Pathway to Zero Natural Gas

Yuting Yang Jamal Mamkhezri Ahmed A. Jawhari Jiaqing Zhao Benjamin Cornelius

University of New Mexico & New Mexico State University
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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.

Data sources

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 $\sim$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 $\sim$61% more electricity demand with a much sharper winter peak.

Resident survey findings

Survey results

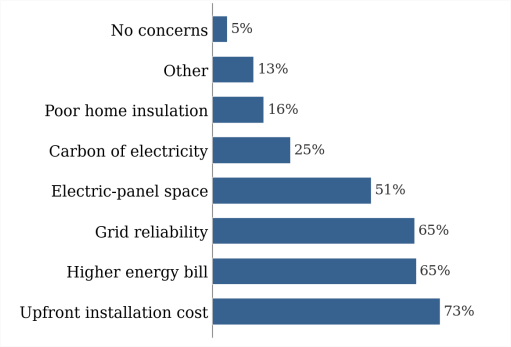
Gas use, satisfaction, and affordability

- 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.

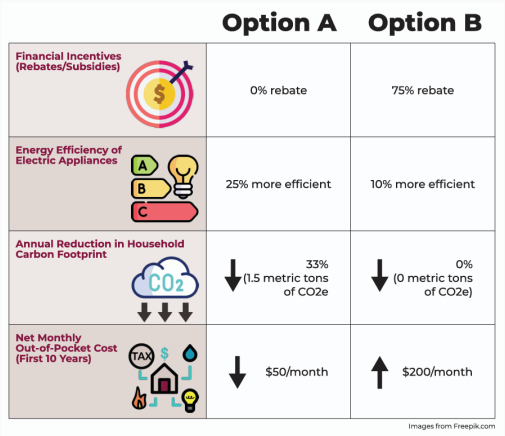
Willingness to pay: the choice experiment

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.



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$\times$ 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

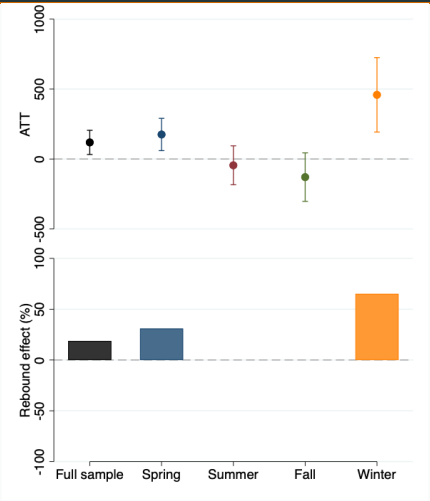
Does rooftop solar reduce energy use?

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%

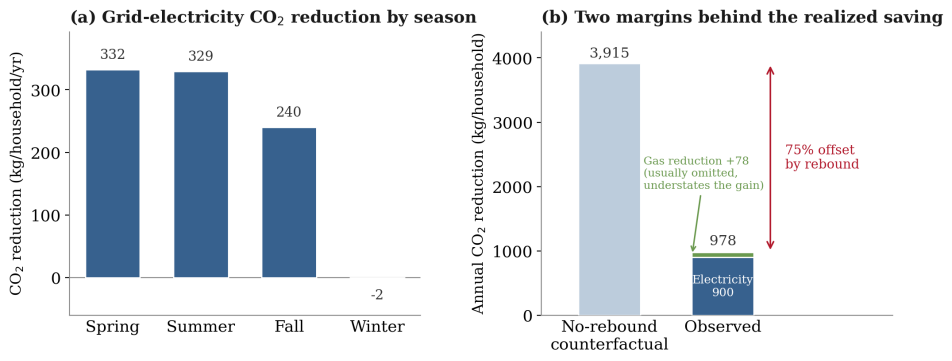
Solar households do more than replace grid power with their own generation. They consume more energy overall. This is the "rebound effect."

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 CO_2 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

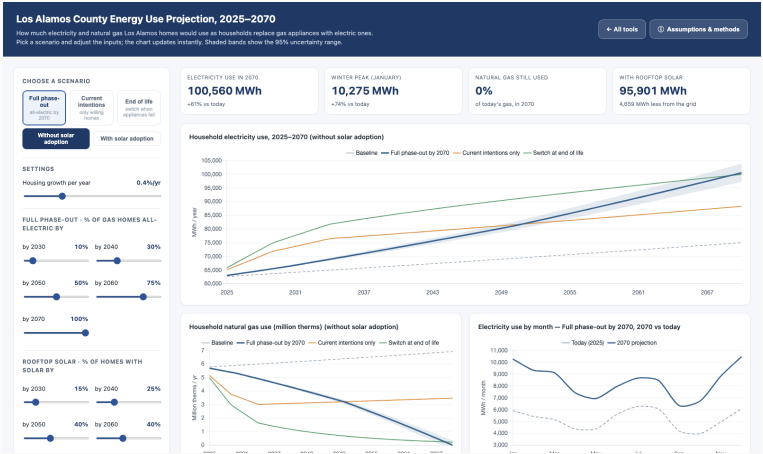
Only the households that say they are "very likely" to switch actually do. The 74% with no plan never switch.

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).

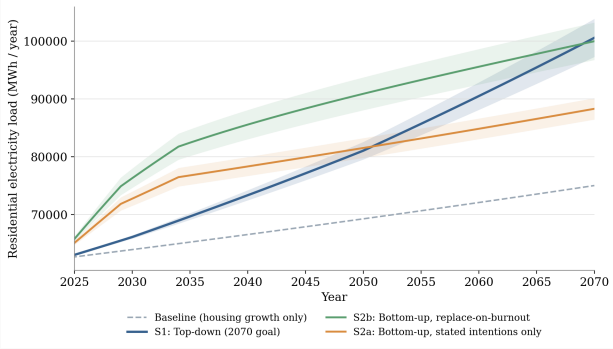
Interactive scenario tool



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

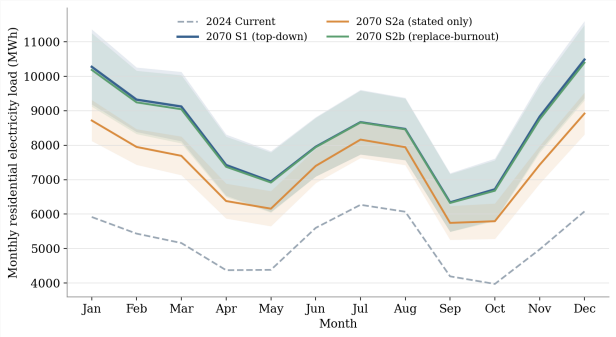
unm-eel.github.io/ladpu: projection, willingness-to-pay, solar-rebound, and home tools

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



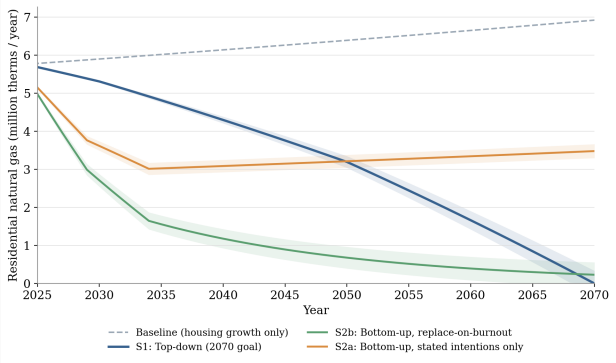
- Meeting the goal would raise residential load from ∼62,400 MWh (2024) to ∼100,600 MWh (2070).
- About a third of the growth is new housing. The rest is electrification.
- Under stated intentions alone (S2a), load would plateau at ∼88,300 MWh, well short of the goal.

Winter becomes the binding constraint



- Electric heating concentrates the new load in winter.
- January load would grow ∼74%, faster than annual energy (∼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.

Conclusions

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