Automated Demand Response Technology Enabling Incentives: Deemed Tool Expansion Project

Prepared for: Pacific Gas & Electric and Southern California Edison

October 17, 2025 CALMAC Study ID: PGE0511.01

Energy Solutions

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Task 1: Evaluate existing tools and conduct needs assessment

For SCE Express tool and PG&E FastTrack tool

1. Review organization and design of tools; Inventory segments, assumptions, calculation; Document discrepancies in tools features and design.
2. Review industry literature to inform stakeholder interviews (e.g., DR Emerging Technology, CalNEXT reports, and CA DR Potential study phase 4 reports.
3. Design and implement stakeholder interviews to further inform needs and opportunities (e.g., sectors, measures, and features) for tool expansion.
4. **Deliverable:** Integrate needs assessment results and present findings to PG&E and SCE and identify which measures, sectors, and/or features to explore in Task 2.

Task 2: Evaluate new segments and measures and develop calculation methodologies

Plan and execute interval meter data requests for up to six segments including two intermittent sectors.

Clean and prepare data for analysis.

Build and evaluate load profiles for consistency, magnitude, and shape.

Select segments with stable and predictable characteristics to move forward with consideration for a deemed approach.

Analyze intermittent segments. Identify additional variables that influence load shapes that could be predicted (e.g. rainfall for irrigation pumps).

Deliverable: New segments expansion recommendations.

Develop or refine calculation methodologies for deemed tools.

Identify input data, assumptions, formulas for non-intermittent and intermittent segments.

Deliverable: methodologies presentation.

Task 3: Build expanded segments and/or measures into existing tools

Decide with IOUs which feature differences of each tool will be harmonized from needs assessment

Build expanded segments/measures and features into PG&E Fasttrack deemed tool and SCE Express deemed tools

Additional build effort for intermittent segments. Test and publish deemed tools.

Deemed tool refresher

FastTrack and Express Tools for small and medium business (SMB) customers - Expedites the load reduction calculation process by only working with a few DR measures and building types.

DR Measures limited to:

a) HVAC: Temperature reset or RTU cycling
b) Lighting: Dimming

Eligible building types:

- Office
- Retail
- Quick Serve Restaurant
- Conditioned Warehouse
- Grocery

ADR

Automated Demand Response Program

Pacific Gas and Electric Company

FastTrack Calculation Form

Please enter or select from drop-down menus the information in each white cell below

If you have questions, contact the ADR team at: 855-866-2205 or pge-adr@energy-solution.com

REQUIRED PROJECT INFORMATION		
Business Name		Use "Multi-Site Application" Tab if you have Multiple Locations
Facility Type	Quick Serve Restraurant	
ZIP code	93650	
Are you on a Time-Of-Use Electric Tariff with Summer On-Peak Demand Billing?	Yes	
Facility On-Peak Demand*	250	kW
Is the Facility On-Peak Demand from when On-Peak was 12 Noon to 6 PM or 4 to 9 PM?	4 to 9 PM	

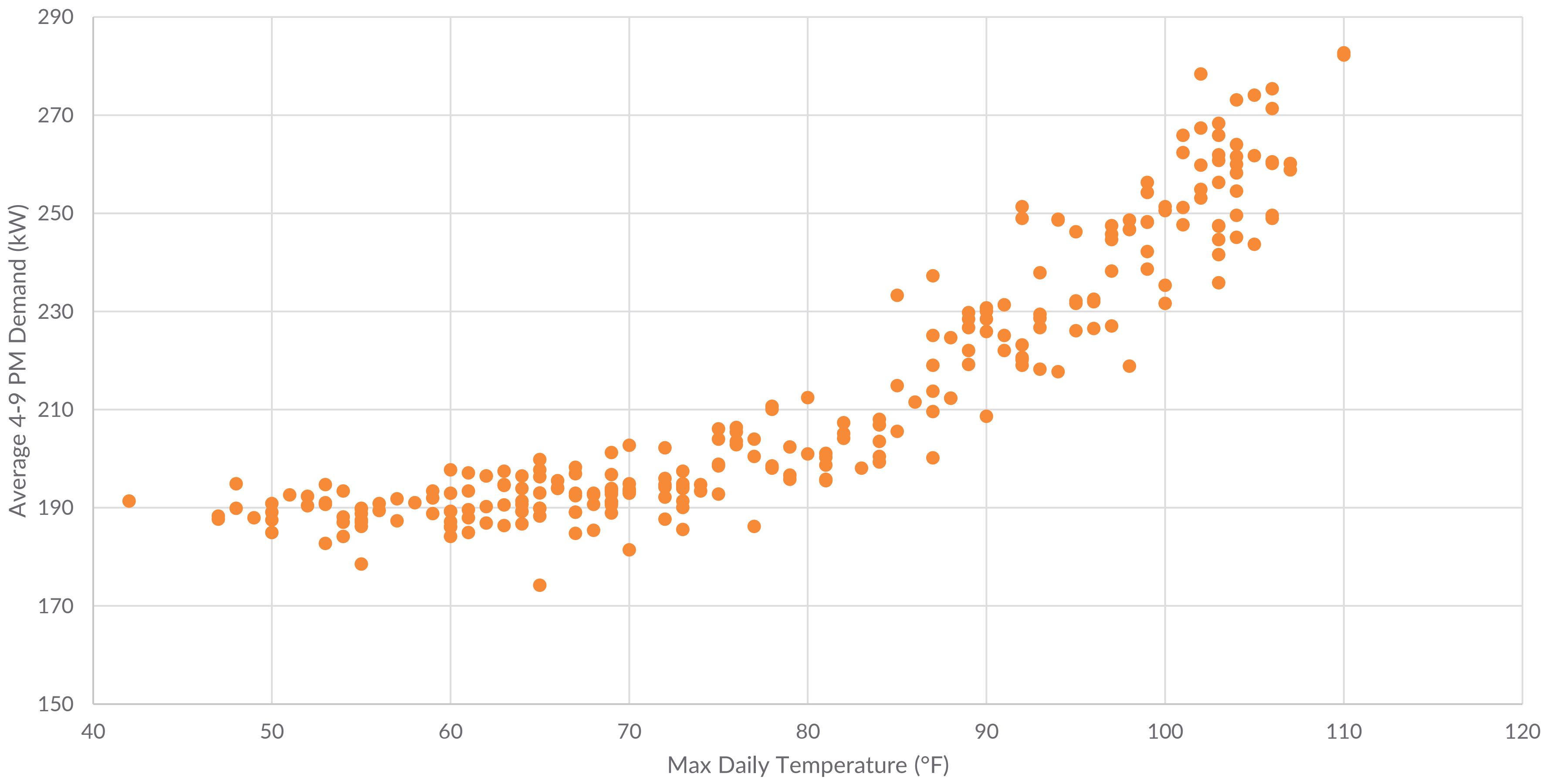
AUTOMATED DEMAND RESPONSE MEASURE INFORMATION		
HVAC (air-conditioning) DR Strategy:	Temperature Reset	Temperature Reset = Increase space temperatures by a pre-set number of degrees Duty Cycling = Disable cooling for a set number minutes each hour
Percent Participating in HVAC DR:	100	What percent of your facility will be included in the HVAC strategy: 0 - 100?
Temperature Reset Amount:	6	How many degrees Fahrenheit (°F) will the indoor temperature increase during DR events?
Fans cycle off along with compressors:		For Duty Cycling: will the HVAC fans shut off along with the compressors?
Duty Cycle (minutes off per hour):		For Duty Cycling: How many minutes per hour will the air-conditioning shut off?
LIGHTING DR Dimming:	20	By what percentage of full power will the lighting in your facility dim?
Percent Participating in Lighting DR Dimming:	100	What percent of your facility will be included in the Lighting DR Dimming: 0 - 100?

What makes a sector good for deemed?

Consistent load shapes--per site across time and across different sites. Example: Grocery Store

Looking at 15-minute interval data across a year, building types that exhibit a “consistent load” shape are ones that react to known and reliable stimulus (e.g., temperature).

Especially ones that generally correlate with the possibility of grid strain periods.

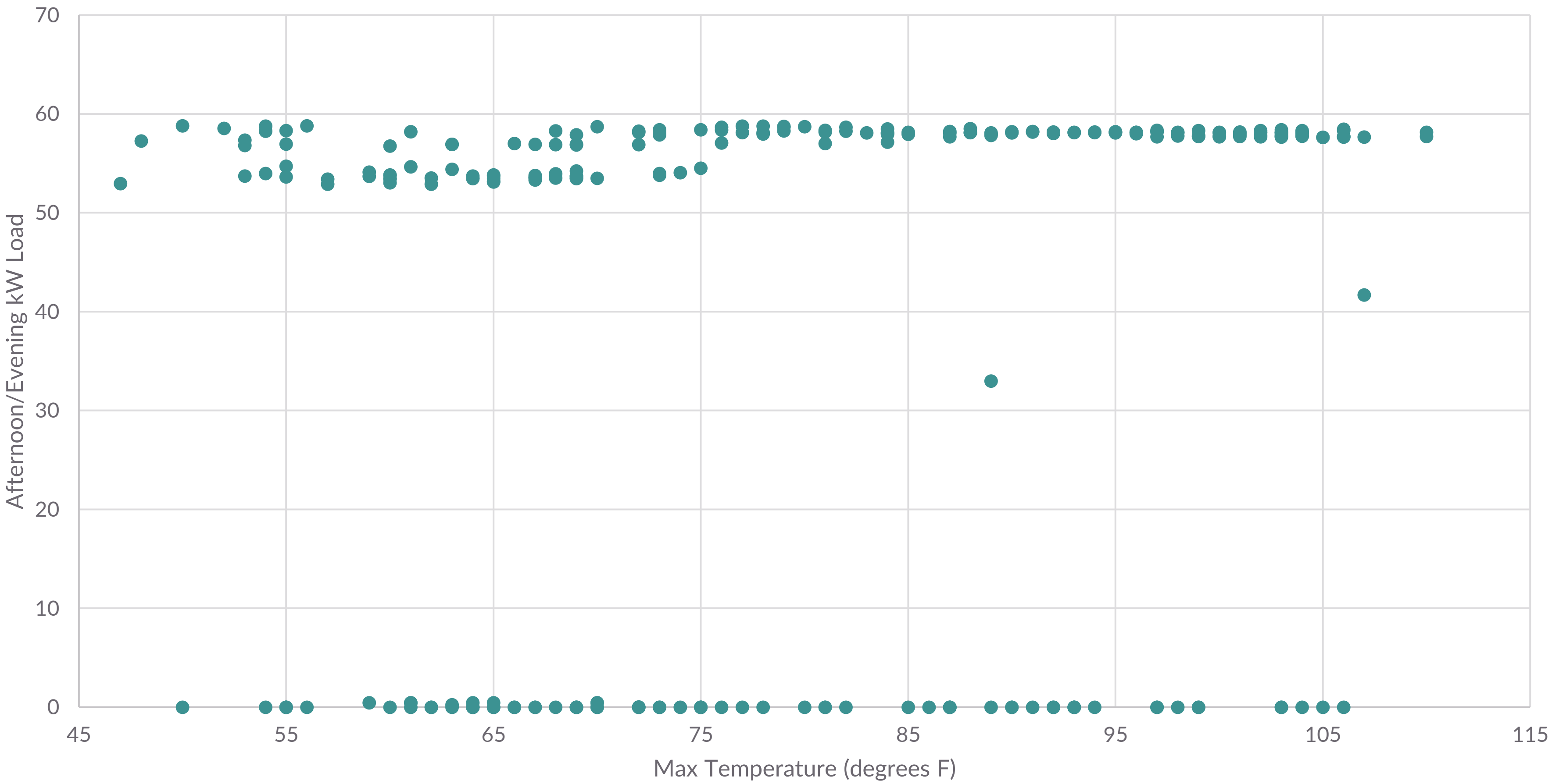


What is challenging for deemed? Inconsistent load shapes

Example: Agricultural Grower

Looking at 15-minute interval data across a year, building types that exhibit an "inconsistent load" shape are ones that *do not* react to known and reliable stimulus (e.g., temperature).

Especially ones that don't generally correlate with the possibility of grid strain periods.

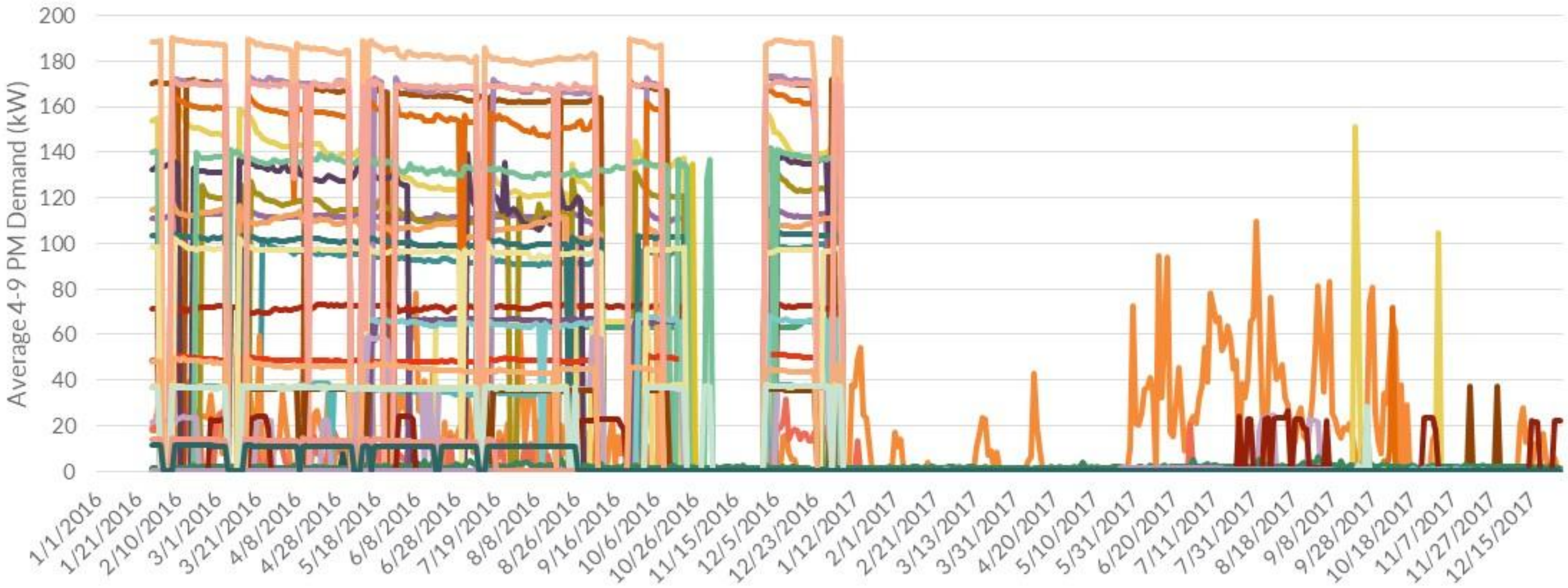


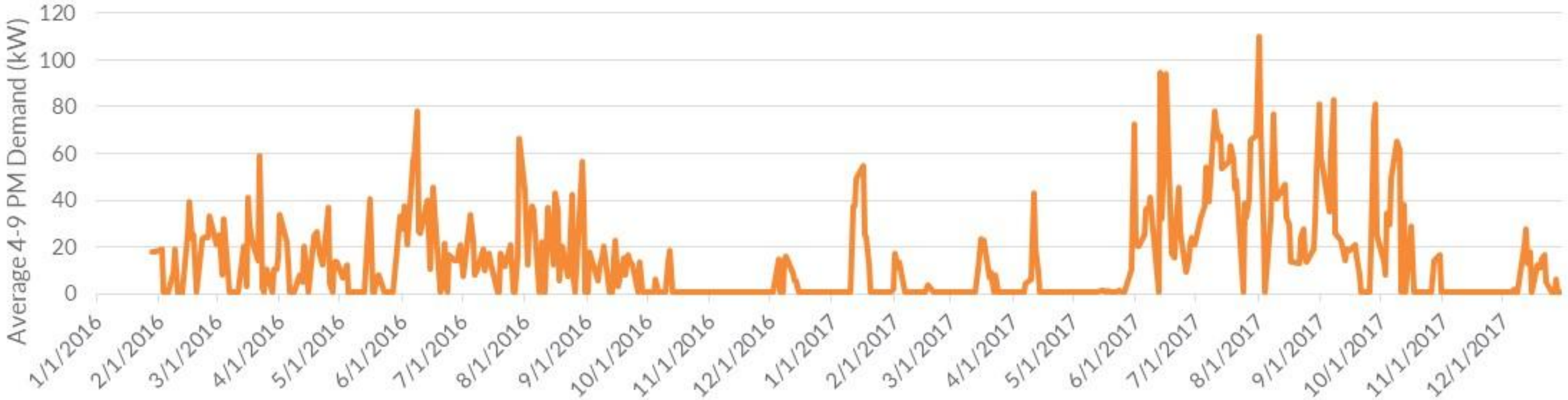
What is challenging for deemed? Inconsistent load shapes

Example: Large Agricultural Grower in the Central Valley

But they may react to other external stimuli that *can* be measured and predicted. E.g., rainfall proxies, crop types, and deep well vs surface well pumping.

Though it's unclear how universal any external stimuli are.





Project timeline

Project start:
Project kickoff

Nov-24 to Feb-25

Task 1: Literature review, evaluate existing tools, design and conduct market interviews, present findings.

Design and submit data request (Task 2)

Mar-Jun 2025

Task 2:
Receive data and analyze load profiles up to 6 segments/measures.
Decide which tool features to harmonize

Jul-Sep 2025

Task 2:
Develop tool assumptions, required inputs, calculation formulas

Oct-Dec 2025

Task 3:
Build tool expansions.
Harmonize tools features (PG&E, SCE)

Jan –Mar 2026

Task 3:
QC, refine, and publish tools (PG&E, SCE)


Task 1 Evaluate Existing Tool, Conduct Needs Assessment, and Select Segments for Study

Activity 1: Literature review highlights

No. of Reports	29 Research reports, technology evaluations, pilot studies, and conference papers
Sources	Calmac, Demand Response Emerging Technology, Emerging Technology Coordinating Council, Lawrence Berkeley National Laboratory, Smart Electric Power Alliance, and conference papers and presentations from Peak Load Management Alliance, and American Council for an Energy Efficient Economy from 2016 - 2024
Segments and Measures Focus Frequency	7x Heating, ventilation, and air conditioning measures 4x Battery and EV storage 4x Thermal energy storage (cold storage, phase change material, heat and pump water heating) 2x Pumping (water treatment and agriculture) 1x Office lighting
Notable Mentions	1x Indoor agriculture study 1x solar integration (Considering adjustments for buildings with solar for deemed analysis)

Activity 2: Stakeholder Interviews

12/9/2024 through 1/15/2025

Pacific Gas and Electric (PG&E)

ADR Program Managers
CBP Program Managers

Southern California Edison (SCE)

AutoDR Program Mangers
AutoDR Helpdesk
AutoDR Project Engineer Team

Aggregators and Technology Providers

Polaris
Gridlink
Universal Devices
Enersponse
GridPoint

Activity 2 Interview comments: Hurdles to making deemed approach

Pumping and process loads	Intermittent loads vary case-by-case
Equipment differences	Equipment age, lighting type, building insulation, and equipment efficiency can cause variability
DR program changes	DR programs may shift towards dynamic pricing, which may be difficult to consider in calculations
Double dipping	Concern about overlap with other incentives, such as battery storage or EV chargers
Onsite generation	Onsite solar and batteries may impact load estimates and customer ability to shed

Activity 2 Interview comments: Accuracy of existing tools

Most stakeholders consider the existing deemed outputs accurate

Customers valued the streamlined approach over maximizing incentive amount

Some mentions of needing to update the tool as technology improves

Mentions of updates to DR programs, such as dynamic pricing

Consider changes to climate zones

Activity 2 interview comments: Usability

- Market actors like consistency among utility tools because large customers may have sites in both territories

- SCE processors don’t like the matrix
- Perhaps an input-output tool or color-coordination

- Customer facing excel tool would be useful

- Aggregators were generally supportive of expanding the tool
- Anything to streamline customer experience helps to enroll customers

- Sometimes there are too many options and users get confused
- May need to retire some infrequently used segments

- Availability to large customers >499kW would make ADR more attractive if all sites were eligible for deemed

Activity 2 Interviews: New segments & measures mentioned

- Agriculture and water district pumping
- Manufacturing and process loads: motors, compressors, plug loads
- Refrigeration for grocery stores and cold storage
- EV fleets and gas station charging with batteries
- New building types with HVAC measures: schools, movie theaters, data centers, automotive, churches
- Large C&I customers with HVAC and lighting measures
- Residential home automation
- Additional HVAC strategies: chiller temperature setpoint adjustment
- Thermal energy storage

Activity 3: Overall Similarities

between PG&E FastTrack tool and SCE Express Tool

Inputs include peak load, building type, climate zone, and measure

Load shed potential kW is calculated for each site/measure, then added together

Both use similar methodologies: using CEUS data by climate zone non-coincident peak load to estimate HVAC and Lighting usage

Activity 3: Overall differences and other observations

PG&E FastTrack	SCE Express
Format	**Format**
One single excel spreadsheet with inputs and outputs	iEnergy user interface and validation matrix/look-up table
Calculations	**Calculations**
Adjustments made for DR event times; changed from 12pm-6pm to 4pm-9pm Changed empirical percent HVAC kW reduction per degree reset (from 3% to 6%)	Similar results (outputs) to 2019 statewide ASWB Engineering tool
Measure Options	**Measure Options**
Pre-cool option for HVAC measure HVAC temperature reset options 1-6 degrees Lighting includes option for percent of facility included in measure	Only offers 4-degree temperature reset 2 different duty cycle options (compressor only or fan & compressor) Different facility options
Restrictions	**Restrictions**
No minimum peak demand Capped at 499kW peak demand for all segments	Imposes minimum kW by segment Office buildings capped at 100,000 sf; Food Stores capped at 250 kW Capped at 499kW peak demand for other segments
Other observations	**Other observations**
Sector definitions differ between PG&E and SCE tools	No documentation on methodology behind Matrix Sector options and definitions may be different between Matrix and program manual

Task 1 Recommendation for Task 2: New segments & measures focus

Retail > 499 kW
HVAC and lighting

Grocery
Refrigeration

Schools K-12
HVAC and lighting

Agricultural
Pumping

Indoor Agriculture
HVAC and lighting

Solar PV flag and adjustment methodology for Ag pumping and one building type (retail)

Task 1 Recommendation for Task 2: FastTrack and Express tools harmonization

Express:
Update to latest ADR rules;
Update HVAC shed per temp reset assumption, add pre-cooling measure;
Align building types with FastTrack

FastTrack:
Increase clarification of sector definitions

FastTrack + Express:
Harmonize ADR measures

Task 2A Evaluate New Segments and Measures

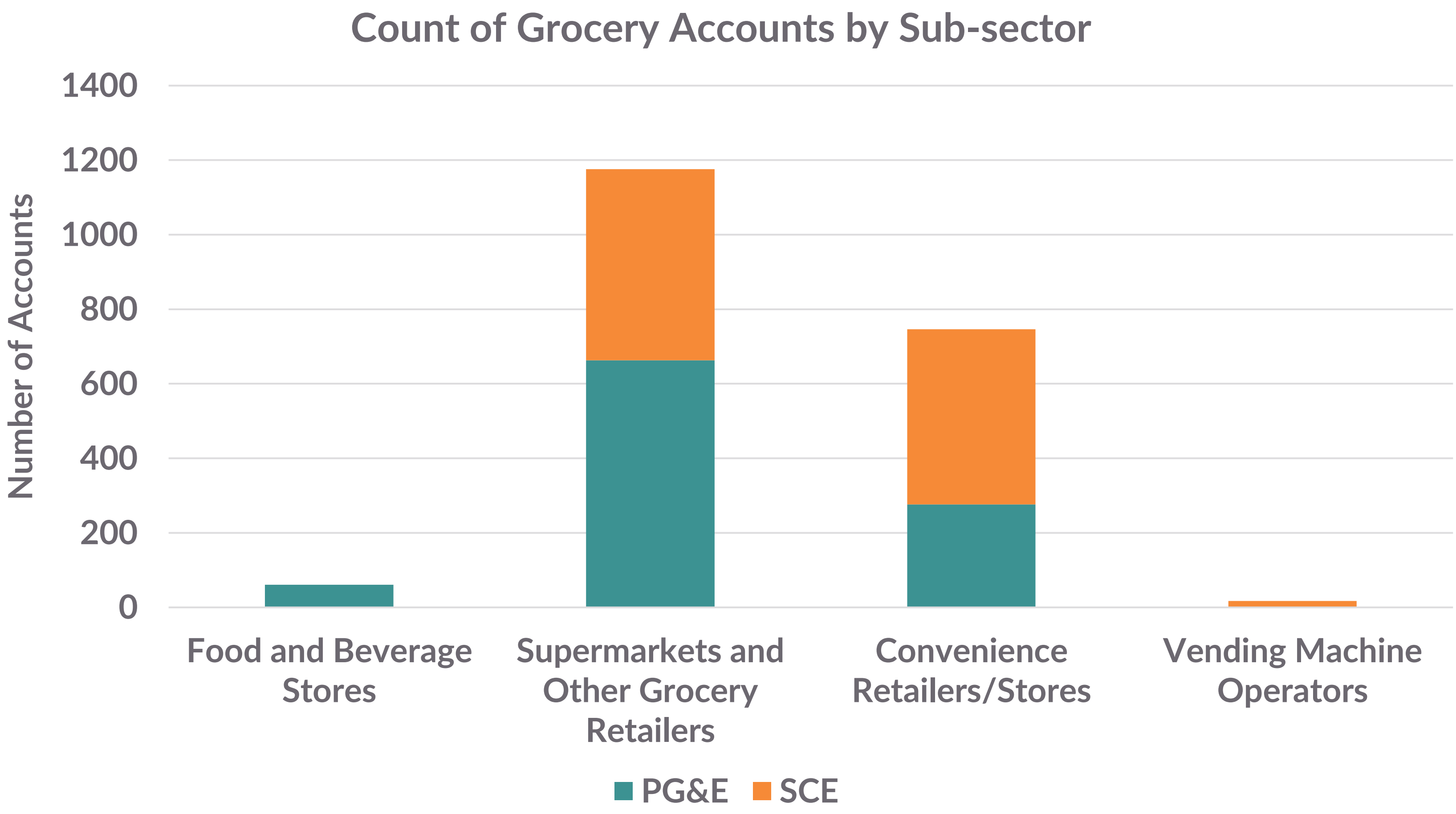
Overview of initial study data

- Energy Solutions requested data for 1,000 accounts by sector (tracked using NAICS)
- For some sectors, less than 1,000 accounts were available
- In particular, retail > 499 kW and indoor ag represent 100% of available accounts in those sectors

Sector	PG&E	SCE
Retail > 499 kW	148	1,000 (mostly <499kW)
Grocery	1,000	1,000
K-12 Schools	1,000	1,000
Ag Pumping	1,000	1,000
Indoor Ag	185	315

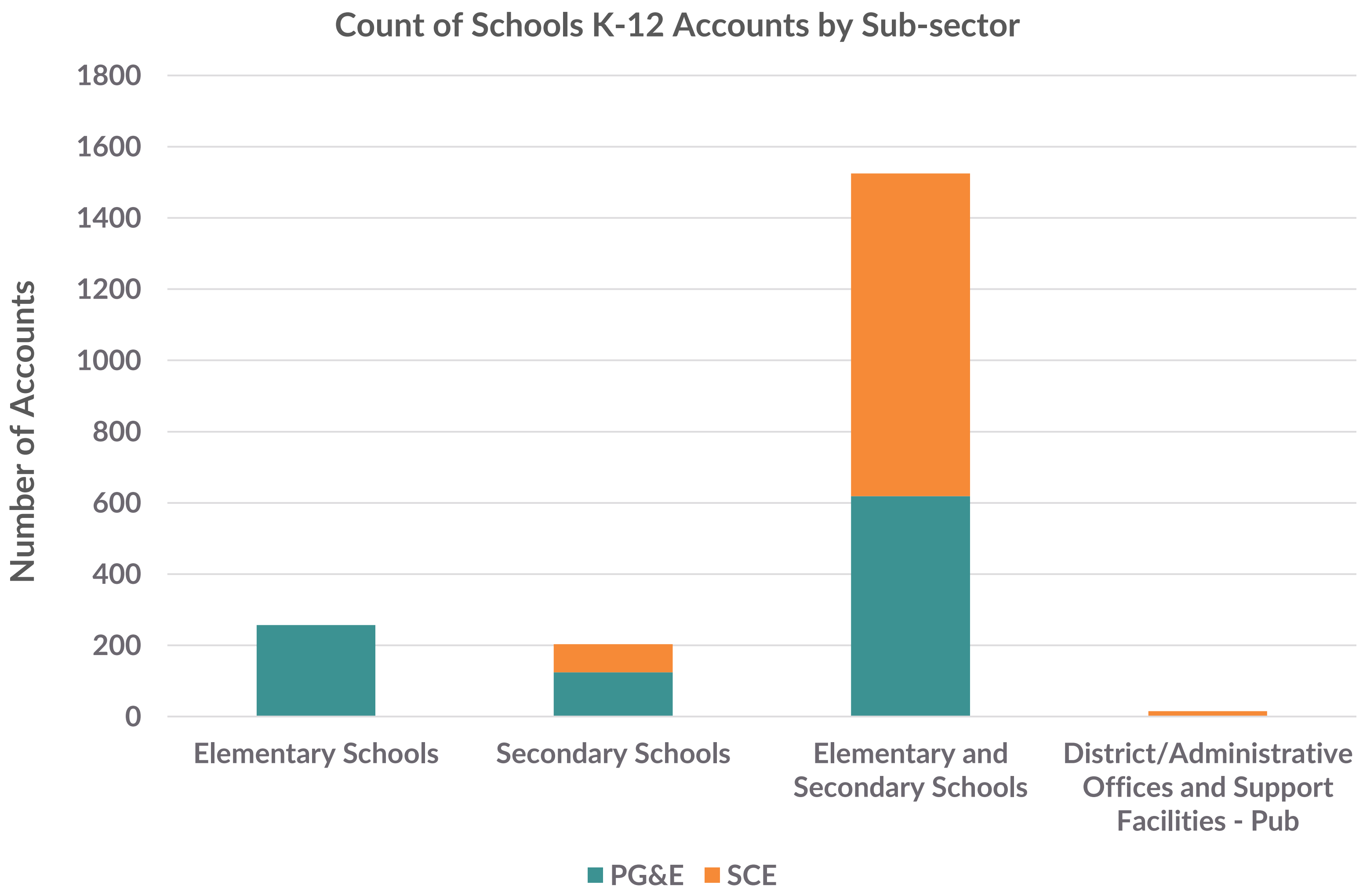
First assessment of grocery sector sample size: good

- Data distribution roughly even between PG&E and SCE
- Supermarkets are majority of accounts- 59%
- Convenience retailers – 37% of all accounts
- NAICS conventions differ slightly between SCE and PG&E
  - PG&E “food and beverage stores” - 3% which include other grocery, specialty food stores, and beer, wine, and liquor stores
- Vending machine operators will likely be removed from the dataset – 17 accounts



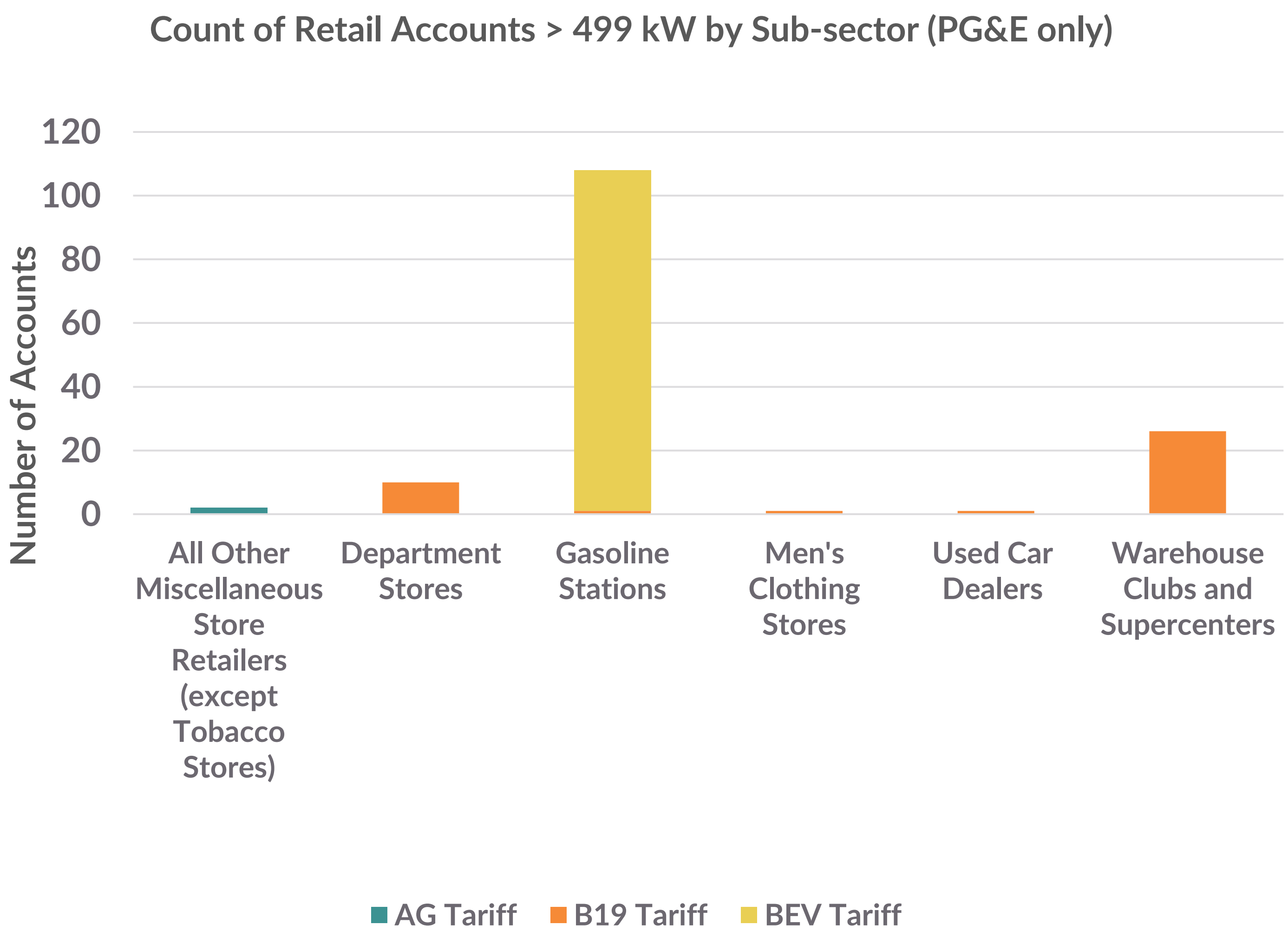
First assessment of K-12 schools sector sample size: good

- Data distribution roughly even between PG&E and SCE
- NAICS conventions differ slightly between SCE and PG&E. SCE data did not have accounts identified as just elementary schools
- Elementary schools – 13%
- Secondary schools – 10%
- Combined elementary and secondary schools – 76%
  - Team will try to break out secondary from elementary



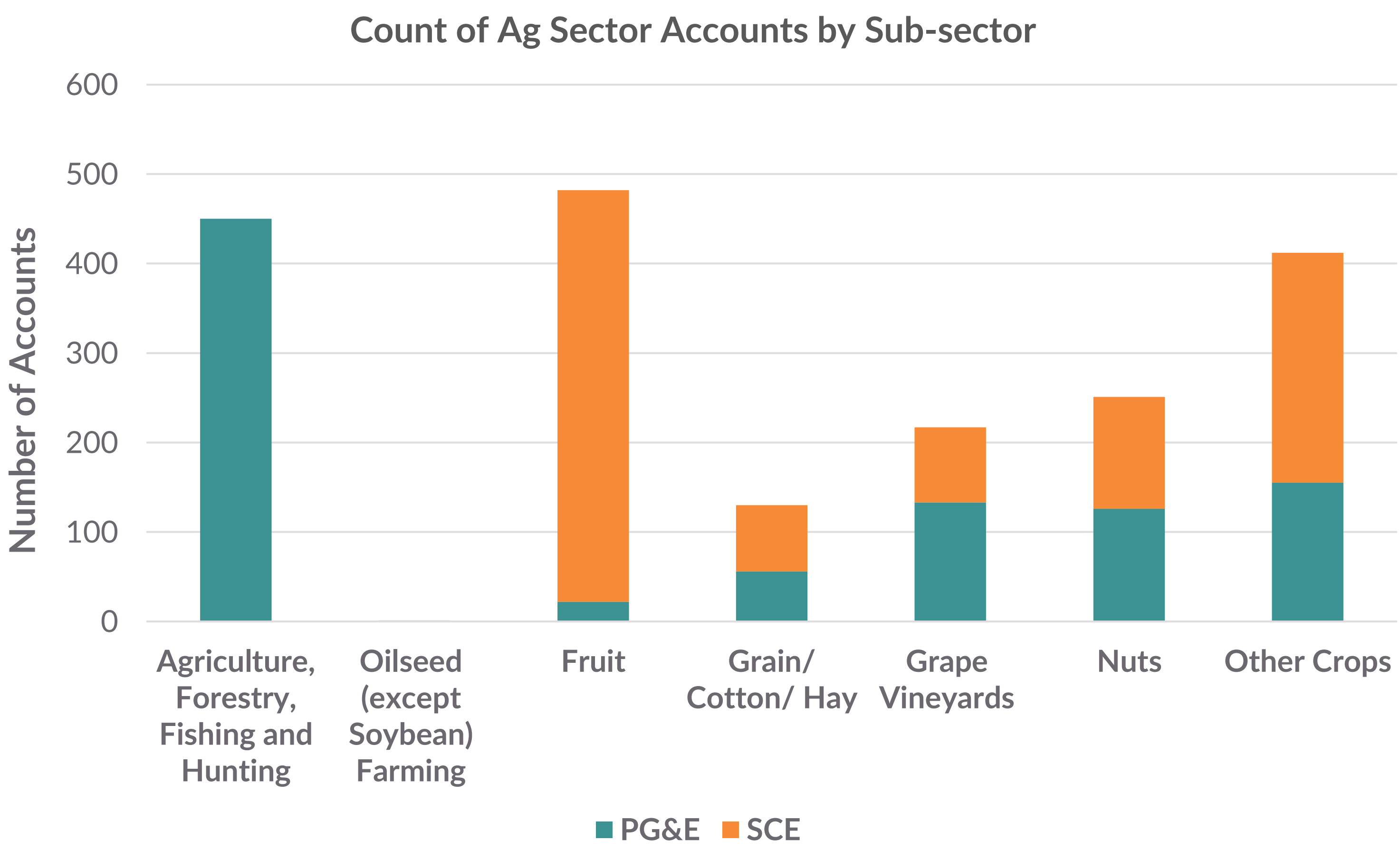
First assessment of retail sector sample size: needs work

- SCE's dataset are 99.3% less than 499 kW
  - Need to request additional data
- 107 or 72% of PG&E's retail accounts fall under the EV tariff
  - 2 of 41 non-EV tariff accounts are on ag rates
  - 39 of 41 non-EV accounts are on B19 tariff
  - Interested in additional retail accounts if available on B-19 tariff



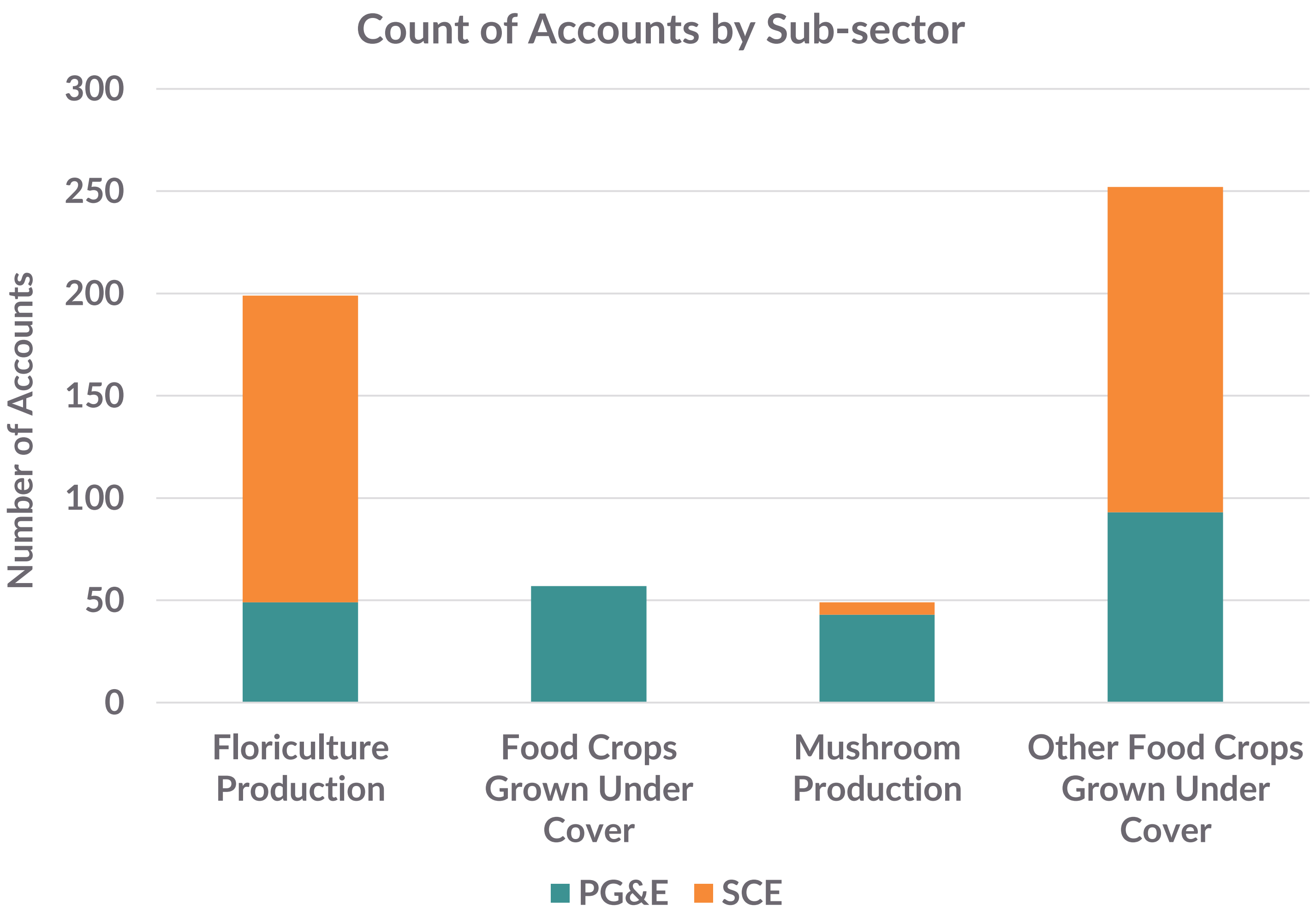
First assessment of agricultural sector sample size: good

- Data distribution roughly even between IOUs and sub-sectors
- Initial investigations indicate that 95+ percent of the data are intermittent pumping loads = data we can use for this analysis



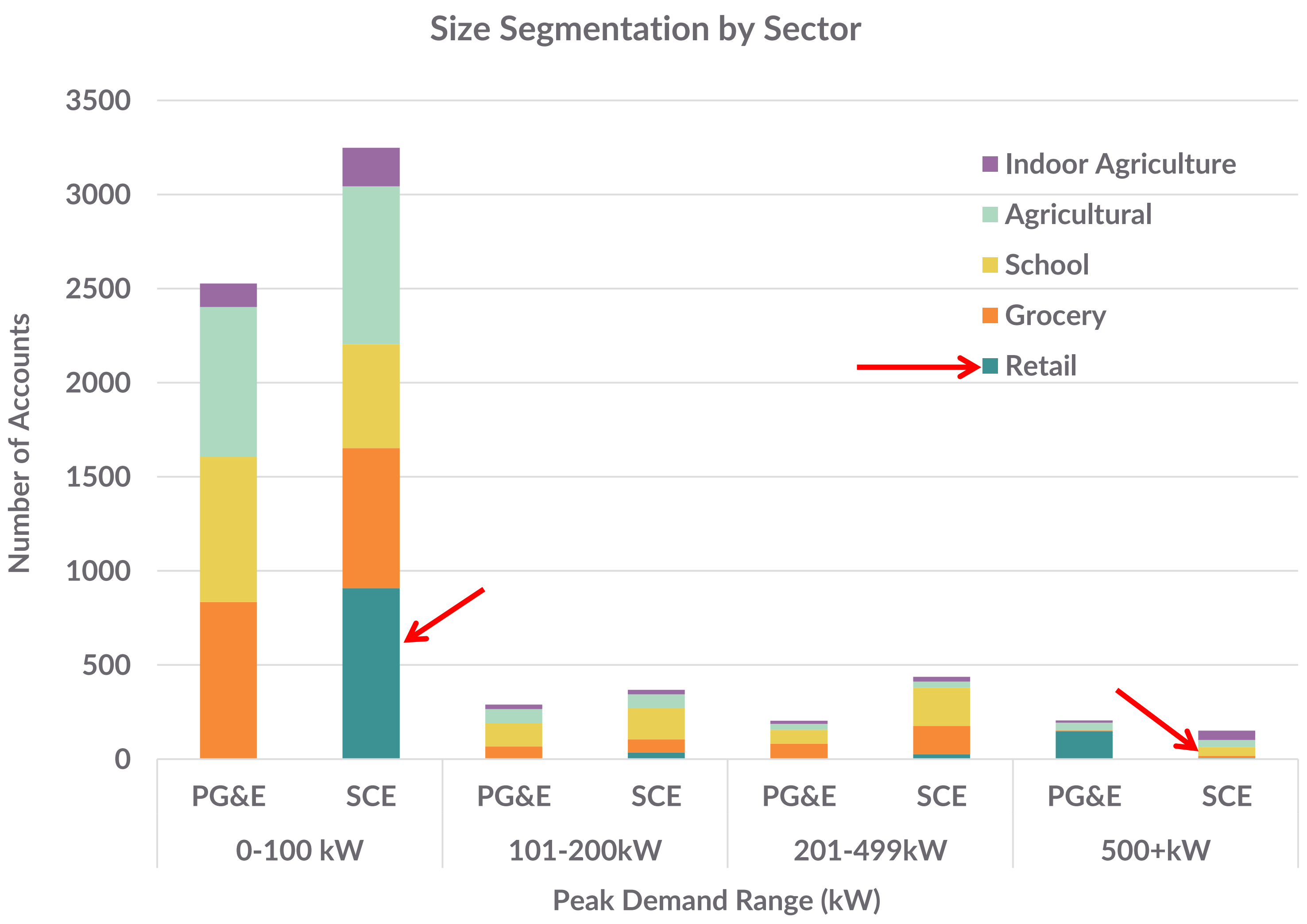
First assessment of indoor agricultural sample size: good

- Data distribution roughly even between PG&E and SCE
- NAICS conventions differ slightly between SCE and PG&E
- Distinguishing end uses from the whole-facility data are TBD

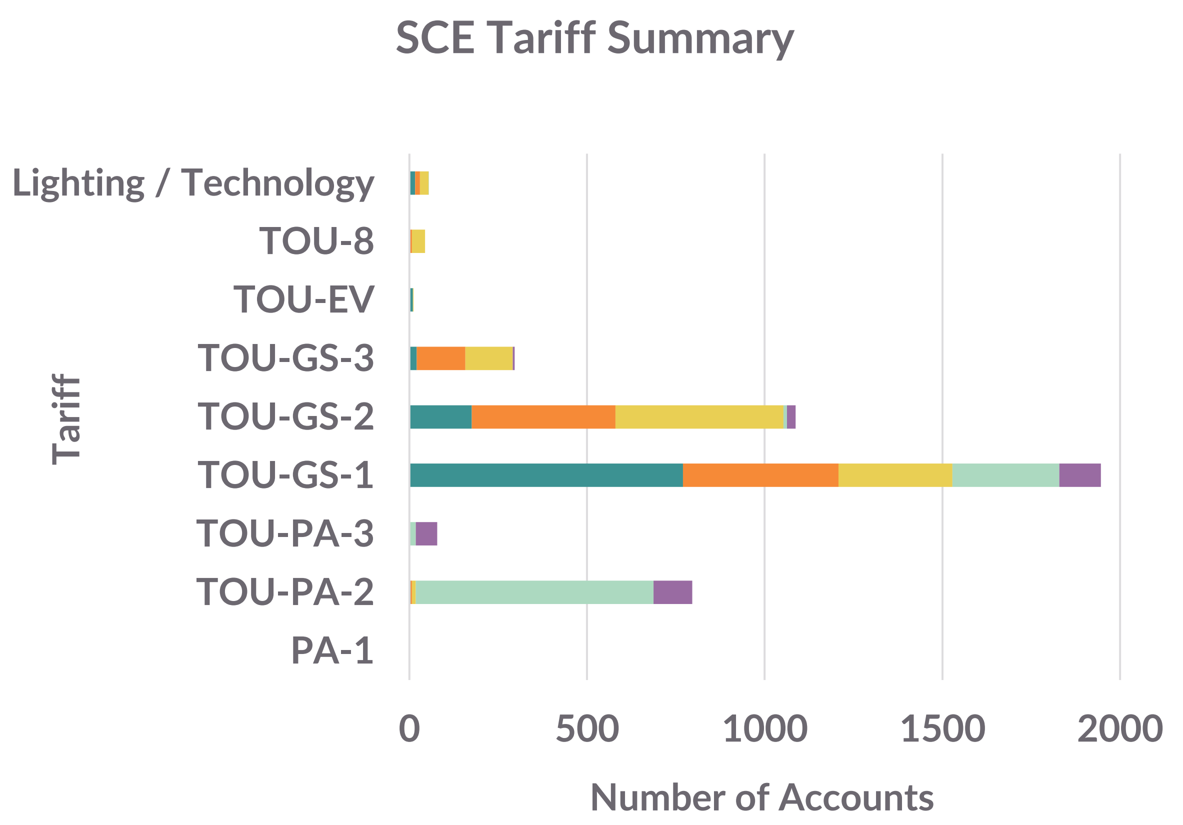


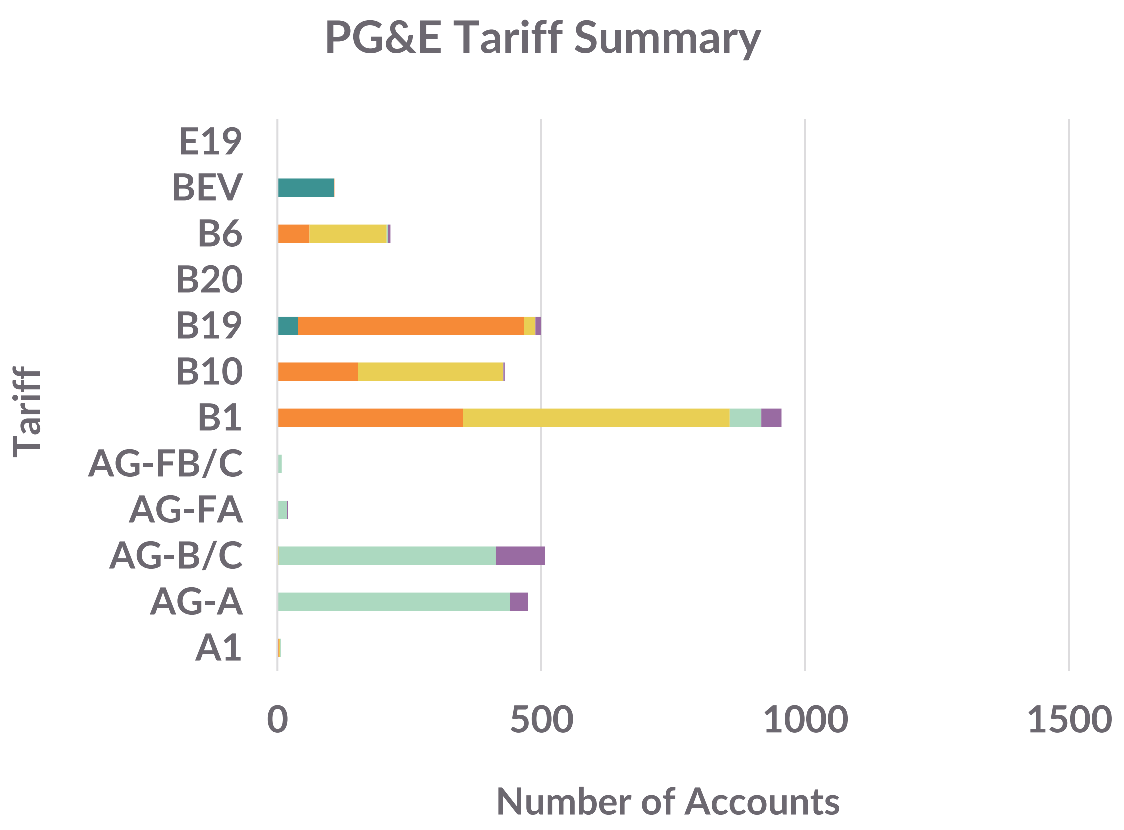
First assessment of size segmentation: good

- Dataset is evenly distributed by size, across sectors, and by IOU
- SCE retail sector data need to be filtered for accounts > 499 kW



First assessment of tariff classification: good





Sector Analysis: Agricultural Pumping

Sector Agenda

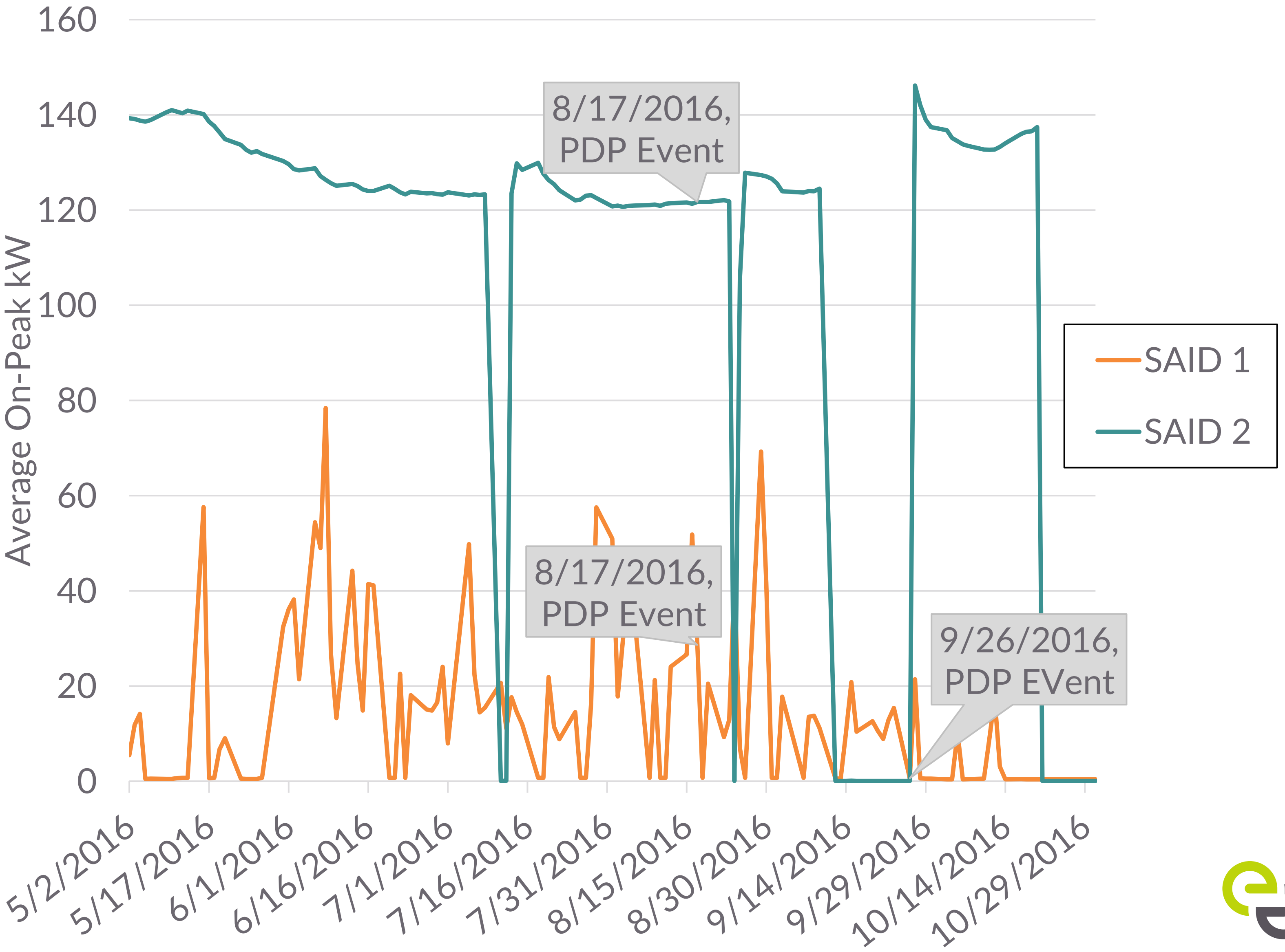
1. Current PG&E ADR Agricultural Pumping Evaluation Method
2. Past PG&E ADR Deemed Investigation
3. New Analysis
4. Next Steps/Questions

1. Current PG&E ADR Agricultural Pumping Evaluation Method

Challenges with ag pumping load shed evaluation: high variability

Compared to a building load (e.g., HVAC or lighting), there are primarily two unique challenges:

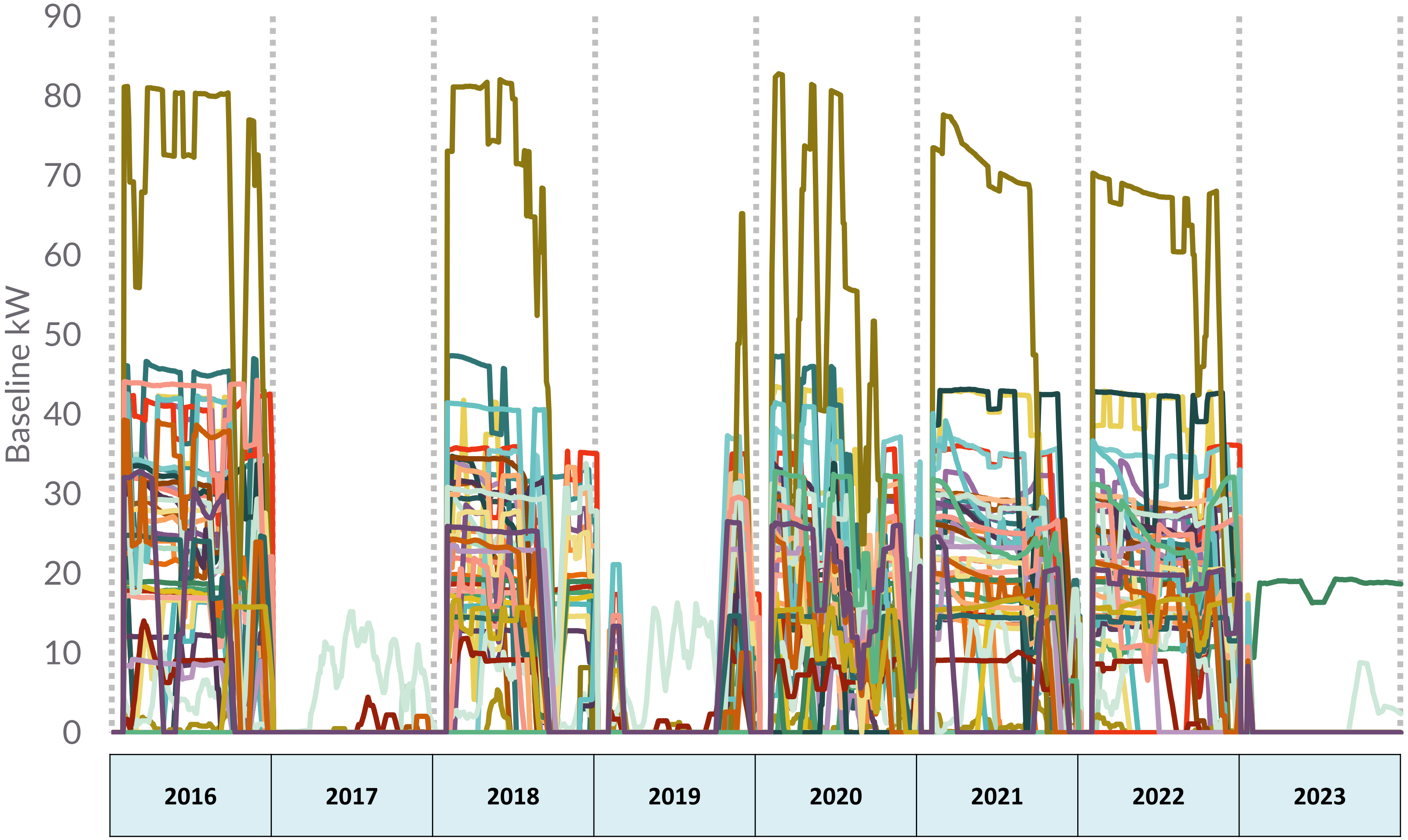
1. Day-to-day variation not necessarily tied to demand response event days.



Challenges with ag pumping load shed evaluation: high variability

Compared to a building load (e.g., HVAC or lighting), there are primarily two unique challenges:

1. Day-to-day variation not necessarily tied to demand response event days.
2. Year-to-year variation



Current PG&E ADR evaluation method

General Custom Method

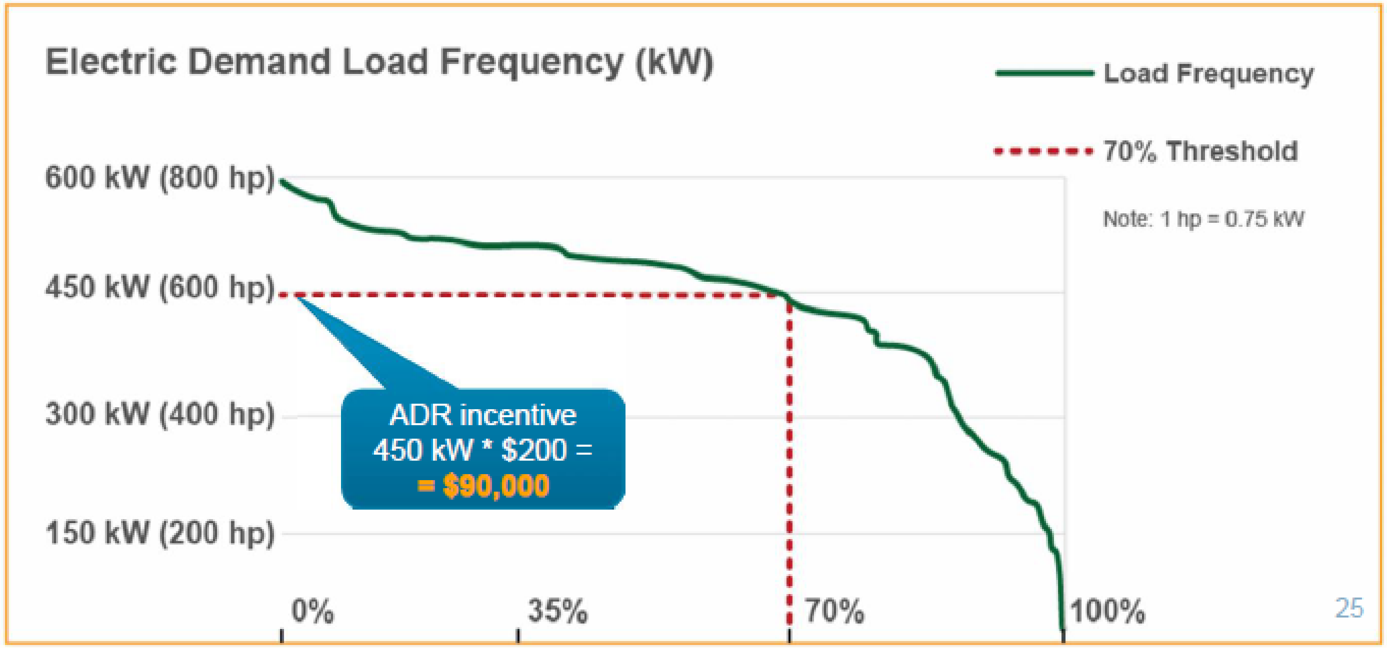
1. Look at 2 to 3 years' worth of interval data
2. Calculate the 10-in-10 baseline for each site across all days in DR period
3. Identify the frequency of available baseline load.
4. 70% availability = load shed potential

Note: Some considerations for year-to-year variation

ADR: Calculating Technology Incentive

Methodology:

1. Calculate 10-day baseline load values for each day in the given DR season(s), based on average of actual electric load for the 10 preceding non-holiday, non-DR event weekdays in the DR program time window.
2. Order the 10-day load values from greatest to smallest for May-Oct period. For each 10-day load value, calculate corresponding percent of likely DR events (based on the probability of DR events within each month). For example, July and August are weighted more heavily, with 63% of likely events, than May and June, with 11% of likely events. Create Load Frequency chart (below).
3. ADR incentives are calculated based on the 10-day load value that is exceeded 70% of likely DR events.

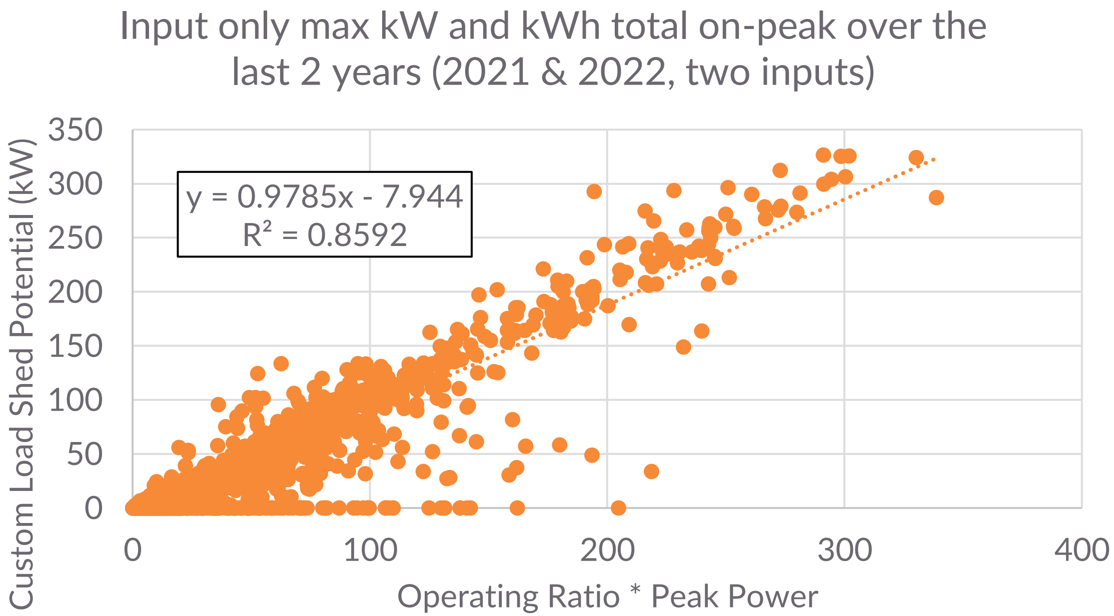


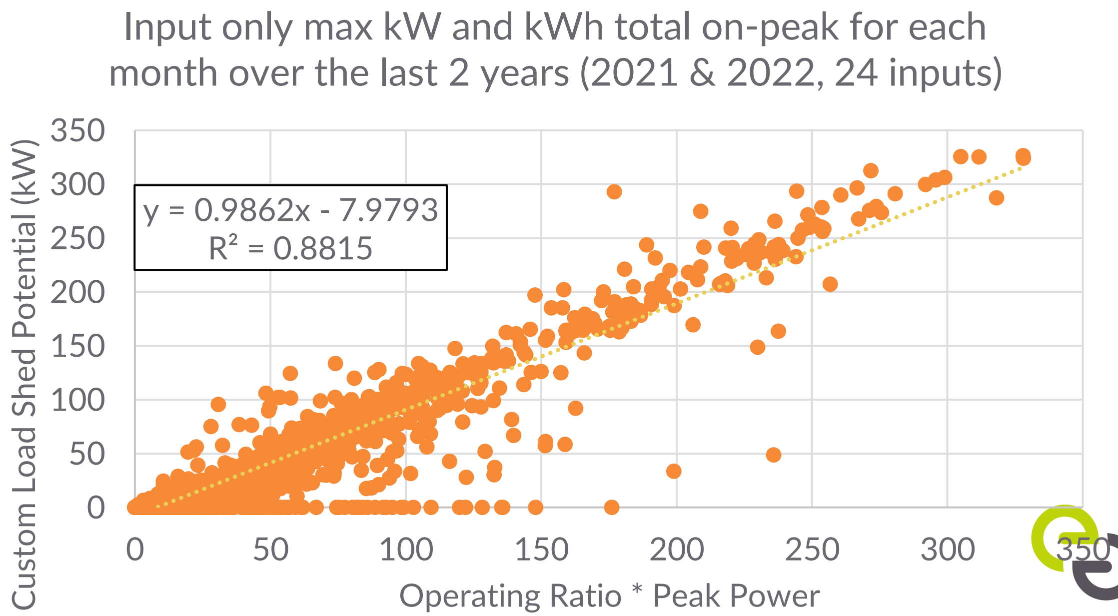
2. Past PG&E ADR Deemed Investigation 2022-2023

Background: Operating Ratio * Peak Power Metric

Input Metric

1. Conducted the custom load analysis approach for 1,573 PG&E ADR SAIDs with ‘21 & ‘22 interval data.
    1. Excluded SAIDs >600 kW peak load, with solar, and those with peak demand <5 kW.
2. Identified “Operating Ratio * Peak Power” as a viable input proxy to calculate load shed potential.
    1. Operating Ratio = How often an SAID is operating at peak power during summer DR hours
    2. Looked at a variety of inputs and frequency. 24 input evaluation (kWh and kW monthly values over 2 years) didn’t produce a noticeably higher correlation to the custom calculator than 2 inputs (kWh and kW multi-year values).
    3. Additional takeaway = limiting the # of inputs is okay to balance easier use with expected accuracy.

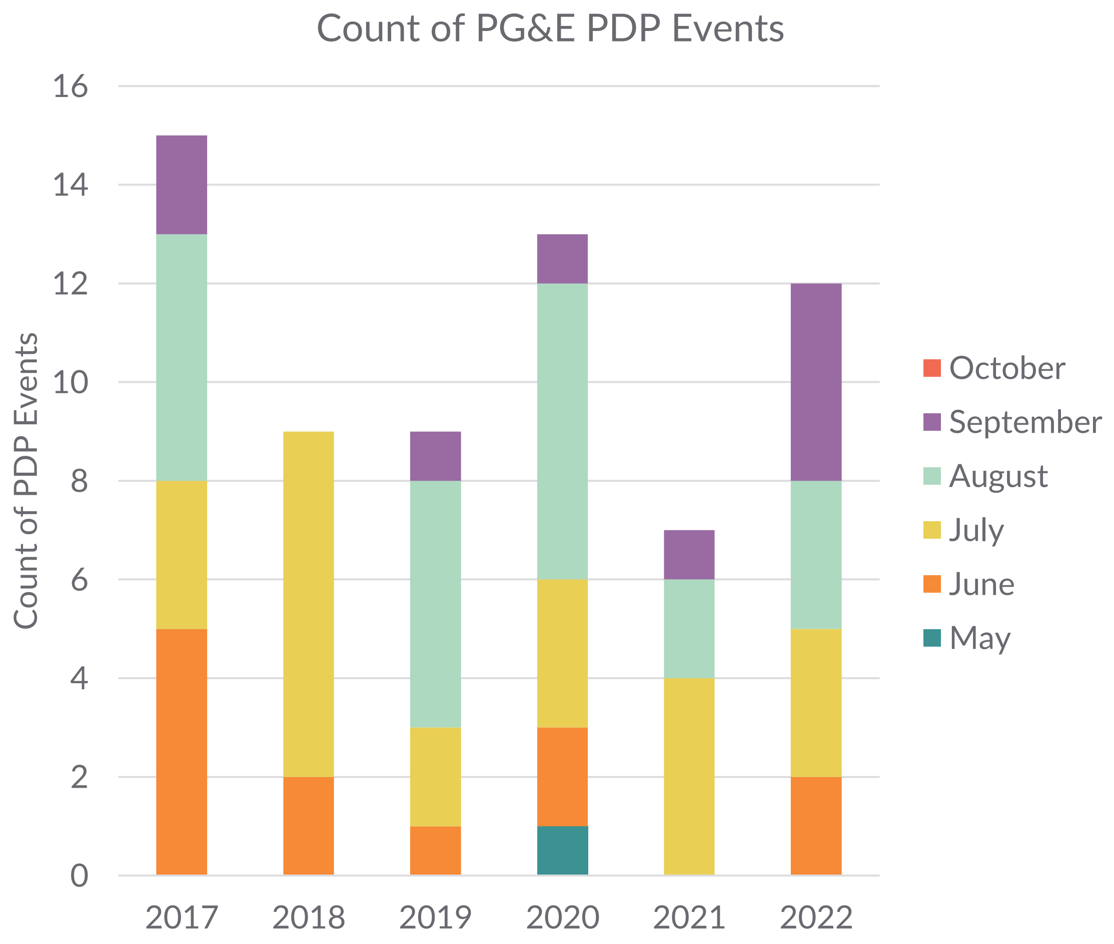




Evaluate DR performance potential in real events

Look at Real Events

1. Calculate available load shed on real events for real PG&E ADR SAIDs to compare against deemed calculation.
   - Available load shed = 10-in-10 baseline.
2. 806 SAIDs that included data from 2017 – 2022, no solar, and <600 kW Peak Demand



1st Deemed effort highlights volatility

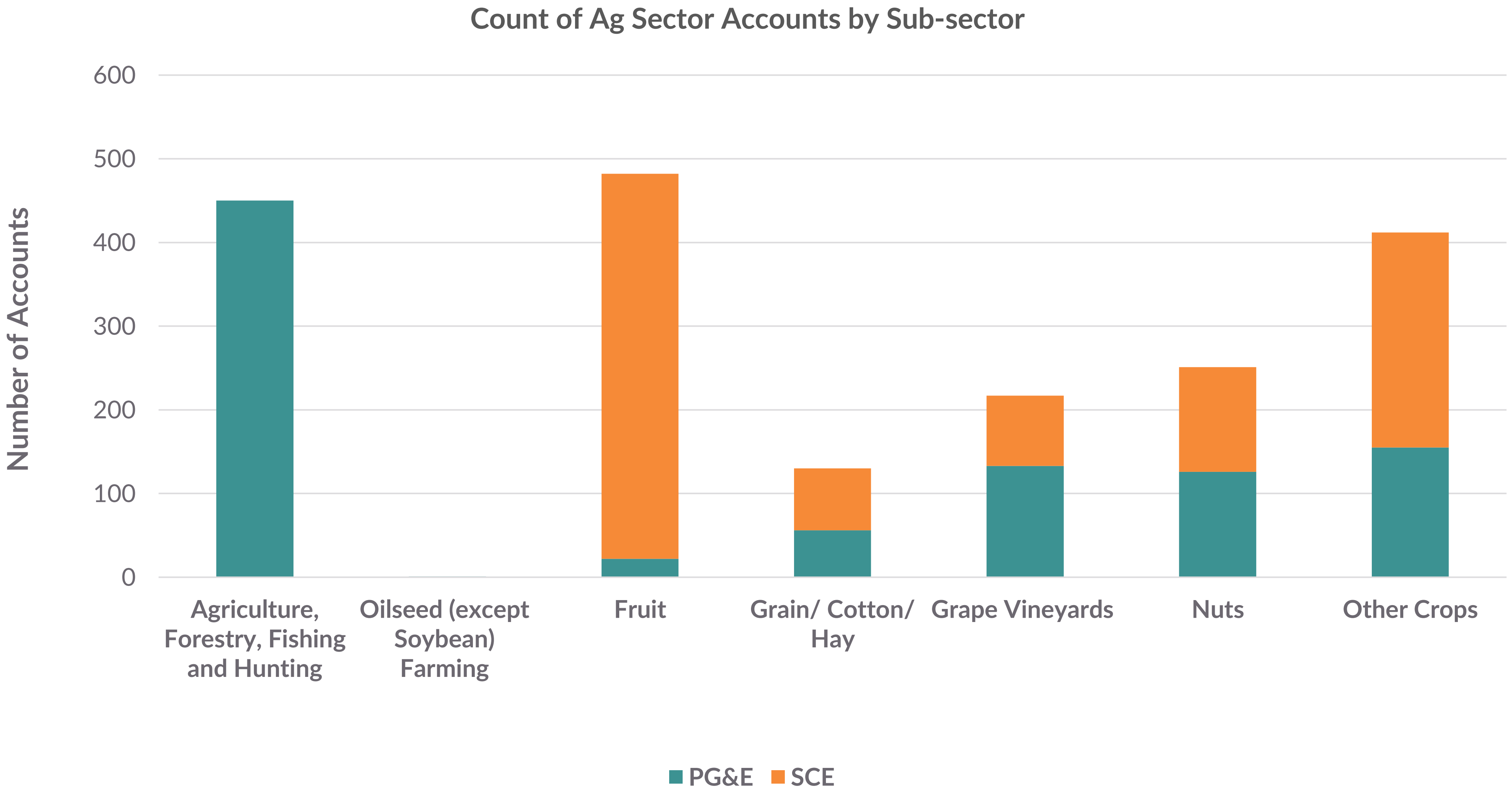
1. Calculations using only very dry years (2020, 2021, and 2022) strongly **overpredicts** load shed potential in wetter years (negative numbers/blue oval).
2. Calculations using predominately wet years, strongly **underpredicts** load shed potential in dryer years (positive numbers/red oval).

This intuitively makes sense. But how to account for it?

Wet v Dry Status	Deemed Calculation Years		Event Years (Positive Values: Real > Deemed Predicted)					
	1st Year	2nd Year	2017 Wet Year	2018 Dry Year	2019 Wet Year	2020 Dry Year	2021 Dry Year	2022 Dry Year
Wet & Dry	2017	2018	0.43	18.86	1.30	35.82	44.05	40.54
Dry & Wet	2018	2019	0.00	18.47	0.91	35.43	43.65	40.14
Wet & Dry	2019	2020	-6.38	12.05	-5.51	29.00	37.23	33.72
Dry & Dry	2020	2021	-26.13	-7.70	-25.26	9.26	17.48	13.98

3. New Deemed Analysis 2025

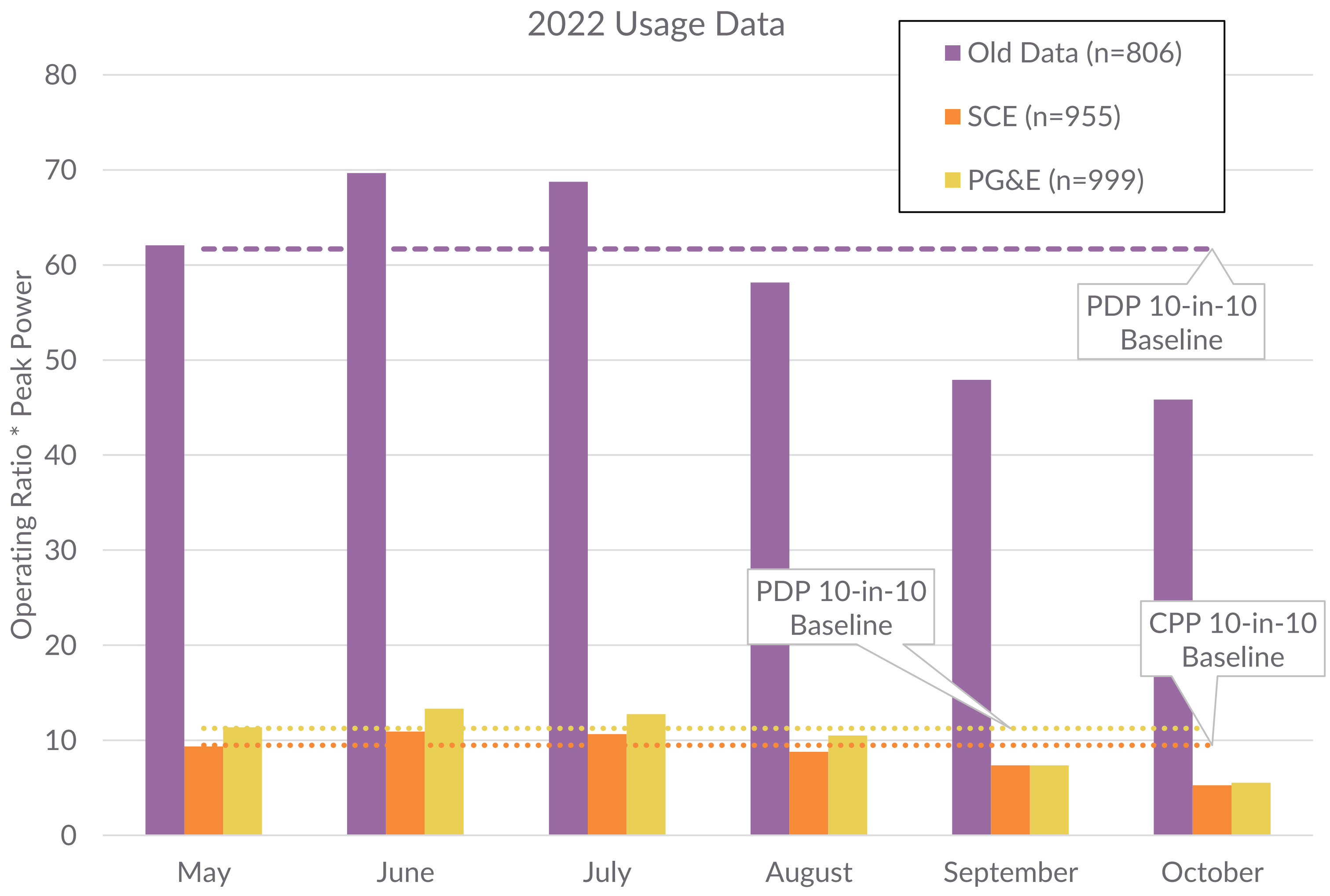
2,000 new Ag SAIDs from PG&E and SCE shows majority tree crop accounts



Old and new data differ in magnitude, but have similar monthly load profiles

3 years ('22 – '24) interval data from 2,000 new Ag SAIDs. Half SCE, half PG&E.

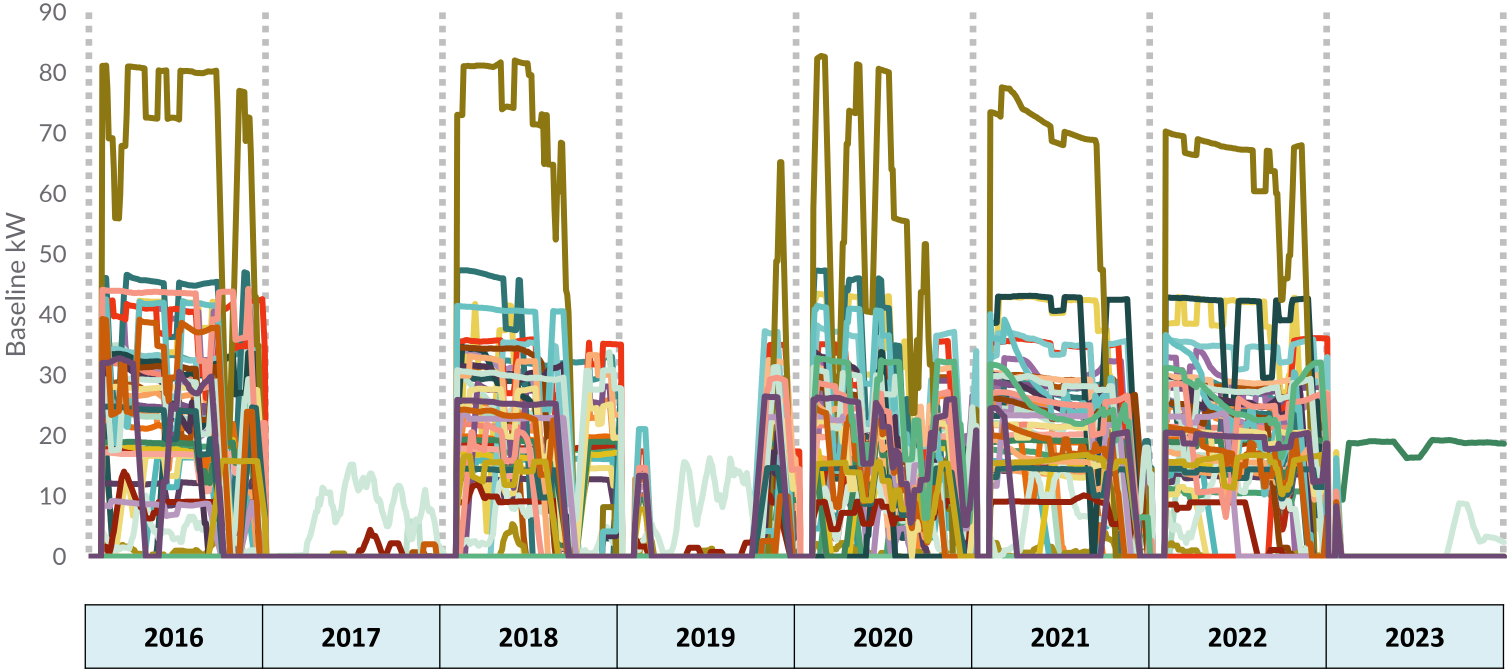
1. Removed sites that didn't appear to be pumping loads, had solar, or >600 kW. Leaving 1,954 SAIDs.
2. Evaluate their PDP (PG&E) and CPP (SCE) event baseline + monthly kWh and kW.
3. **Takeaway:** Old Data is much larger in magnitude, but all follow similar trends



New data effort

Issue of Year-to-Year Variation. Two Approaches:

1. Incorporate a method to account for year-to-year variation.
2. Adjust evaluation horizon.
   a) Both how many years of data are used & how many years of performance is considered.

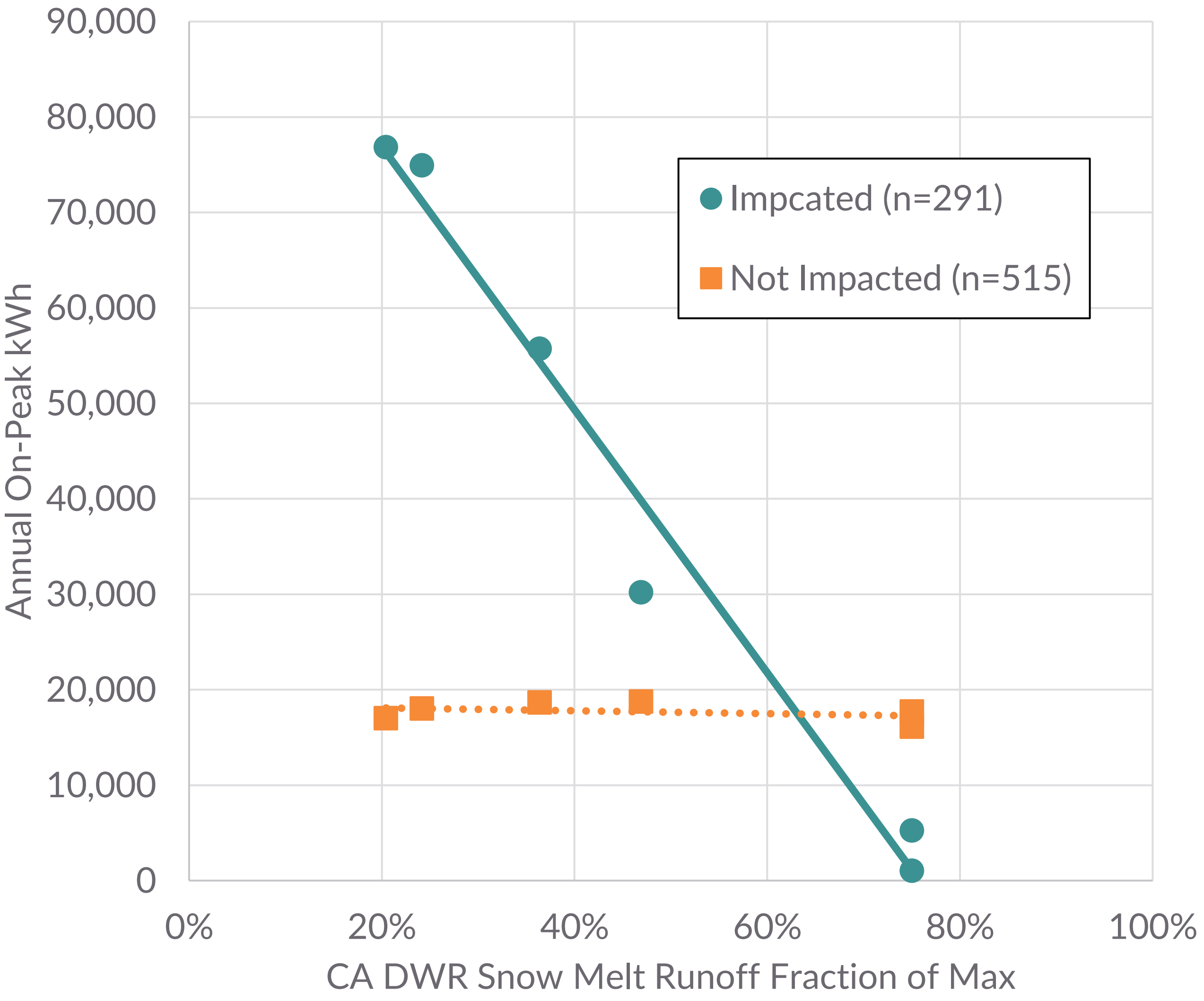


Wet v Dry Status	Deemed Calculation Years		Event Years (Positive Values: Real > Deemed Predicted)					
	1st Year	2nd Year	2017 Wet Year	2018 Dry Year	2019 Wet Year	2020 Dry Year	2021 Dry Year	2022 Dry Year
Wet & Dry	2017	2018	0.43	18.86	1.30	35.82	44.05	40.54
Dry & Wet	2018	2019	0.00	18.47	0.91	35.43	43.65	40.14
Wet & Dry	2019	2020	-6.38	12.05	-5.51	29.00	37.23	33.72
Dry & Dry	2020	2021	-26.13	-7.70	-25.26	9.26	17.48	13.98

Account for year-to-year variation by identifying heavily impacted sites and scaling load to idealized usage

Incorporate a method to account for year-to-year variation.

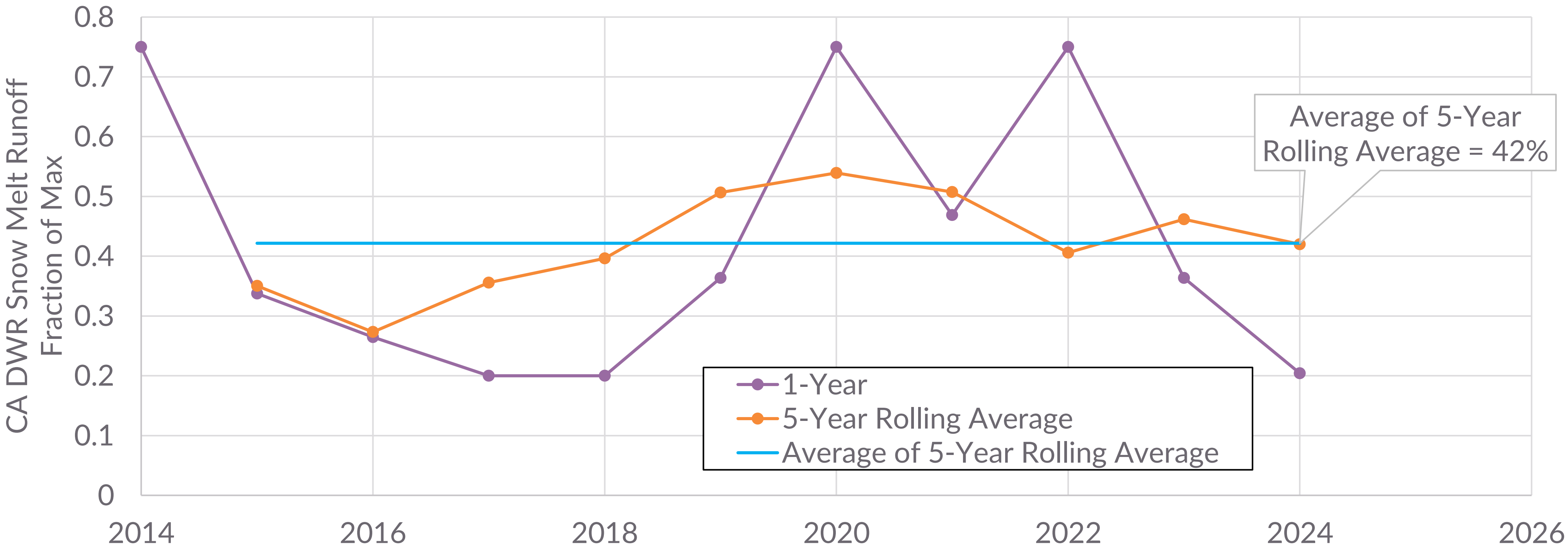
1. Some sites are impacted by yearly variations, some not. Need to be able to identify which is which based on limited inputs.
    1. Negative kWh/Snow Melt runoff index slope
        1. CA DWR Snow Melt Runoff Index as a proxy for yearly variation
    2. High and low usage year reasonably high coefficient of variation (CoV)
    3. High usage year is non-trivial



Adjust event horizon by allowing for more interval data and evaluate performance over 5-year period

Incorporate a method to account for year-to-year variation.

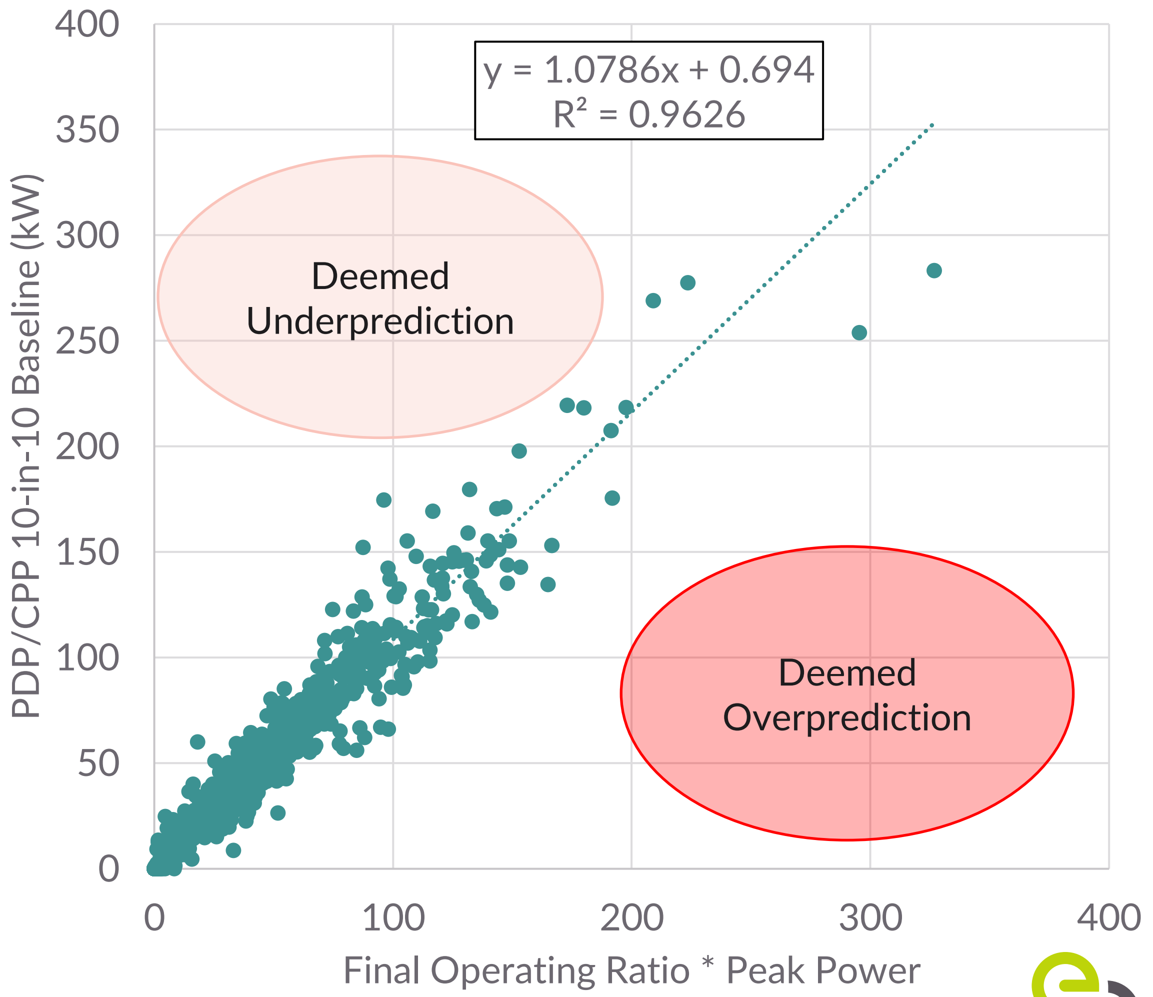
1. For impacted sites, what do you scale to?
    1. Consider a 5-year time horizon to coincide with common PG&E ADR program commitment = 42% CA DWR Snow Melt Runoff Fraction of Max



Success! Found strong correlation between input metric (operating ratio * peak power) and real event potential

What would the deemed calculation look like?

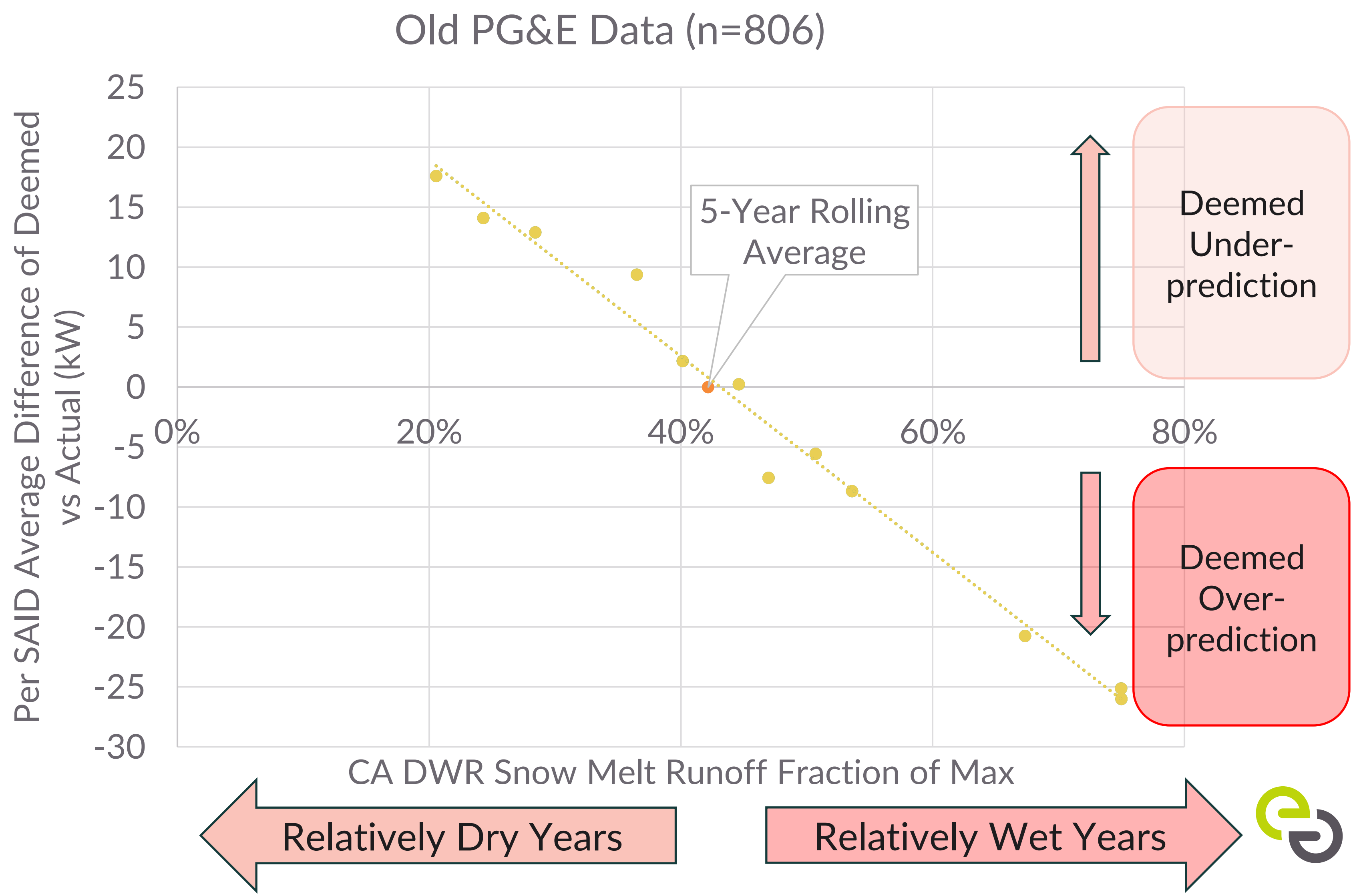
1. Calculate final Operating Ratio * Peak Power for all 2,760 SAIDs for maximum available data ('17-'22 for 806 old SAIDs, '22 to '24 for 1954 new SAIDs) and compare to their PDP/CPP 10-in-10 baseline.
2. Very Strong Correlation! **Have a deemed equation based on operating ratio * peak power (1 kW and 1 kWh value per year) to predict real event potential.**
    1. Final calculation needed to adjust to remove situation where a 0 Operating Ratio & Peak gives a non-zero load shed potential. Final result = 3 equations.
        1. One for all sites categorized as heavily impacted by year-to-year variation
        2. One for large operating ratio * peak power sites categorized as not impacted by year-to-year variation
        3. One for small operating ratio * peak power sites categorized as not impacted by year-to-year variation



Success! Average difference of varying evaluation years show strong correlation to prediction. Extreme drought years = underprediction, heavy wet years = overprediction.

Let's use the deemed equations with the data we have.

1. Calculate the average kW difference from what the deemed load shed potential give vs the PDP/CPP 10-in-10 baseline.
2. Result = Exactly what we'd want!
   1. Dry years will result in an underprediction
   2. Wet years will result in an overprediction
   3. But on a rolling basis, should balance out with California 5-year rolling average (42% CA DWR Snow Melt Runoff Fraction of Max)

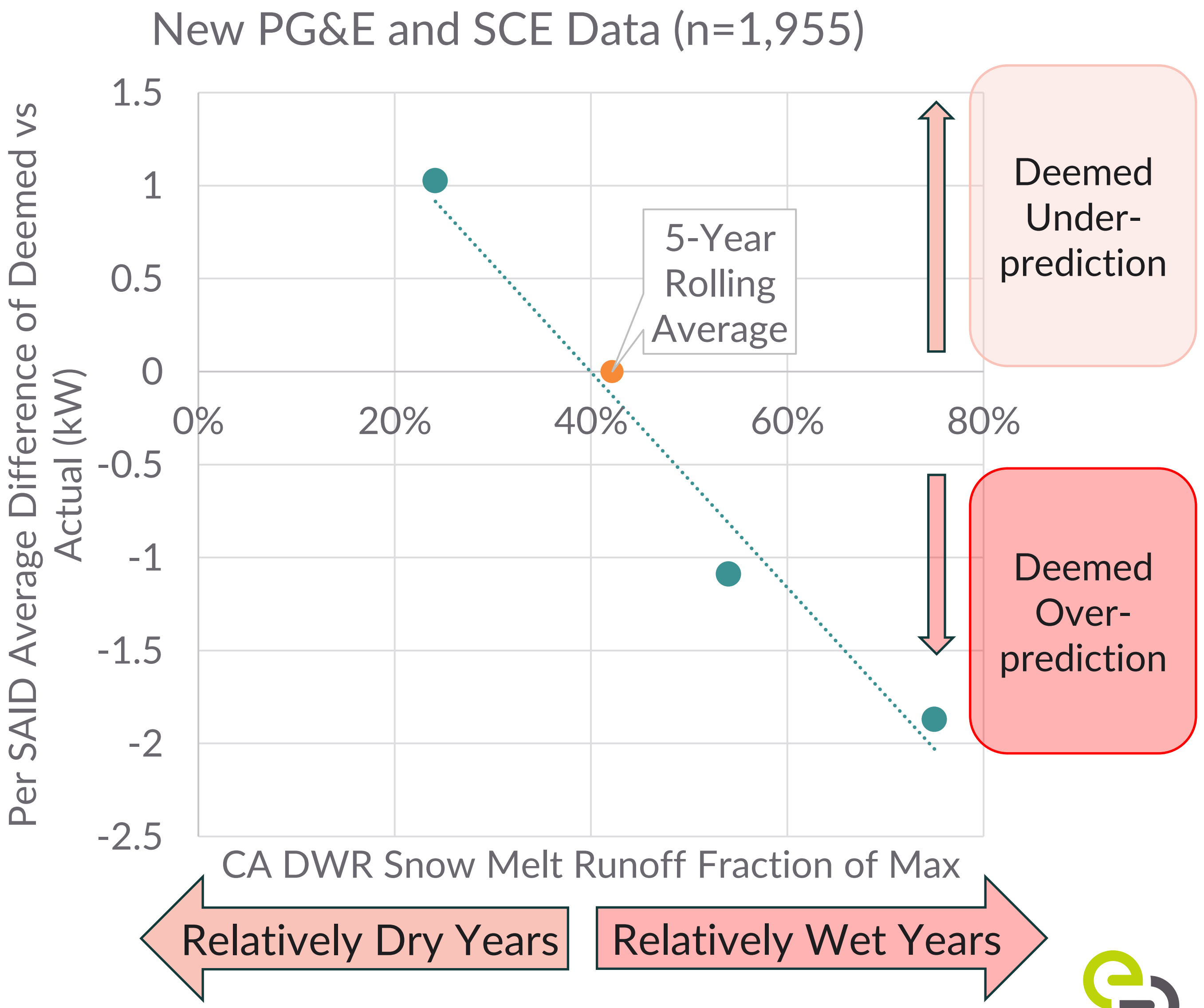


New PG&E and SCE data show similar successful implementation

Similar results from old data (n=806 of previous PG&E ADR submitted SAIDs) compared to new data (n=1,955, SCE & PG&E randomly selected sites)

Successful investigation! Found a strongly correlated deemed approach based on the summer on-peak kW and kWh of multiple years of data.

Application	Slope	Intercept
All SAIDs heavily impacted by drought conditions	1.02750	0.46607
Small load SAIDs (operating ratio * peak power ≤20) not impacted by drought conditions	1.24804	-0.1169
Large load SAIDs (operating ratio * peak power >20) not impacted by drought conditions	1.07027	5.08516



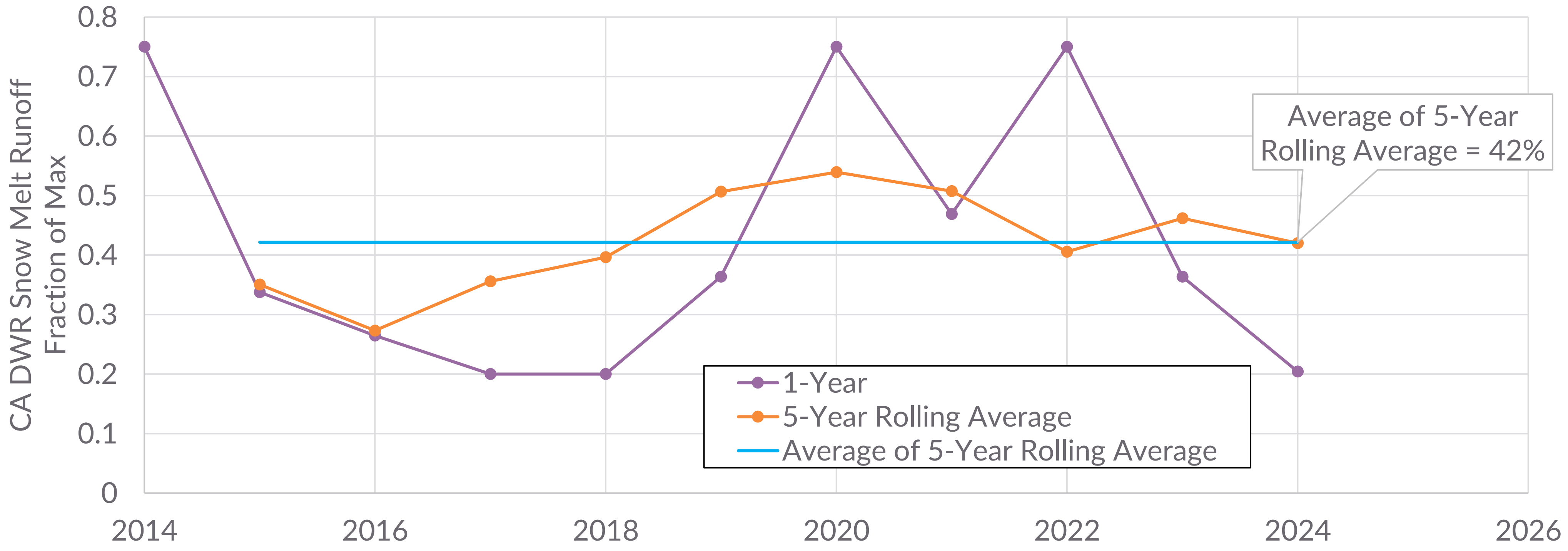
4. Questions/Next Steps

Idealized year-to-year value

5-year rolling average of past 10 years = 42%.

- Low of 27%, high of 54% in same period.

How do we feel about this idealized value?



Developing qualified characteristics for deemed use in Ag pumping

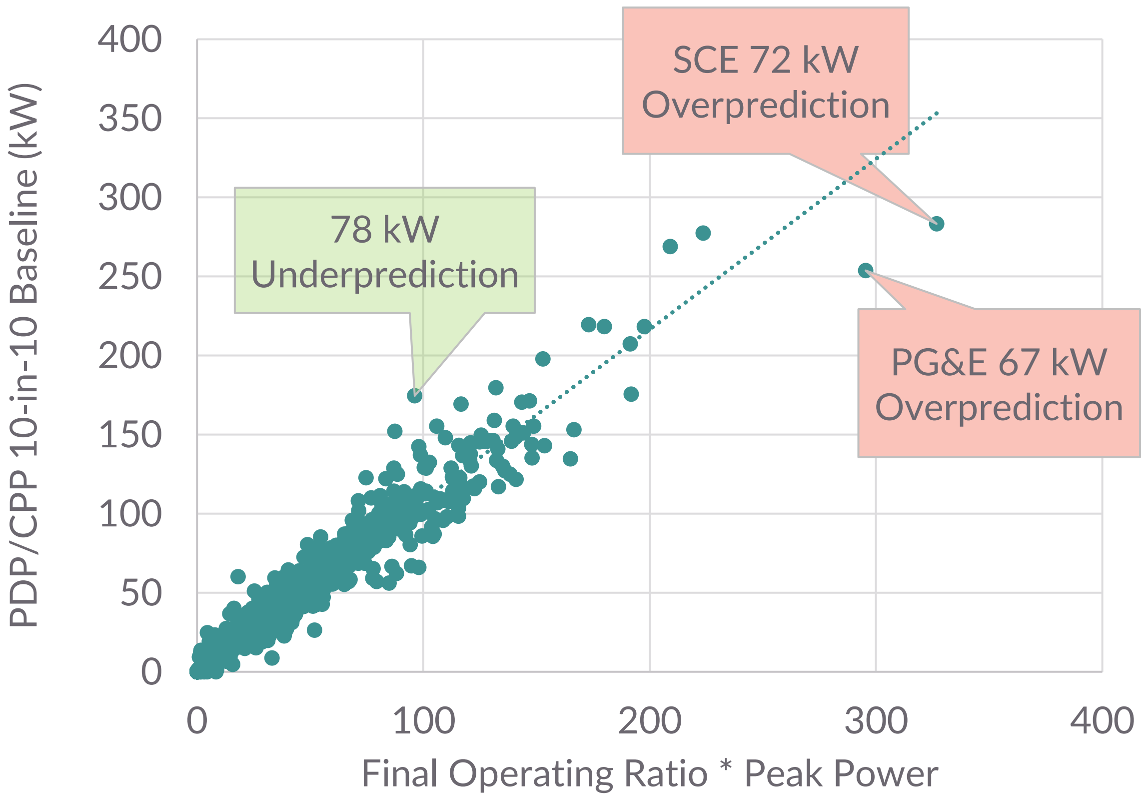
Recommending analysis/application to be limited to the following:

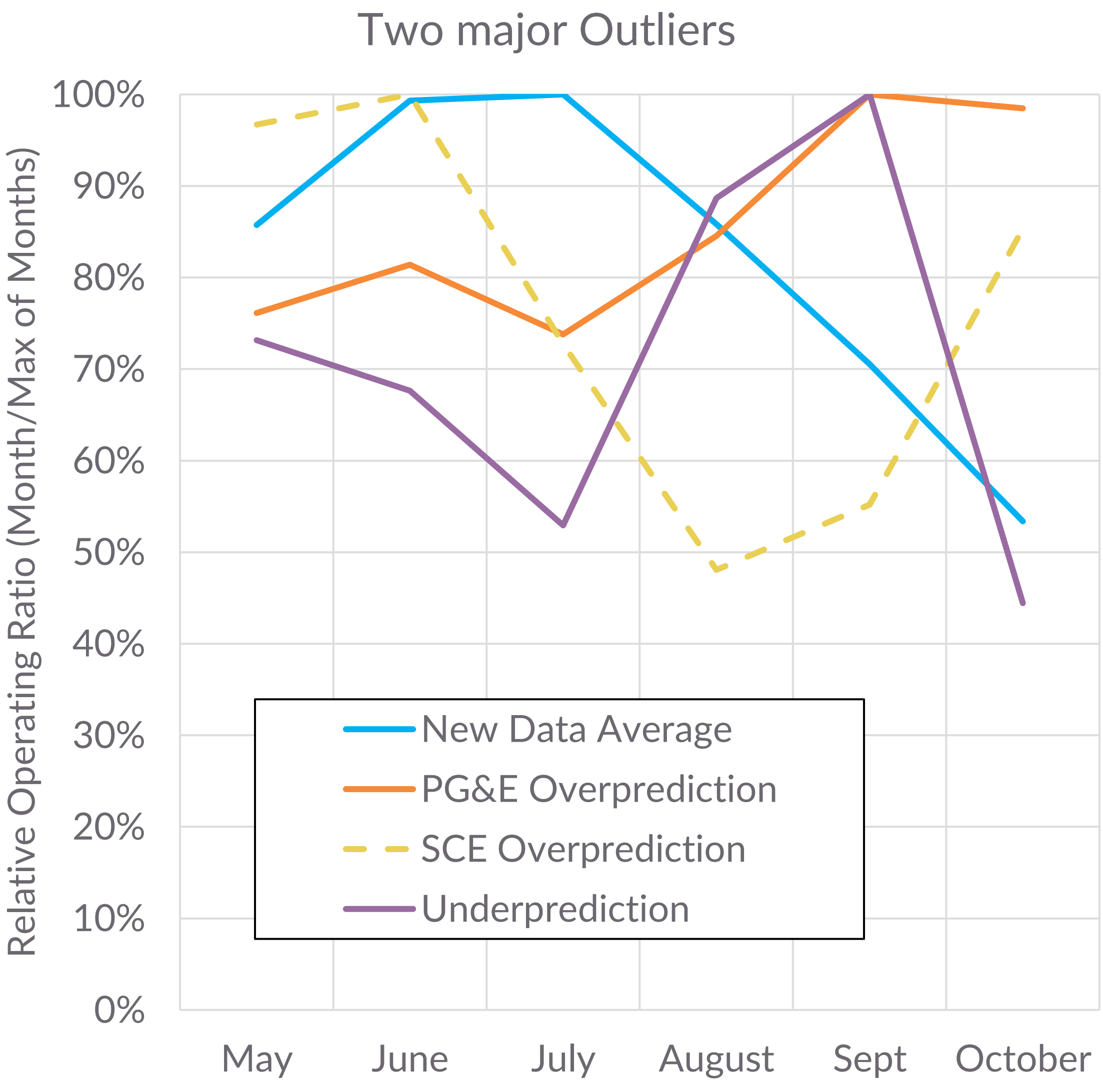
1. Irrigation Pumping without solar (or other generation sources)
2. <600 kW peak kW
3. Require users to submit annual on-peak kWh & kW data that includes years that bind the 5-year rolling CA DWR Snow Melt Runoff Fraction of Max of 42%.
4. Requires users to submit data that is only representative of future usage. E.g., if a new pump was installed, new irrigation strategy, or a new crop was planted, a deemed approach (similar to custom) would falter.

Any concerns with these qualifying characteristics?

Outlier considerations

1. Outliers – Any significant concerns?
    1. No obvious way to filter out without requiring everyone to submit more data.





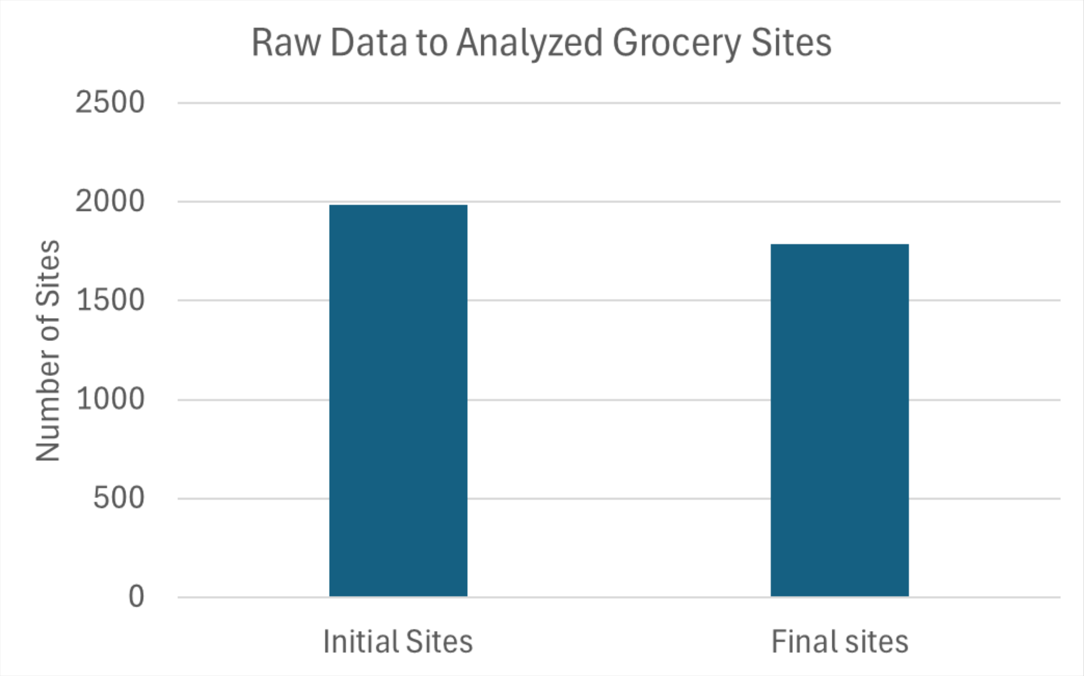
Sector Analysis: Grocery Refrigeration

Introduction: Grocery DR potential assessment (refrigeration focus)

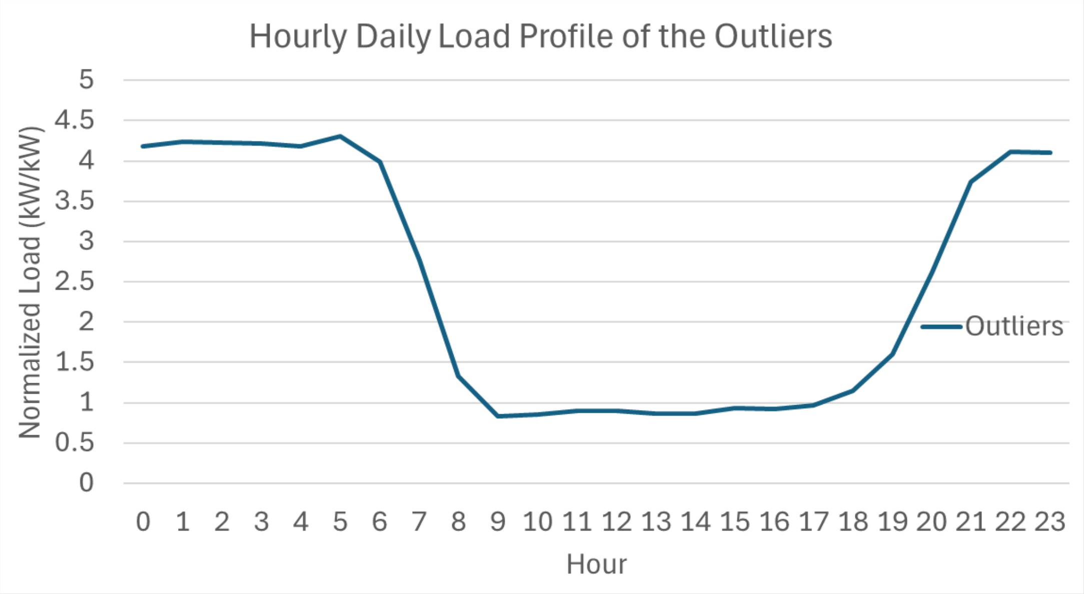
- Grocery stores are energy-intensive facilities with a significant share of their load attributed to refrigeration systems that run continuously, regardless of time or occupancy. This presents a unique opportunity for demand response (DR) participation, particularly through refrigeration-based load flexibility measures.
- The objective of this analysis is to evaluate the demand response potential of grocery stores with a specific focus on identifying refrigeration-driven DR opportunities. By analyzing the hourly load profiles of over 2,000 grocery sites during the demand response season (May–October).

Data size of grocery sector is robust

- Started with 2,000 accounts
  - Excluded Vending Machines
  - Excluded sites with solar
  - Excluded site with no data and 0 peak kW
    - Final number of PG&E Accounts: 922
    - Final number of SCE Accounts: 862

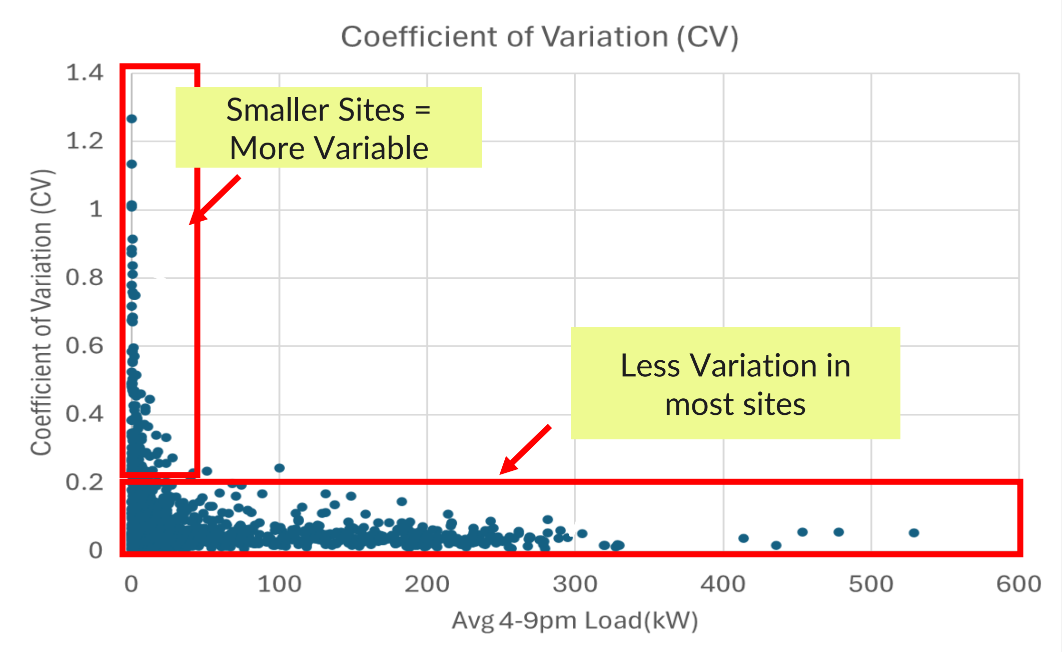


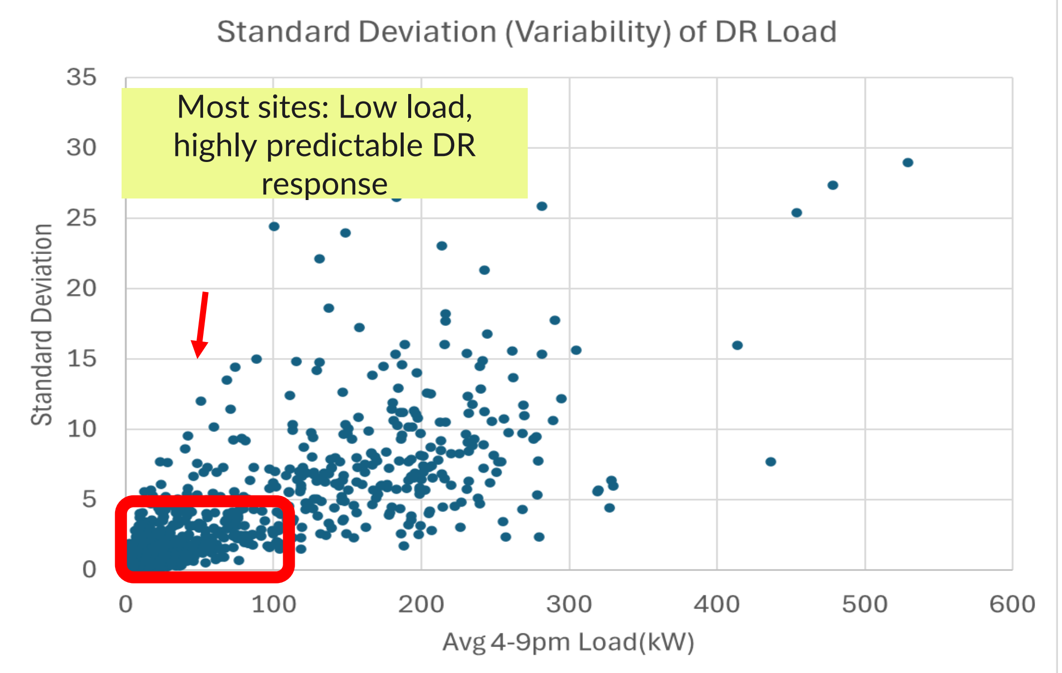
Also excluded sites (~117 accounts) (with load shape that doesn't seem to represent a typical grocery load shape



Grocery sector loads exhibit low variability

- Nearly all stores above 50 kW average load have a coefficient of variation (CV) below 0.2—these are highly consistent during DR hours. Even among the smallest stores, most have a CV under 0.5, meaning day-to-day variability is modest.
- For sites above 200 kW, CV approaches zero, indicating almost perfectly steady loads, ideal for DR automation. Only a handful of small-load outliers have a CV above 0.8, suggesting possible data issues or rare operational variability.
- Standard deviation (SD) grows slightly with larger average loads. This is expected as higher loads naturally have a wider operational range.
- For stores above 200 kW average, SD is commonly 10–20 kW, which is usually less than 10% of its average load, making it still highly predictable. (as seen in CV plot).





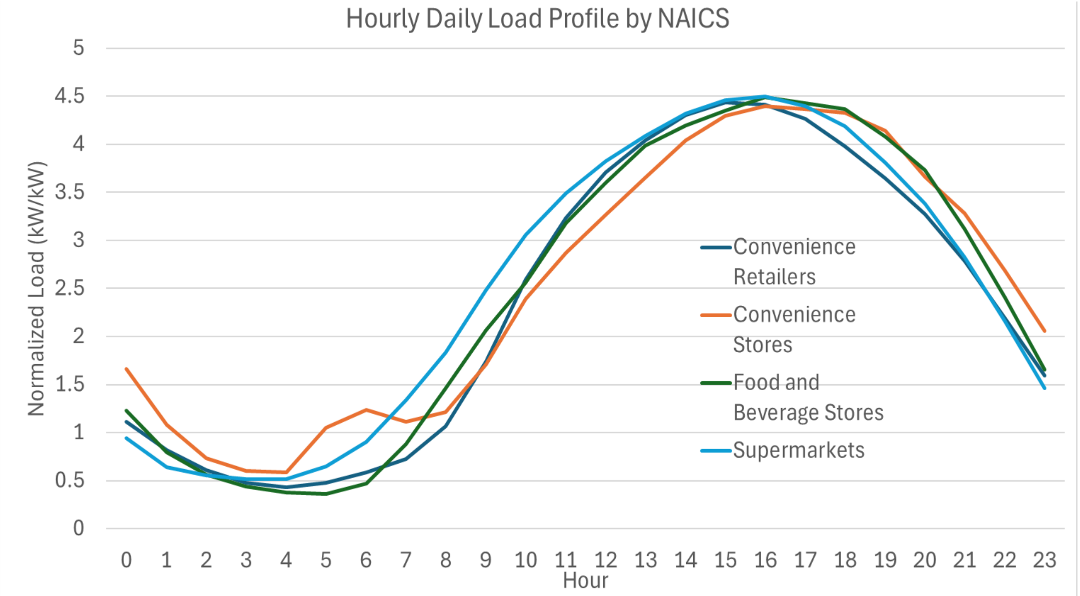
Hourly daily load profiles are consistent across building types

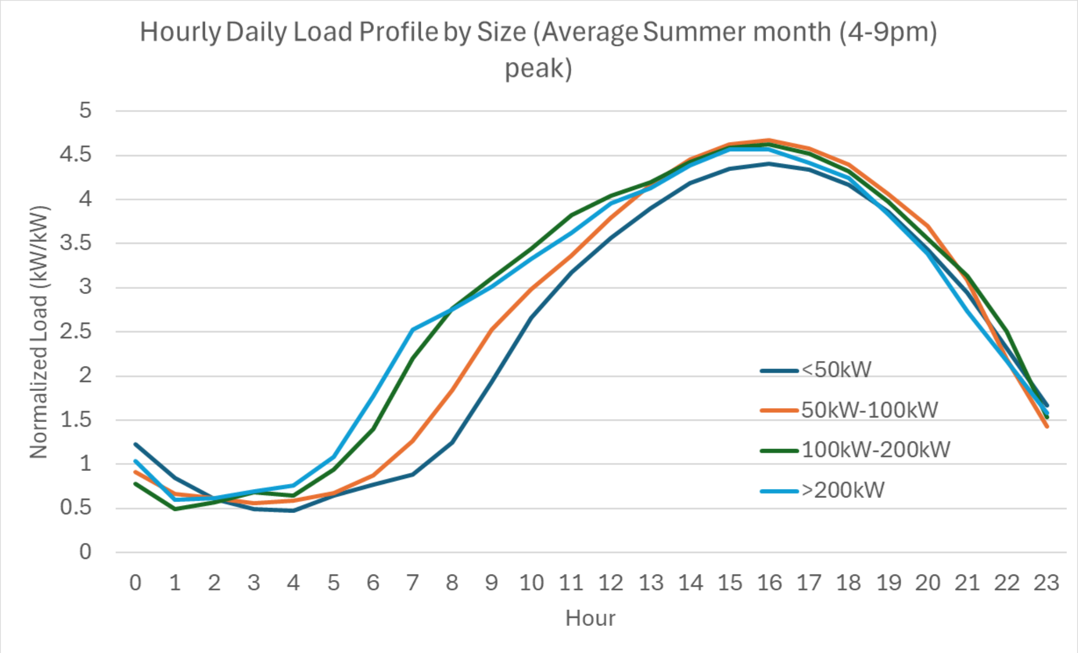
- The overall shape barely changes with store size and type. This highlights the strong influence of refrigeration, lighting, and HVAC, which are continuous and scale with store size and type but don't change the pattern. The minimal overnight drop highlights the high "baseload" nature, primarily refrigeration.

- Supermarkets and food/beverage stores reach the highest normalized peak loads and sustain higher evening loads.

- Convenience stores display a slightly lower overnight load, possibly due to different refrigeration patterns, smaller HVAC, or shorter open hours.

- The consistency across both type and size means DR programs can be broadly applied across the sector, with predictable results. Large stores (>200 kW) offer the highest absolute load shed, but even small stores mirror the same curve—every site has meaningful DR potential.

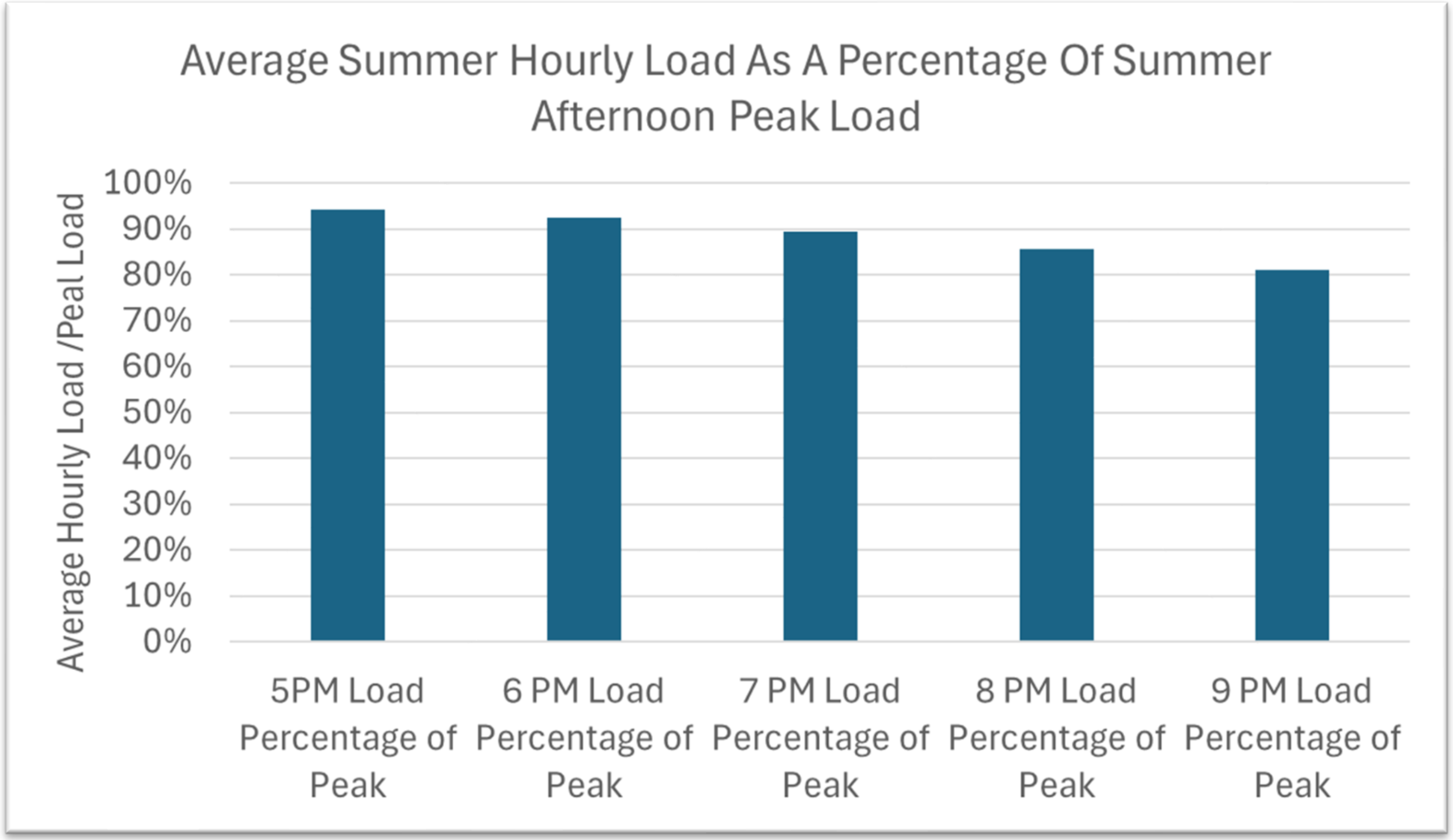




Groceries also maintain high summer peak loads from 4 p.m. to 9 p.m.

- At 5 PM, the average grocery site operates at approximately 94% of its summer afternoon peak load. Even by 9 PM, stores are still at approximately 82% of peak, only a 12% drop over four hours.

- Grocery stores maintain very high load levels well into the evening, reflecting the continuous nature of refrigeration, lighting, and possibly other end uses (like HVAC and food service equipment).



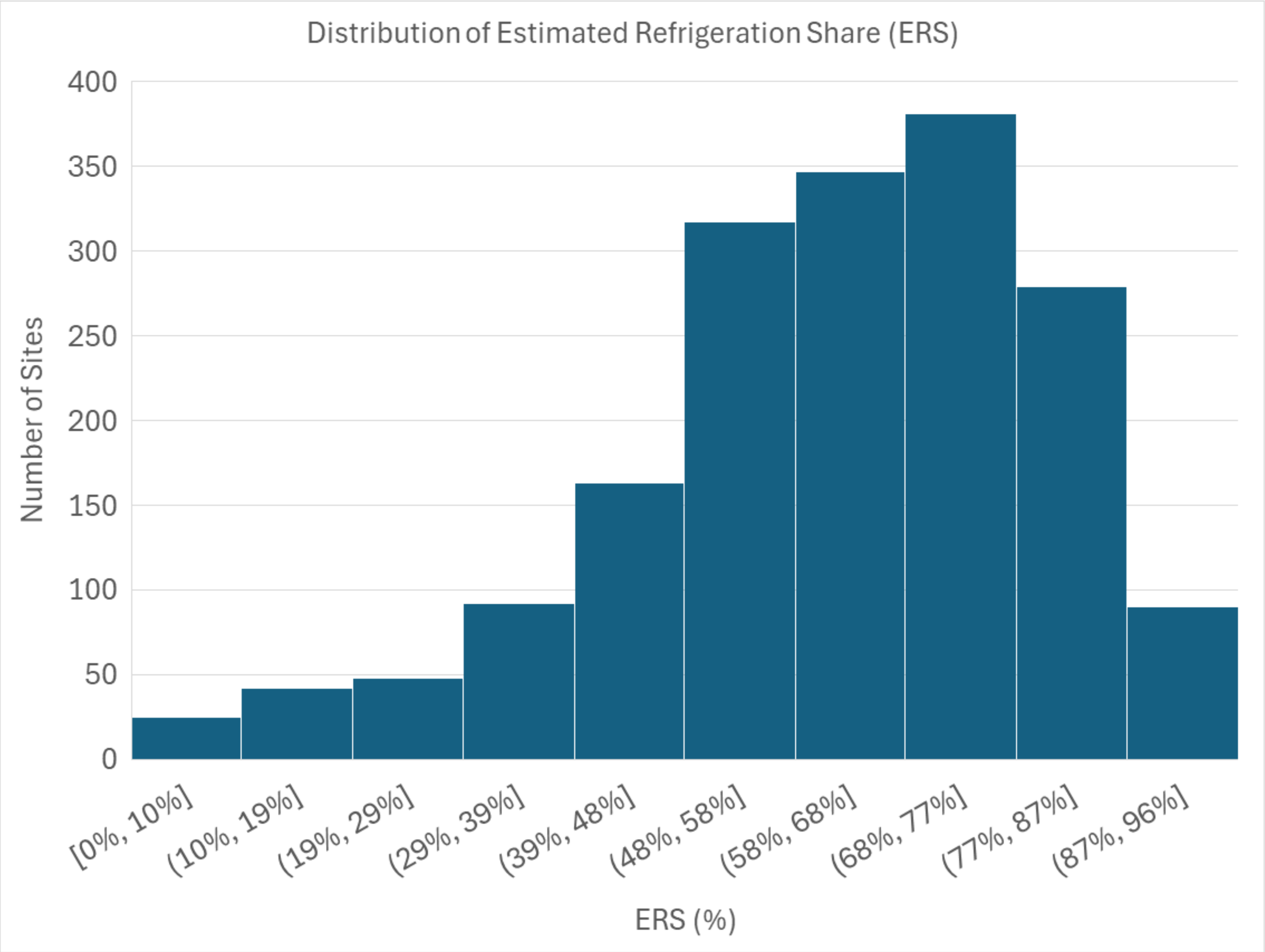
Metric Development: Estimated Refrigeration Share (ERS)

ERS quantifies the proportion of a grocery site's total electricity consumption during the 4–9 pm DR window that can be attributed to refrigeration equipment.

- A higher ERS indicates that refrigeration is the dominant load—common in supermarkets, where refrigeration systems often account for 60%–80% (or more) of total load.
- A higher ERS means a larger fraction of evening load is available for demand response via refrigeration measures such as setpoint adjustments, cycling, or pre-cooling.

Estimated share of refrigeration load in groceries is >50%

- The majority of grocery sites (nearly 80% or 1,340 accounts) have an ERS between 48% and 87%, meaning that at least half—and often much more—of their total load is due to refrigeration.
- The most common ERS range is 68–77%, with nearly 400 sites in this bin alone.
  - High ERS sites are especially well-suited for ADR events as they offer significant, predictable load shed potential with minimal risk of customer impact.
- Only a small minority of stores have an ERS below 40%, confirming that refrigeration is the primary and persistent driver of energy use across the sector.

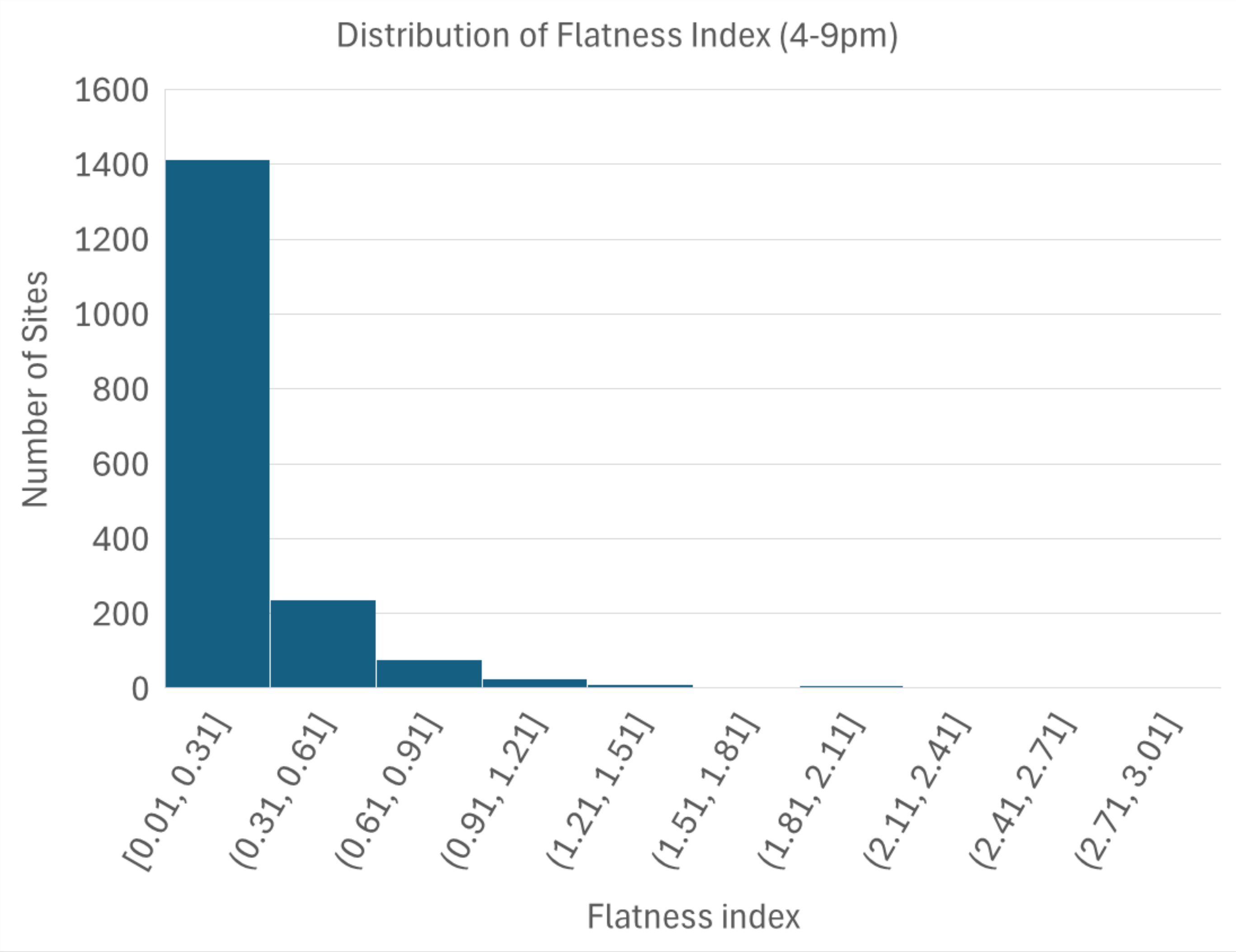


Groceries loads are very flat (steady) during 4 p.m. to 9 p.m.

Flatness Index measures how steady or variable the load is during a specific period (like the DR window of 4–9pm).

- Low Flatness Index: Load is very steady. ideal for DR, as shed is reliable, Baseline is predictable
- High Flatness Index: Load swings a lot within the window, less predictable, may reflect cycling, operational events, or non-baseload end uses.

Over 1,400 sites have a flatness index between 0.01 and 0.31, indicating that their 4–9 pm load is extremely stable, there is minimal variation from hour to hour within the DR window.



Sector Analysis: K-12 Schools

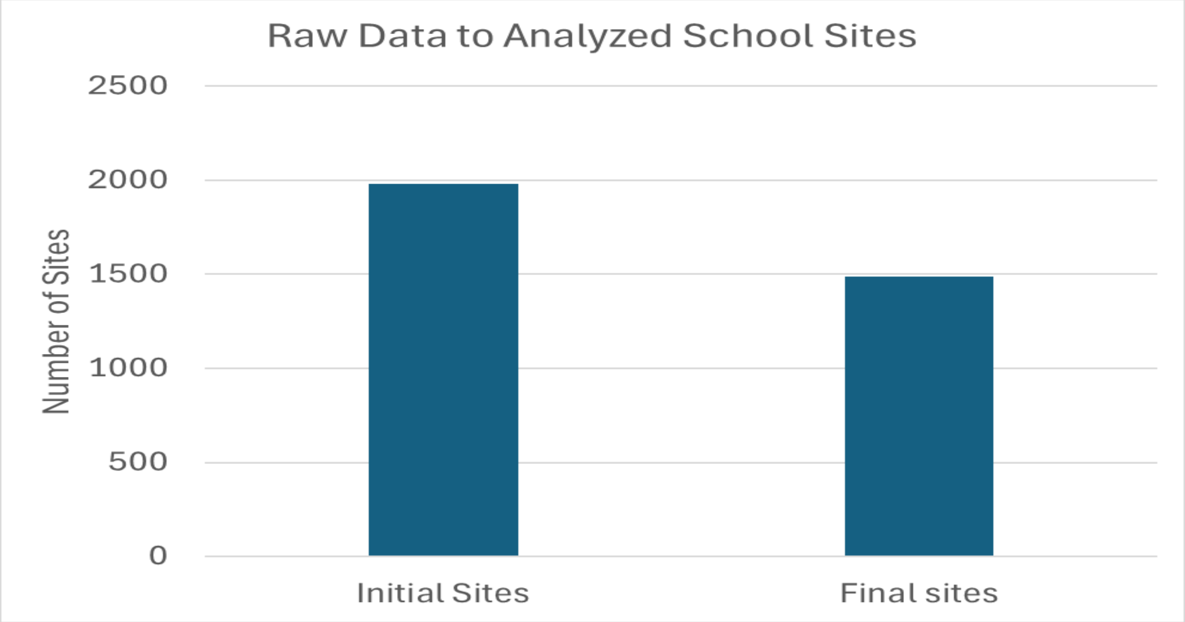
Introduction: School DR potential assessment

This analysis investigates the demand response (DR) potential of approximately 2,000 school sites across the May–October DR season (4–9 PM). Given that schools operate on varied daily schedules and experience seasonal closures, the goal was to determine whether sufficient electrical load remains during unoccupied hours to support meaningful DR participation—particularly through HVAC curtailment.

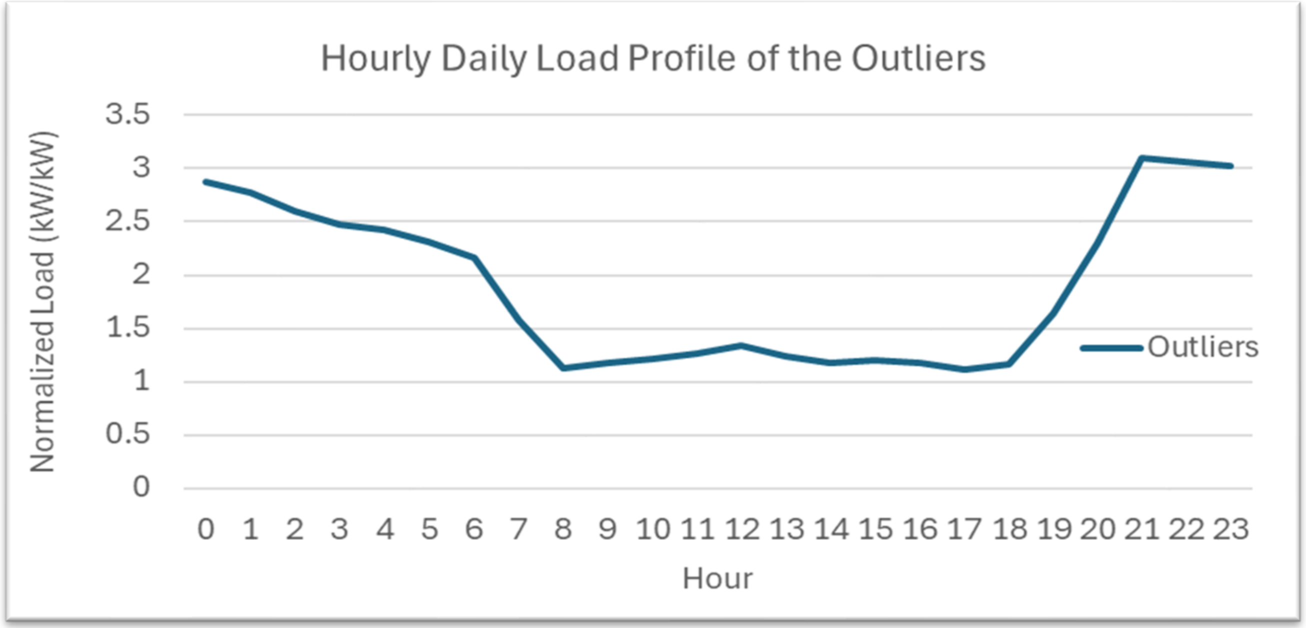
The study evaluates load drop ratios, residual HVAC consumption, and consistency across the DR window to identify sites with viable flexibility—even when students and staff are no longer present.

Data size of K-12 schools is robust

- Started with 2,000 accounts
  - Excluded EV chargers
  - Excluded sites with solar
  - Excluded site with no data and 0 peak kW
    - PG&E Accounts: 859
    - SCE Accounts: 627



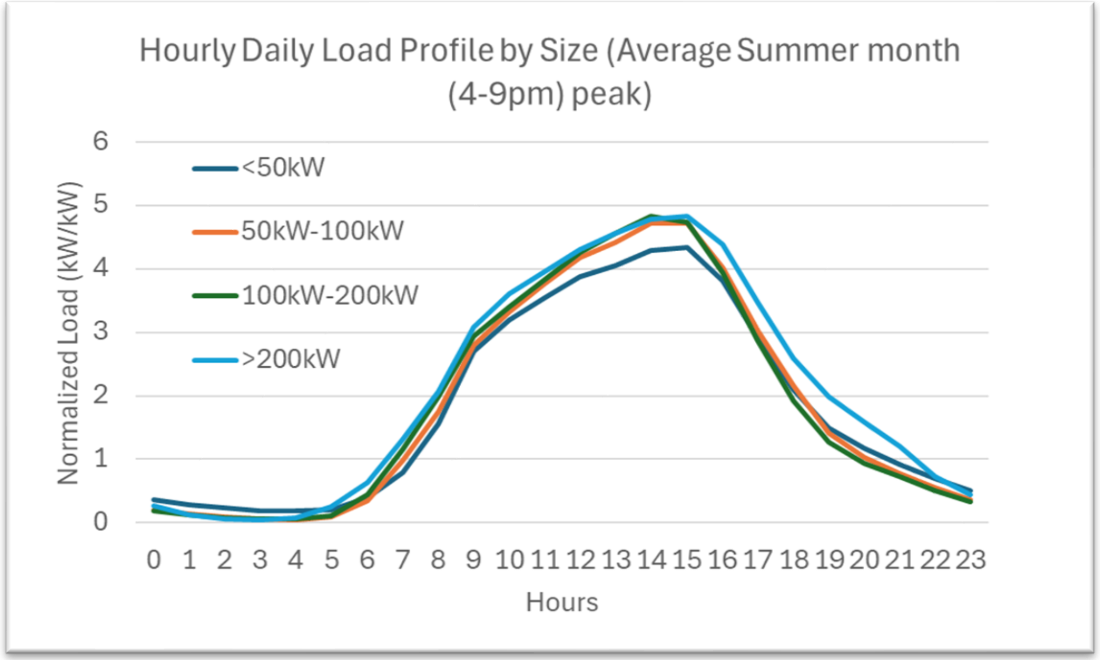
Excluded sites (~170 accounts) with load shape that doesn't seem to represent a typical school load shape



Hourly daily load profile

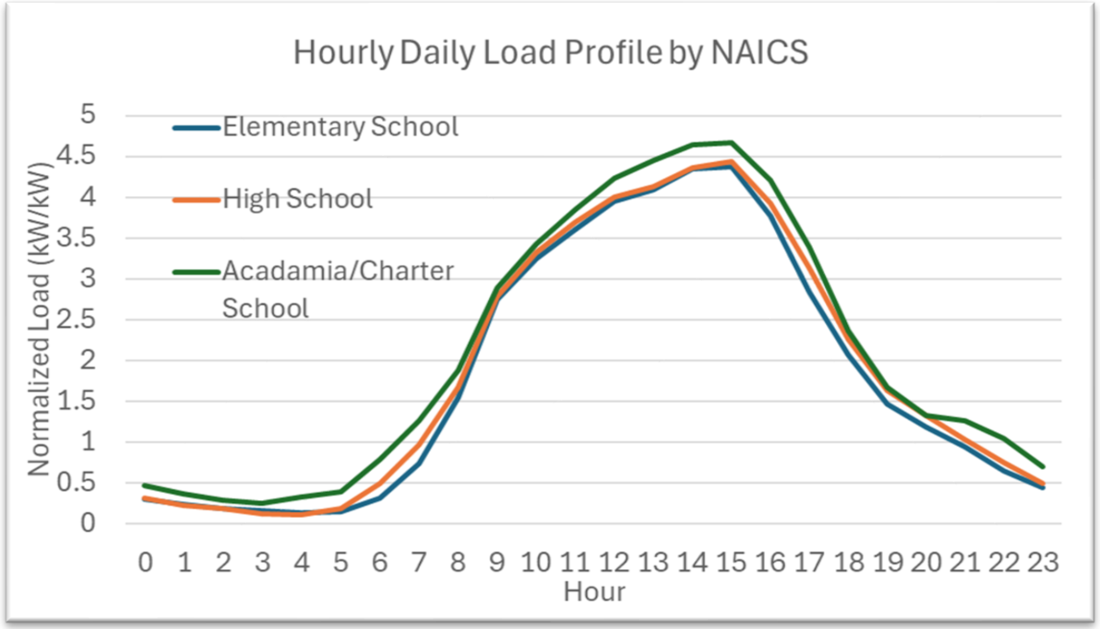
By size (peak kW):

- All size categories show a similar normalized load profile, peaking around 2-4 PM.
- The largest schools (>200 kW) appear to sustain a slightly higher 4-9 PM load, hinting at greater potential for DR or the presence of more after-school activity/equipment.



By NAICS or school type:

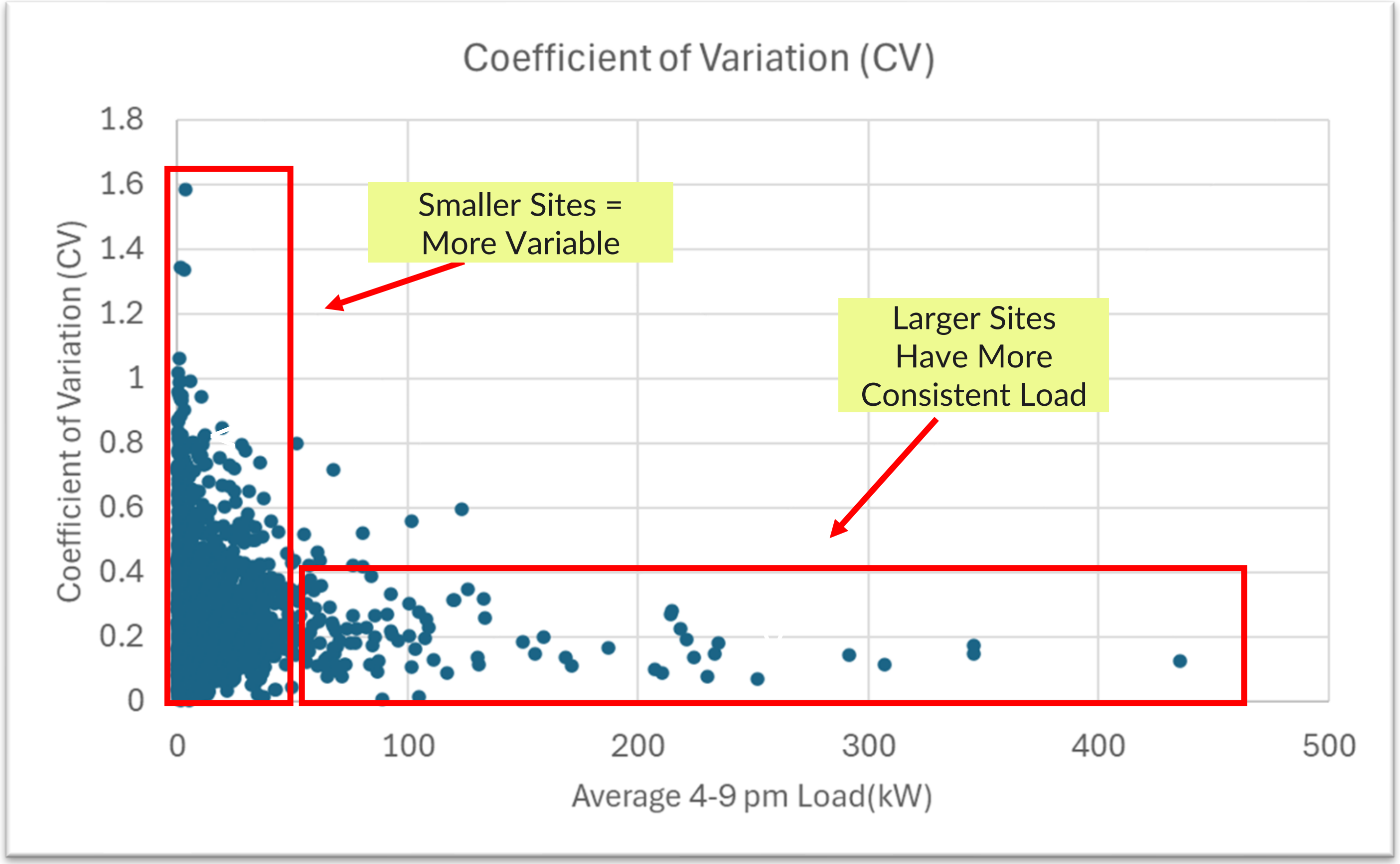
- Elementary schools (blue line) show a sharper decline after their daily peak, suggesting earlier closures or stricter after-hours controls.
- All three school types follow a similar bell-shaped load profile with low early-morning usage, a sharp rise after 6–7 AM, and a pronounced peak in the early afternoon (around 1–3 PM).



Schools have high load variability during 4-9 PM particularly small schools <50 kW

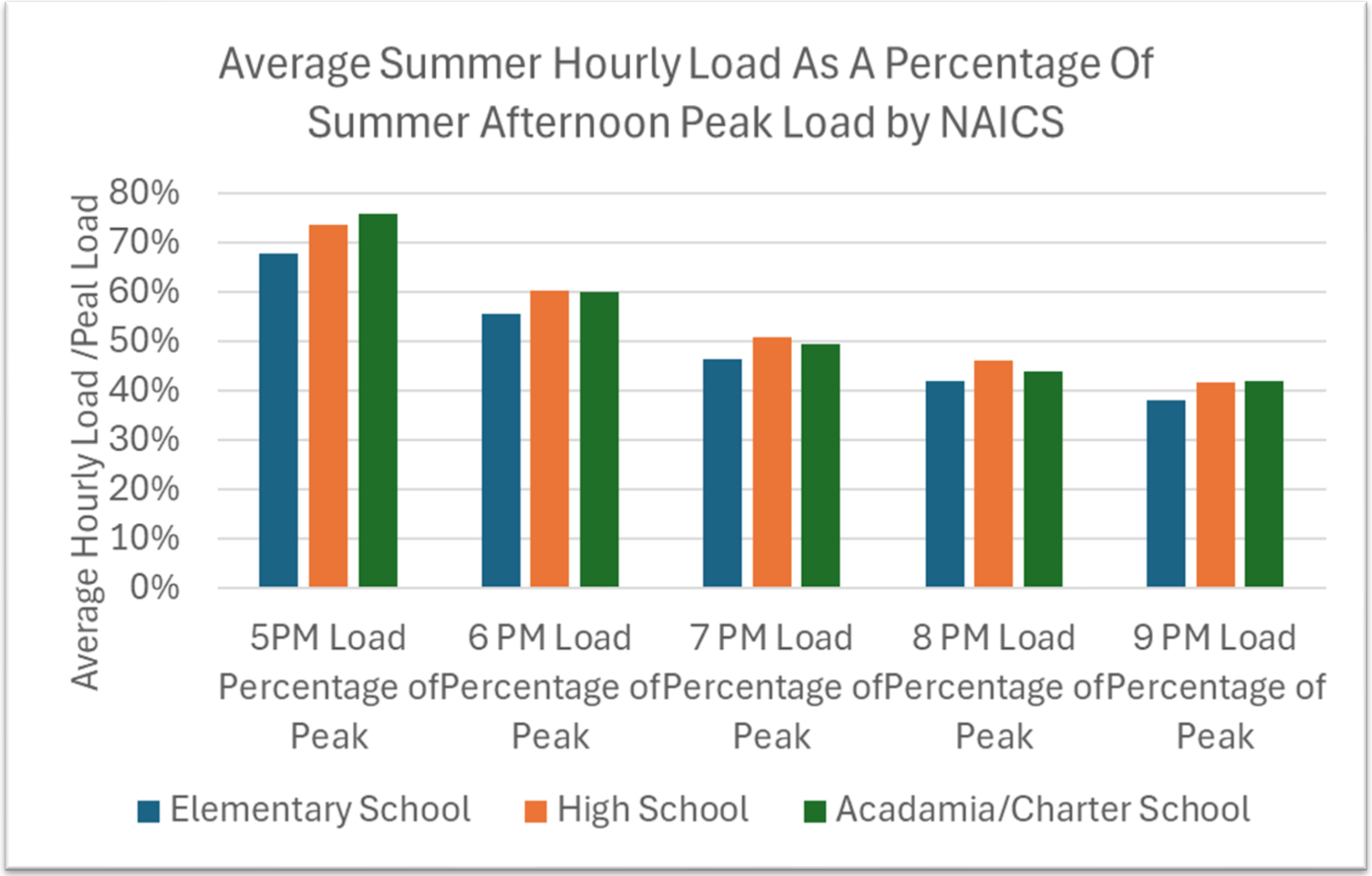
- 1,369 schools smaller than 50 kW average 4-9 PM summer load have a high coefficient of variation (CV), indicating day-to-day variability in DR window. This could be due to smaller buildings being more sensitive to weather and activities. Small sites with high CV may still be included but are less predictable and may need to be treated differently.

- 117 accounts are large-load schools with average 4-9 PM summer load greater than 50 kW. These show more consistent load profiles in the DR window and worth exploring their DR participation potential further.



All schools retain 50-75% of their peak load from 4 – 7 p.m.

- Substantial Residual Load Post-Peak: At 5 PM, all school types maintain 65–75% of their afternoon peak load—showing significant load persists into the DR window (4–9 PM).
- Evening Load Persistence:
  By 7 PM, all schools still operate at nearly 50% of their peak load, indicating ongoing HVAC use, after-school activities, or building base loads.
- Recall however, the loads have high variability particularly for schools <50kW of peak load

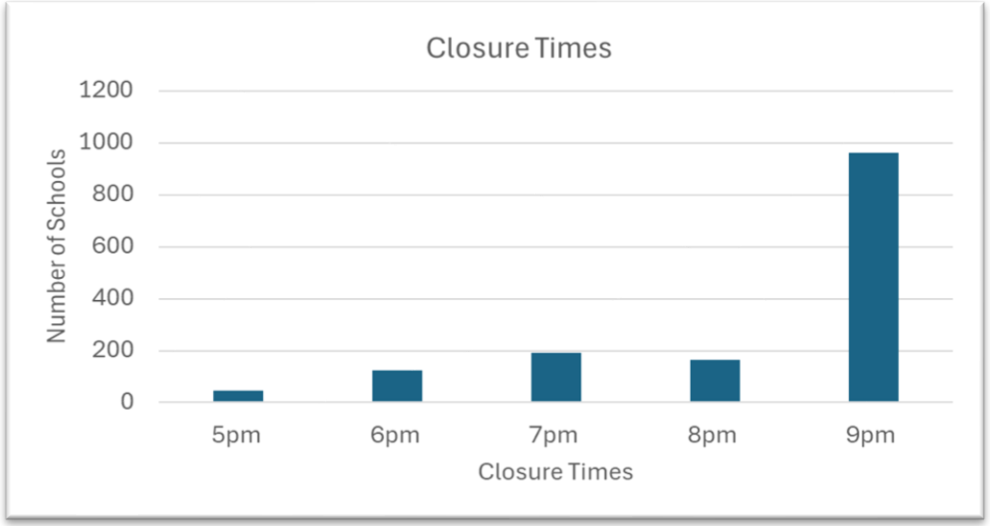


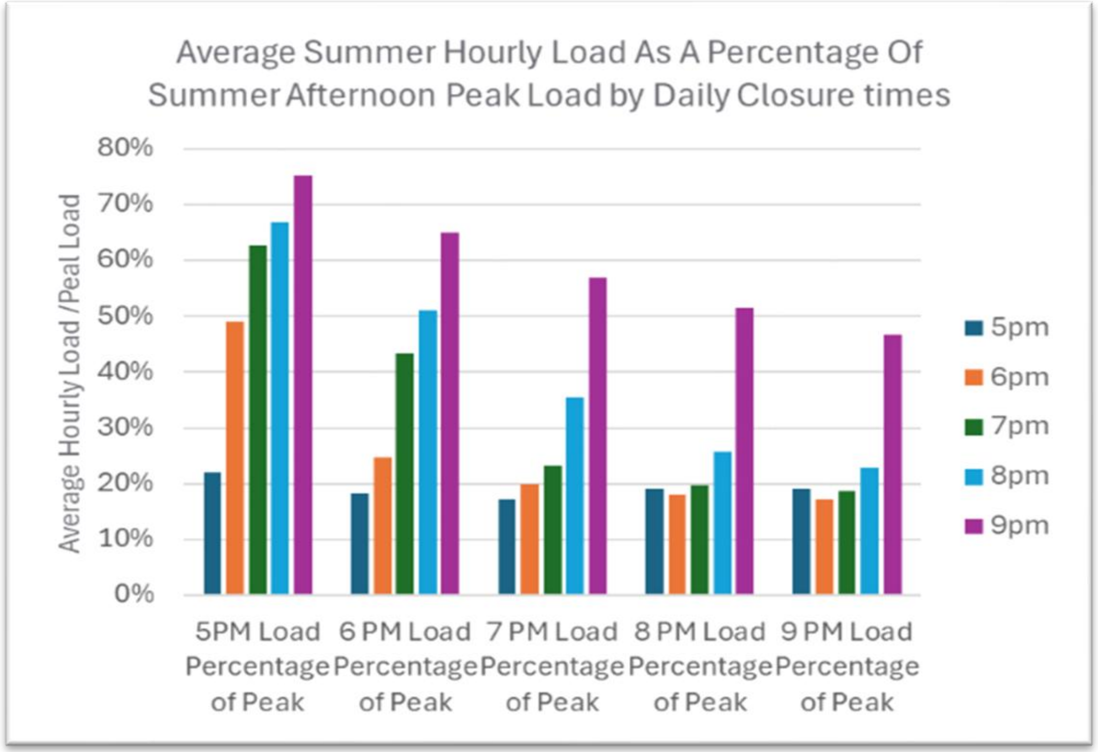
~1,000 schools closing after 9 PM also show okay summer peak load persistence (>45% of daily peak)

- The closure time for each site is not from reported schedules but was determined empirically—the “closure hour” is the first time the site’s load drops below 30% of its daily average during the evening.

- For almost 1,000 accounts, the empirical closure time occurs after 9 PM —suggesting either sustained evening activities, persistent HVAC use, or cleaning.

- Schools with a closure hour between 5 and 7 PM show steep drops in evening load as a % of peak, with schools closing at 5 PM falling below 25% of peak load by 6 PM. Schools that close after 9 PM retain the highest proportion of their peak load throughout the DR window (still above 45% after 9 PM)



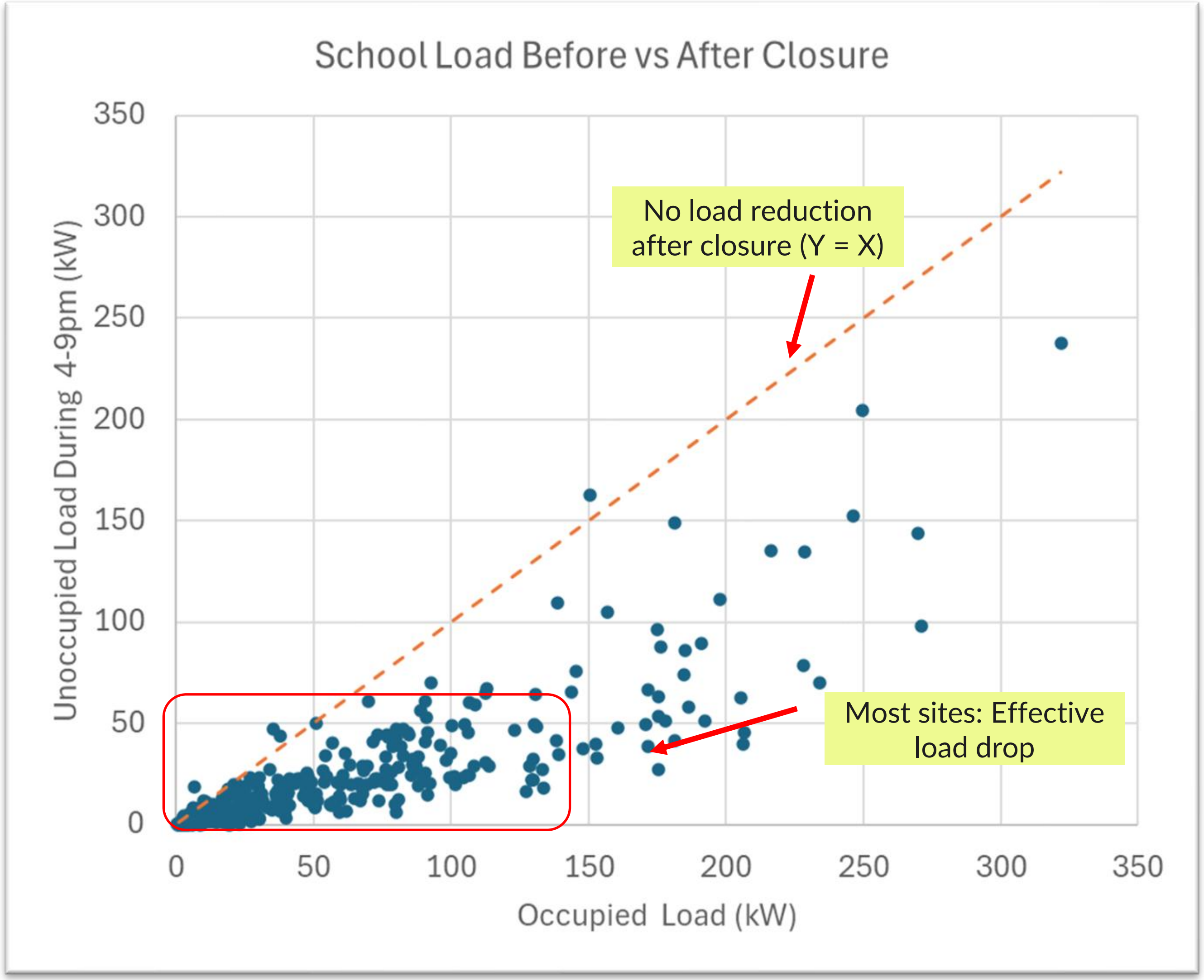


Load Persistence of schools that close from 4 PM to 9 PM

- The 500+ schools in the dataset with empirical closure times during 4 – 9 PM. fall well below the 1:1 line (= equal kW load before and after closure).

- Roughly 60–80 sites maintain more than 30 kW of load, even after closure. Only about 10% of schools retain over 50% of their peak load into unoccupied (closed) hours.

- This indicates that these schools have less load available to shed during 4 – 9 PM. window if a DR event were called.




Sector Analysis: Indoor Ag

Background

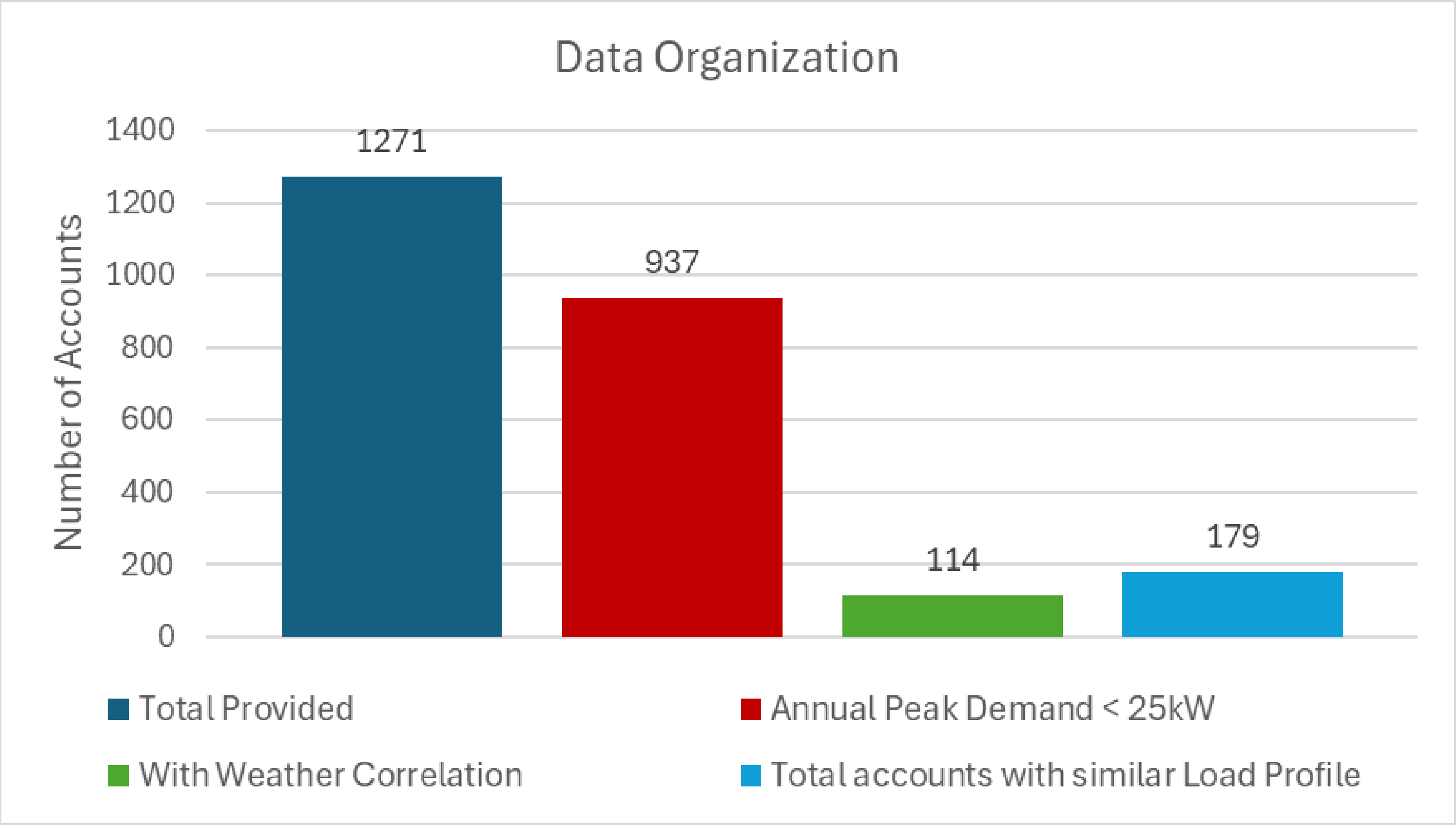
- A PG&E field study report defines **controlled environment horticulture** as "the practice of growing plants in indoor environments, such as greenhouses or indoor farms, where factors like temperature, light, humidity, and nutrients are carefully regulated by the grower"
- The same study found that **HVAC cooling** makes up **45% of energy usage** in CEH facilities

- **Task**: determine which accounts are tied to sites with HVAC loads
- Only include sites that have DR potential in this analysis

Source: Stober, W. and Weitze, H., "Controlled Environment Horticulture: Energy Consumption and Environmental Control Field Study," July 2024, https://etcc-ca.com/reports/controlled-environment-horticulture-energy-consumption-and-environmental-control-field

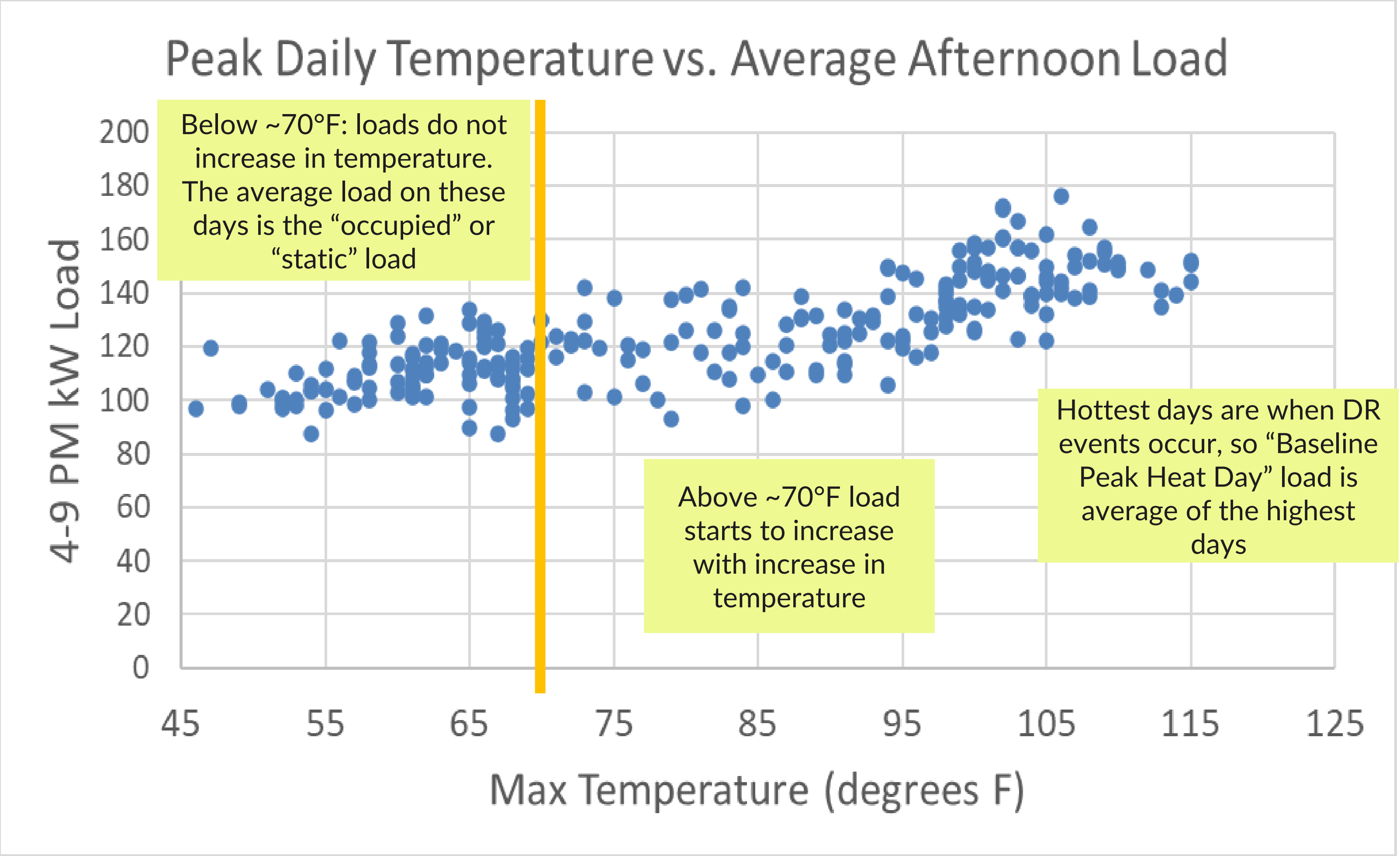
Limited number of accounts were left after data cleaning

- Started with 1,271 accounts
- Several accounts had very small load, so anything with annual peak demand < 25kW was excluded
- 114 accounts had some weather correlation
- Additional accounts were considered if their total 4-9 PM difference was less than the total 4-9 PM standard deviation of these accounts
  - In other words, included additional accounts if their afternoon load shape was like the weather correlated accounts
- New total: **179 accounts**



Loads appear to correlate with weather on days > 70° F

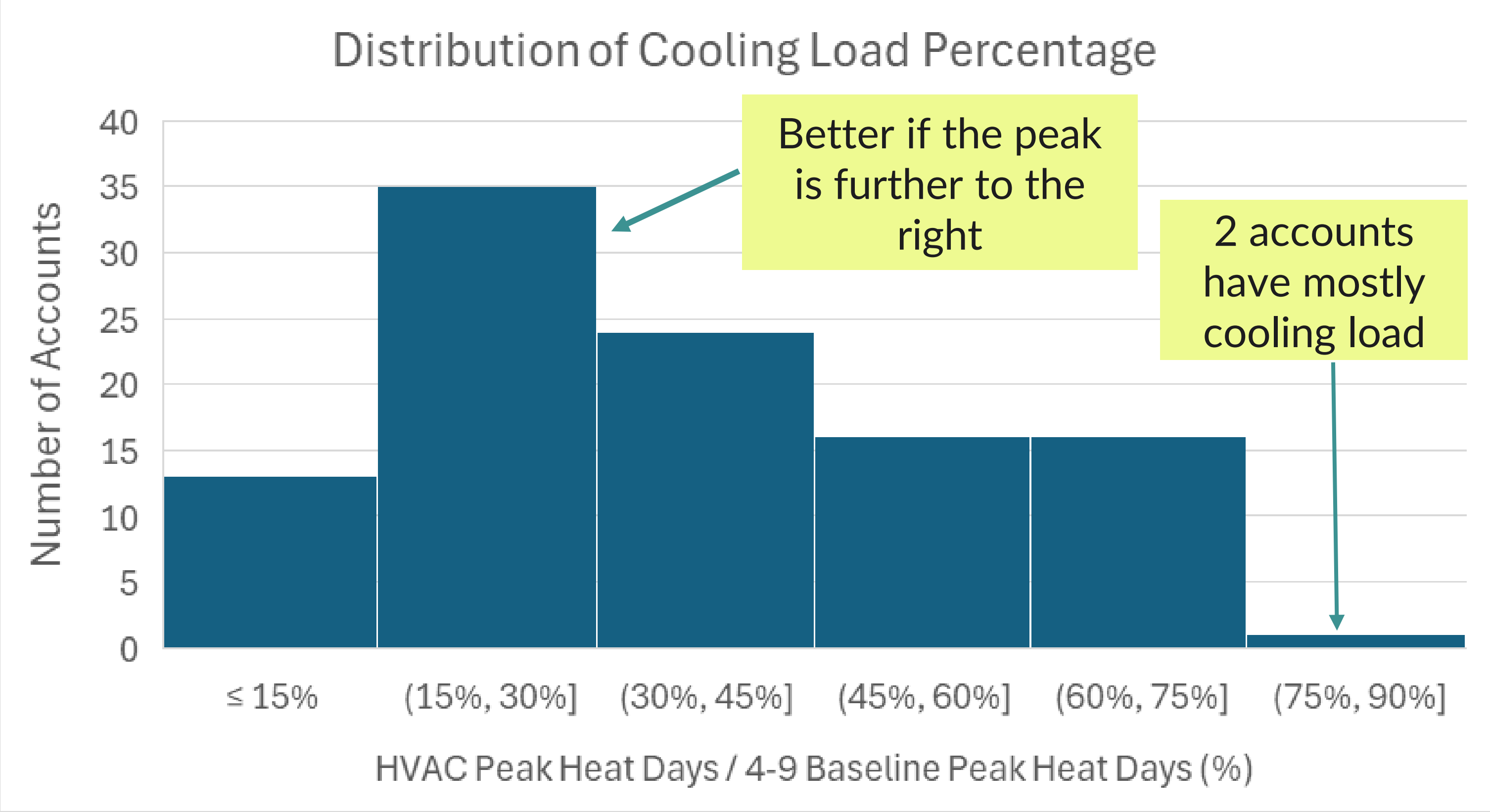
- If afternoon load increases with outside temperature, then likely there is HVAC load
- Identified 114 accounts with similar correlation to graph on the right



However, there is high variance in the temperature-dependent loads

- Using sites that have weather correlation, need to determine **how much of the load is cooling**
- Static/Occupied load = Average 4-9 Load when climate zone temperature <70°F
- HVAC Load = 4-9 PM Baseline Peak Heat Days – Static Load

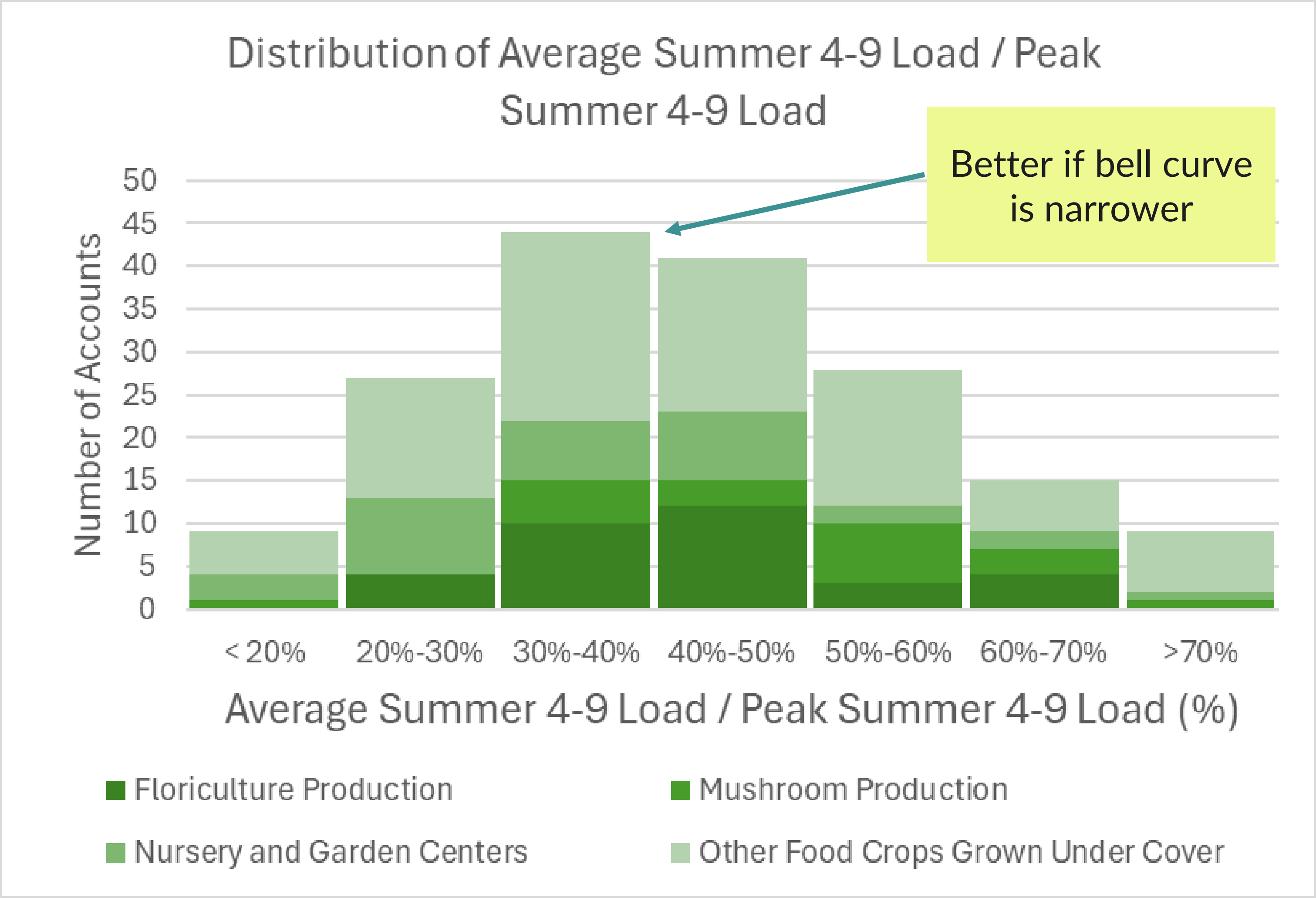
- Mean: 37% with Standard Deviation of 20% - This is high variance
- COV: 0.539 - This is high for the dataset, lowers our confidence in the tightness or consistency of the accounts in this sector



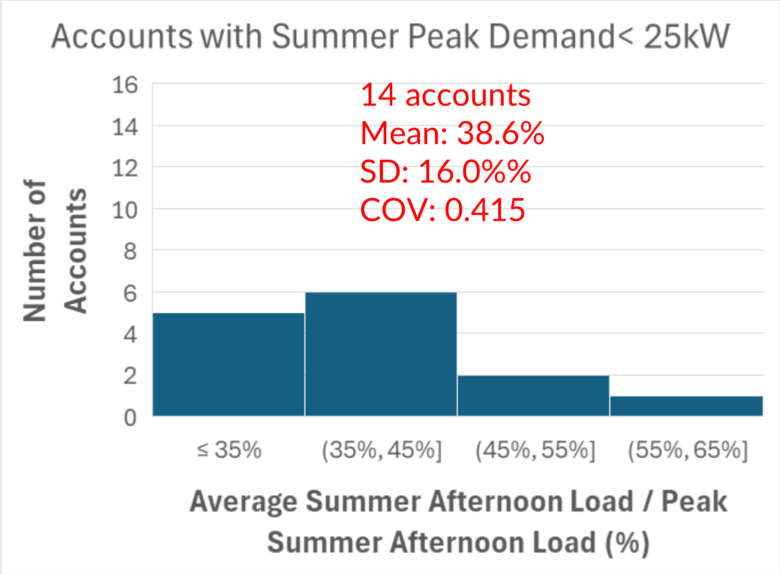
Note: Baseline Peak Heat Day” load = average load of the highest days

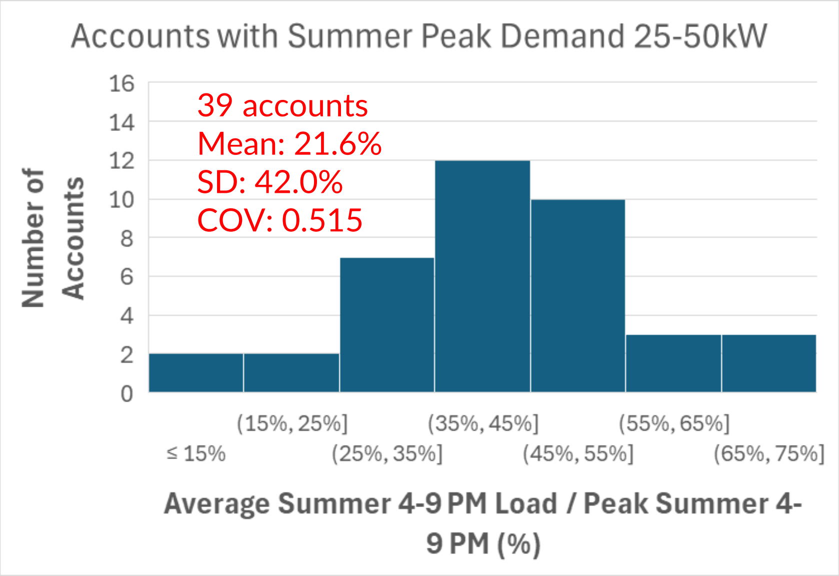
Similarly, summer 4-9 PM peak ratio distribution shows high variability

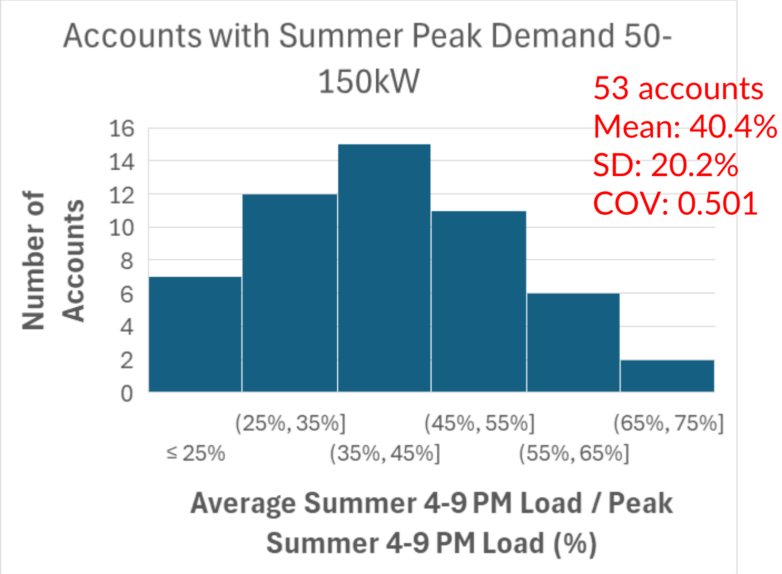
- Average: 42.5% of peak
- Standard Deviation: 22.4%
- Coefficient of Variation: 0.5266
- Peak ratio of 43% ± 22% is high variation
- Might be difficult to accurately predict Cooling Load with Peak Demand only



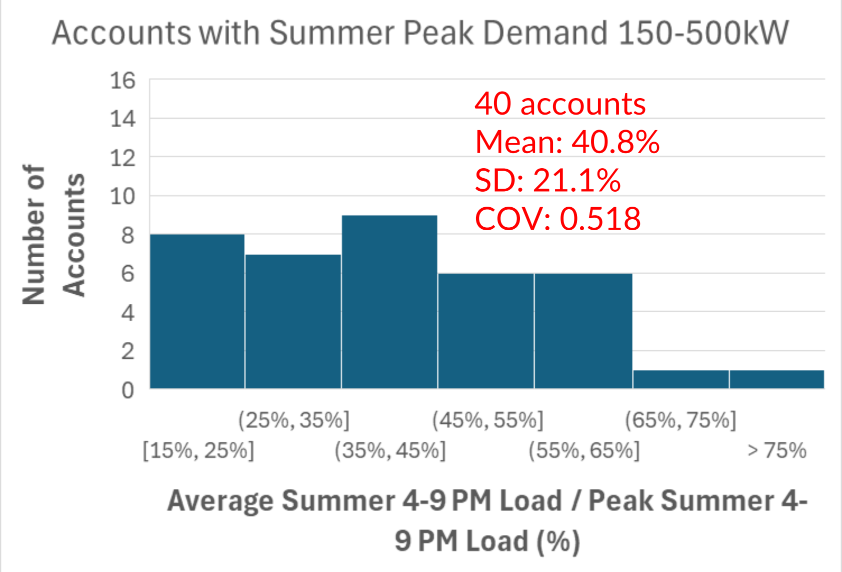
A closer look by size reveals selective, not general, potential

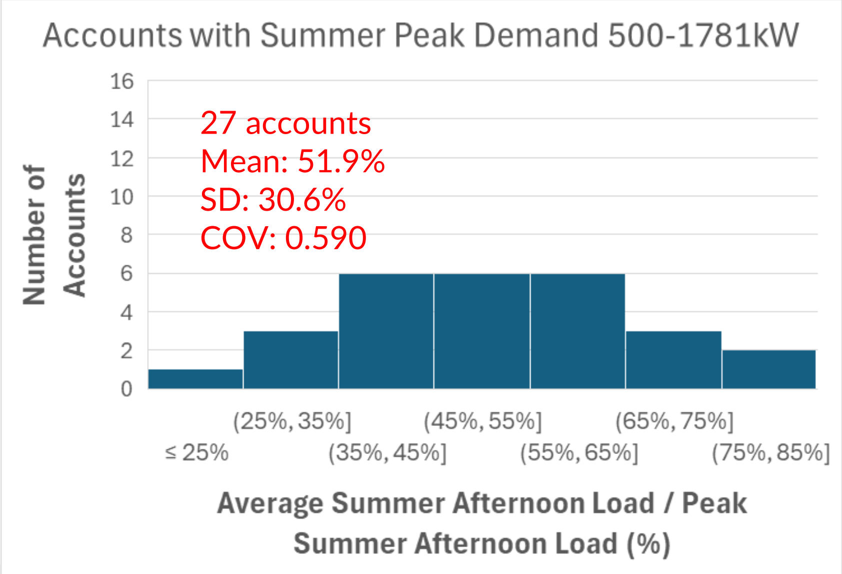






- Flatter, less peaky histogram means higher variation and less load profile consistency. We want to see any peaks shifted further right

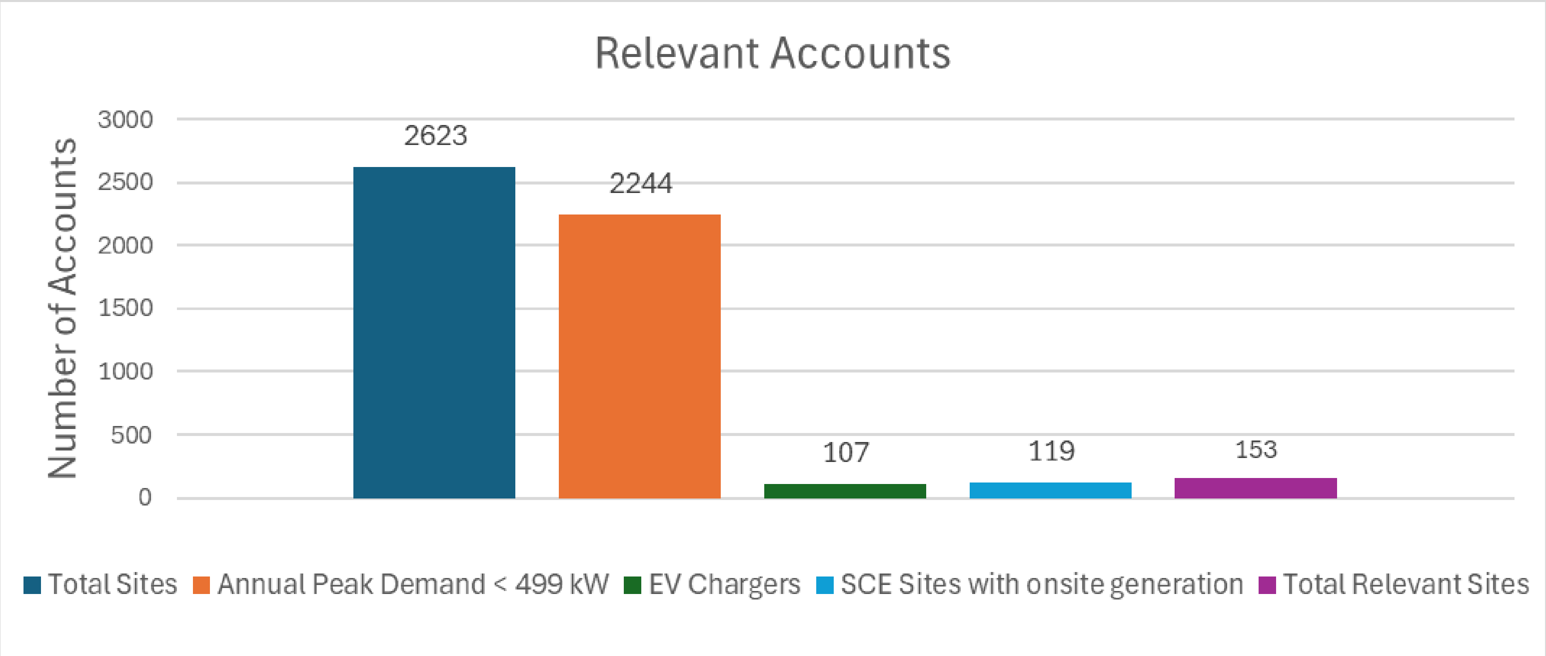


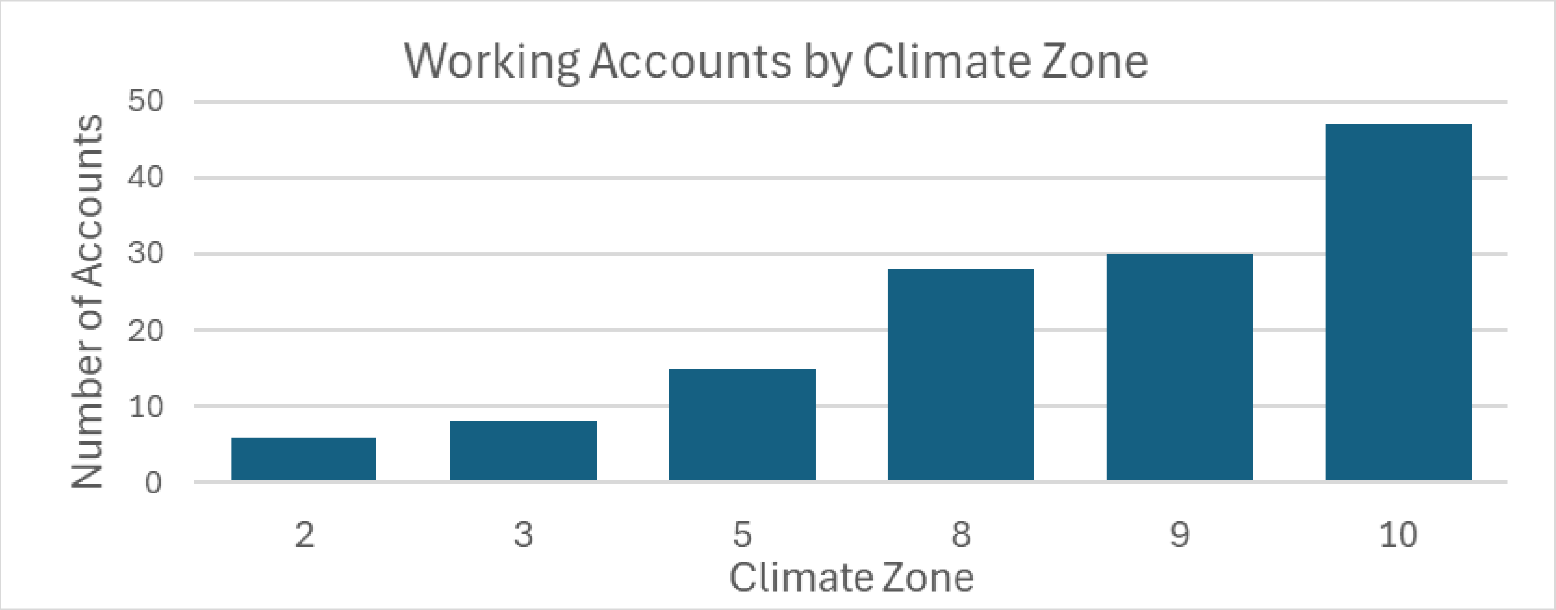


Sector Analysis: Retail >499 kW

Limited number of accounts after data cleaning

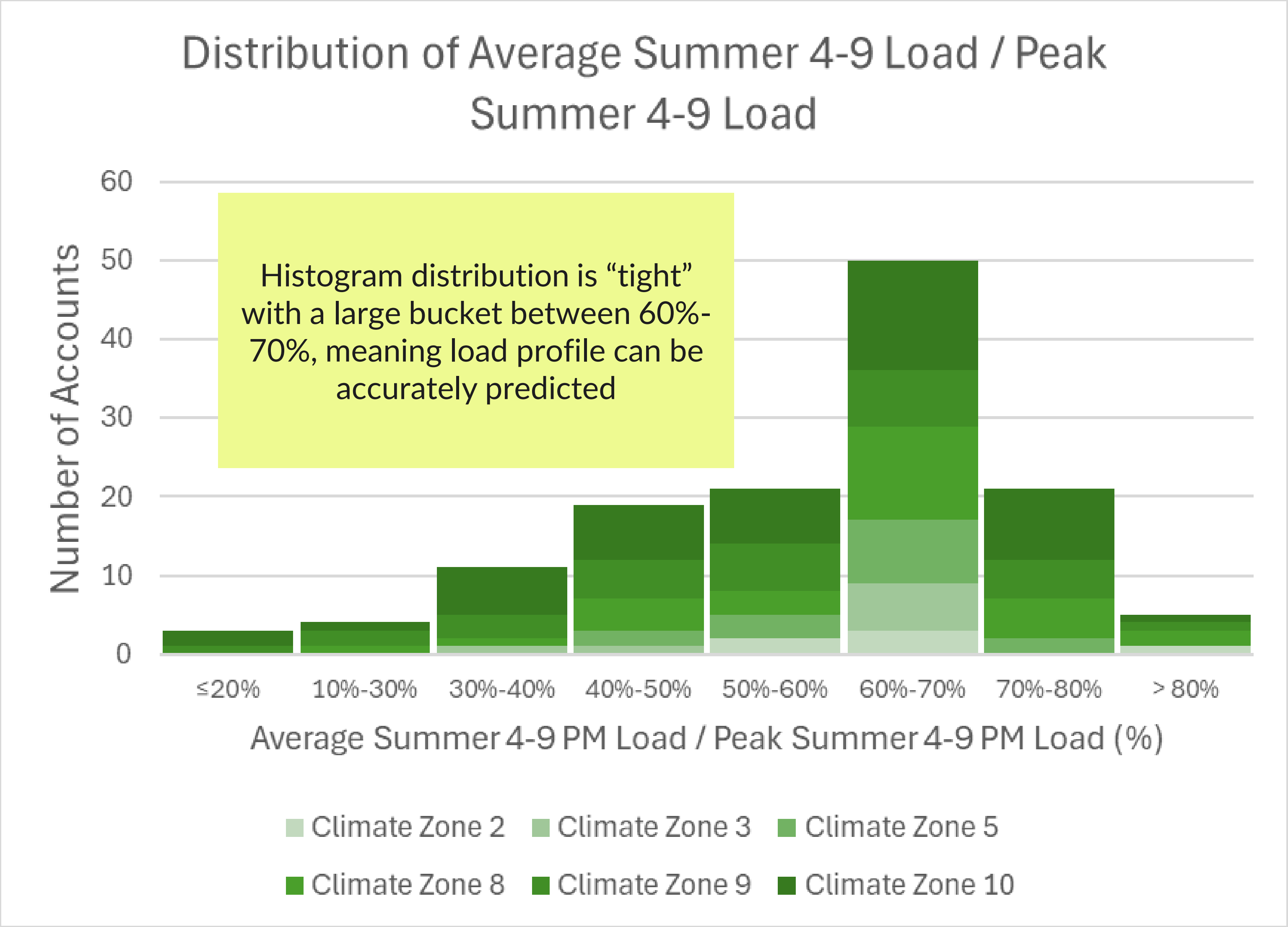
- Supplemental data requests with varying filters produced 2,623 accounts from initial request
- Excluded/removed:
  - Sites with Annual Peak Demand < 499 kW
  - EV rates
  - SCE sites with solar (PG&E pre-filtered in data request)
- Final working data set: **153 accounts**
  - PG&E Accounts: 45
  - SCE Accounts: 108





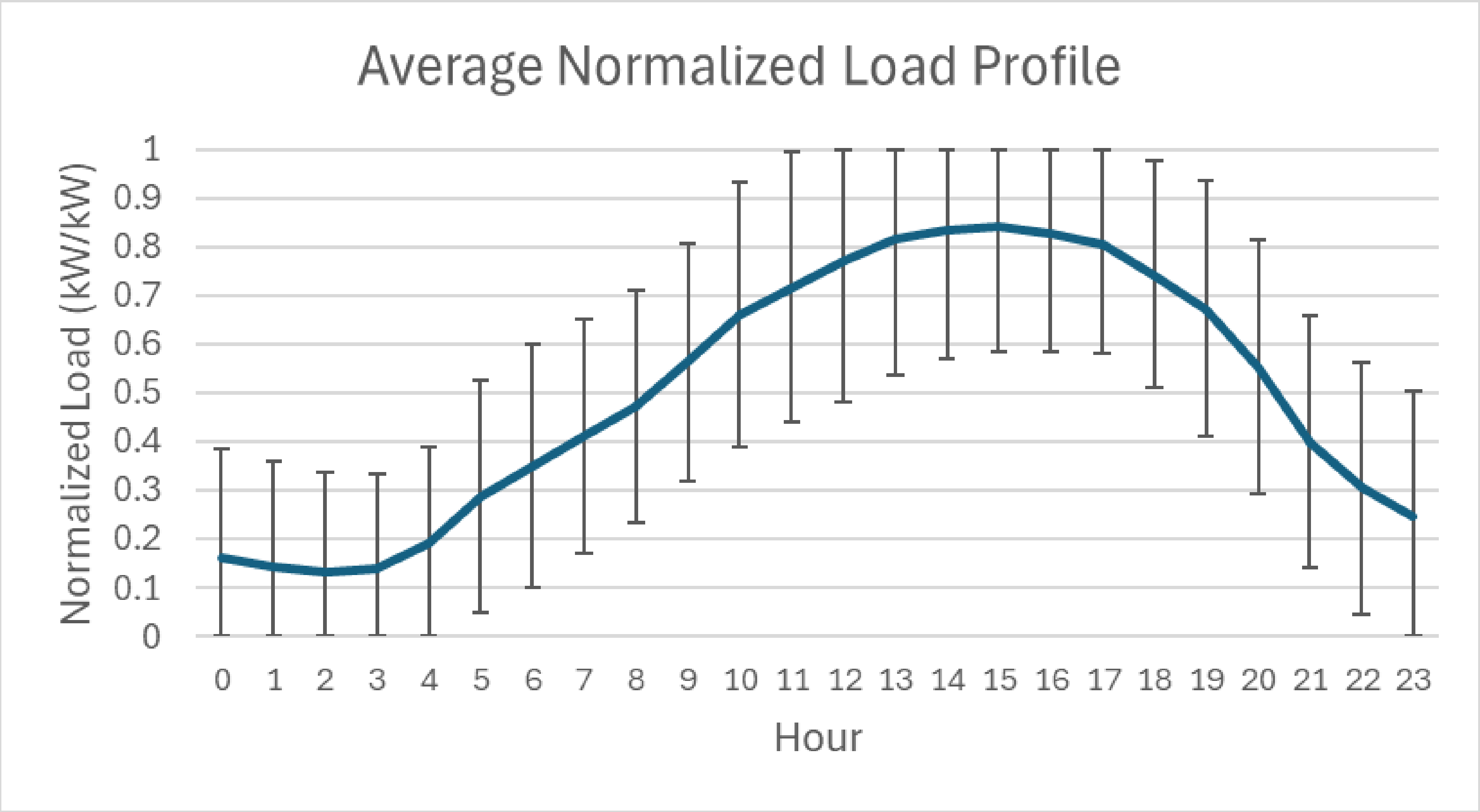
Consistent afternoon load shape during 4-9 PM

- Overall average summer load: 59.6% of peak summer load
- The standard deviation (15.0%) and coefficient of variation (0.252) for the average/peak summer load are both low, indicating low variability between accounts
- Low variability and high consistency are positive indicators for deemed measure



Average load profile also shows low variability across accounts

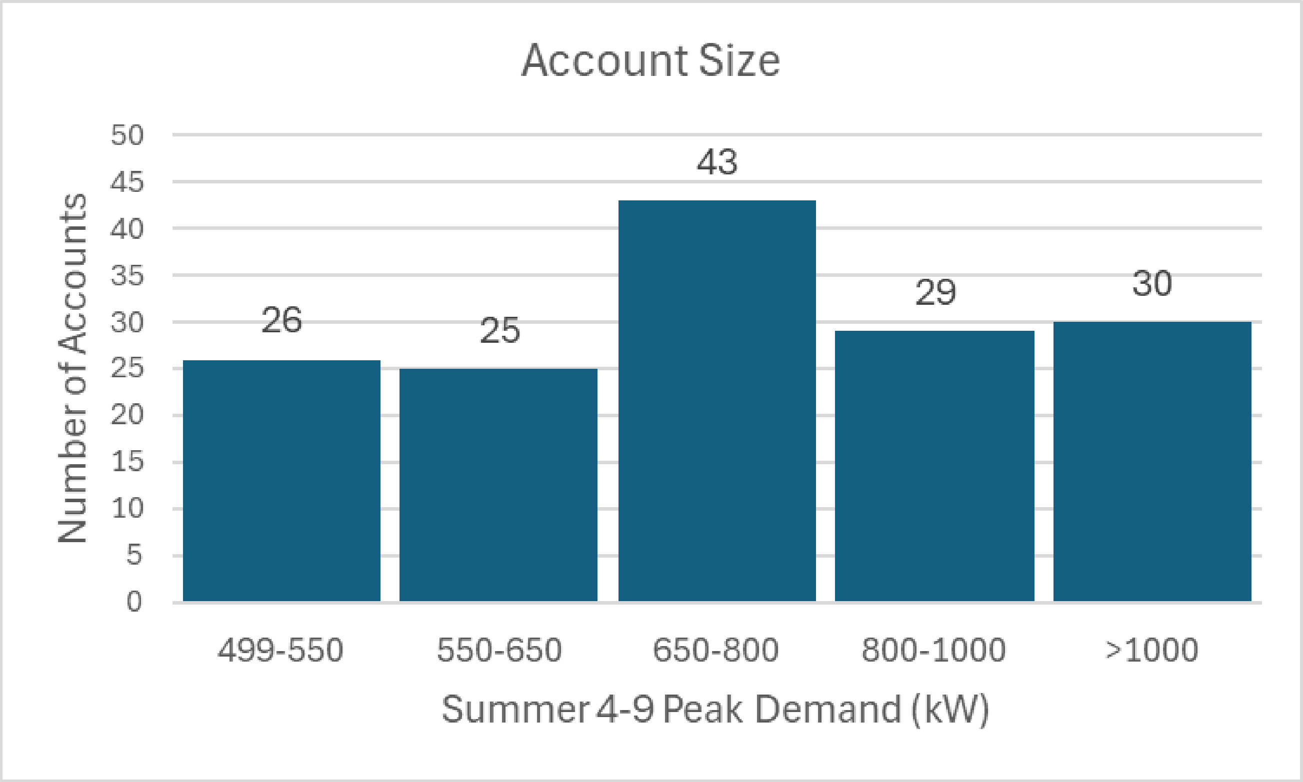
- Bars are standard deviation bars
- Average 4-9 PM normalized load: 0.614± 0.24
- Variability is low
- For this sector, loads peak between 3 and 4 PM and fall slowly from 5 to 9 PM



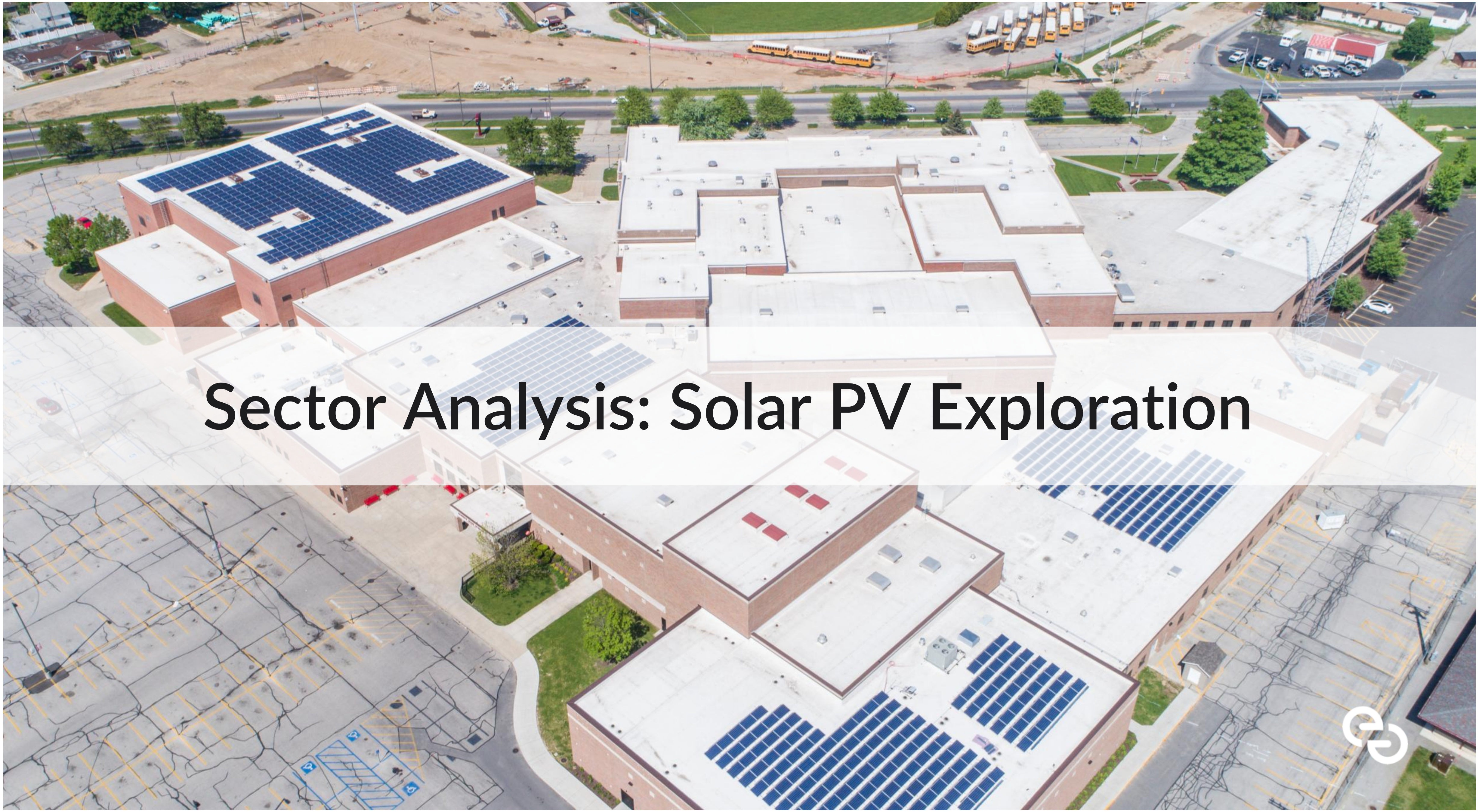
The average summer load for each hour was taken for each site, then normalized according to…
$x_{normalized} = (x - x_{min}) / (x_{\_max} - x_{min})$
where x is the average load at that hour, and the min and max values are out of the 24 hour period

Estimate of DR potential of ~80 kW per site

- Does not include sites with onsite Solar
- Estimated Total DR potential for 153 sites: **10+ MW or ~80 kW per site**
  - Assuming all sites participate in +3F Cooling Measure
  - Note: this estimation is based on <499 kW Retail methodology, but still need to analyze if this end use load distribution is applicable to Large Retail

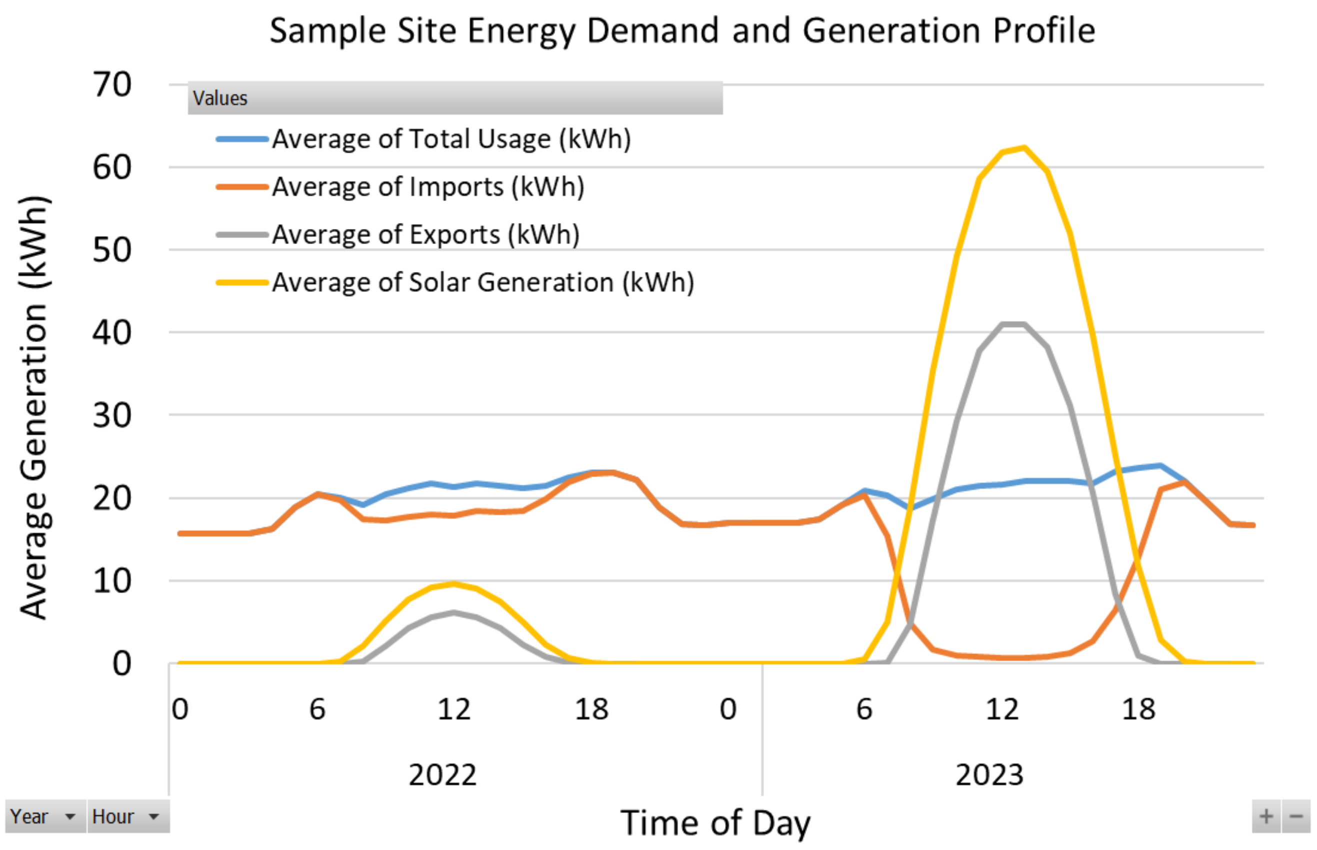


Sector Analysis: Solar PV Exploration



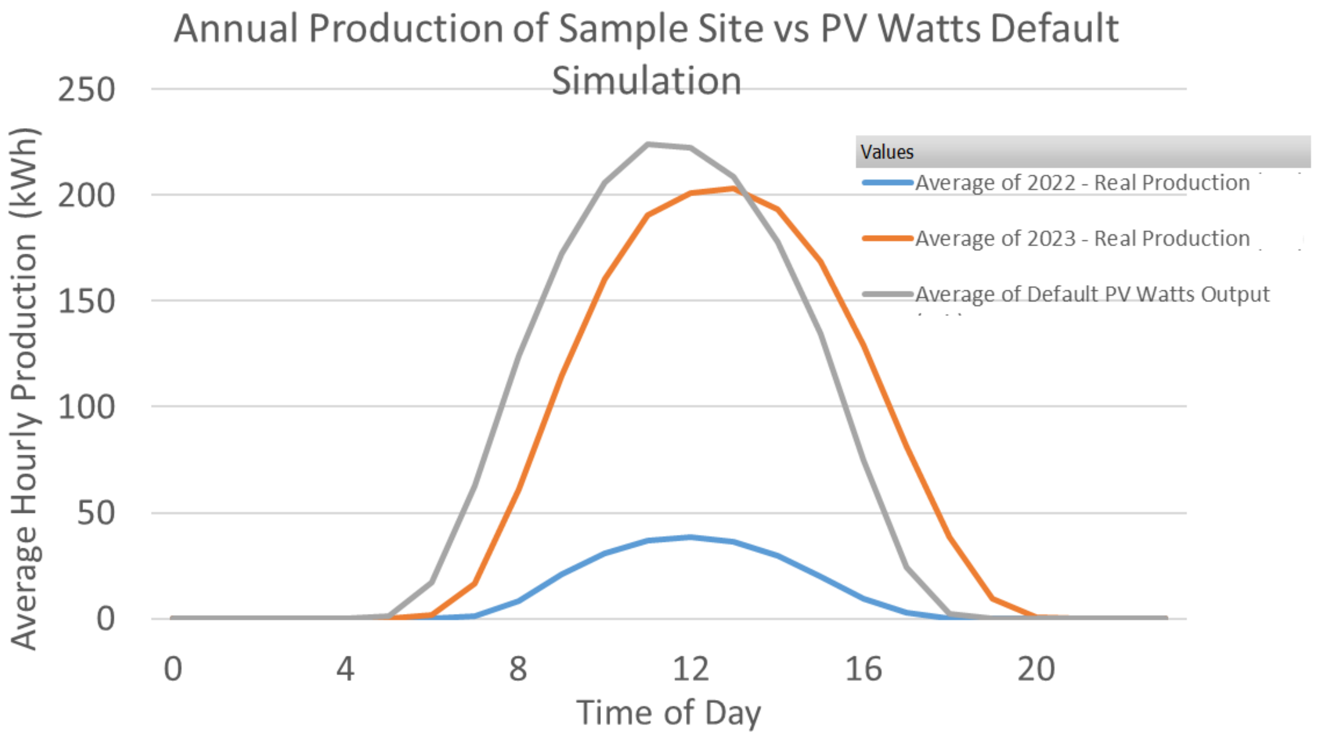
Solar PV exploration: available data were insufficient to pursue

- The utility provided 15-min interval data for this study was discovered to be net data (utility imports minus onsite solar).
- We asked the utility to exclude accounts with onsite solar to ensure that profiles reflect gross consumption for sector analyses.
- We then explored using PV Watts (a solar generation modeling tool) to predict usage/ generation profiles for a site with net generation data.



Accuracy of PV Watts using default model assumptions is inconsistent

- Simulated generation values showed high sensitivity (>100% percent diff. when varying inputs against default) to **DC/AC** ratio and **azimuth.**
  - High sensitivity meant default assumed values were not representative of the system and may require additional customer input to accurately simulate.
- Low consistency in annual solar generation profiles from sample sight suggest risk of over/underestimating production using PV Watts.
- PV Watts could not reliably reproduce solar profiles for a system with known net generation data.



Sector & Measure Recommendations

Summary of recommendations: add

Sectors/measures to add to Express and Fasttrack tool

New Sector & Measure: Agricultural pumping ≤599 kW

Justifications: Reasonable correlation found between a metric derived from multi-year on-peak kW and kWh compared to a site's load shed potential. Use the CA DWR Snow Melt Runoff Index to identify and adjust year-to-year drought condition impacted sites usage to better predict average load shed potential.

Recommend performance evaluations on a longer time horizon to account for year-to-year drought driven variation, e.g., 5-years, instead of after each season.

New Measure: Refrigeration for grocery stores ≤ 499 kW

Justifications: Load is stable, predictable, significant, and dominates evening consumption; A few inputs can estimate load performance; measures are operationally feasible

New Sector: Retail > 499 kW

Justifications: Load is significant during 4-9pm in summer; Load profiles are relatively consistent across accounts and performance can be predicted relatively accurately using a few inputs

Summary of recommendations: don’t add

Sectors/measures to remain as custom calculations

(sector) K-12 schools
Evening loads drop off dramatically when buildings become unoccupied; high variability for accounts < 200 kW; many inputs needed to estimate load shed potential

(sector) Indoor agriculture
Accounts demonstrate high variability; scarcity of accounts showing weather correlation; no reference for determining lighting load overall lack of existing ADR applications

(measure) Solar PV adjustment
Many inputs needed to determine solar generation; verification challenging as meter data do not measure total solar generation

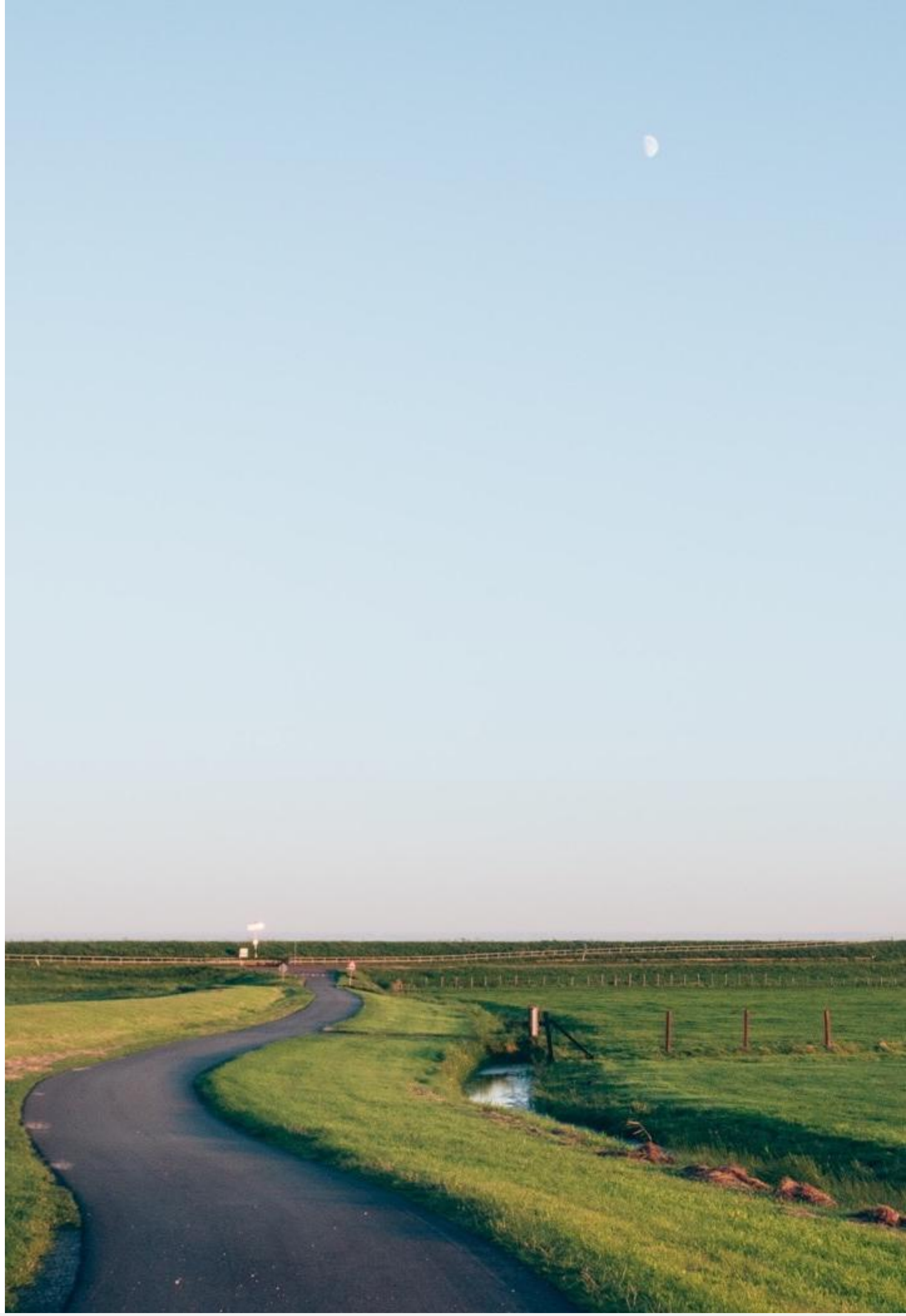
Background on <499 kW sizing for deemed sectors

Inception 2010	SCE creates deemed application option for retail and office 100 to 199 kW based on small and medium business tariff GS2
Expansion 2015	SCE expands deemed to customers on the GS2 and GS3 tariffs, which include all facilities with peak demand between 100 to 499 kW
Statewide 2016	PG&E adopts deemed application option, extending eligibility to all facilities with peak demand between 1 kW and 499 kW in retail and office
Expansion 2019	PG&E and SCE add grocery, restaurants, hotels, and conditioned warehouses with peak demand to 499 kW to deemed application option
Expansion 2025	Analysis of PG&E and SCE meter data in retail, office, grocery, restaurants, conditioned warehouses, shows that the number of accounts by sector with peak demand $\geq$ 500 kW comprise less than 2 percent of accounts in five out of six sectors, or about 98% of all accounts in these sectors are eligible for Express and Fasttrack. In conditioned warehouse, Express and FastTrack covers about 70% and 84% of accounts, respectively.

Background on ≤599 kW sizing for agricultural pumping

Over 2,000 service accounts in agricultural pumping were analyzed in PG&E and SCE service territories. The population of accounts with peak demand ≤599kW was found to be reasonably predictable using just two or three inputs per year that are relatively easily accessible, which makes them a good fit for deemed.

When agricultural accounts greater than ≥ 600 kW peak demand were analyzed, the load shapes stopped behaving like pumps. The loads were not intermittent and instead more consistent, resembling buildings. The <599kW demand threshold was selected because it included the largest set of agricultural accounts up to when the data stopped resembling pumps.



Recommendation close up: Agricultural pumping: Add

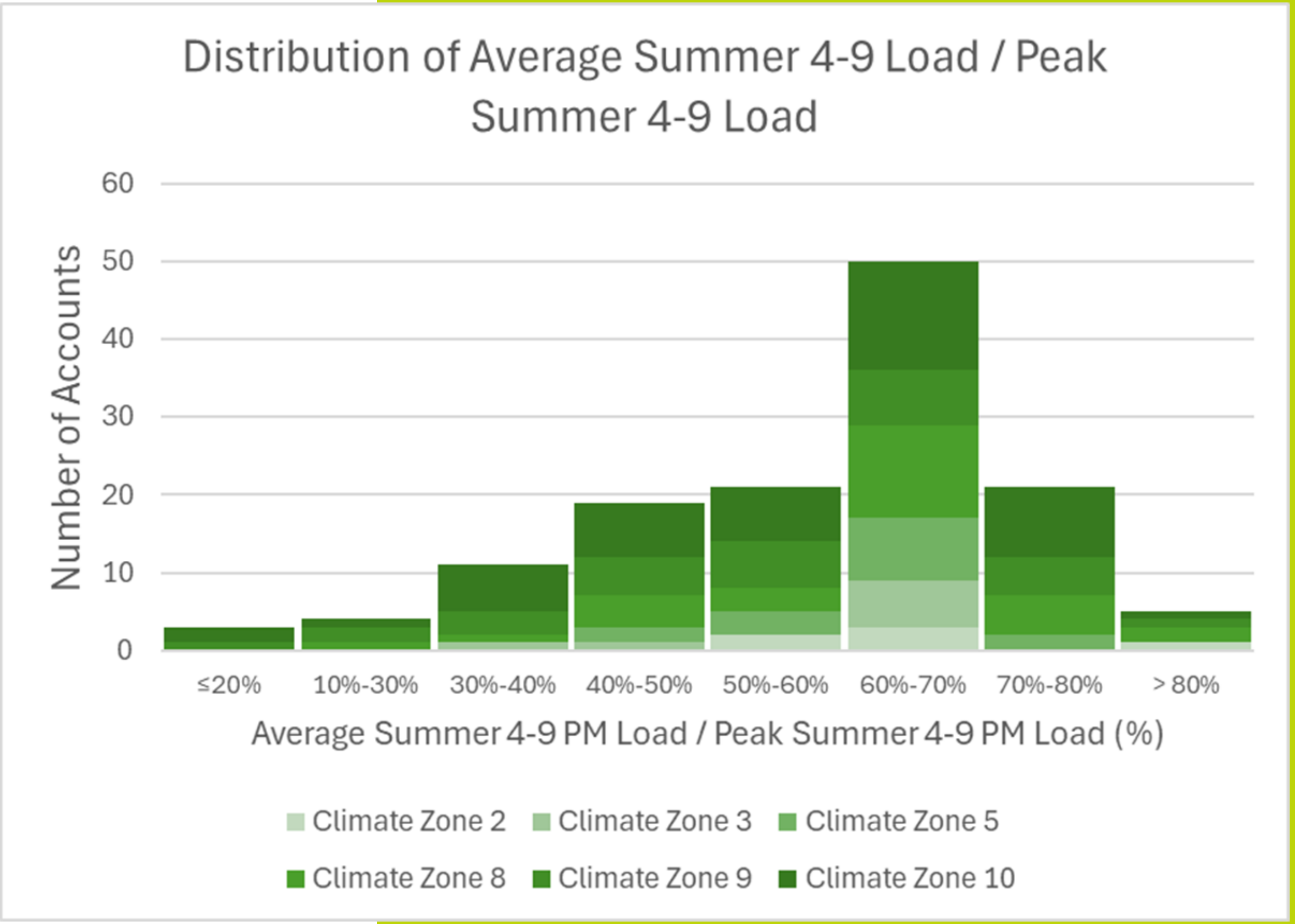
- Data show high variability based on traditional deemed input (peak/rated kW). However, peak power (kW) + usage (kWh) provides reasonable correlation to load shed potential. Scaling usage with CA DWR Snow Melt Runoff Index to help mitigate year-to-year variation.
- Limiting the number of inputs is okay to balance easier use with expected accuracy.
  - Most inputs = on-peak kW and kWh of each summer month. Reasonable inputs = on-peak kW and kWh of entire summer.
- Evaluating performance over 5-year period provides more reasonable performance analysis for a naturally variable end use.
- Found strong correlation between input metric (operating ratio * peak power) (one kW and one kWh value per year) to predict real event potential.

Recommendation close up: Grocery refrigeration: Add

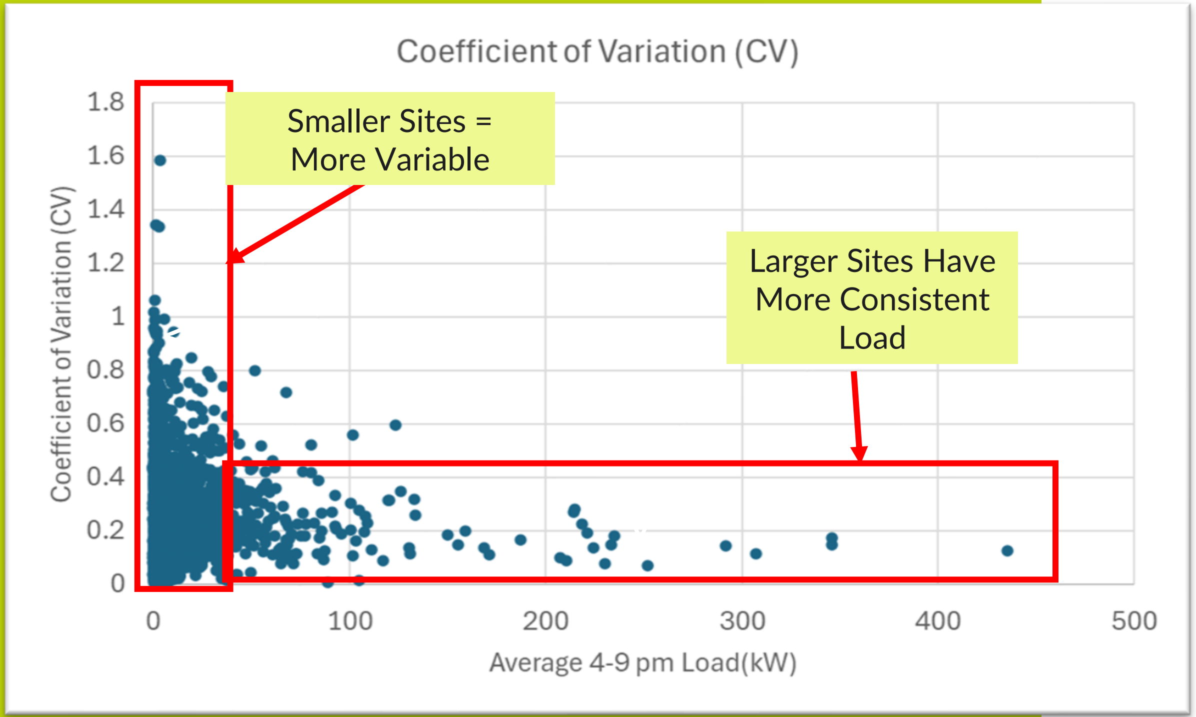
- Load is stable and predictable in the DR window.
  CV during 4–9 PM is low for most stores
- Flatness Index (4–9 PM) is clustered near zero → minimal hour-to-hour swing
- Refrigeration dominates evening load
- Simple inputs are enough
  - A 2–4 input deemed method (Avg 4–9 PM peak kW, Estimated Refrigeration Share from CEUS, etc) explains most variability
- Operationally practical
  - DR is delivered via refrigeration setpoint nudges and/or compressor duty-cycle control with food-safety guardrails (ΔT and max drift time)
  - Consistency across store types and sizes simplifies implementation

Recommendation close up: Retail > 499 kW: Add

- Distribution of the ratio: Average summer 4-9 p.m. Load / peak summer 4-9 p.m. Load is narrow with large number of accounts with this ratio at 60%-70%, meaning load profile can be accurately predicted.
- The standard deviation (15.0%) and coefficient of variation (0.252) for the average/peak summer load are both low, indicating low variability between accounts
- Overall average summer load = 59.6% of peak summer load



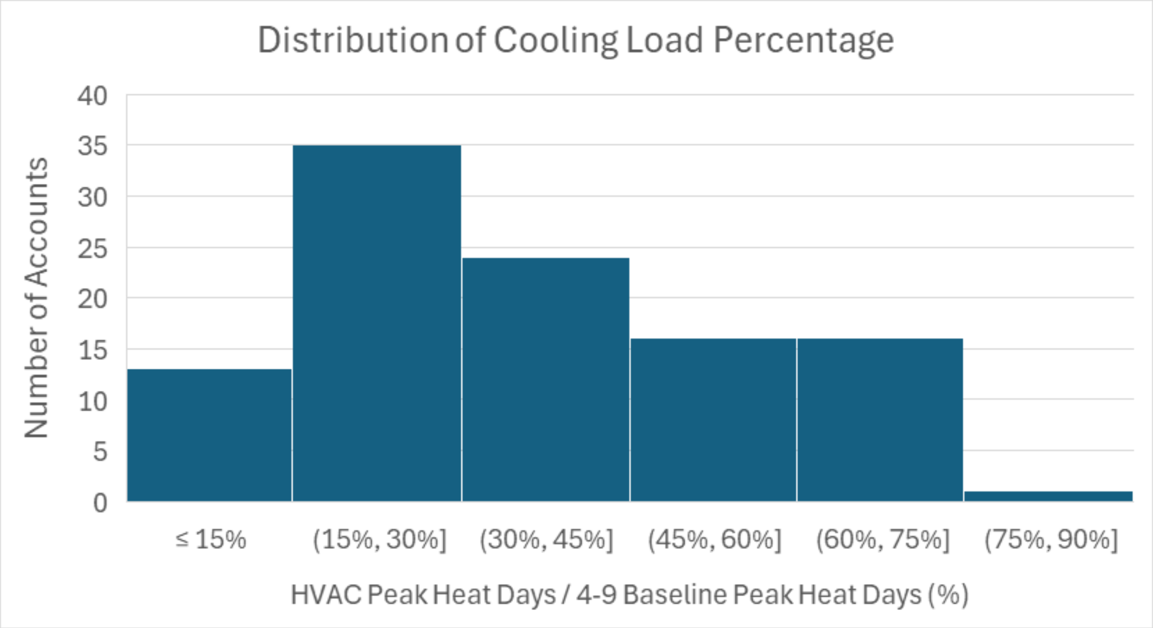
Recommendation close up: K-12 schools: Don't Add

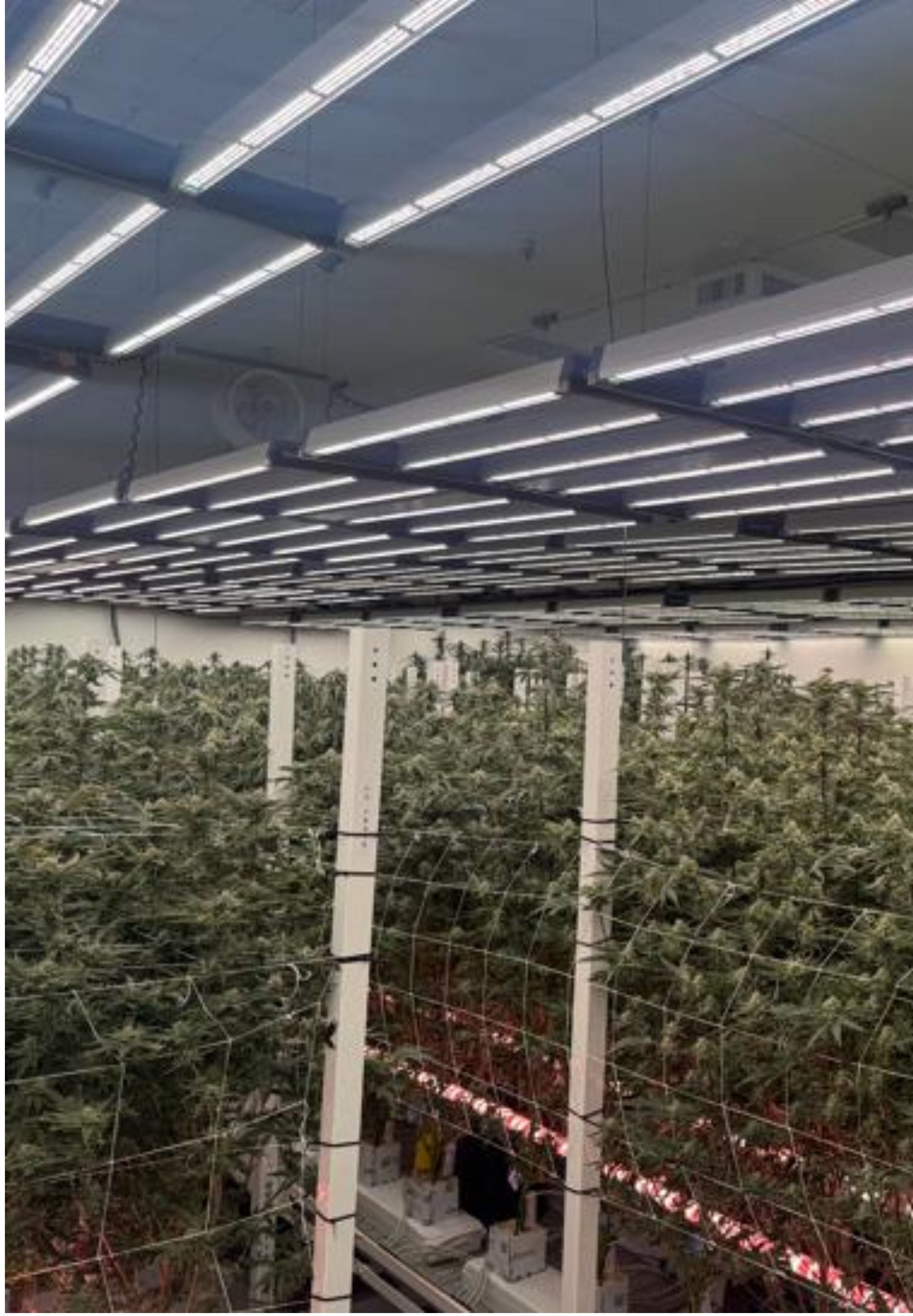


- Evening load is schedule-driven. 4–9 PM spans last hour(s) of occupancy and after-hours. Load shape and shed potential flip at the closure time; a single deemed value would over/under-pay depending on the day.
- Large spread in "flexibility" potential, not just magnitude. Relative Evening Flexibility potential varies widely by site and month; many small sites cluster at low flexibility (tight baseload), while some large sites stay high after hours.
- Baseline instability at low loads. Many schools <50 kW evening load show higher CV and small absolute shed, making deemed estimates noisy relative to meter variance.

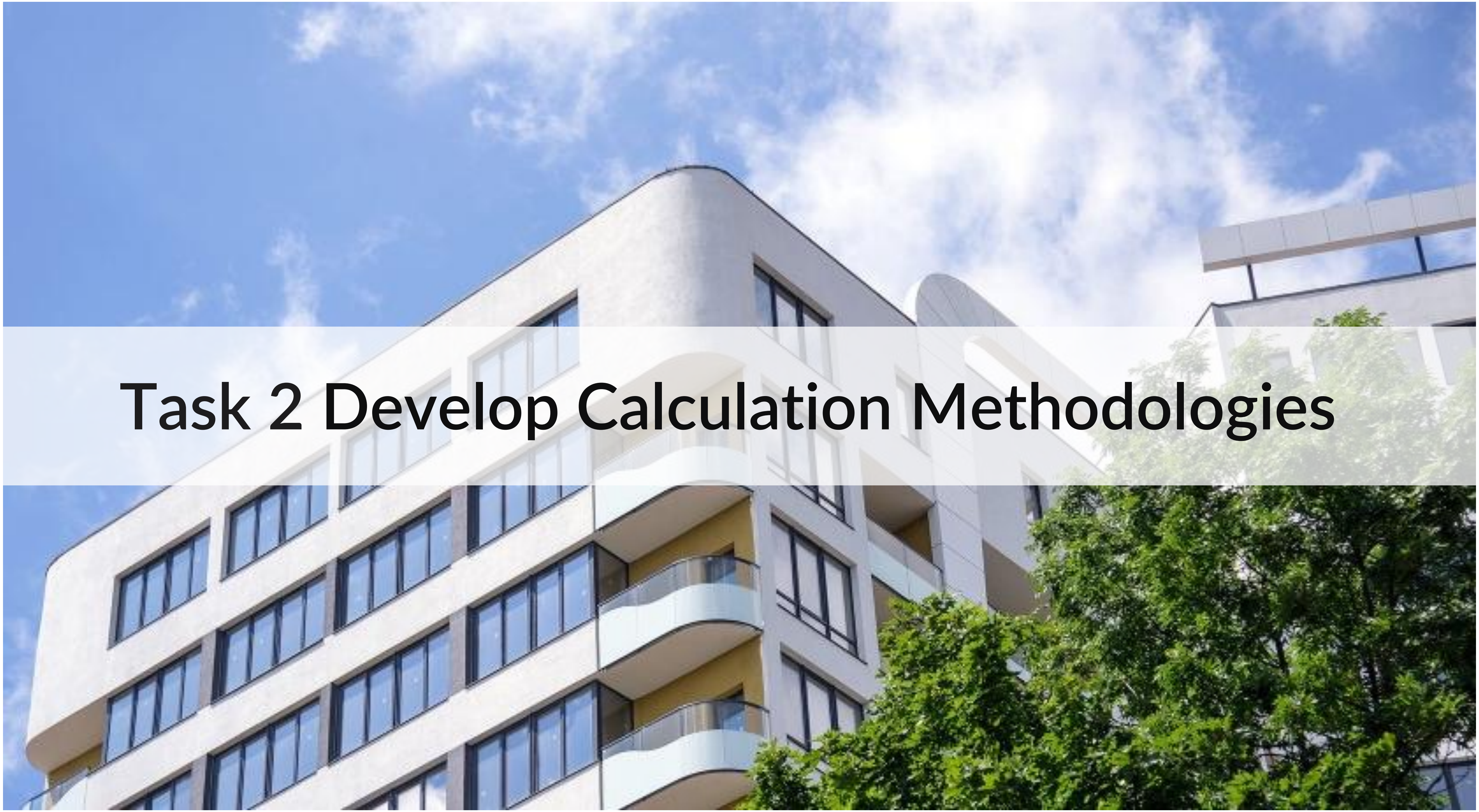
Recommendation close up: indoor agriculture: Don’t add

- Limited number of accounts
- Too much variability in end-use for each account
- Hard to predict end use with interval data only
- Too much inconsistency in HVAC percentage of peak load





Task 2 Develop Calculation Methodologies



Deemed Methodology: Agricultural Pumping

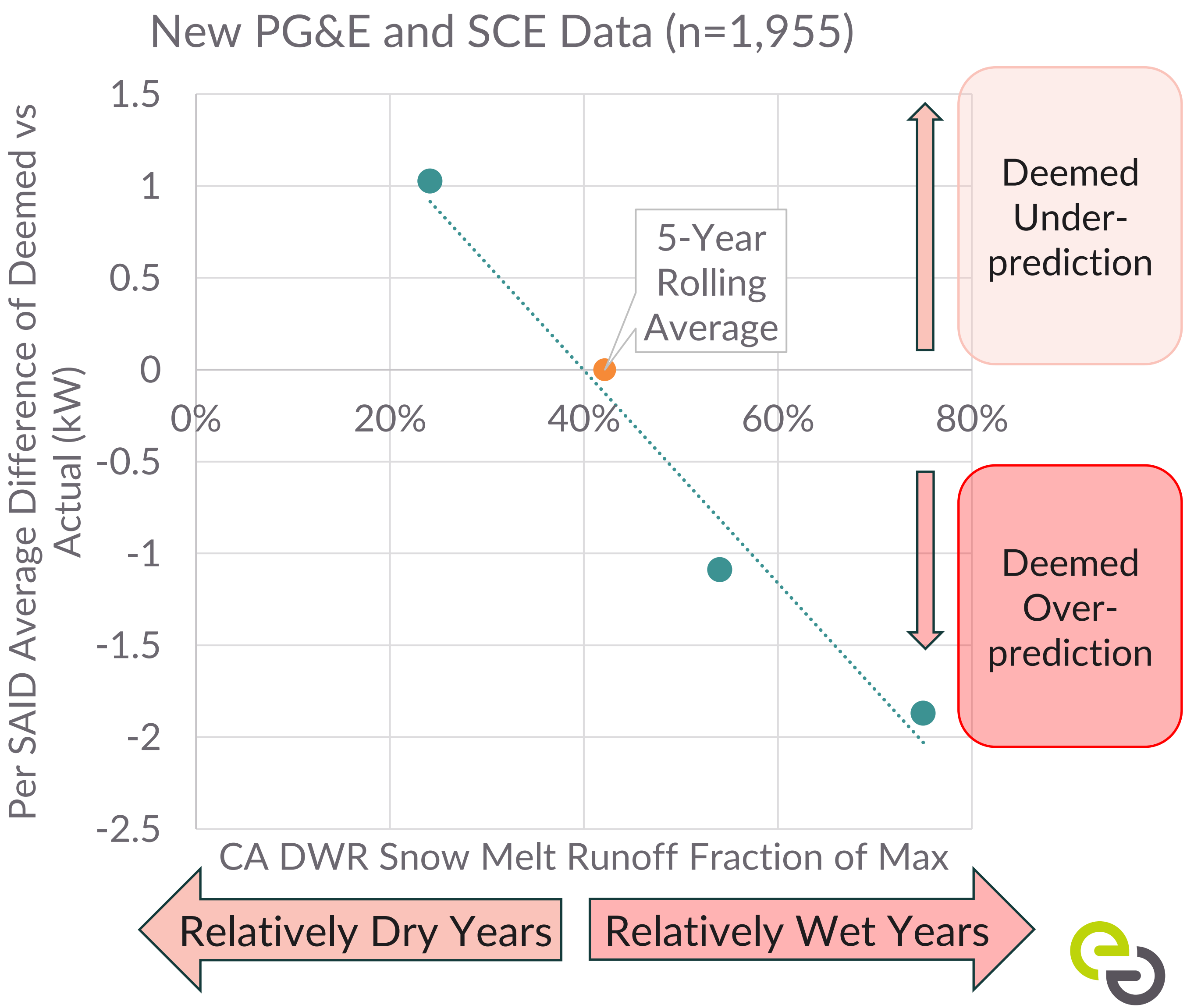
Ag pumping methodology involves 3 equations for 3 cases

Found a strongly correlated deemed approach based on the summer on-peak kW and kWh of multiple years of data.

Scope limitations:

- Sites under 600 kW peak demand
- No solar (or other on-site generation)
- Need data that binds the CA DWR 5-year rolling average (42%). In practice, requires at least going back to 2022.
- Requires users to submit data that is only representative of future usage. One kWh and one kW for on-peak summer usage per year.

Application	Slope	Intercept
All SAIDs heavily impacted by drought conditions	1.03047	0.42382
Small load SAIDs (operating ratio * peak power ≤20) not impacted by drought conditions	1.24804	-0.1169
Large load SAIDs (operating ratio * peak power >20) not impacted by drought conditions	1.07027	5.08516



Deemed Methodology: Grocery Refrigeration

Deemed methodology for grocery refrigeration measure

Source: (physics basis)

NREL gray-box refrigeration modeling (O'Connell et al., 2015) with Carnot-based COP modifier (Hasse et al., 1996):

$$\dot{Q}_R = \alpha\, P\, COP_{\text{Carnot}} = \alpha\, P\, \frac{SST}{SCT - SST}, \quad \alpha \approx 0.38 - 0.40$$

- Measure — Pre-Cooling and Temperature Reset (+ΔT_set on LT racks)

Load shed estimate equation (kW):

$$\Delta P \approx \frac{UA_{\text{store}}}{COP_{\text{sys}}} \Delta T_{\text{set}}$$

Source: Hirsch, A., Deru, M., Clark, J., Studer, D., Trenbath, T.-K., & Doebber, I. (2015). *Pilot testing of commercial refrigeration-based demand response* (NREL/TP-5500-65009). National Renewable Energy Laboratory. https://doi.org/10.2172/1226469

Equation was validated against field data from 69 grocery sites

Test Population:

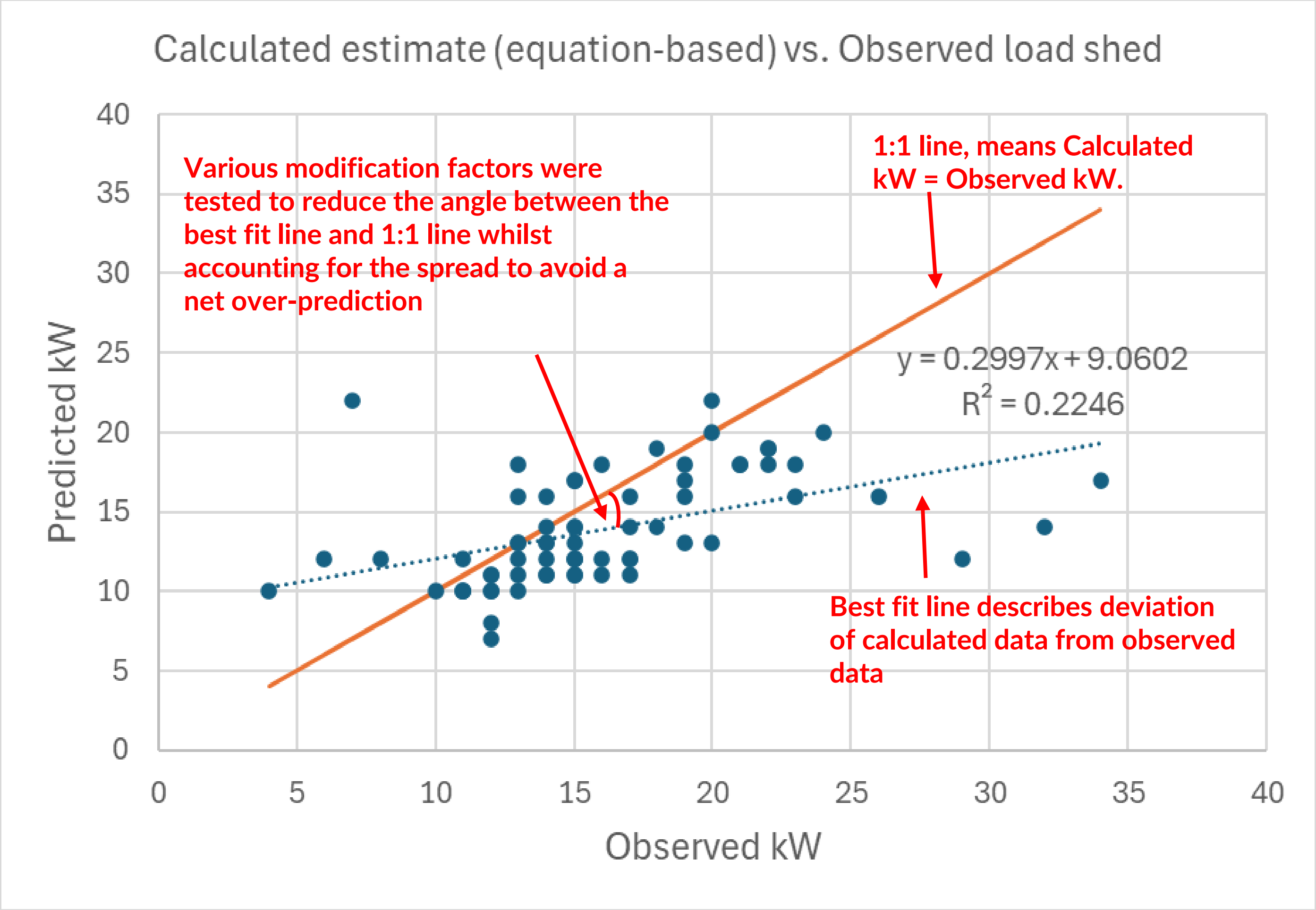
- 69 stores across two different grocery chains
- All sites completed DR verification testing with pre-cooling & LT rack temperature reset

Comparison:

- Calculated (equation-based) vs. Observed load shed during verification

Findings:

- Baseline equation structure was sound
- Calculated kW deviated from observed due to site-level variability & interference
- Follow up investigation into modification factor to minimize deviations



Final modification factor aligns with validated data with 90% accuracy

Method:

- Run bias and uncertainty analysis across multiple iterations
- For each iteration, with the ratio Predicted/Observed, using the mean, standard deviation, sample size, and a one-sided t-critical (e.g., 90%), a modification factor is derived and tested.
- Adjusted for human/operational errors (interference during DR events)

Outcome:

- Derived Modification Factor applied (1.25) to base equation
- Prediction accuracy improved to ~90%

Takeaway:

- Final equation = (Base Equation) × (1.25)
- Provides reliable, scalable estimator for DR load shed in grocery refrigeration

Grocery Sites	Total Observed kW	Total Predicted kW	% Error	% Prediction	Class
Grocery Chain 1	397	381	4%	96%	Under-predict
Grocery Chain 2	709	630	11%	89%	Under-predict
Total	1106	1011	9%	91%	Under-predict

Deemed Methodology: Retail >499 kW

Existing FastTrack methodology for retail ≤ 499 kW

Measures: HVAC and Lighting Only

- Tool uses CEUS survey data of non-coincident peak load for relevant sector and climate zone to determine percentage of load is attributed to HVAC or lighting
- User enters Zip Code and Average Summer Peak Demand
- Lighting percentage dimming is entered by user
- For temperature reset, FastTrack tool uses 6% kW reduction per degree reset, which is empirically derived

The units for heating and cooling in this colum are SF/Kbtu and SF/ton respectively ⇩

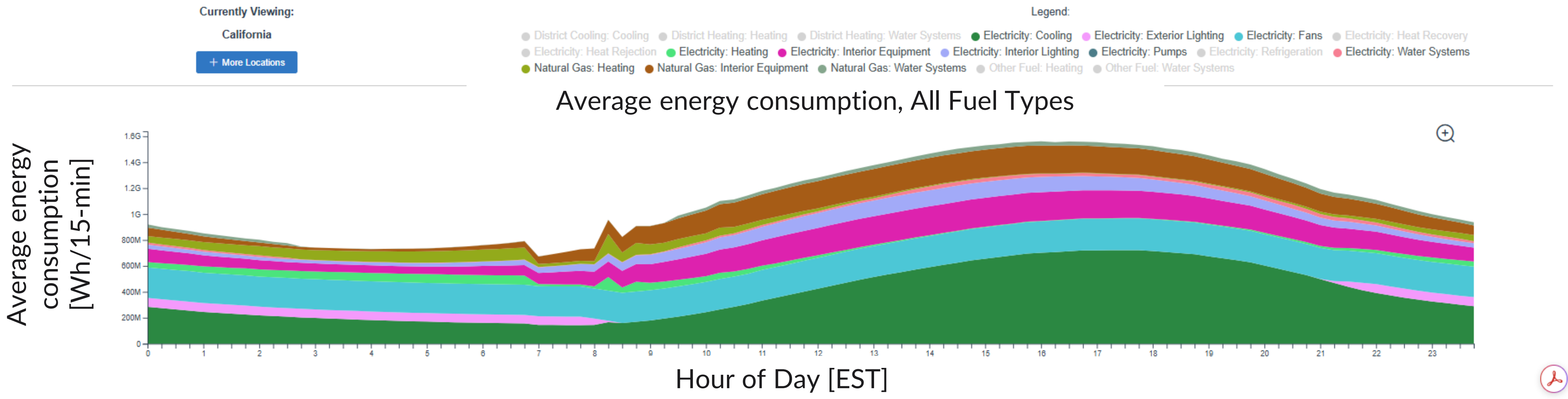
Segment	FCZ10_RE

Row Labels	Sum of EUFS End-use Floor Stock (kSqFt)	Sum of EUI Energy-use Indices (kWh/EUFS/Year)	Sum of End-use Floor Stock Distribution (%)	Sum of EI Energy Intensity (kWh/Segment FS/Year)	Sum of End-use Energy Distribution (%)	Sum of Non-coincident Peak Load (watts/SF)	Sum of Connected Load (watts/SF)	Sum of Annual Energy Usage (GWh)
Heating	18,249.66	0.23	28.5%	0.07	0.4%	0.29	-	4.18
Cooling	54,775.46	4.43	85.5%	3.79	21.6%	2.43	-	242.60
Ventilation	54,875.74	2.71	85.7%	2.32	13.3%	0.50	0.79	148.84
Water Heating	38,867.99	0.25	60.7%	0.15	0.9%	0.03	0.12	9.90
Cooking	56,036.24	0.25	87.5%	0.22	1.3%	0.05	0.28	14.19
Refrigeration	60,085.98	0.67	93.8%	0.63	3.6%	0.08	0.62	40.22
Exterior Lighting	50,403.99	2.43	78.7%	1.91	10.9%	0.62	0.82	122.57
Interior Lighting	64,037.52	6.81	100.0%	6.81	38.9%	1.18	1.37	436.29
Office Equipment	64,037.52	0.37	100.0%	0.37	2.1%	0.07	0.43	23.87
Miscellaneous	53,943.58	0.76	84.2%	0.64	3.6%	0.12	0.68	40.78
Process	449.71	3.43	0.7%	0.02	0.1%	0.01	0.03	1.54
Motors	27,670.39	1.05	43.2%	0.45	2.6%	0.10	0.35	28.93
Air Compressors	7,856.62	0.93	12.3%	0.11	0.7%	0.02	0.08	7.30
Segment Total	64,037.52	--	--	17.51	100.0%	4.55	--	1,121.22

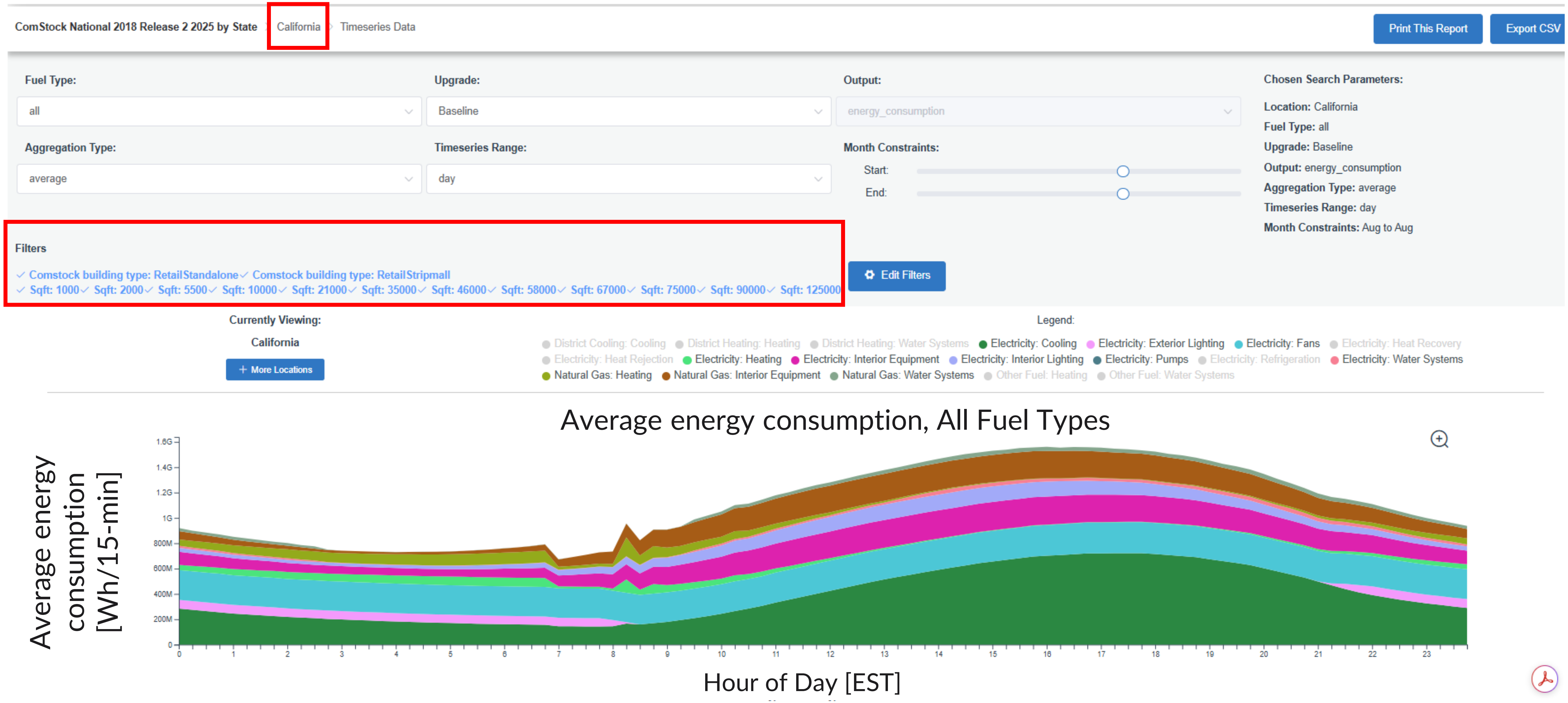
FCZ	Facility	Climate Zone	HVAC Perentage of Average Summer Peak Load
FCZ02	RETL	2	57.3%
FCZ03	RETL	3	49.0%
FCZ04	RETL	4	48.8%
FCZ05	RETL	5	38.2%
FCZ08	RETL	8	38.6%
FCZ09	RETL	9	48.1%
FCZ10	RETL	10	52.8%

Using NREL Comstock to compare HVAC and lighting end use fractions between large retail & retail ≤ 499 kW

- Comstock is aggregated data from several energy **models**, weighted to be representative of the building types in each state
- Provides electric consumption by end use, including **cooling, fans, and lighting**
- Looking at peak days, compare HVAC (cooling + fans) percentage of Average Summer Peak Demand between "Small" Retail and "Large" Retail (filtering by sq. Footage) and Interior Lighting percentage
- Use this modeled data comparison to scale the CEUS data (real data) accordingly for each climate zone



Filtering NREL Comstock data for HVAC and lighting end use fractions between large retail & retail < 499 kW



Results: HVAC and lighting kW as percentage of peak for large & small retail

	Fans Percentage of Peak Load		Cooling Percentage of Peak Load		Lighting Percentage of Peak Load	
Climate Zone	Current FastTrack Tool for Retail ≤499kW	Calculated Values for Large Retail >499kW	Current FastTrack Tool for Retail ≤499kW	Calculated Values for Large Retail >499kW	Current FastTrack Tool for Retail ≤499kW	Calculated Values for Large Retail >499kW
FCZ01	9.3%	10.9%	52.1%	47.9%	22.9%	18.4%
FCZ02	9.9%	11.5%	47.4%	43.6%	22.1%	17.8%
FCZ03	7.1%	8.3%	41.9%	38.5%	26.6%	21.4%
FCZ04	9.7%	11.3%	39.2%	36.0%	32.0%	25.7%
FCZ05	8.6%	10.0%	29.6%	27.3%	37.4%	30.1%
FCZ06	10.0%	11.7%	39.9%	36.7%	26.9%	21.6%
FCZ07	7.2%	8.4%	49.9%	45.9%	21.9%	17.6%
FCZ08	7.6%	8.8%	31.1%	28.6%	40.2%	32.3%
FCZ09	11.0%	12.8%	37.2%	34.2%	28.7%	23.1%
FCZ10	9.0%	10.5%	43.9%	40.4%	24.3%	19.6%
FCZ13	6.9%	8.0%	30.1%	27.7%	36.6%	29.4%
Statewide Average	8.5%	10.0%	36.2%	33.2%	32.6%	26.2%

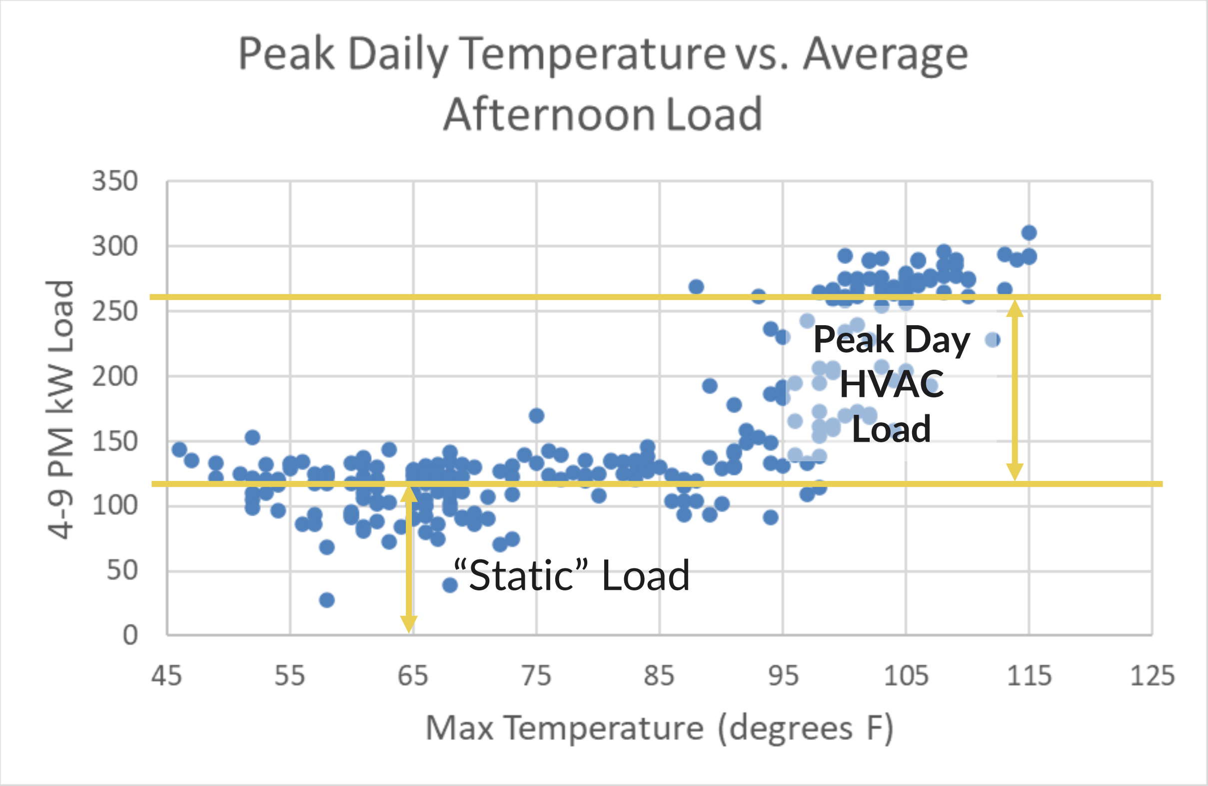
Retail sites >499kW with significant grocery profiles should remain custom

Estimating HVAC Load of Study Data

- Estimate HVAC load of study data based on historical weather data
- For each account in data set, subtract average load on <70F days from load on peak heat days to estimate peak HVAC load

Takeaway

- Using this weather correlation method, some sites have lower HVAC percentage than CEUS data results
- We think these are likely retail superstores with grocery sections
- We recommend they undergo custom grocery load shed analysis instead of deemed for these sites



Additional notes about deemed analysis for large retail

- There are only 153 sites in the study data statewide
- Excluding superstores with significant refrigeration (like Costco and Walmart) makes the dataset smaller for this segment
- On the other hand, there are retail chains where a portion of sites have >499kW peak demand that are currently excluded from deemed pathway
- Adding this sector would allow those types of retail customers to include all sites on the deemed pathway, streamlining the application process and simplifying the overall experience for the customer

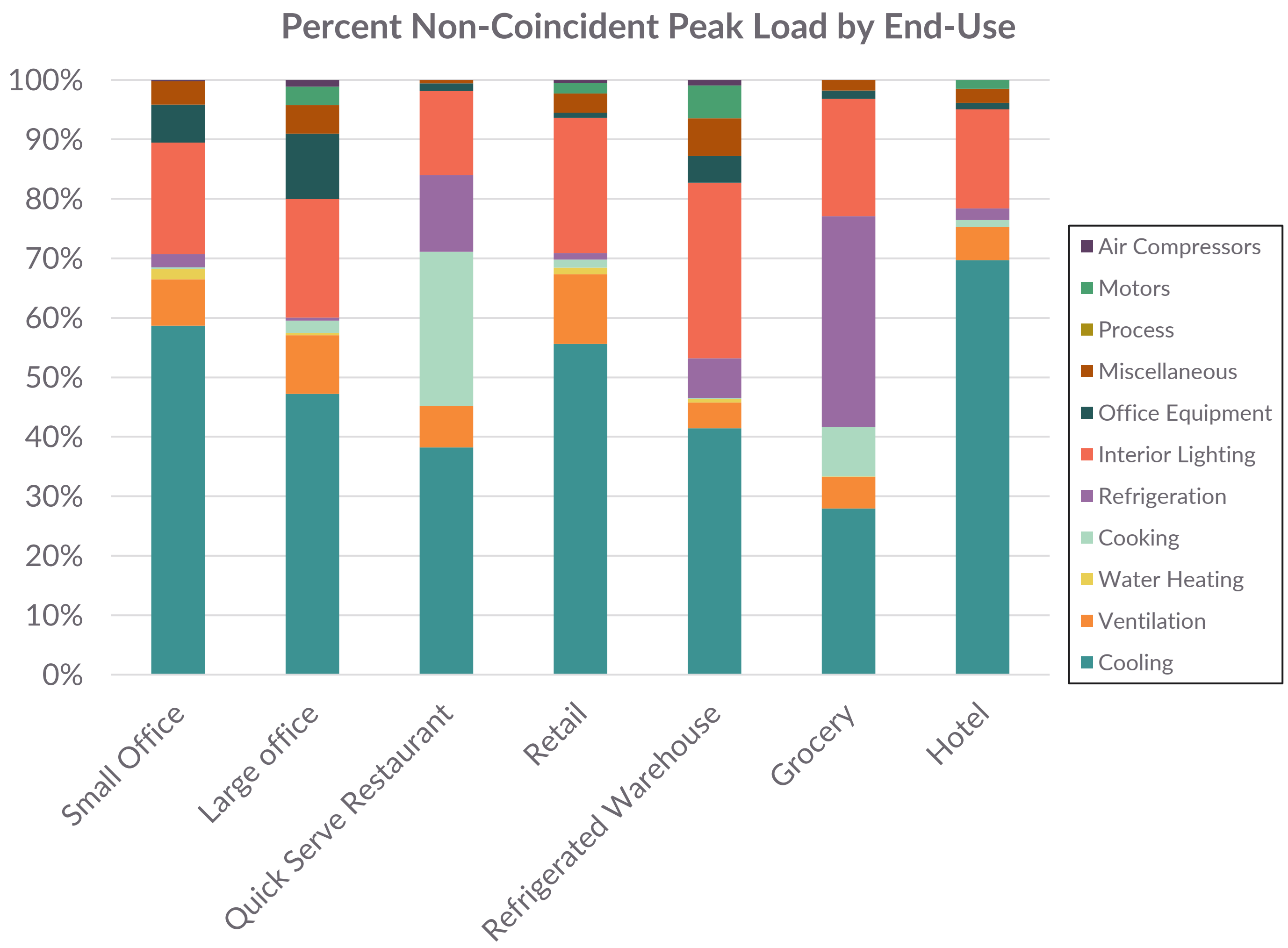
Zip Code to Climate Zone Mapping

Deemed tool refresher: Use of climate zones as reference for percent consumption by end use

FastTrack and Express load calculations make assumptions about:

a) The end-use demand distribution of different building types and 2006 CEUS* forecast climate zones (FCZ)

b) Requires limited inputs e.g., summer peak demand and zip codes



*CEUS = California Commercial End Use Survey

Deemed tool updates: mapping zip codes to climate zones

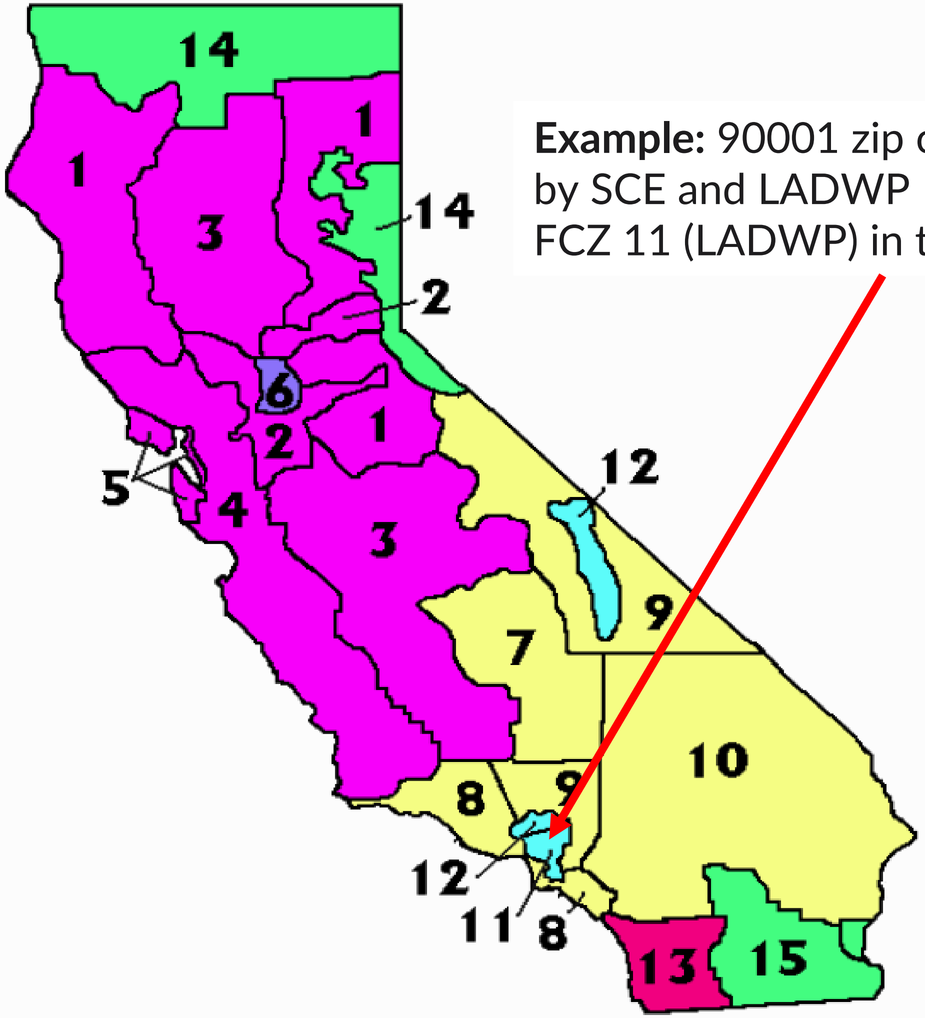
Problem:

Study data included zip codes that fall in FCZ* 11 and FCZ 12, corresponding to LADWP based on the 2006 CEUS mapping

The existing tools do not have FCZ 11 and FCZ 12

Consequently, deemed incentives cannot be calculated as LADWP FCZs are not supported by existing tools

Example: 90001 zip code is served by SCE and LADWP but assigned to FCZ 11 (LADWP) in the current tool.



CEC 2006 Forecast Climate Zone Map

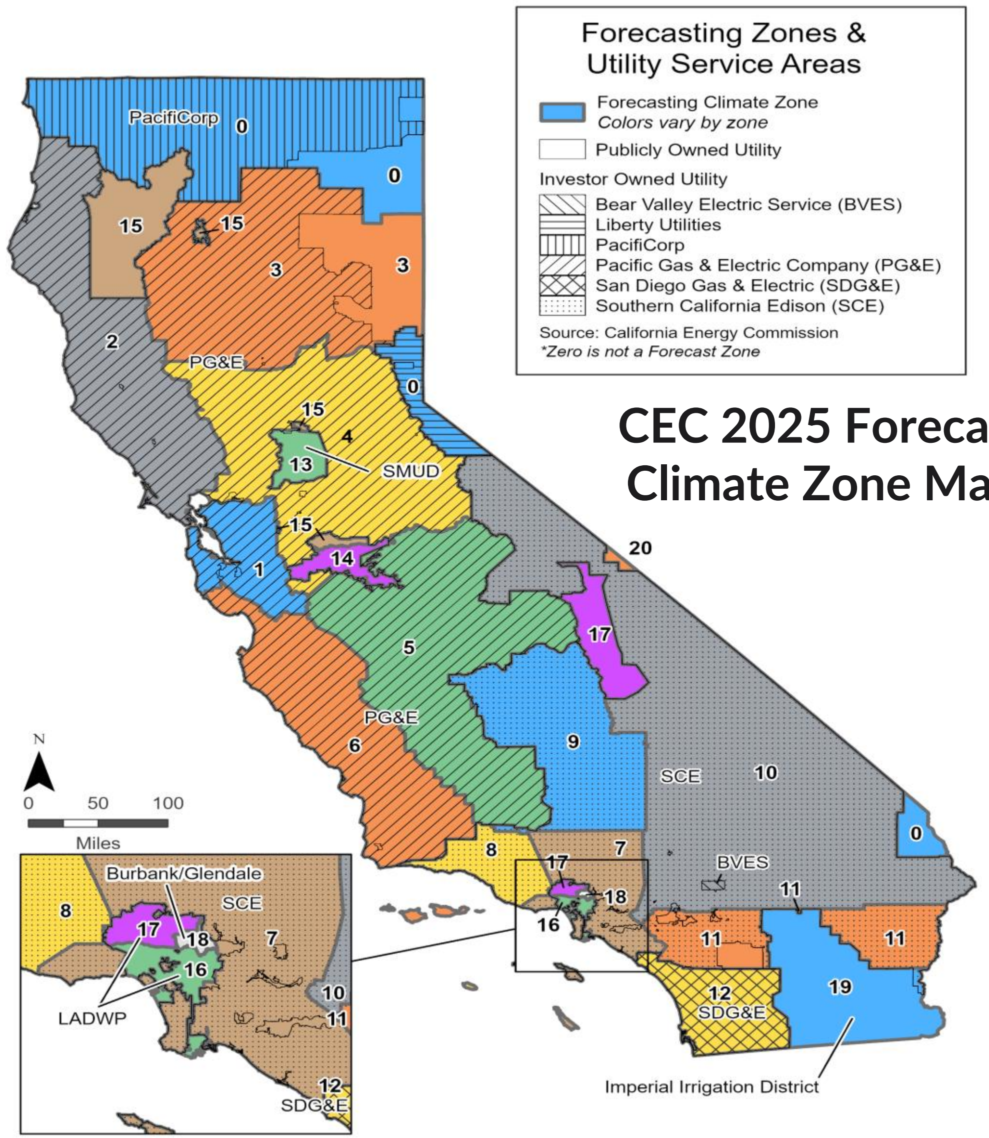
*The CEC uses forecast climate zones (FCZ) and climate zones (CZ). The CEC CEUS is based on FCZ.

Deemed Tool Updates: Using 2025 FCZs to support mapping

The 2006 FCZ data only assigns one FCZ per zip code, so mapping alternatives would be imprecise

The 2025 CEUS report's FCZs are more granular and provide multiple FCZ assignments for zip codes that are in overlapping utilities/ climate zone boundaries

The 2025 FCZ's can be referenced to resolve many cases where zip codes with overlapping boundaries complicates the FCZ assignment



CEC 2025 Forecast Climate Zone Map

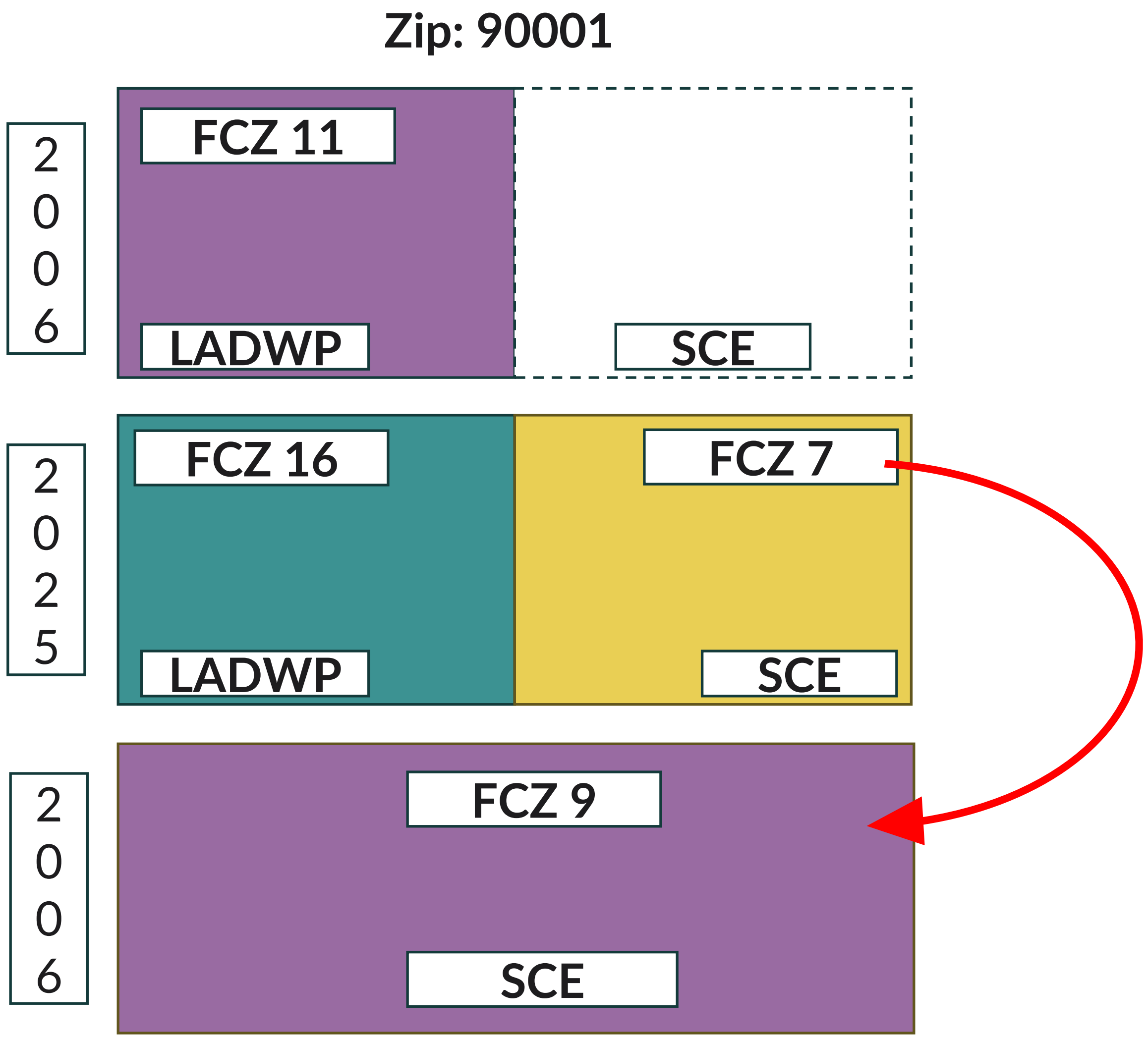
Deemed tool updates: Mapping FCZ for zip codes with a simple match

Case 1:

Simple matches are cases where the 2025 FCZ assigns the zip code to **two** FCZs, one in LADWP and the other in SCE

We assign zip codes in FCZ 11 (2006) to the FCZ that corresponds to their 2025 FCZ assignment for SCE

Example: 90001 maps to SCE's FZC 7 (2025) which corresponds to FCZ 9 (2006)



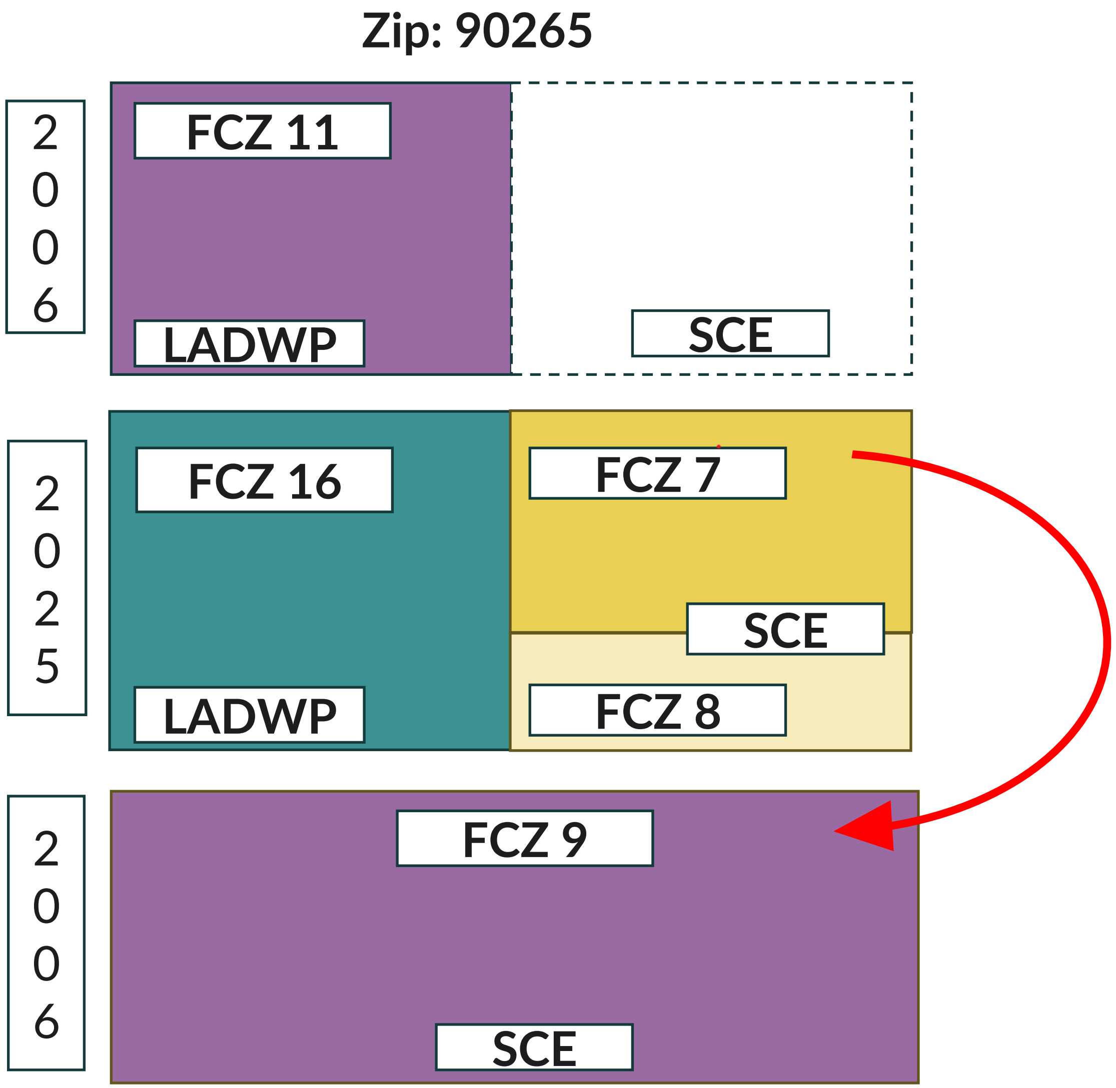
Deemed tool updates: Mapping for zip codes with multiple climate zones

Case 2:

If zip code is assigned to multiple FCZ's (within the **same utility territory**) in 2025, we assigned by population size in each FCZ

Example: 90265 maps to SCE's FZC 7 and FCZ 8 in 2025. FCZ 7 has a higher percentage of the population than FCZ 8

So, we assign 90265 to FCZ 9 (2006)




Thank you