

# A National Survey of Electrical Panels Using Citizen Scientists

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## Problem Statement

There is surprisingly little data on the panel capacities in existing homes and the appliances in them. How many homes will need upgraded electrical panels before heat pumps, EVs, and induction stoves can be installed?

### Smaller questions:

- How many panels have empty expansion slots?
- Can we confidently predict panel capacities based on simple building characteristics?

## Survey Challenges

- We paid “Workers” up to \$2 - \$8 per submission (increased over time)
- We excluded foreign workers (mostly from India) and restricted survey to occupants of single-family homes
- Many Workers tried to cheat by faking the data and using photos from the web
- We used a trick question and reverse image searches to eliminate fake data

*Moral: Citizen Scientists aren't always good citizens.*

## Solution: Gather Data!

### Our Approach

- Use “citizen science” techniques to gather panel and building characteristics
- Recruit submissions through the web platform “Amazon Mechanical Turk”



Follow this QR to learn more about Amazon Mechanical Turk (along with an explanation of the origin of its curious name).

### What is Amazon Mechanical Turk?

Mturk is a crowd-sourcing web platform where “Workers” are hired to perform small “Human Intelligence Tasks” (HITS) that cannot be done by machines.

- ~200K Workers in US, but probably not representative of US population
- Payments per task range from 1 cent to many dollars

I have used it to learn about thermostat settings, dishwasher habits, and use of roof racks on automobiles.

## We Asked Only 12 Questions

1. Single-family attached or detached
2. State
3. City
4. Zip code
5. Home construction year
6. Home floor area
7. Primary heating fuel
8. Select all major electric appliances from list
9. Select all major gas (propane, oil) appliances from list
10. Upload photo of whole panel
11. Upload close-up photo of MAIN or Service Disconnect switch
12. Enter value on switch labeled MAIN



## Results

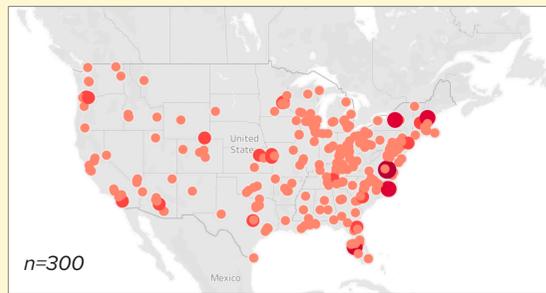
### Survey Results

Submissions to date:

- Total: 500
- Usable: 300
- Growth: 60/month

West coast is under-represented

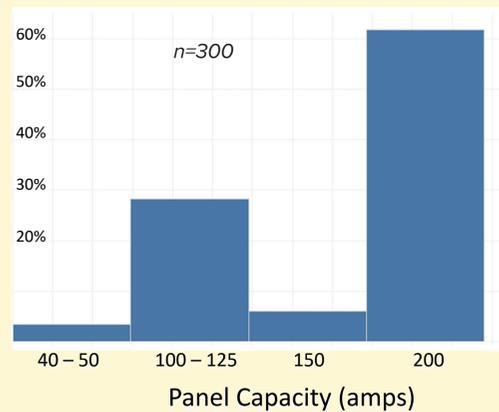
Rural areas are over-represented



The Workers are more rural, which is reflected in a greater percentage of well-pumps in the homes (for example).

### Technical Findings

- **60%** of homes have 200 amp panels
- **35%** have panels 125 amp or less
- Panels in homes with gas service have lower capacity



### Future Work

- Enlarge sample through other platforms and social media
- Compare/calibrate to RECS
- Count empty slots in panels
- Can we use house characteristics to identify homes with insufficient panel capacity for electrification?
- Propose standardization of panel labeling

## Donate Your Data!



Contribute your home's panel capacity to our data base. Use the QR or URL to link to the survey and upload photos of your electrical panel.

It takes an average of 4 minutes to fill out the form (plus time to photograph your electrical panel). The survey is anonymous, asks no personal questions, and has been approved by LBNL IRB.

surveymonkey.com/r/DVMFVNH

## Questions?



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