

# ET Summit 2024

Presented by



# Affordable and Equitable Residential Electrification Under Electrical Panel Constraints

Accelerate home electrification with low-cost alternatives to panel upsizing



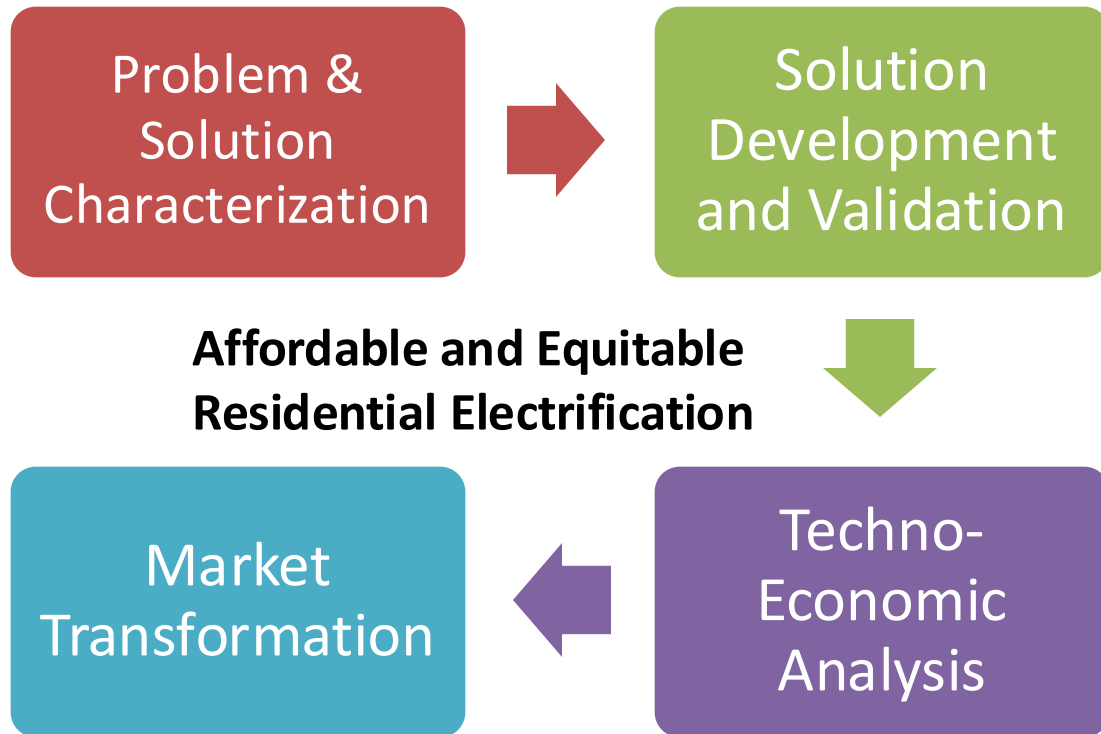
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# Challenges for Home Electrification: Electrical Panels with Capacity or Space Constraints

- Decarbonization of homes will require electrification of currently fuel-fired end uses and introduce new electric end uses such as electric vehicles and heat pumps.
- In many cases, low-capacity and space-limited panels in vintage homes cannot accommodate the new loads according to current rules in the National Electrical Code (NEC).
- Due to long wait times or high costs, upgrading panels is not always feasible— especially for low-income families—and there are upstream impacts on the distribution grid.

# DOE National Lab researchers are working together to advance affordable solutions and support equitable home electrification

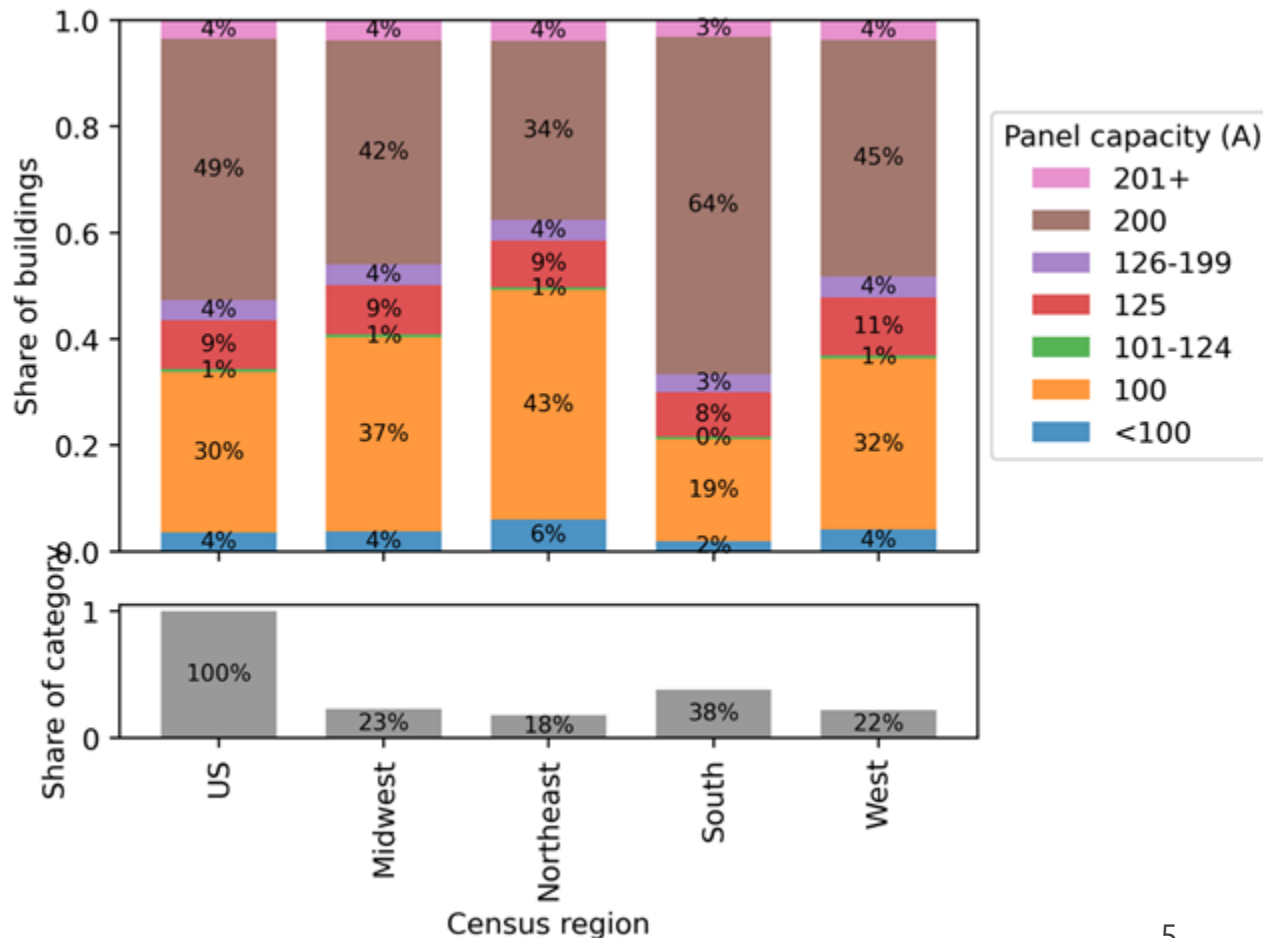


## Objective and Outcome

**Develop publicly available resources** to characterize residential electrical panel capacity constraints, and **advance affordable and equitable solutions** to electrify the U.S. housing stock under electrical panel and service constraints.

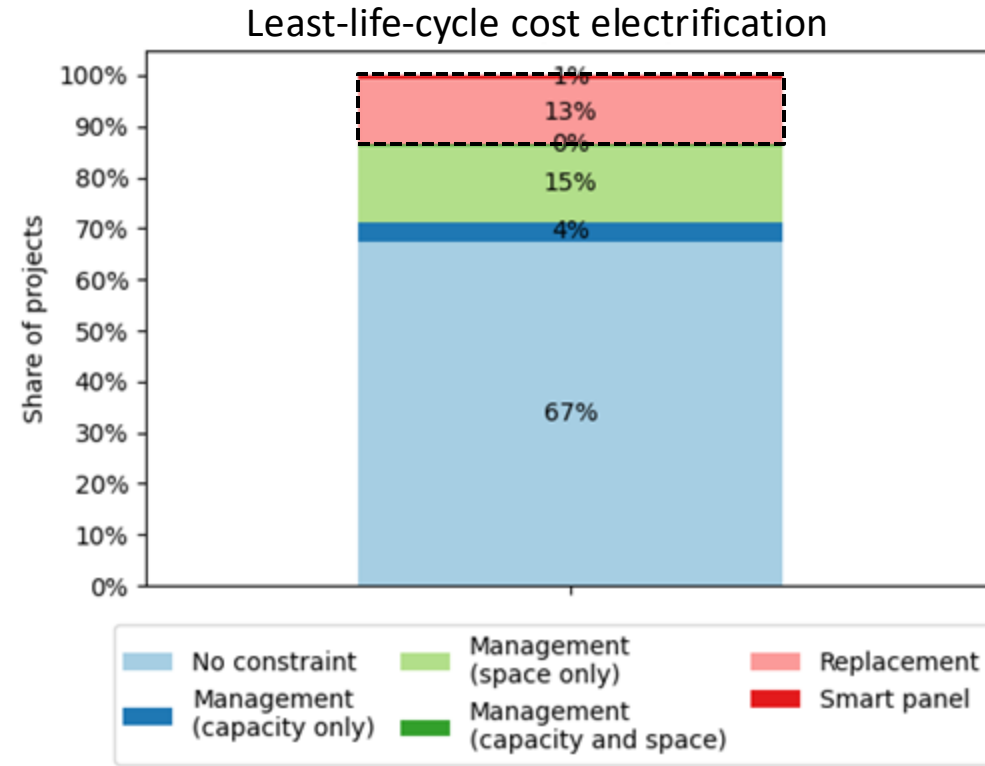
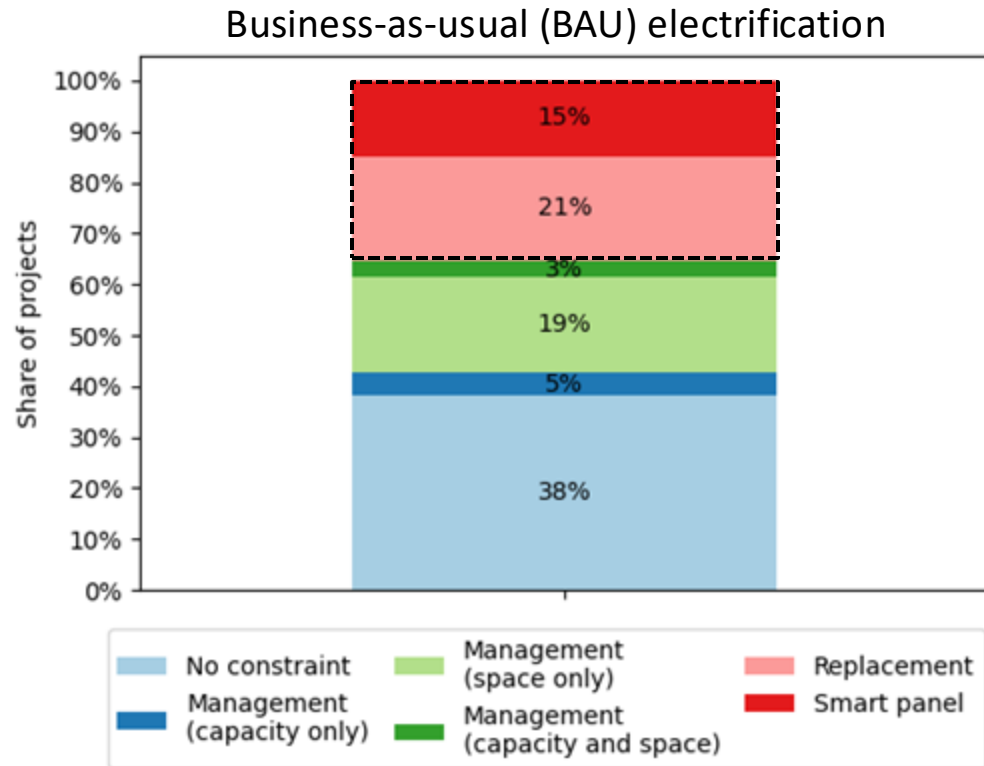
## A field data-trained predictive model was applied to the ResStock database to estimate panel capacities across the U.S. housing stock

### Preliminary results



- Nationwide, we estimate 30% of homes have 100A panels and 49% have 200A panels. The South has more 200A panels while the Northeast has more 100A panels.
- We also find that panel capacity varies with building vintage, area, and type as well as by state and area median income.

## Capacity and space management, envelope upgrades, and low-voltage and high efficiency equipment reduce the need for panel replacements



- Under business-as-usual (BAU) electrification, 62% of buildings face panel constraints. Capacity and/or space management can allow nearly half of those buildings to keep their existing panel.
- With envelope upgrades and lower-voltage and higher efficiency equipment, 87% of buildings can keep their existing panel.

# Active stakeholder engagement drives market transformation to support affordable and equitable home electrification

## Public-facing training materials:

- Case studies of low-power electrification from 12 existing dwellings
- NEC load calculation guide | Low-power solution guide | Low-power design flow chart

## Proposed changes to the 2026 National Electric Code (NFPA Standard 70):

- Our team member led a working group and submitted 19 public inputs to NFPA
- Also participated as a voting member of Task Group 4 under Code-Making Panel 2

## Technical publications:

- Electrical Service Panel Capacity in California Households with Insights for Equitable Building Electrification ([link](#))
- A Comprehensive Survey of Electrical Panel Capacities in U.S. Single-Family Homes and Implications for Nationwide Electrification ([link](#))
- HVAC Heat Pump Upgrades and Their Impact on Household Maximum Power Demand ([link](#))
- Characterizing Panel Capacity, Breaker Space, and Loads in the U.S. Residential Building Stock (coming soon)
- Evaluating the Ability to Add New Electrical Loads to Existing US Dwellings (coming soon)
- Low-Power Home Electrification Solutions for Addressing Panel and Service Upsizing Needs (coming soon)

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Our research shows most U.S. homes can safely electrify without panel replacement by adopting least-life-cycle electrification measures such as capacity/space management, envelope upgrades, and lower-voltage and higher efficiency equipment. We are generating publicly available resources and engaging with stakeholders to advance affordable and equitable home electrification. NEC code revision (or interpretation), utility incentive programs, and workforce development are the key to drive the market transformation and scale the impact.

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