



DRIVING TRANSFORMATION

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Co-Convened by

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Engaging Vulnerable Multifamily Properties for Resilient Retrofits

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Research Question

What are the attributes of the multifamily (MF) properties exposed to public safety power shutoffs (PSPS)?

- Are they less energy efficient and more vulnerable than other MF properties?

Findings from Previous Research

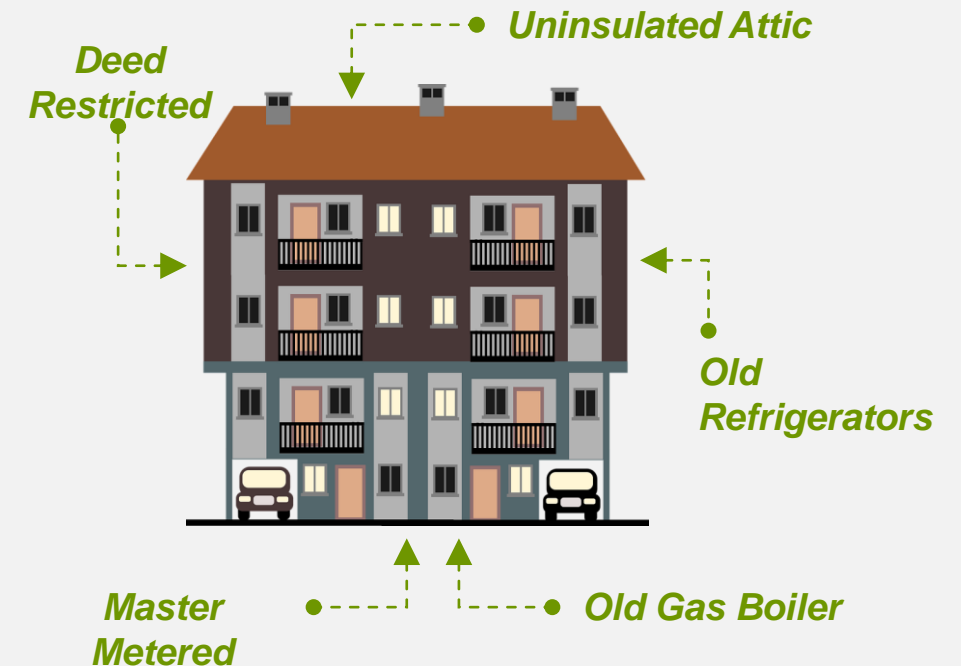
- Extremely low-income MF residents more likely to live in Low-Rise and Garden (Low-Rise with >4 buildings) properties
 - More likely to be tenant-metered (gas & electricity)
 - Tenant-metered properties are ~30% LESS efficient (20% Gas + 10% Electricity)
- Properties with the highest share of low-income residents are another ~20% LESS efficient
- MF properties in disadvantaged communities are LESS efficient due to higher baseload energy use

Methodology

1. Create first-ever residential:
 - Property inventory
 - Building inventory

2. Create advanced building attributes

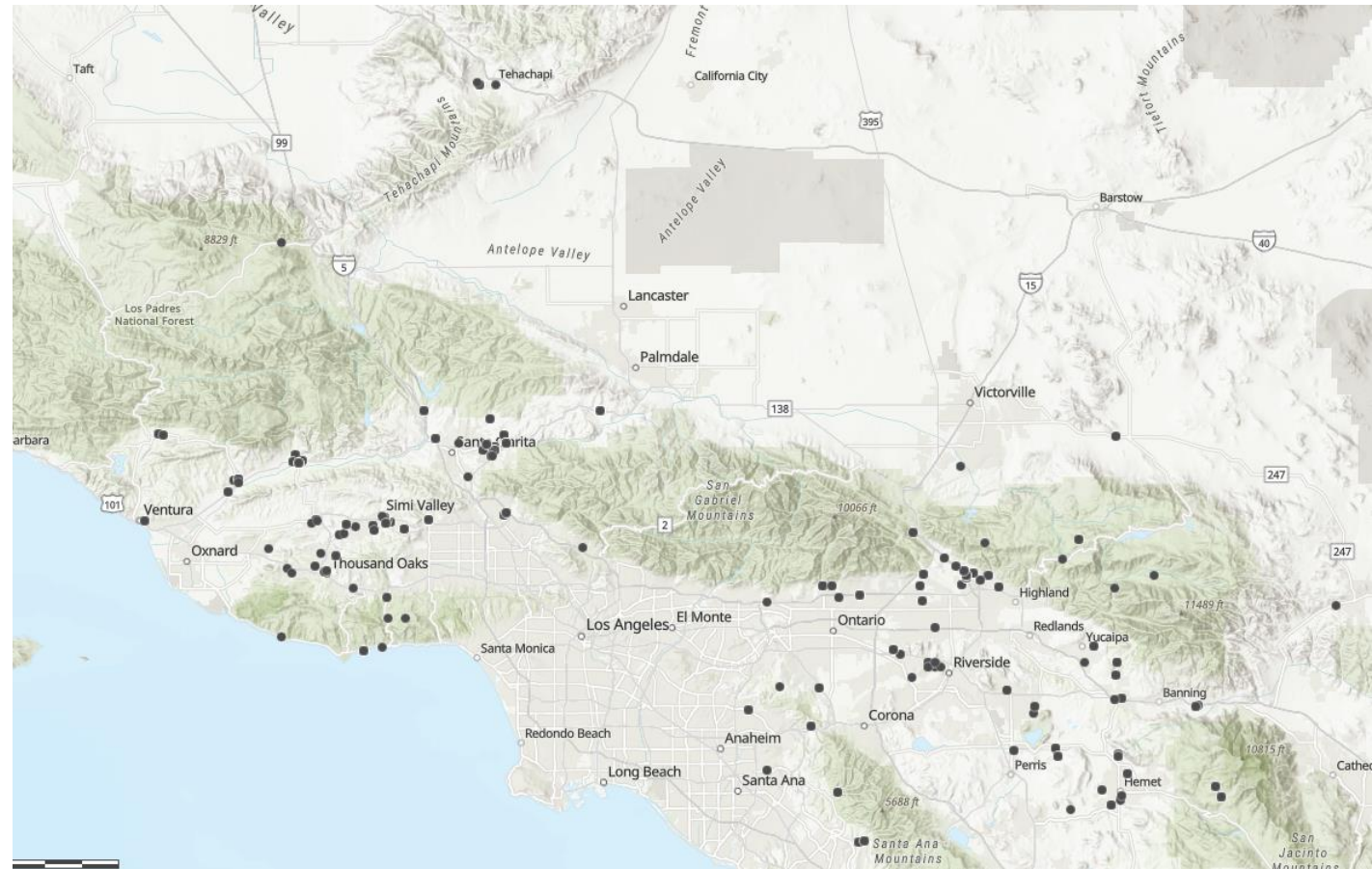
3. Building energy benchmarking
 - Energy-use disaggregation



Results (I)

- All ~40,000 MF properties mapped to the nearest circuit
- 144 MF properties exposed to ~970 reported PSPS events between 2019-2022

| | Total Outages | Avg Customer Weighted Duration (Hrs) |
|---------|---------------|--------------------------------------|
| Mean | 3 | 27 |
| Median | 2 | 25 |
| Minimum | 1 | 2 |
| Maximum | 19 | 76 |
| Sum | 429 | 3816 |



- PSPS events are largely suburban, exurban



Results (II)

- Suburban and exurban properties tend to be larger than the MF population
- Higher electricity use
- Non-coastal

| | Number of Units | Year Built | Subsidized Low-Income | Heating Degree Days | Energy Use Intensity (kBTU/sqft) | Building Energy Benchmark Score |
|---------|-----------------|------------|-----------------------|---------------------|----------------------------------|---------------------------------|
| No PSPS | 23 | 1961 | 0.05 | 2769 | 17.0 | 49.6 |
| PSPS | 69 | 1974 | 0.08 | 3227 | 25.4 | 52.2 |
| Total | 23 | 1961 | 0.05 | 2771 | 17.0 | 49.6 |

- Next, we matched the energy attributes of PSPS impacted properties to similar properties based on # of units, year built, climate zone, heating degree days, low-income:
 - No statistically significant difference in building energy benchmark scores between PSPS and matched non-PSPS properties

Results (III)

- PSPS property types:
 - More likely to be large, low-rise MF style (not shown)
 - The duration of PSPS events for Large Garden style is nearly 2x the average
 - Large Garden properties have more medical baseline customers impacted than mid-rise (another large MF property type)

| Property Style | Mean Outage Duration (Hrs) |
|----------------|----------------------------|
| Garden-Lg | 306 |
| Garden-Sm | 174 |
| Low-Rise | 135 |
| Mid-Rise | 91 |
| Average | 170 |



| Property Style | Quartile 1 | Quartile 2 | Quartile 3 | Quartile 4 | Total |
|----------------|------------|------------|------------|------------|-------|
| Garden-Lg | 10 | 20 | 30 | 40 | 100 |
| Garden-Sm | 16.67 | 30.95 | 33.33 | 19.05 | 100 |
| Low-Rise | 33.75 | 22.5 | 18.75 | 25 | 100 |
| Mid-Rise | 0 | 50 | 50 | 0 | 100 |



Implications

- Garden-style properties are the most exposed to PSPS events. These are extremely vulnerable properties:
 - 50 years old so ~half don't have much/any envelope insulation
 - More exterior walls and likely significant air infiltration of wildfire (etc) smoke
- Medical baseline customers associated with these types and related longer outages
- PSPS exposed MF properties are less likely to be subsidized low-income than non-PSPS
 - Tailored outreach to these MF owner types
- Customer health and safety a new motivation for retrofits by MF property owners?
- How to mitigate renovictions from retrofits?



Thanks for your Interest!!

Follow-Up:

- Questions
- Brainstorming / Problem-Solving

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<https://res-intel.com/solutions/>

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Extra Slides

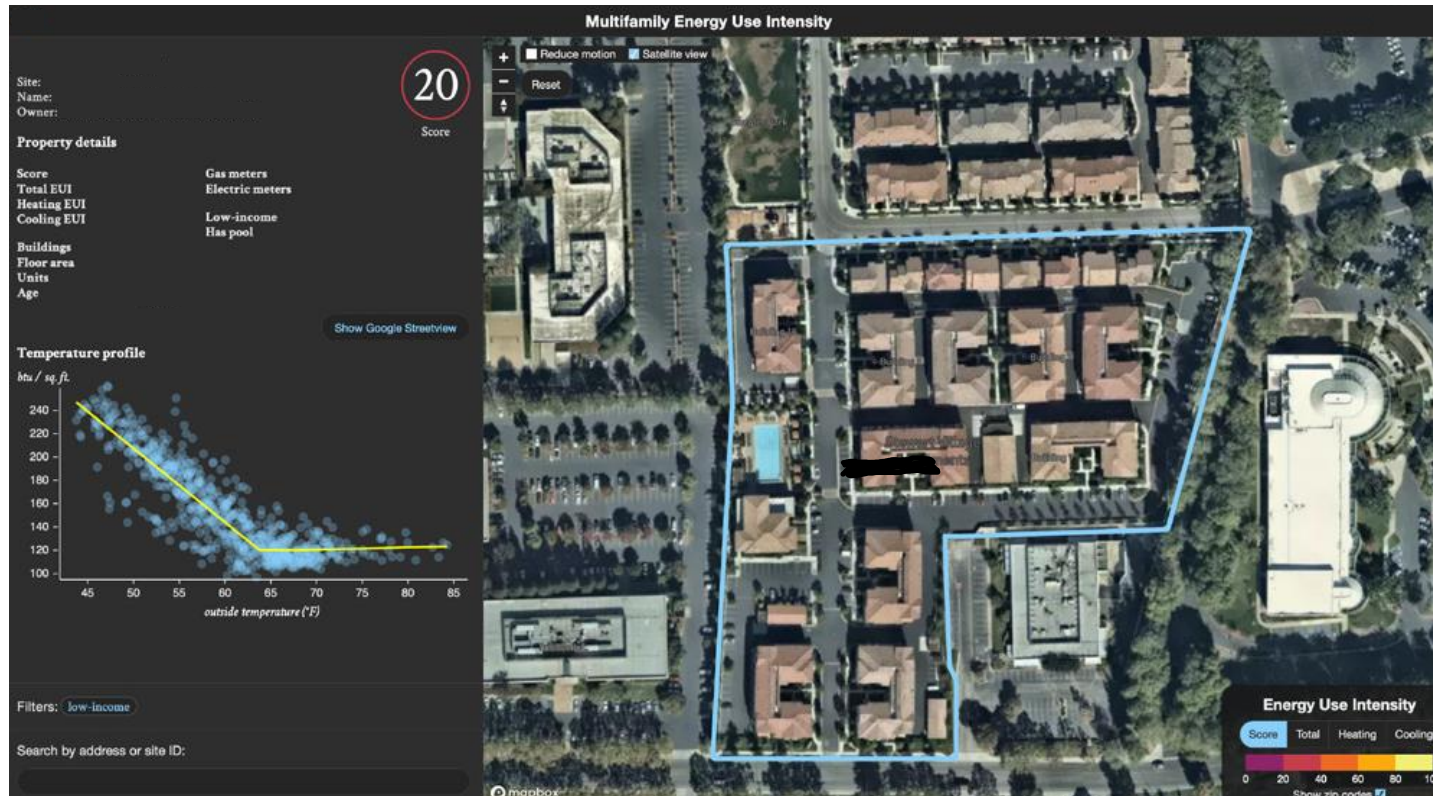


Tool Methodology



1. **Property inventory: Real estate data aggregation**
 - CoStar + Public records + Geocoding
2. **Utility meter matching**
 - 95%-98% of meters are matched to properties
3. **Create 1st-ever building inventory**
 - LiDAR (Light Detection & Ranging)
4. **Mass-scale building energy benchmarking**
5. **Energy disaggregation analytics**
6. **Existing equipment predictions**
7. **Whole-building retrofit recommendations**

Property-Level Dashboard



- Energy use intensity (kBTU/sqft)
- **Benchmark Score**
- Heating, cooling, and baseload performance indices
- Electric vs. gas heat
- Master-metered
- Amenities
- Google streetview
- Meter and premise ID's mapped to buildings (not shown)

Propensity matching regression

- More units, newer year built, inland climate zone (cz), and more heating degree days predict PSPS properties
- Treated group benchmark scores are higher than Control group for ATT group but not statistically significant (T-stat less than 1.96)

```
. psmatch2 psp units yr_built low_income cz hdd, outcome(score) neighbor(1)
```

Probit regression

Number of obs = 35,893

LR chi2(5) = 129.23

Prob > chi2 = 0.0000

Log likelihood = -641.15353

Pseudo R2 = 0.0916

| psps | Coefficient | Std. err. | z | P> z | [95% conf. interval] | |
|------------|-------------|-----------|-------|-------|----------------------|-----------|
| units | .001919 | .0002878 | 6.67 | 0.000 | .001355 | .002483 |
| yr_built | .0070998 | .0019613 | 3.62 | 0.000 | .0032557 | .0109438 |
| low_income | -.0563733 | .1343967 | -0.42 | 0.675 | -.3197861 | .2070395 |
| cz | .0838437 | .0146539 | 5.72 | 0.000 | .0551226 | .1125648 |
| hdd | .0000334 | .0000232 | 1.44 | 0.151 | -.0000122 | .0000789 |
| _cons | -17.63525 | 3.830718 | -4.60 | 0.000 | -25.14332 | -10.12718 |

| Variable | Sample | Treated | Controls | Difference | S.E. | T-stat |
|----------|-----------|-----------|------------|------------|------------|--------|
| score | Unmatched | 52.223301 | 49.6087455 | 2.61455551 | 2.68036649 | 0.98 |
| | ATT | 52.223301 | 46.0679612 | 6.15533981 | 3.80490316 | 1.62 |

Note: S.E. does not take into account that the propensity score is estimated.

| psmatch2: Treatment assignment | psmatch2: Common support | |
|--------------------------------------|--------------------------------|--------|
| | On suppor | Total |
| Untreated | 35,790 | 35,790 |
| Treated | 103 | 103 |

