



Pathway to Zero Natural Gas

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- Partner utility: Los Alamos Department of Public Utilities (LADPU)
- Co-investigator: Jamal Mamkhezri (New Mexico State University)
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Los Alamos County Climate Goal 2070

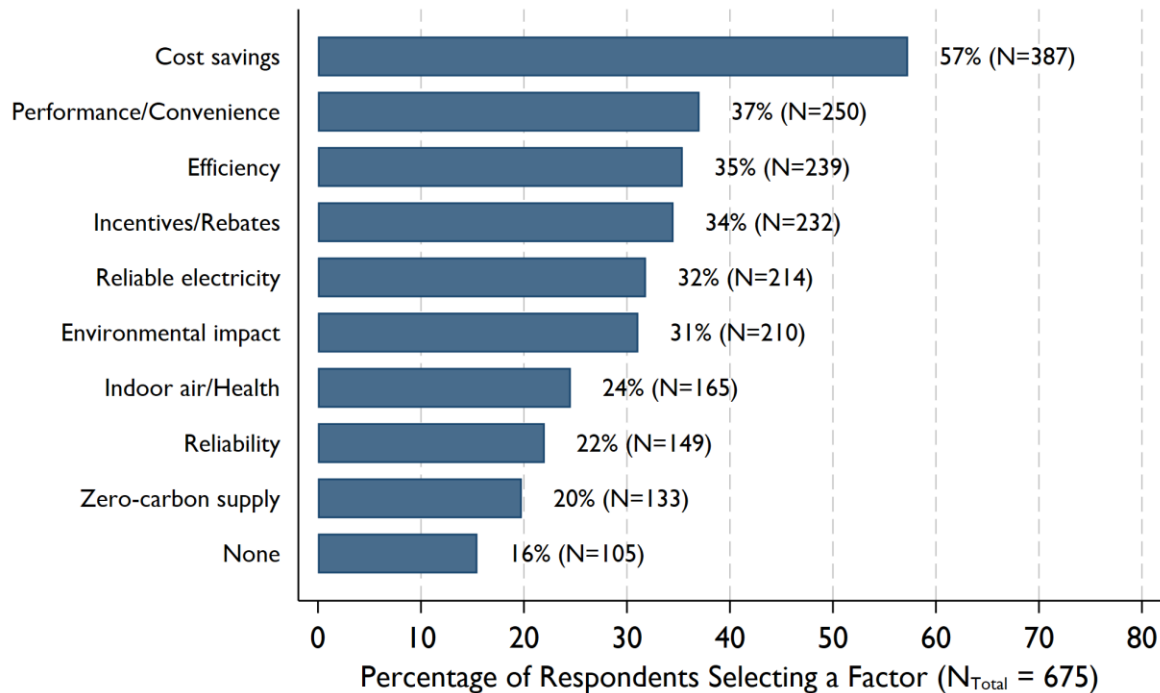
- Los Alamos County has committed to ending natural gas service by 2070
- Almost every home runs on gas today: 96% own gas appliances, 90% heat with gas
- Need to know the intentions to switch and the implications to grid planning
- Research questions:
 - What are households' willingness to switch? What are the key drivers and barriers?
 - Does rooftop solar help the utility get there?
 - What are the implications on electricity load for LADPU?

Data and Methods

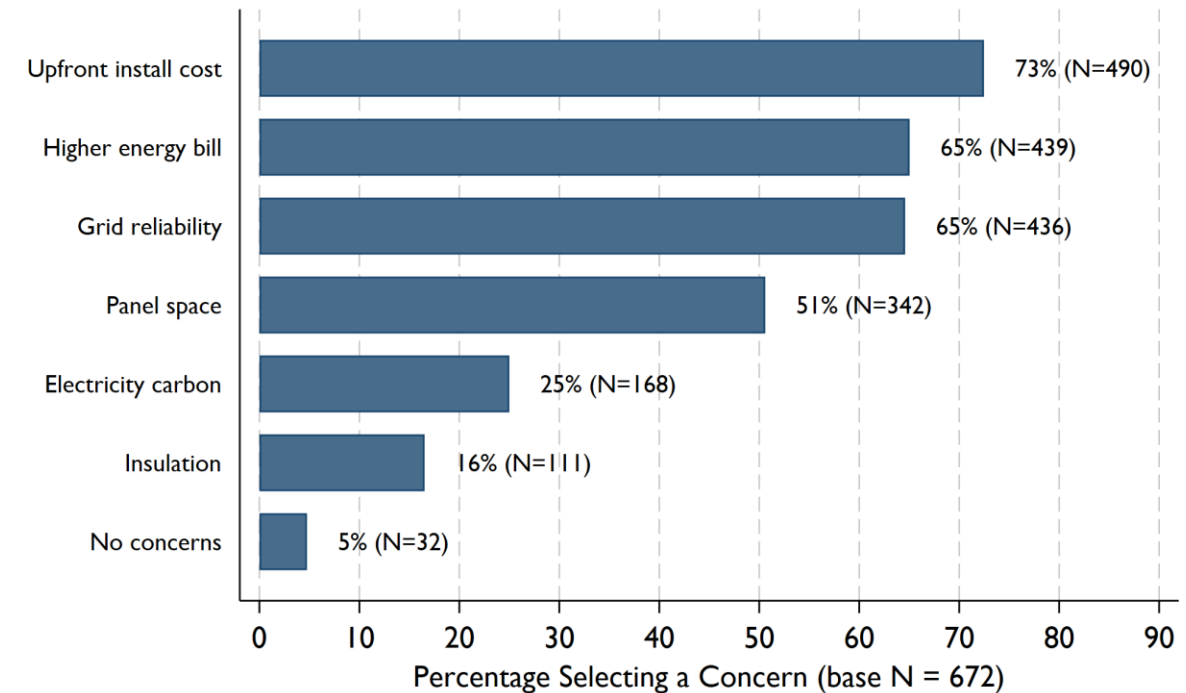
- **Surveyed** LADPU customers, July-September 2025: 912 responses, about one in nine households
- **Discrete choice experiment:** Asked them to choose between realistic electrification packages, which lets us put a dollar value on what they care about
- Linked households' **hourly electricity and gas meter readings** (01/2022 to 06/2025) to solar installation record, housing information, and survey responses, to study
 - the **effect of solar adoption** in household electricity and gas consumption
 - **appliance stock on electricity and gas consumption**
- **Projected the electricity load growth** with increasing electrification

Drivers and Barriers of Switching

(a) Factors that would influence switching



(b) Concerns and barriers to switching



Willingness to Pay for Electrification

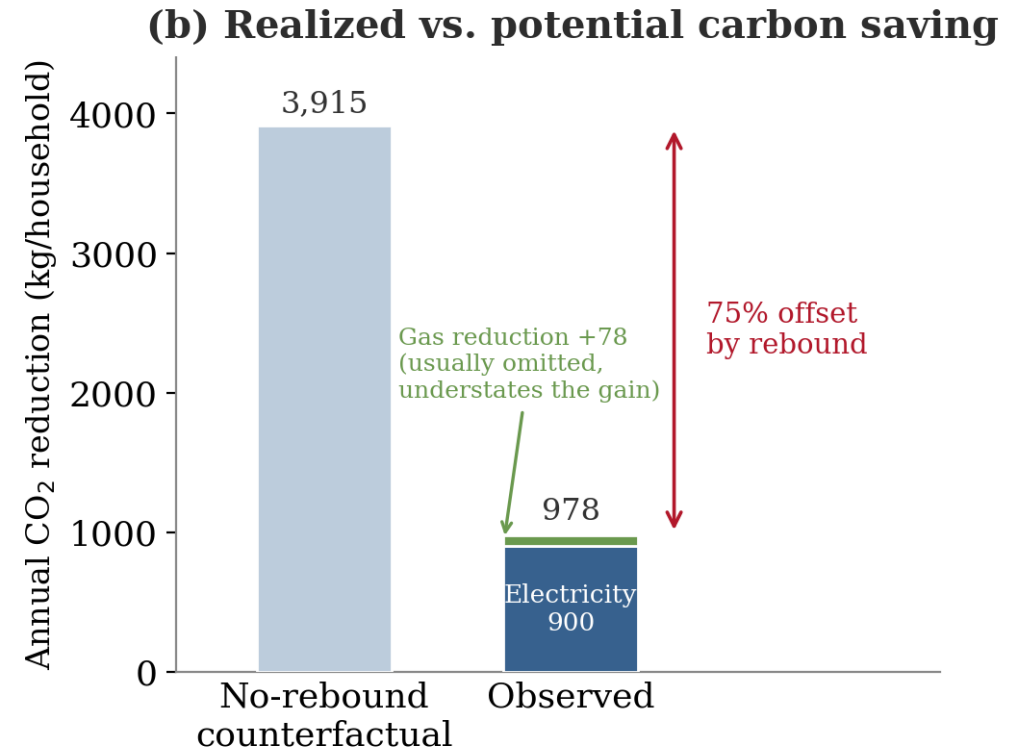
- Households value **appliance efficiency** most (\$2.31 per pp per month), then **carbon reduction** (\$1.49), then **rebates** (\$1.10).
- The electrical panel is the largest single barrier. About 75% of homes require a 200-amp upgrade, at \$2,000 to \$8,000.
- Households facing a panel upgrade require roughly **\$800 to \$1,000 per year in additional benefits** before they choose to electrify.
- Information on climate and health effects had no measurable effect on willingness to pay

	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

The Solar Rebound Effect

- After solar adoption, households purchase **21% less electricity from the grid** on average, but **total electricity use rises 19%**, and total energy use rises 7%.
- The rebound is largest in winter, including evening hours when panels are not generating.
- Absent the rebound, an average solar home would avoid 3.9 tonnes of CO₂ per year, but the realized saving is about 1 tonne (25% of the theoretical carbon reduction).



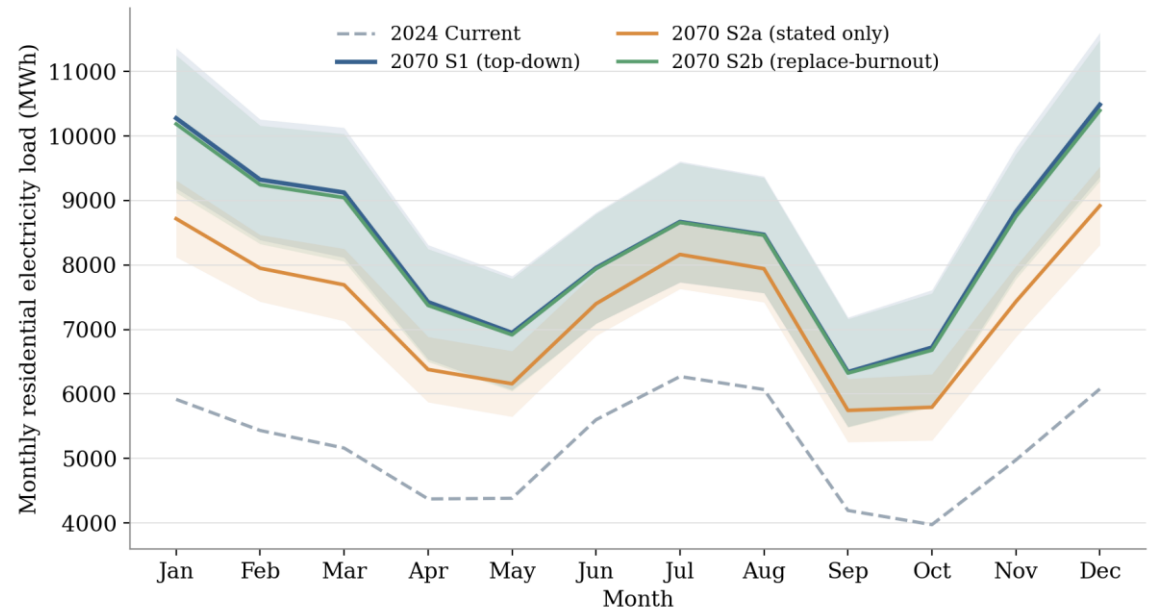
Determinants of Gas and Electricity Consumption

- Gas use is set by the building **size and age**, electricity use by **appliances and occupancy**
- Space heating is weather-driven and analyzed separately; it is the largest new electric load and peaks in winter

	Effect on electricity use	Effect on gas use
<i>The building</i>		
Home size (per 1,000 sqft)	+4.9 kWh/day (+25%)***	+0.68 therms/day (+33%)***
Home age (per decade)	+0.3 (+1%)	+0.05 (+2%)**
<i>Appliances and usage</i>		
Electric water heating	+4.3 (+21%)**	-0.25 (-12%)
Electric cooking	+1.5 (+7%)*	-0.06 (-3%)
Clothes dryer use (per load/week)	+1.6 (+8%)***	+0.07 (+3%)***
<i>Occupancy</i>		
Renter	-4.6 (-23%)***	-0.42 (-20%)*
Retired	+3.3 (+16%)***	-0.03 (-1%)

Load Projections: Winter Becomes the Binding Constraint

- Meeting the 2020 goal raises residential electricity use by about 61%
- The January peak rises about 74%. Winter, not summer, becomes the binding constraint
- Under stated intentions alone, 60% of today's gas is still in use in 2020
- If electric becomes the default when equipment fails, 96% of homes convert
- Rooftop solar trims the projected load by about 5%, not enough to close the gap



<https://unm-eel.github.io/ladpu/>

Policy Implications

- **Near term: lower the cost and friction of switching**
 - Lead with bills, comfort, and performance rather than carbon; reach households when gas equipment fails
 - Offer low-interest financing for panel upgrades and refer households to income-qualified rebates
- **Medium term: target and sequence conversions**
 - Weatherize large, older, high-gas homes before electrifying them; prioritize space and water heating
- **Long term: plan the grid and protect affordability**
 - Size the system to the winter peak; account for solar rebound in planning
 - As homes leave gas, the fixed costs of the gas system fall on the customers who remain

Thanks!
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