act [Chapter 10, Article 15 NMSA 1978]. . . .”

NMSA 1978, Section 10-15-1.B.

QUORUM

WHAT CONSTITUTES A QUORUM OF THE BPU?

THREE MEMBERS SHALL CONSTITUTE A QUORUM FOR THE BUSINESS OF THE BOARD.

BPU ACTIONS MAY BE TAKEN AND CONSIDERED VALID ONLY IF A QUORUM HAS BEEN ESTABLISHED AT THE MEETING.
THE BOARD SHALL MEET AT LEAST ONCE A MONTH.

THE MEETINGS AND RECORDS SHALL BE PUBLIC.

BOARD OF PUBLIC UTILITIES POWERS AND DUTIES

Chapter 40 UTILITIES

ARTICLE II Administration

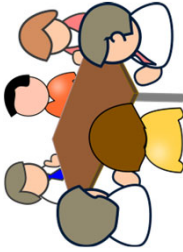
Power and duties, shall include: Jurisdiction and control over the utility systems owned by the county.

Section 40-45 The board of public utilities shall propose the public policy of the department and those other policies unique to each utility system. Policies shall be adopted by the board at public hearings and shall become effective upon approval by the council.

The BPU will be appointed by the council. The ideal representation will include residents from a diversity of geographical areas. **The total number of members will equal five (5) persons.**

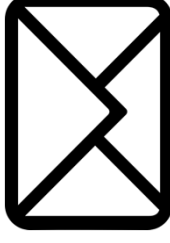
OMA - “ROLLING” OR “WALKING” QUORUMS PROHIBITED

- A quorum may exist, for purposes of the Act, even when members are not physically present together at the same time and place.



■

Example: 3 members of a 5-member Board discussing public business in a series of telephone or email conversations. Such discussion is a meeting of a quorum. The use of a rolling quorum to discuss public business or take action is a violation of the Act because it constitutes a meeting of a quorum of the Board outside a properly noticed public meeting.





NOTICE

WHAT IS THE REQUIRED NOTICE FOR MEETINGS OF THE BPU?

COUNTY NOTICE REQUIREMENTS FOR OPEN MEETINGS

- **OMA** - “Any meetings at which the **discussion or adoption** of any proposed resolution, rule, regulation or formal action occurs and at which a majority or quorum of the body is in attendance, and any closed meetings, shall be held only after reasonable notice to the public. **The affected body shall determine at least annually in a public meeting what notice for a public meeting is reasonable when applied to that body.** That notice shall include broadcast stations licensed by the federal communications commission and newspapers of general circulation that have provided a written request for such notice.” NMSA 1978, § 10-15-1(D)(2024).
- **BPU Meetings:** The BPU meets at least monthly. All meetings of the BPU are subject to and will **comply with the New Mexico Open Meetings Act**, NMSA 1978, Section 10-15-1 to 10-15-4, and will adhere to the requirements outlined in the County’s Resolution adopted annually pursuant to Section 10-15-1(D) of the New Mexico Open Meetings Act.”
- Current County Resolution is **Resolution No. 25-01**

11



AGENDA

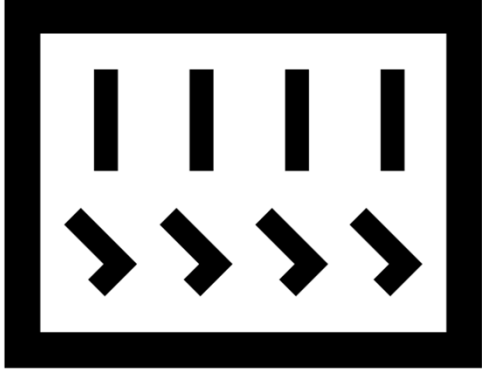
THERE MUST BE A PUBLISHED AGENDA FOR ALL BPU MEETINGS

WHAT IS REQUIRED FOR A MEETING AGENDA?

“Meeting notices shall include an agenda containing a list of specific items of business to be discussed or transacted at the meeting or information on how the public may obtain a copy of such an agenda. Except in the case of an emergency or in the case of a public body that ordinarily meets more frequently than once per week, **at least seventy-two hours prior to the meeting, the agenda shall be available to the public and posted on the public body’s web site, if one is maintained.** A public body that ordinarily meets more frequently than once per week shall post a draft agenda at least seventy-two hours prior to the meeting and a final agenda at least thirty-six hours prior to the meeting. Except for emergency matters, a public body shall take action only on items appearing on the agenda.”

NMSA 1978, Section 10-15-1 (F) (2024)

OMA - MEETING MUST FOLLOW THE PUBLISHED AGENDA



- Only items or topics listed on the published agenda, may be discussed by the BPU

AGENDA FORMAT

- LOS ALAMOS COUNTY
BOARDS AND
COMMISSIONS
PROCEDURAL RULES
(rev. 2019)
- Covers all Boards &
Commissions
- General Format

Exhibit A:



Sample Agenda
Name of B&C
Location of Meeting
Date and time of Meeting

- I. CALL TO ORDER/ROLL CALL**
- II. PUBLIC COMMENT** (Can be limited to ____ minutes per person)
- III. PUBLIC HEARINGS**
(if applicable)
- III. B&C BUSINESS**
 - A. Approval of B&C Minutes
 - B. Chairman's report
 - C. (List other topics)
- IV. B&C/ STAFF COMMUNICATIONS**
 - A. Action Items
(List individual items)
 - B. Staff Reports

POSTING OF AGENDAS

- “Agendas for all board or commission meetings will be posted in accordance with the Council’s annual Open Meetings Resolution.” LAC Boards & Commission Procedural Rules.
- **Resolution 25-01. Section V. A.** - For regular and special meetings – Notice shall be posted in “conspicuous place in the vicinity of the **front door of the Municipal Building** located at 1000 Central Avenue, Los Alamos, New Mexico and visible from the exterior of the building, as well as being **posted on the County’s web site** provided the web site is operational. Copies of the notice shall be provided to those broadcast stations licensed by the Federal Communications Commission **and newspapers of general circulation** which have made a written request for notice of public meetings for the coming calendar year. Only one such written request shall be required for each calendar year.”
- **Charter 909. - Definition: Publish and Publication—Defined.** “Except as otherwise provided in this Charter, the term “publish” or “publication” shall have the meaning as prescribed in state law for legal notices **and shall also include posting at the Municipal Building, the public library and its branches, and such other places as may be designated by ordinance.**”



MEETING MINUTES

WHEN, WHO, AND CONTENT



MEETING MINUTES

“The board, commission or other policymaking body shall keep **written minutes of all its meetings.**

The minutes shall **include at a minimum**

the date,

time and place of the meeting,

the names of members in attendance and those absent,

the substance of the proposals considered

and a record of any decisions and votes taken that show how each member voted.

All minutes are open to public inspection. Draft minutes shall be **prepared within ten working days** after the meeting and shall be **approved, amended or disapproved at the next meeting where a quorum is present.** Minutes shall not become official until approved by the policymaking body.”

NMSA 1978, § 10-15-1(G)(2024)

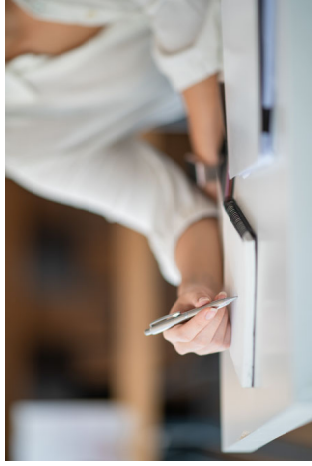
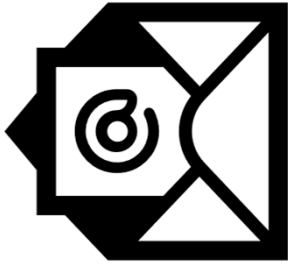
FAILURE TO COMPLY WITH OMA -INVALID ACTIONS AND PENALTY

No action of a board shall be valid unless taken or made at a meeting held in accordance with the requirements of the OMA.

It is the members of the board that are responsible for compliance with the OMA, not the County as an entity.

Any person violating any of the provisions of the OMA is guilty of a misdemeanor and upon conviction shall be punished by a fine of not more than five hundred dollars (\$500) for each offense

IPRA – INSPECTION OF PUBLIC RECORDS



- Every person has a right to inspect public records of this state except as specifically limited by law.
- All persons are entitled to the greatest possible information regarding the affairs of government and the official acts of public officers and employees.
- “Public Records” means **all** documents, papers, letters, books, maps, tapes, photographs, recordings and other materials, regardless of physical form or characteristics, that are used, created, received, maintained or held by or on behalf of any public body and **relate to public business**, whether or not the records are required by law to be created or maintained;



GETTING MORE INFORMATION...

- You can obtain more information at:
 - New Mexico Attorney General's Office- <https://nmdoj.gov/inspection-of-public-records-act/>
 - County Attorney's Office

INCORPORATED COUNTY OF LOS ALAMOS RESOLUTION NO. 26-01

A RESOLUTION ESTABLISHING MINIMUM STANDARDS OF REASONABLE NOTICE TO THE PUBLIC FOR ALL MEETINGS OF THE COUNCIL, COUNTY BOARDS, COMMISSIONS, AND OTHER PUBLIC BODIES CREATED BY THE STATE AND THOSE APPOINTED BY THE COUNCIL (COLLECTIVELY “APPOINTED COUNTY COMMITTEES”)

WHEREAS, the democratic ideal is best served by a well-informed public, and sunshine laws generally require that public business be conducted in full public view, that the actions of public bodies be taken openly, and that the deliberations of public bodies be open to the public; and

WHEREAS, the Open Meetings Act states that, except as may be otherwise provided in the Constitution or the provisions of the Open Meetings Act, all meetings of a quorum of members of any board, council, commission, administrative adjudicatory body or other policymaking body held for the purpose of formulating public policy, discussing public business, or for the purpose of taking any action within the authority of or the delegated authority of such body, are declared to be public meetings open to the public at all times [Section 10-15-1(B) NMSA 1978]; and

WHEREAS, when it is difficult or impossible for a member to attend a meeting in person, the member may participate by means of a conference telephone, video communications, or similar communications equipment [Section 10-15-1(C) NMSA 1978]; and

WHEREAS, any meetings subject to the Open Meetings Act at which the discussion or adoption of any proposed resolution, rule, regulation or formal action occurs shall be held only after reasonable notice to the public [Section 10-15-1(D) NMSA 1978]; and

WHEREAS, the Open Meetings Act requires the Council of the Incorporated County of Los Alamos (“Council”) to determine annually what constitutes reasonable notice of its public meetings and those of all County boards, commissions and policymaking bodies [Section 10-15-1(D) NMSA 1978]; and

WHEREAS, the Council wishes to establish the minimum standards of reasonable notice to the public for all public meetings of the Council and all Appointed County Committees, as defined herein, for the remainder of the year 2026, and until a new resolution concerning public meetings is adopted.

NOW, THEREFORE, BE IT RESOLVED by the Council of the Incorporated County of Los Alamos as follows:

I. General Provisions

A. All meetings of a quorum of the Council of the Incorporated County of Los Alamos shall be open to the public except where specifically provided for in the State of New Mexico’s Open Meetings Act, NMSA 1978 §10-15-1, and as provided herein.

B. All meetings of a quorum of an Appointed County Committee shall be open to the public except where specifically provided for in the State of New Mexico’s Open Meetings Act, NMSA 1978 §10-15-1, and as provided herein. Appointed County Committees are defined as the

Boards, Commissions, Committees, Task Forces, etc., that are created by State Statute, County ordinance, or through formal Council action, and include but are not limited to the following:

- Art in Public Places Board
- Board of Appeals
- Board of Public Utilities
- DWI Planning Council
- Environmental Sustainability Board
- Historic Preservation Advisory Board
- Library Board
- Lodgers' Tax Advisory Board
- Los Alamos County Health Council
- Parks and Recreation Board
- Personnel Board
- Planning and Zoning Commission
- Transportation Board
- Valuation Protests Board

II. Regular Meetings.

A. Council Meetings.

All meetings of the Council shall be held on the dates specified in the schedule attached to this Resolution as Schedule A unless notice is otherwise provided at least seventy-two (72) hours in advance of the meeting date. An agenda for all regular meetings of the Council shall be available at least seventy-two (72) hours prior to the meeting from personnel in the Office of the County Manager. All agendas shall be posted on the County's website, provided the website is operational during the period of seventy-two (72) hours prior to the meeting.

B. Appointed County Committee Meetings.

Notice of regular meetings of all Appointed County Committees shall be given no less than ten (10) days in advance of the meeting date. The notice may include an agenda for the meeting or indicate how a copy of the agenda may be obtained. An agenda shall be available at least seventy-two (72) hours prior to the meeting. All meetings of each Appointed County Committee shall be held at the time and at the place indicated in the meeting notice. Each Appointed County Committee may adopt a schedule of its regular meetings for the present calendar year or the balance thereof. Such a schedule shall contain the date, time, and place of each regular meeting. For purposes of Paragraph V of this Resolution, notice of all regular meetings contained in such schedule is met if a copy of the schedule is posted and provided to the media as provided for in Paragraph V of this Resolution; provided, however, that Appointed County Committee must still post and provide to the media a copy of the agenda prior to each regularly scheduled meeting as required under this Resolution. All agendas shall be posted on the County's website, provided the website is operational during the period of seventy-two (72) hours prior to the meeting.

III. Special meetings.

Special Meetings may be called by the Chair or a majority of the members of the Council or respective Appointed County Committee upon at least seventy-two (72) hours' notice. The

notice shall include an agenda for the meeting or information to indicate how a copy of the agenda may be obtained. An agenda for the meeting shall be available to the public and posted on the County's website at least seventy-two (72) hours before any special meeting, provided the website is operational during the period of seventy-two (72) hours prior to the meeting.

IV. Emergency meetings.

Emergency Meetings may only be called under unforeseen circumstances which demand immediate action to protect the health, safety and property of citizens or to protect the public body from substantial financial loss. The Council and all Appointed Council Committees shall avoid emergency meetings whenever possible. Emergency meetings may be called by the Chair or a majority of the members of the Council or the respective Appointed Council Committee upon twenty-four (24) hours' notice, unless threat of personal injury or property damage requires less notice. The notice for all emergency meetings shall include an agenda for the meeting or information on how the public may obtain a copy of the agenda, which shall be posted on the County's website as soon as is practicable after the agenda is created, provided the website is operational during the period prior to the meeting.

V. Notice Requirements.

A. For the purposes of regular meetings described in Paragraph II of this Resolution, notice requirements are met if notice of the date, time, and place is posted in a conspicuous place in the vicinity of the front door of the Municipal Building located at 1000 Central Avenue, Los Alamos, New Mexico and visible from the exterior of the building, as well as being posted on the County's website, provided the website is operational. Copies of the notice shall be provided to those broadcast stations licensed by the Federal Communications Commission and newspapers of general circulation which have made a written request for notice of public meetings for the coming calendar year. Only one such written request shall be required for each calendar year.

B. For the purposes of special meetings described in Paragraph III of this Resolution, notice requirements are met if notice of the date, time, place and agenda is posted in a conspicuous place in the vicinity of the front door of the Municipal Building at 1000 Central Avenue, Los Alamos, New Mexico and visible from the exterior, as well as being posted on the County's website, provided the website is operational. Copies of the notice shall be provided to those broadcast stations licensed by the Federal Communications Commission and newspapers of general circulation which have made a written request for notice of public meetings for the coming calendar year. Only one such written request shall be required for each calendar year.

C. For the purposes of emergency meetings described in Paragraph IV of this Resolution, notice requirements are met if notice of the date, time, place and agenda is posted in a conspicuous place in the vicinity of the front door of the Municipal Building at 1000 Central Avenue, Los Alamos, New Mexico and visible from the exterior and posted on the County's website as soon as is practicable, provided the website is operational. Copies of the notice shall be provided to those broadcast stations licensed by the Federal Communications Commission and newspapers of general circulation which have made a written request for notice of public meetings for the coming calendar year. Only one such written request shall be required for each calendar year.

D. In addition to the information specified above, all notices shall include the following language:

“If you are an individual with a disability who is in need of a reader, amplifier, qualified sign language interpreter, or any other form of auxiliary aid or service to attend or participate in the hearing of the meeting, please contact the County Human Resources Department at (505)662-8040 at least one (1) week prior to the meeting or as soon as possible. Public documents, including the agenda and minutes, can be provided in various accessible formats. Please contact the personnel in the Office of the County Manager at (505)663-1750, if a summary or other type of accessible format is needed.”

VI. Closure of Public Meetings.

The Council and all Appointed Council Committees may close a meeting to the public only if authorized by the Open Meetings Act [Section 10-15-1H NMSA 1978]:

A. If any meeting is closed during an open meeting, such closure shall be approved by a majority vote of a quorum of the Council or respective Appointed Council Committee, as applicable, taken during the open meeting. The authority for the closure and the subjects to be discussed shall be stated with reasonable specificity in the motion for closure and the vote on closure of each individual member shall be recorded in the minutes. Only those subjects specified in the motion may be discussed in the closed meeting.

B. If the decision to hold a closed meeting is made when the Council or an Appointed Council Committee is not in an open meeting, the closed meeting shall not be held until public notice, appropriate under the circumstances, stating the specific provision of law authorizing the closed meeting and the subjects to be discussed with reasonable specificity is given to the members and to the general public.

C. Following completion of any closed meeting, the minutes of the open meeting that was closed, or the minutes of the next open meeting if the closed meeting was separately scheduled, shall state whether the matters discussed in the closed meeting were limited only to those specified in the motion or notice for closure.

D. Except as provided in the Open Meetings Act, any action taken as a result of discussions in a closed meeting shall be made by a vote of the Council or respective Appointed Council Committee, in an open public meeting [Section 10-15-1(H) NMSA 1978].

VII. Remote Attendance.

Any member may participate by means of a conference telephone, video communication, or similar communications equipment when it is difficult or impossible for a member to attend a meeting in person, provided that each member participating by other means can be identified when speaking, all participants are able to hear each other at the same time and members of the public meeting attending the meeting are able to hear any member of the public body who speaks during the meeting.

VIII. Public Health Emergency.

In the event this Resolution is in effect during a public health emergency, the conduct of public meetings shall comport with any and all public health orders issued by the New Mexico

Department of Health and comply with all guidance documents including advisory opinions issued by the Open Government Division of the Office of the Attorney General for the State of New Mexico. To the degree that this Resolution conflicts with these public health orders or the advisory opinions of the Attorney General, the provisions of the public health orders and the advisory opinions of the Attorney General shall control.

PASSED AND ADOPTED this 6th day of January 2026.

**COUNCIL OF THE INCORPORATED
COUNTY OF LOS ALAMOS**

_____,
Council Chair

ATTEST:

**Michael D. Redondo,
Los Alamos County Clerk**



2026 Los Alamos County Council Calendar

Regular meetings will be held in Council Chambers in the Municipal Building at 1000 Central Avenue or at Fire Station 3, 129 State Road 4 in White Rock. Tuesday meetings start at 6:00 PM. Work Sessions maybe held at Fire Station No. 3, 129 State Road 4 in White Rock. Special meetings are scheduled as needed.

NMC Legislative Conf.
Jan. 19 - 22
Santa Fe

Martin Luther King Jr. Day

2026 State Legislative
Session
1/20 - Opening Day
2/19 - Session Ends

NMML Municipal Day
2/6 — Santa Fe

DC Advocacy Trip
3/22—3/26 Tentative

Presidents' Day

Washington, DC CONFERENCES

NACO legislative
Conference
Feb 21 – 24
Washington D.C.

NLC Congressional
City Conference
March 16 – 18
Washington, D.C.

Waste Management
Symposium
March 8 - 12
Phoenix, AZ

LAPS Spring Break
March 30—Apr 3

DRAFT

NACO Western
Region Conf. (WIR)
May 5—8
Maui County, Hawaii

Memorial Day

NMC Annual
Conference
June 15 - 18
Mckinley County

Juneteenth

January

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LA

WR

LA

February

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LA

WR

LA

March

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LA

WR

LA

April

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LA

LA

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WR

WR

WR

June

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LA

WR

LA

July

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4th of July

LA

WR

LA

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LA

WR

LA

September

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LA

WR

LA

October

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WR

Indigenous People Day

WR

WR

November

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LA Veteran's Day

LA

Thanksgiving and day after

December

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LA

LA

Christmas Day Holiday

January 2027

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NACO Annual Conf.
July 17—20
New Orleans, LA

DRAFT

NMML—Annual Conf.
Sept. 1—4
Las Cruces, NM

ECA Cleanup Workshop.
Sept. 14 - 16
Washington, DC

LA Labor Day, Rosh Hashanah

WR Yom Kippur

LA

- Council Regular Meeting
- Council Work Session
- Holidays
- ◇ Budget Hearings
- ◇ Strategic Planning
- Election

ICMA Annual Conf.
Oct. 17—21
Long Beach, CA

LAPS Fall Break
Oct. 9—12
Tentative

NLC City Summit
Nov. 18—21
Nashville, TN

NMC - BIPO
Dec. 8-10
Bernalillo County ABQ

LAC Board of Public Utilities Meeting Calendar

2026

WORK SESSIONS

1st Wednesday at 5:30 pm
(None in Jan., Jul., or Dec.)
Council Chambers & Zoom
<https://us06web.zoom.us/j/84348385574>

REGULAR SESSIONS

3rd Wednesday at 5:30 pm
Council Chambers & Zoom
<https://us06web.zoom.us/j/85828927209>

SPECIAL SESSIONS

April: Begin Utilities Mgr's FY26
Performance Review @ 5pm
May: Finalize Utilities Mgr's FY27
Performance Review @ 5pm
June: Utilities Manager's FY27
Performance Planning @ 5pm
August: BPU FY 28 Strategic
Planning
October: Utilities Manager FY27
Mid Year Performance Review

CHANGES

to the Normal Schedule

ANNUAL PRESENTATION
by the BPU Chair at July
Council Work Session

Staff Reports and attachment
documents are due nine (9)
days prior to each meeting.

The BPU will normally meet at
1000 Central Avenue
(Municipal Building) in
Council Chambers.
The public is encouraged to
participate either in person or
remotely via Zoom.

Agendas and special meeting
notices are published
at least 72 hours in advance.
If you would like
to be added to the BPU
distribution list please e-mail
kathy.casados@lacnm.us.

Email Public Comments to:
bpu@lacnm.us.

If you are an individual
with a disability who is in need of a
reader, amplifier, qualified sign
language interpreter, or any other
form of auxiliary aid or service to
participate, please contact Human
Resources at 505-662-8040 as
soon as possible.

Public documents, including the
agenda and minutes, can be
provided in various accessible
formats. Please contact the DPU
Executive Assistant at
505-662-8136 for more information.

January

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February

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March

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April

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June

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July

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Rescheduled to July 22

August

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September

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October

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November

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December

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January 2027

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HOLIDAYS

**COUNCIL
Regular Meetings**
February-December dates TBD

**COUNCIL
Budget Hearings**

B&C LUNCHEONS
Council Chambers
2nd Thurs. of March,
May, September, &
November
(Dates subject to change)

For videos, agendas and minutes
go to:

[losalamos.legistar.com/
Calendar.aspx](https://losalamos.legistar.com/Calendar.aspx)

and select
"Board of Public Utilities"

To view meetings live online, visit
the website above and click on
"Live Proceedings."

Learn more about the
BPU online at
ladpu.com/bpu



LOS ALAMOS
Department of Public Utilities

Electric, Gas, Water, and Wastewater Services

1000 Central Ave
Suite 130
Los Alamos, NM 87544

Customer Care
505.662.8333
Fax 505.662.8005

ladpu.com/BPU