



WHEN TRUST MATTERS

# Are You Ready for Plug and Play?

Insights from Holistic Electrification Program Evaluation

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# Agenda:

- study overview and design
- baseline study findings
- impact study findings
- loadshape findings
- NILM findings



# STUDY OVERVIEW

# SMUD Residential Electrification Evaluation Overview

## Baseline study

- Space and water heating
  - penetrations of EE equipment,
  - building characteristics,
  - panel conditions, and
  - customer demographics

## Impact Evaluation

- M&V of
  - energy savings,
  - carbon reduction
  - increased electric usage

## Loadshapes

- Identify space and water heating loadshapes

## NILM

- Identify and evaluate key load disaggregation technologies.



# Study Design



## Baseline study

Participant surveys (n=207)

Non-participant surveys (n=1,213)

Property manager interviews (n=30)



## Consumption analysis

Quasi-experimental design

Matched comparison group

Difference in difference model to estimate savings



## Onsite data collection and NILM

Onsite data collection (n=66)

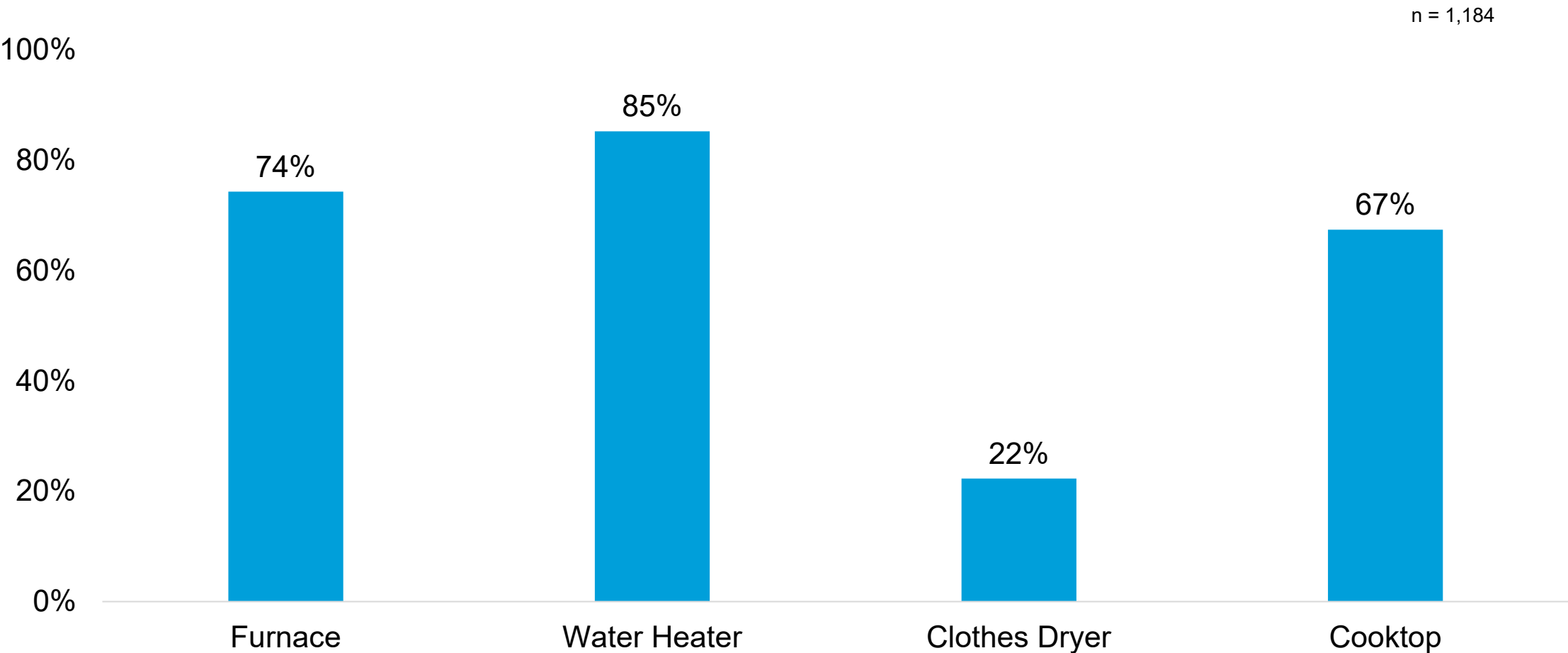
Non-intrusive load monitoring (n=10)

## SMUD's Go-Electric Survey

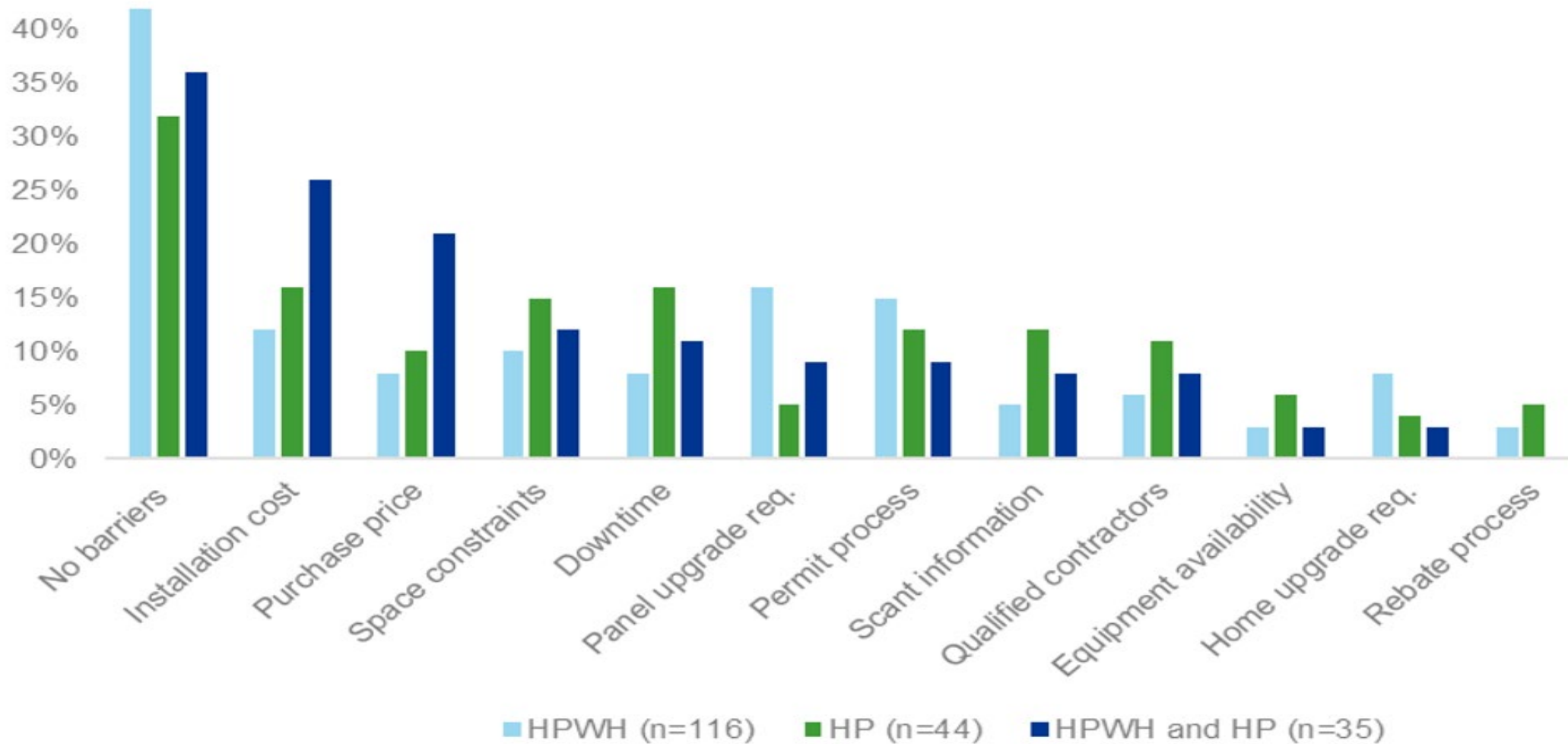


# BASELINE STUDY

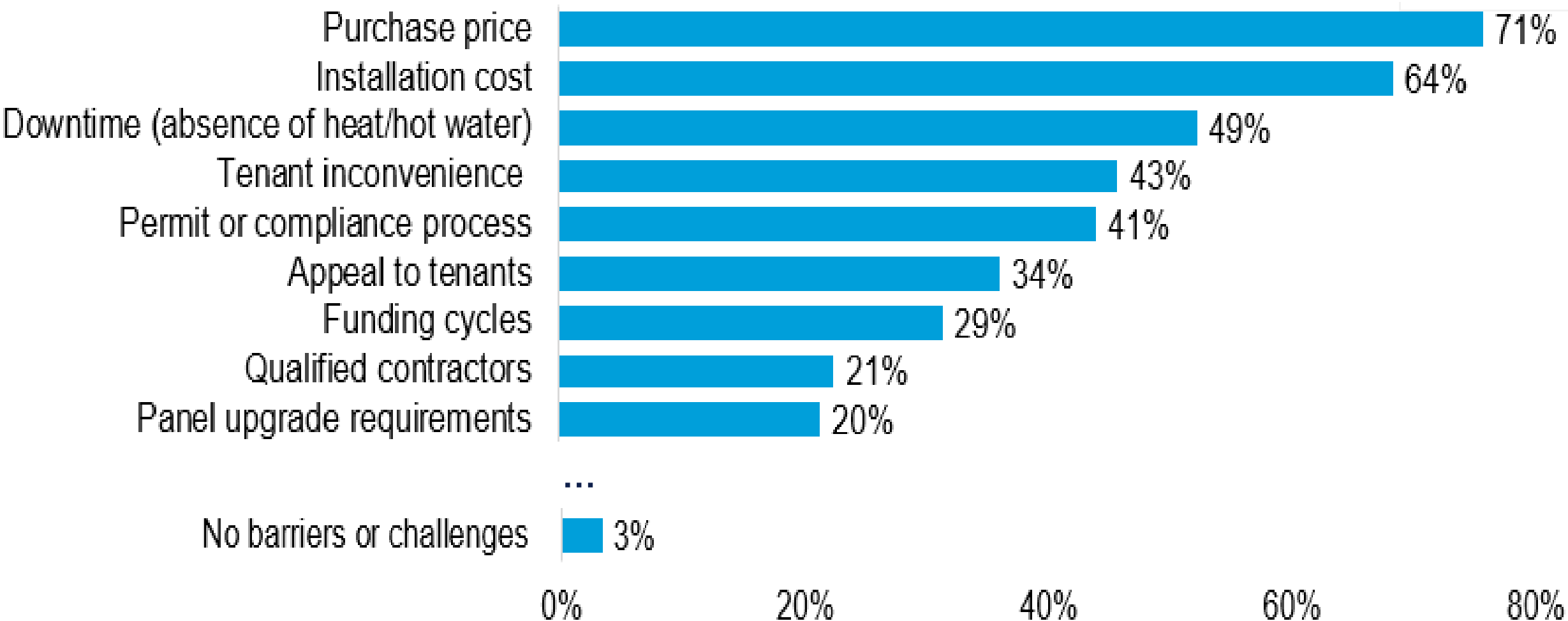
# Penetration of natural gas appliances – Non-participants



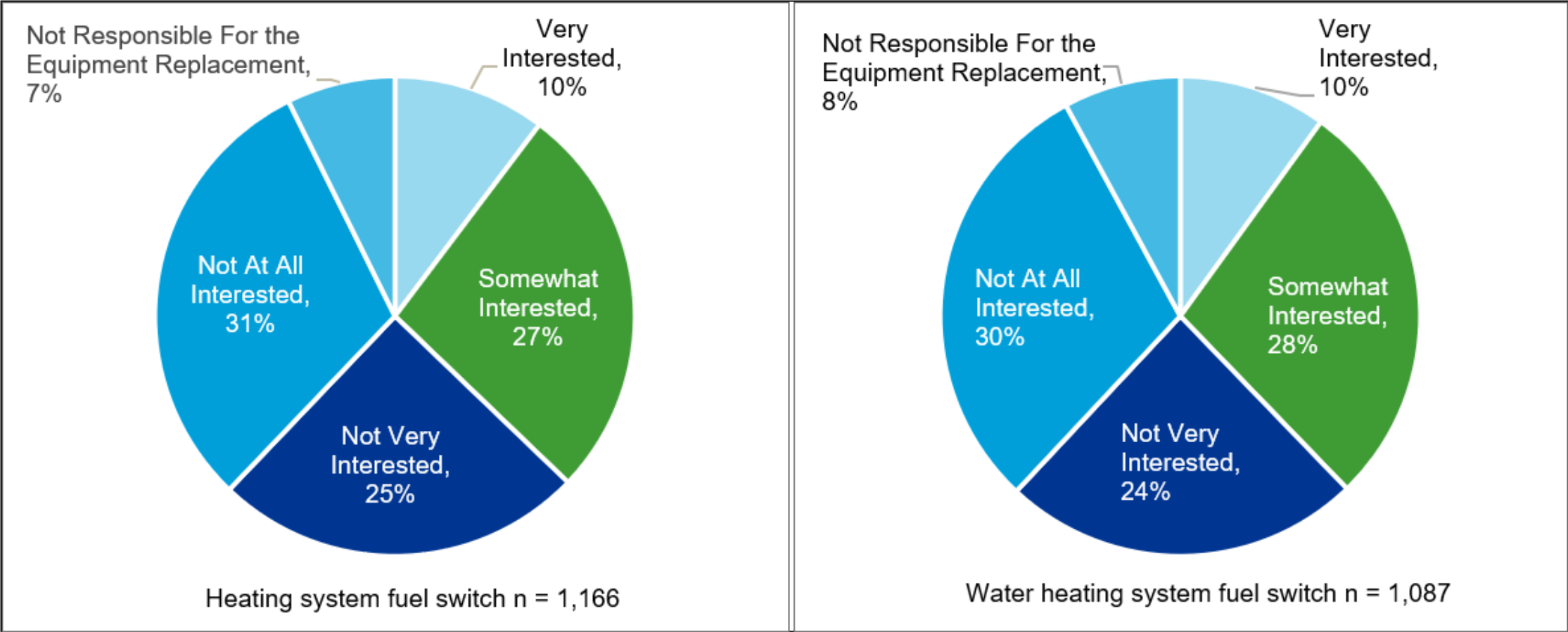
# Barriers or challenges related to equipment installation

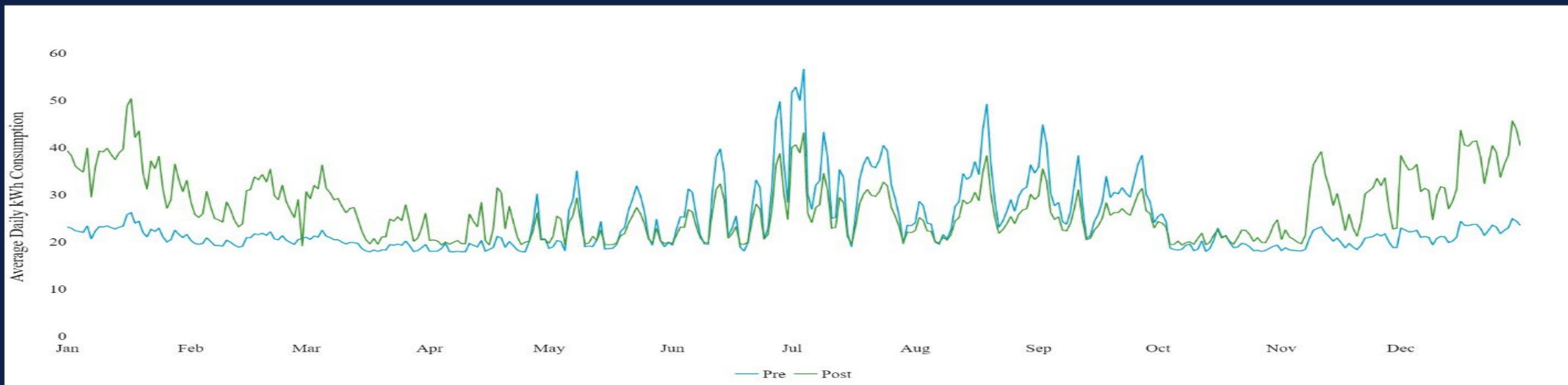


# Numerous electrification barriers for multifamily property owners



# Non-participant interest in heating system fuel switch incentive, all respondents





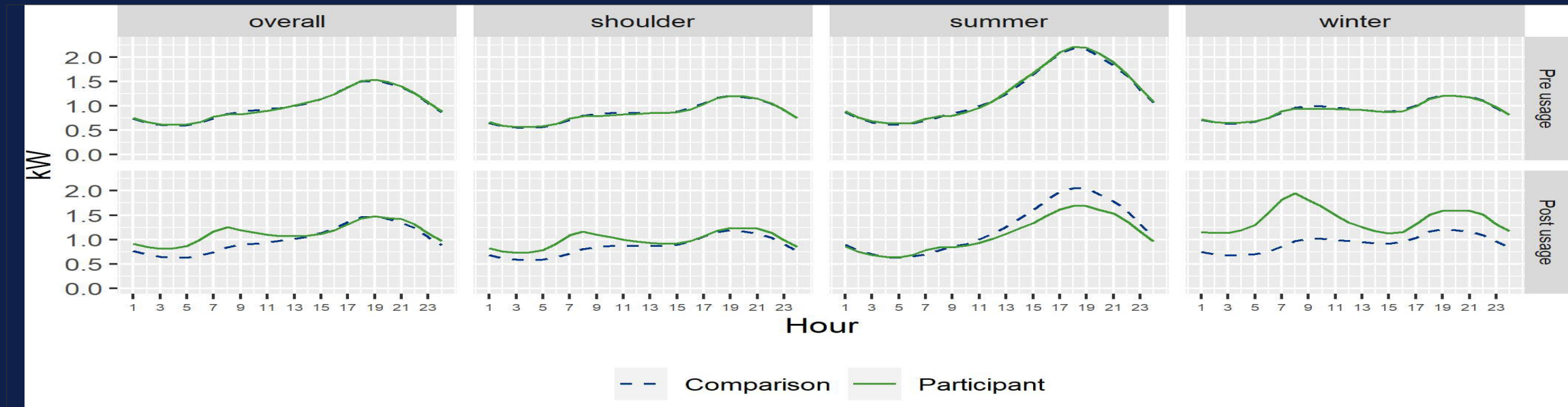
# IMPACT EVALUATION

# Estimated savings and realization rates from single-family electrification projects

Measure	Estimated Increase in Load per unit (kWh)	Estimate Gas Savings per Unit (therms)	Estimate Gas Savings in kWh	Estimated Savings in Load per Unit (kWh)	Deemed Savings per Unit (kWh)	Realization Rate
HPSH, gas baseline	-1,169	219	6,413	5,244	7,525	70%
HPWH, gas baseline	-1,156	139	4,077	2,921	3,672	80%

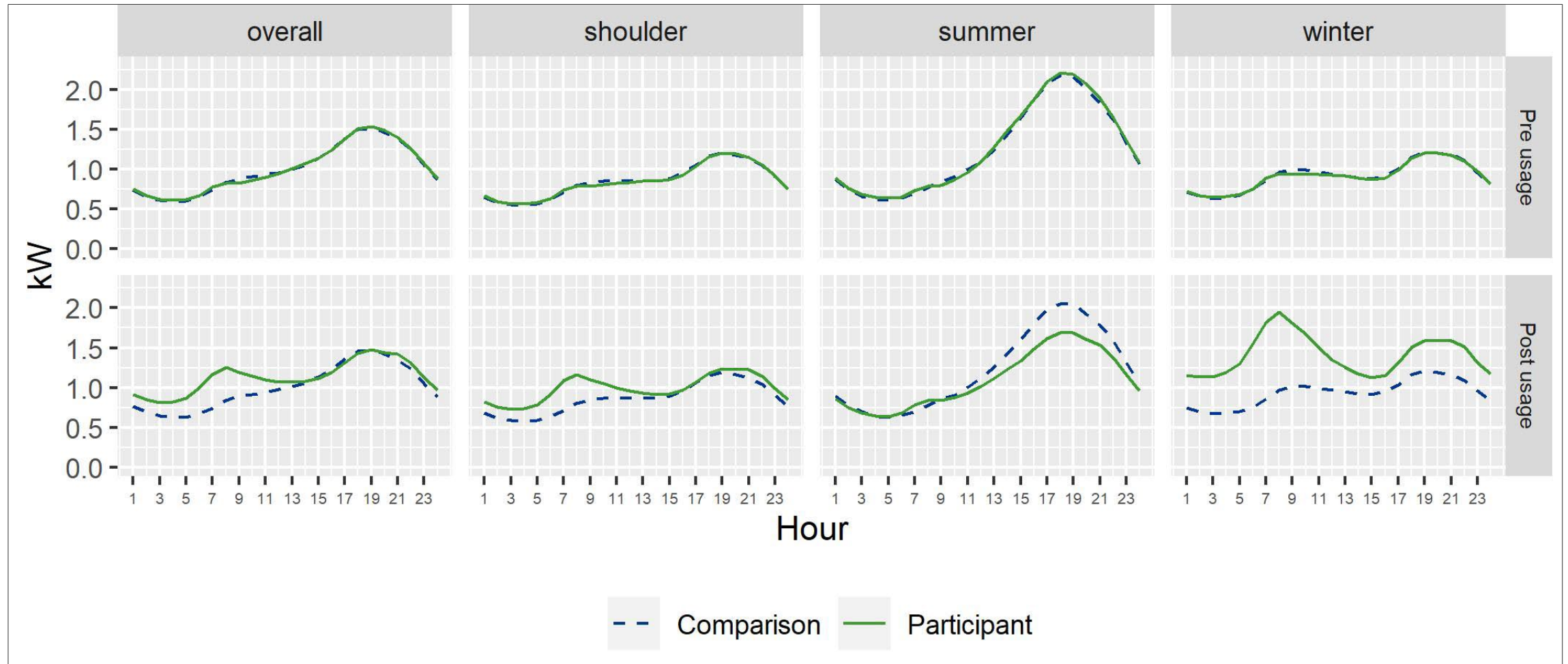
# Estimated savings and realization rates from multifamily electrification project

Measure	Estimated Increase in Load per Unit (kWh)	Estimated Gas Savings per Unit (therms)	Estimated Gas Savings in kWh therms (kWh)	Estimated Savings in Load per Unit (kWh)	Deemed Savings per unit (kWh)	Realization Rate
HPSH, gas baseline	905	77	2,266	3,171	1,340	237%
HPWH, gas baseline	-1,470	204	5,970	4,500	2,027	222%

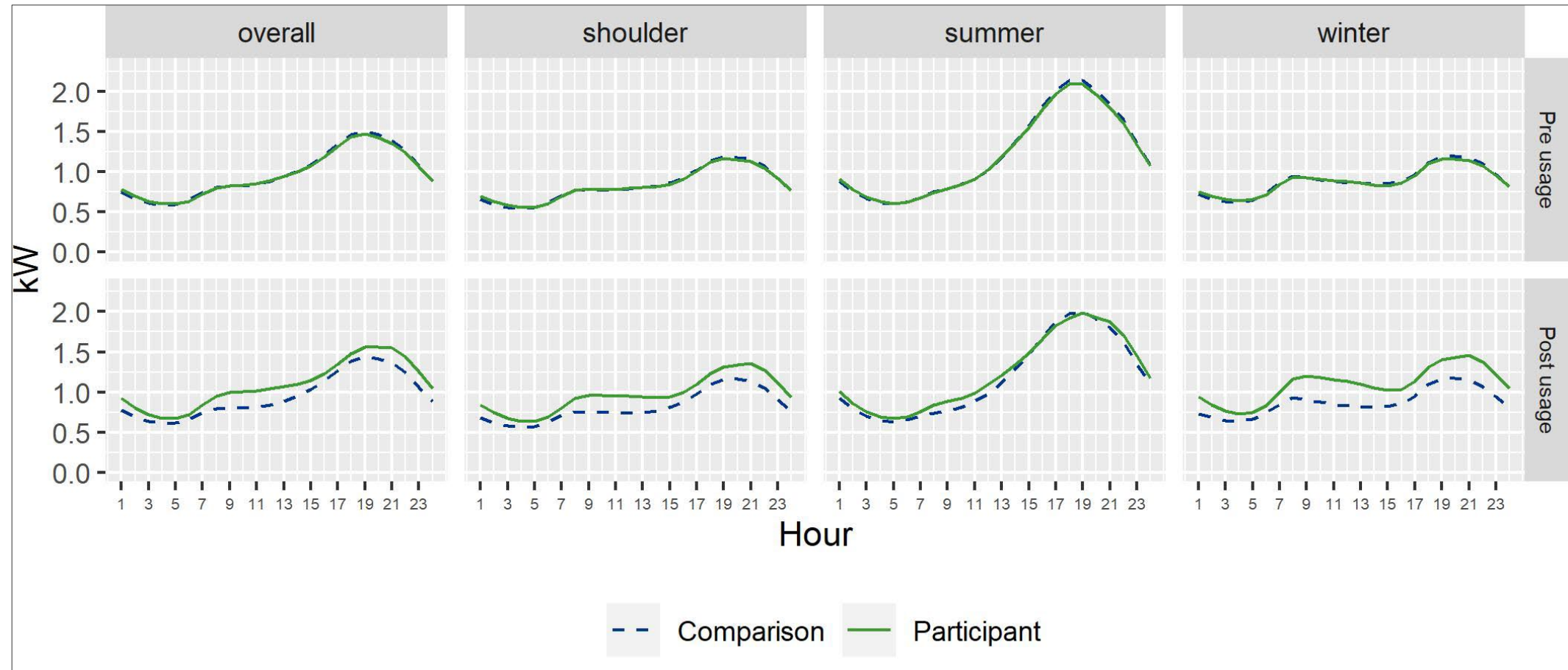


# LOADSHAPES

# AMI-based whole-home load shape changes due to HVAC conversions



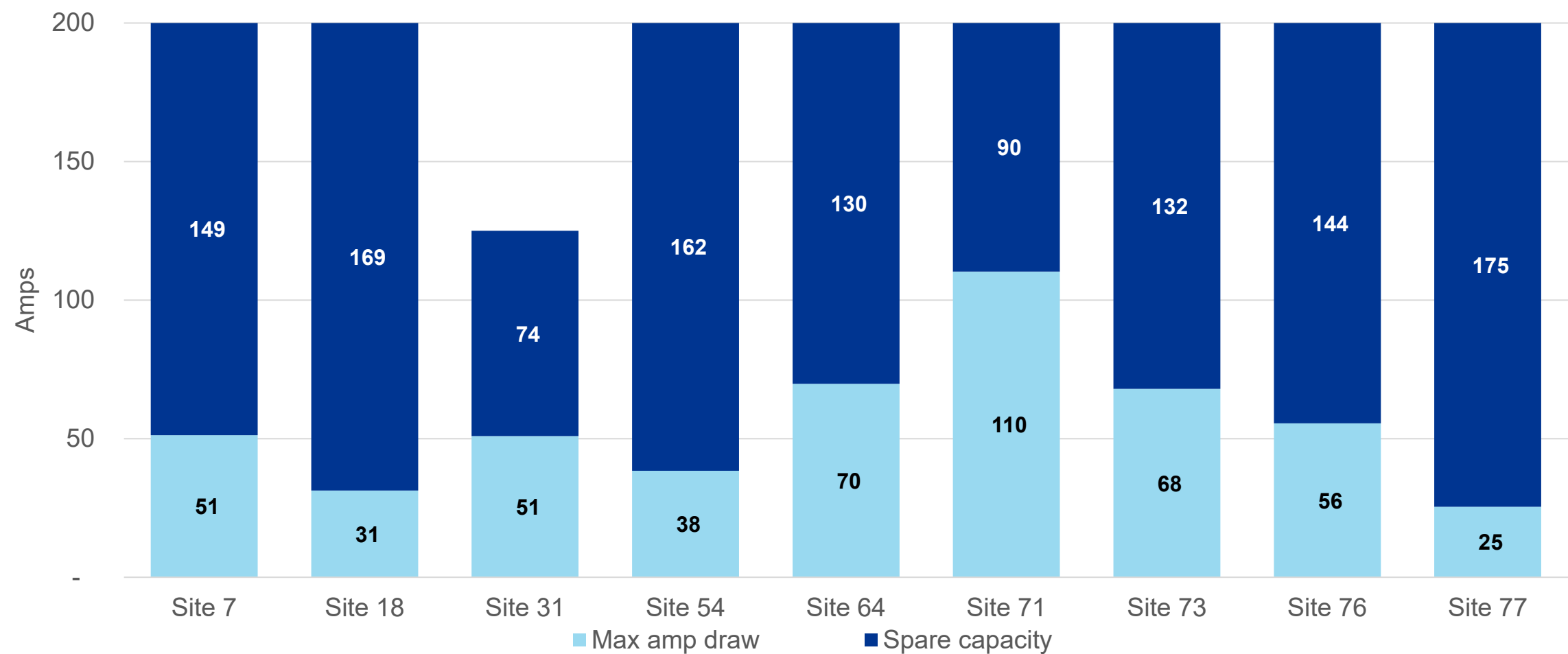
# AMI-based whole-home load shape changes due to water heater conversions

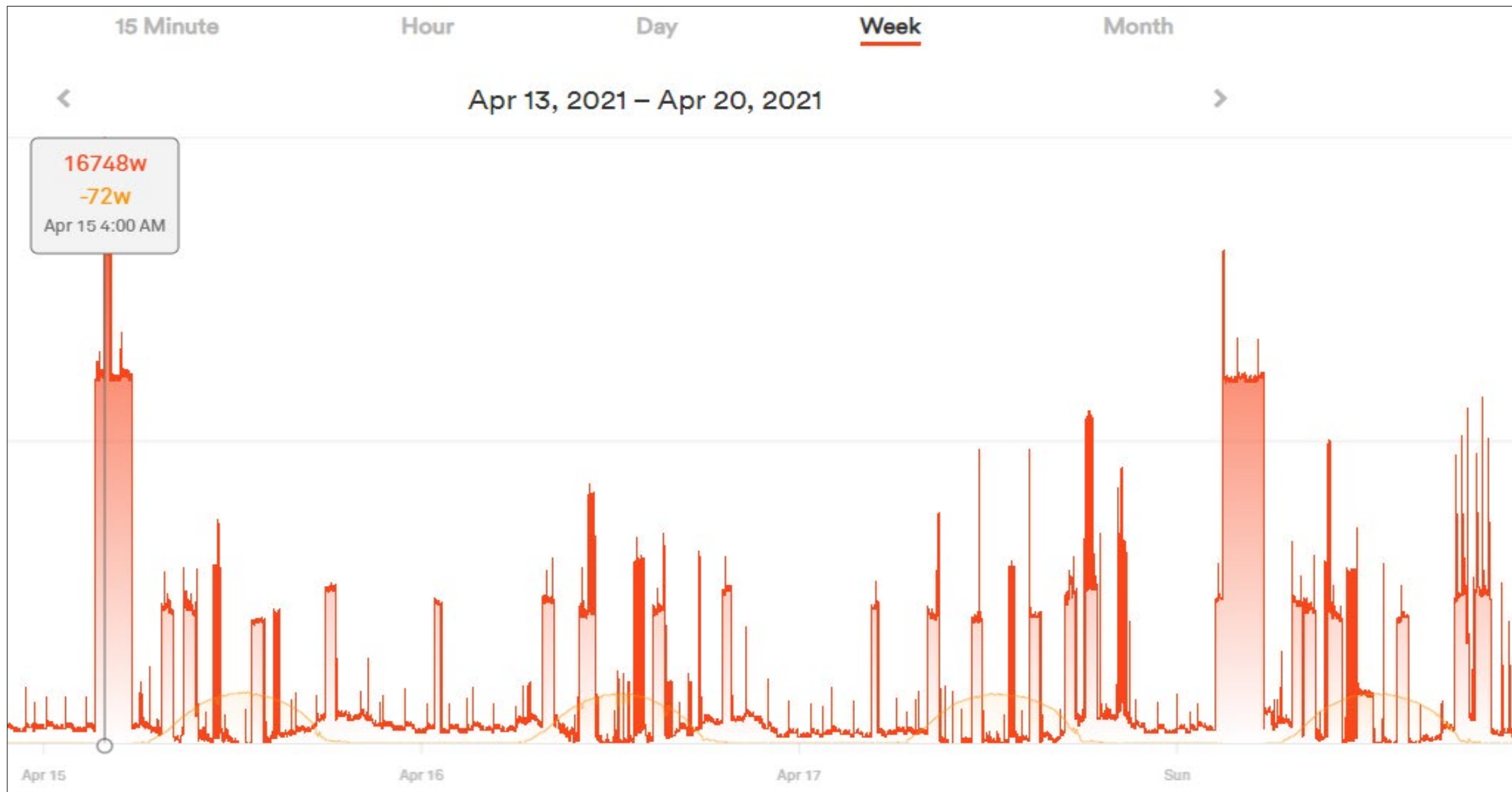




# NILM

# NILM Estimate of electric service panel spare capacity





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