Navigating Multifamily Electrification, Readiness and Phasing Strategies - Mitigating Upsizing

Amy Dryden, Emma Doherty, Association for Energy Affordability

ABSTRACT

Multifamily buildings, housing 50% of California's low-income households, are a critical segment for achieving equitable electrification. Ninety-one percent of multifamily units are occupied by renters, who are often underserved by electrification incentive programs due to split incentives and lack of agency over home improvements. A major barrier for electrification is electrical infrastructure upsizing and upgrades required for fuel switching, which increase the complexity and cost of projects, disincentivizing decarbonization of many older buildings. The cost of upgrading or upsizing building, unit, or site infrastructure, especially at large properties, is often prohibitive for low-income properties.

Data from twenty-three properties showcased different approaches to electrification and the value of flexibility in a resource-constrained sector. Investments in comprehensive scope evaluation and technical assistance to navigate electrical complexities can mitigate electrical upsizing, enabling full or partial electrification today and reducing future costs. Electrical infrastructure upsizing —or the studies required to avoid them—were a main expense. Twenty-one out of 23 properties avoided upsizing services to the building or units to electrify due to investment in monitoring and/or engineering and analysis. Access to demand data was critical to avoid utility upsizing and to mitigate significant project delays and negative impacts on the grid. Installation of readiness measures reduced future capital costs. Scaling this approach requires contractor and engineer training on electrical infrastructure and scope analysis and property owner training on strategy adoption.

This paper provides project-specific pre- and post-retrofit monitoring data to support learnings, identifies key findings, and recommends strategies to mitigate and avoid electrical infrastructure costs.

Introduction

California aims to achieve carbon neutrality by 2045 through aggressive emissions reductions, clean energy expansion, and carbon reduction initiatives. Electrification of residential buildings, which generate 25% of the state's annual greenhouse gas emissions, is a key strategy to achieve these goals. This work is supported by building decarbonization programs funded by cap and invest revenues and state budget allocations (UCLA, 2026). Equitable participation is critical to ensure cost savings are achieved and that benefits are received by all communities. Multifamily housing, as a hard-to-reach sector, is a critical segment for achieving equitable electrification in California, ensuring residents benefit (Miller, 2019). Yet, existing electrical infrastructure limits are a common and costly challenge of electrification for the multifamily sector.

Multifamily landscape

Representing more than 30% of the total housing stock in California, multifamily housing is occupied by 50% of California's low-income population. Twenty-five percent of low-income households reside in subsidized affordable housing, while the remaining households live in market-rate properties (Bachman 2022). Ninety-one percent of multifamily units are occupied by renters, who are often underserved by energy programs due to split incentives where owners purchase equipment and tenants, who lack agency over capital improvements to their homes, pay utility bills and also benefit from the savings (VEIC, 2023). Multifamily building electrification challenges include:

- **Limited access to capital**. Typically, the limited capital owners have access to is allocated to specific investments, which constrains the ability to undertake projects with increased upfront costs, such as electrification with higher equipment cost and additional scope compared to like-for-like replacements.
- **Complex and increased electrical infrastructure scope from fuel switching.** The electrical metering configuration (how buildings and units receive utility service) varies. This complicates electrical evaluation. There is increased scope of work associated with analysis and upgrading and upsizing electrical infrastructure for fuel switching that is a cost and time barrier.
- **Split incentives.** On average 50% of water heating systems are in-unit systems, of which the majority are natural gas appliances. On the other hand, 35% of in-unit HVAC systems are natural gas appliances (Bachman 2022). These conditions provide a high opportunity for decarbonization in rental housing but are complicated by split incentive dynamics of owner investments and resident benefits.
- **Lack of awareness.** The multifamily stakeholder segment which includes owners, consultants, contractors, and design professionals, is diverse and comprehensively lacks awareness of heat pumps and best practices, including critical electrical infrastructure evaluation. This is magnified by the complexity of retrofits due to the diversity of ownership structures, building types, and property and metering configurations present across and within multifamily properties (Dryden, 2026; Aitchison, 2021).

Electrical Infrastructure Challenges

Electrifying gas end uses adds electrical loads not accounted for in the original building design and engineering. This will often trigger costly infrastructure upgrades and/or upsizing and may trigger code compliance requirements. The cost of upgrading or upsizing this infrastructure, especially at a large property with many units, is often prohibitive for low-income properties, particularly if the need for these upgrades is exposed later in a project's development, after initial budget has been defined and initial funding has been curated and allocated.

- **Electrical upgrades** are defined as upgrading the equipment, location, or feeders without requiring an increase in electrical capacity delivered to the building or unit. This may include aged, unsafe, or non-code compliant infrastructure.

- **Electrical upsizing** indicates a need for increasing electrical capacity and can include service drop upgrades, transformers, or building and unit disconnects and feeders.

Upsizing is required when it is determined that the existing infrastructure cannot safely handle the combination of the existing and projected added loads. If a service upsizing is recommended, this requires coordination with the utility which adds administrative time to the project as well as additional engineering and scope costs. While the complexities and variations of multifamily infrastructure make it hard to generalize (Fournier, 2024; Aitchison, 2021), the infrastructure in a multifamily building that may need to be upgraded or upsized if there is not space or capacity to accommodate additional electrical loads includes:

- Apartment subpanel(s): This can include the main circuit breaker, feeder, or both (and possibly the conduit) from the main circuit breaker to the subpanel in the apartment.
- House subpanel(s) at a building: This can include the house main circuit breaker, feeder, or both (and possibly the conduit) from the main circuit breaker to the subpanel for common area loads.
- Building Service: This can include the building main circuit breaker, feeder, or both (and if so, possibly the conduit) from the transformer to the building, to support the added load of the equipment in that building.

For service upgrades, the utility does the engineering, planning, and installation and the costs vary significantly and the party responsible for that cost also varies. Costs may range from $2500- $40,000 (SPUR, 2024) after initial engineering fees which are paid by the owner. Multifamily properties with multiple transformers can result in significantly higher costs. The owner must incur costs to the utility to initiate an engineer review without knowledge of costs or confidence in the ability to move forward. The incongruence between the timeline of the utility support for electrical infrastructure and the timelines of funding cycles incentivizing installation of electric equipment can lead to long stalls in projects, added costs, and sometimes ultimately dissuading building owners from considering electrification at all. Therefore, it is valuable for owners, residents, and climate goals to enable electrification without upsizing and mitigating upgrades.

Electrical Load Calculation Methodologies

To determine if a property needs any type of electrical upgrade due to added load, an electrical engineer or contractor will complete electrical load calculations following one of the code-compliant load calculation methodologies in the California Electrical Code (CEC, 2025) making load assumptions for the new equipment. The load calculation methods include loads that scale with building size, demand factors and continuous loads which affect the resulting allowance (Fournier, 2024). If the calculation estimates a peak power draw higher than the capacity of the electrical infrastructure, that electrical infrastructure must be upsized to account for this calculated load. The Standard method, NEC Article 220, Part III Feeder and service load calculations (CEC, 2025) a common method used to calculate anticipated peak demand, is not specific to residential occupancies and typically results in highly conservative estimates relative to a unit's or property's actual usage (Fournier, 2024).

There are alternative methods in NEC Article 220, Part IV, Optional feeder and service calculations as adopted by California Building Standards Commission, Section 220.83 Existing Dwelling Unit, Section 220.84 Multifamily Dwelling, and Section 220.87 Determining Existing Loads (CEC, 2025), that are generally less conservative but still code compliant.

Section 220.87 allows the engineer to use the actual historical peak demand from a building or unit as input into the load calculations. This peak demand is defined as the maximum demand through the service over one year, or the maximum demand through the service over a 30-day period during peak demand season. Although not always the case, the actual existing peak demand is often low enough to allow for added loads, whereas the results of the deemed calculations (NEC Section 220 Part III and Section 220.83) exceed existing capacity. Studies have shown existing dwelling units use less than full capacity with some citing 35% of the capacity (Schmidt, 2024; SPUR, 2024, Less, 2026). Despite the advantages, Section 220.87 isn't well-known or often undertaken in multifamily electrification projects for a variety of reasons including: additional cost and time, lack of knowledge of the methodology and limited access to monitoring equipment. While the maximum demand over a one-year period is straightforward to access for a single-family home with access to peak demand data through bills or a smart meter, gathering this information for an acceptable sample of units per building for a multifamily property requires resident permission, accessing the data and aggregating the data, requiring additional time and effort from both owner, management staff and the contractor. For example, on a 200-unit, individually metered property, this would equate to 2400 utility bills or 200 consent forms (or fewer if the electrical engineer allows sampling) to access resident utility data through an online platform. Utility data is typically only accessible through large investor-owned utilities and not municipal utilities in California, which creates an additional barrier. In addition, for multifamily properties, electrical evaluation must be conducted at both the unit and building service level. Because the units and common loads are metered, but the building is not, there is no demand data for the service to the building. Therefore, the consented unit data must be mapped to each building to inform building demand calculations. To achieve results, the contractor needs to understand what monitoring equipment to use, how to install monitoring equipment for property-specific metering configurations, access the data and then complete the analysis or subcontract the work. All these steps require time and knowledge.

Project Approach and Methodology

Effective project design process that avoids unnecessary electrical upgrades includes the following steps:

1. Identify all end uses for electrification
2. Complete initial calculations using NEC methodology evaluating results from Section 220 Part III, Section 220.83 and Section 220.84 for full electrification
3. Identify efficiency measures to reduce loads of new equipment
4. Select power efficient equipment to mitigate impacts on electrical infrastructure
5. Employ Section 220.87 in the situation where results from other NEC methodologies require infrastructure upsizing (Aitchison, 2021).

Using the approach above to complete an evaluation for full electrification at the outset coupled with other factors such as availability of funding, necessary upgrades and the owner's appetite for scale of project will result in one of the following outcomes:

- **Full electrification:** Undertaking full electrification within the scope of a single project makes sense, provided there is adequate access to capital, timelines can be navigated, and there are no electrical infrastructure barriers in front of the meter.
- **Electrification readiness:** In the event full electrification cannot be undertaken in a single scope, a phased approach coupled with electrification readiness measures may be a cost-effective way to achieve full electrification over time. Electrification readiness can include installing new circuits for future electric appliances, adding louvers to doors for ventilation, upgrading electrical panels, beginning the process of a service upgrade, and other work that will ultimately smooth the process for installing electric equipment where there were originally gas appliances. Importantly, these strategies do not provide an alternative to replacing recalled or non-code-compliant infrastructure or necessary modernization of electrical systems. Future planning provides owners with the ability to complete replacement over time according to capital plans and budget, in response to failures or in response to regulatory requirements (i.e. Zero NOx rules) and avoid locking in existing natural gas infrastructure (Dryden, 2024). Another benefit of the electrification readiness strategy is that it can help bring benefits to residents sooner. For example, providing space conditioning with cooling and removing combustion appliances from the living space in the first phase supports comfort and improved indoor air quality today, while planning to electrify water heating in the future.

To further characterize the potential of this approach, the Association for Energy Affordability (AEA) implemented an electrification readiness pilot under the TECH Clean California Initiative, a heat pump retrofit market transformation program in California. While electrification readiness has been utilized in new construction programs such as Zero Energy Homes as well as California Energy Code, it is nascent as a retrofit strategy due to the lack of savings associated with the work. Typical retrofit programs incentivize measures that result in energy savings or bill savings. Because electrification readiness measures do include appliance replacement, there are no savings associated with this scope of work that can contribute to a program's attribution of savings. In addition to this TECH pilot, AEA also implemented load monitoring and electrical load calculation technical assistance through its other existing multifamily whole building programs to advance this approach. The intent was to identify strategies to effectively advance multifamily electrification cost effectively, while mitigating project delays, costs and utility grid impacts.

The TECH Electrification Readiness Pilot (TECH Pilot) explicitly tested the impact of providing building owners with technical assistance, site assessments, and electrical analysis to develop a detailed plan for how to electrify all appliances and equipment in a property over time to overcome knowledge and cost barriers. These projects included a scope of work for electrical upgrades for full electrification, appliances available for immediate installation, readiness measures for future appliances, and plans for future installations. Electrical load monitoring was conducted when necessary, utilizing loggers recording 1-minute average current with local storage and current transducers rated for the specific application. Readiness measures included electrical circuits, raceways and receptacles for future appliances, as well as modifications to spaces to enable future installations. Thirteen properties participated in the TECH pilot.

In addition, ten projects outside of the TECH pilot received technical assistance, site assessments, and electrical analysis to develop a scope of work to electrify appliances but excluded incentives for electrification readiness measures. A total of twenty-three projects engaged in this strategic approach to electrification. These projects were all either naturally occurring affordable housing, defined as market rate housing occupied by low-income households or deed restricted projects. The unit count ranged from 4- 100 and the number of buildings per site ranged from 1 to 24 (See Table 1).

These properties faced challenges such as needing to upsize unit service, the utility service or both to accommodate the additional load of electrification, and some faced particularly complex service upgrades that would be triggered by the added load, such as transitioning from single- to three-phase services or from overhead to underground services. The goal was to understand to what extent electrification infrastructure upsizing and upgrades can be mitigated through strategic electrical infrastructure evaluation.

Results

These 23 projects with limited electrical capacity received technical support defined as: electrical load calculations review (exclusive of 220.87 support), recommendations for power-efficient equipment, electrical load monitoring to support load calculations using Section 220.87, electrical capacity evaluation, and scope development. Table 1 summarizes the support provided to 23 project teams. Seven received electrical calculation reviews, 8 received power efficient equipment recommendations, and 15 received support monitoring actual demand and performing 220.87 load calculations based on the review of initial load calculations.

Seventeen out of 23 properties (73%) were able to avoid triggering service upsizing through revisions to their electrical calculations, power efficient equipment selection, or the use of 220.87. Twenty-one projects mitigated or avoided service and unit upsizing as a result of these strategies. Two properties were able to mitigate upsizing of their services, by either reducing the number of services that needed to be upsized or reducing the complexity of those upgrades. Finally, one property still needed a service upgrade to serve the desired electrification scope.

Of the 23 properties, four were able to fully electrify in a single phase of work. Thirteen were able to partially electrify with six of those incorporating electrification readiness measures under the TECH pilot to support future full electrification. Four projects undertook electrification readiness and upgrades to prepare for future retrofit work. Lastly, two projects were unable to move forward with recommended electrification and readiness work due to funding constraints, but the recommended scope and analysis can be leveraged in the future. Some properties completed fewer electrification measures than were determined to be possible within existing electrical capacity due to budget or timeline constraints of available funding.

Table 1 provides basic property information for the 23 properties, as well as the challenges each project faced from an electrical capacity standpoint, and whether those challenges were avoided (A), mitigated (M), remaining (R) after the technical assistance and the resulting electrification and/or electrification readiness that were included in the retrofit. The challenges addressed through technical support included: “Unit service upsizing”, which refers to increasing capacity to the unit but remaining within building service; “Service upgrade required” refers to upgrading the service from the utility to the building; and “In-unit upgrades for safety and code compliance” refers to scopes like panel relocation or panel upgrades. Under the resulting electrification for DHW, the X-C denotes electrification of a central domestic hot water (DHW) system, and X denotes electrification of unitary water heating systems. In this section, “n/a” denotes the end use was already electric. Empty cells in the table indicate the condition did not exist or occur.

Table 1: Summary of Electrification Retrofit Projects Receiving Electrical Strategy Support

	Property Information			Challenges Avoided (A), Mitigated (M), or Remaining (R)			Support Provided			Resulting Electrification				
	Property	Apartments	Buildings	Unit Service Upsize Required	Service Upsize Required	In-unit Upgrades for Safety or Compliance	Electrical Calculation Review	Power Efficient Equipment	Power Monitoring + 220.87	HVAC	Cooking	DHW	Dryers	Readiness
Full Elec.	D	9	1		A	R			X	X	X	X - C	X	
	P	50	15		A				X	X	n/a	X	n/a	
	U	32	3	A	A			X	X	X	X	X - C	X	
	W	17	1		A	R			X	X	n/a	X - C		
Partial Electrification	B	14	1		A	R				X	n/a	X - C		
	C	11	1		A	R				X	n/a	X - C		
	F	33	1	A	A		X	X		X		X	n/a	X
	G	46	12	A			X			X		X	n/a	X
	H	45	1	A			X			X		X- C	n/a	X
	M	4	1		A				X	X		X		
	V	55	1		A				X		n/a	X - C		
	E	15	1		A	R			X	X	X	X- C	X	
	N	75	19		A				X		n/a	X		X
	O	55	6		A				X	X	n/a	X		X
	R	36	13	M	A	R		X	X	X	n/a			
	S	40	13	M	A	R		X	X	X	n/a	X		
	T	28	5	M	A	R		X	X	X	n/a			
No Electrification	A	40	13	A	A	R		X	X		n/a			
	I	46	2	M	M		X		X				n/a	X
	J	21	1				X							X
	K	100	24	A	A	X	X	X						X
	L	59	1		R		X	X						X
	Q	57	6		M				X		n/a			

Detailed Methods and Results of Six Buildings

A case study of six of the buildings within the TECH Pilot illustrates the electrical evaluation approach and outcomes of the multiple load calculation methods and pre-and post-retrofit monitoring results. The six buildings were all part of deed-restricted properties serving low-income seniors and disabled individuals. The properties included studio, one-bedroom, and two-bedroom apartments. Each building had between five and nine units and was monitored for at least 30 days between January and May 2025. All units had electric ranges, gas space heating (wall furnaces or ducted furnace), no cooling, and 40-gallon unitary gas water heaters. None of the buildings had existing seasonal electric loads, thus seasonality was not a determining factor in monitoring timing. Full electrification proposals included replacing existing furnaces with package terminal heat pumps, existing ducted furnaces with ducted mini split heat pumps, and each of the existing unitary gas water heaters with 240 V, 15 A hybrid heat pump water heaters. Table 2 shows the major equipment that would be installed (plus existing electric ranges) to electrify buildings A-F.

Table 2: Proposed and existing appliances for fully electrified units

Building	Unit Makeup	Electric Ranges (existing)	50 gal 240v HPWH	Inverter-driven PTHP	Ducted Mini Split HP
A	4 1B units, 4 2B units	8	8	8	4
B	8 1B units	8	8	16	0
C	5 studios + common area	5	5	5	0
D	8 studios	8	8	8	0
E	6 studios	6	6	6	0
F	9 studios	9	9	9	0

First, an NEC 220.84 calculation was completed for each of the buildings (see Figure 1) and showed that for five of the six, a utility service upgrade would be required to fully electrify with the proposed and existing equipment (see Table 2). The service upgrade process would have pushed the electrification projects past existing funding timelines; therefore, any load added to the buildings in this phase of the work had to remain within the building service capacity. Because the initial electrical load calculation results required upsizing, these six buildings were power monitored to capture peak demand for use in NEC 220.87 calculations to evaluate the potential to electrify within existing capacity. The building main feeders were monitored using DENT ElitePro XC data loggers and compatible current transducers rated to measure up to 300A. The loggers were set to record the average, minimum, and maximum current, voltage, kW, and power factor at one-minute intervals. The maximum recorded 1-minute average current from the monitoring period was then used in the NEC 220.87 calculations. The results of the monitoring are shown in Figure 2: the black line on each green bar shows the maximum measured average current for each building, or the peak historical demand used in the NEC 220.87 calculation. The green bar shows the calculated maximum demand for the fully electrified building using NEC 220.87.

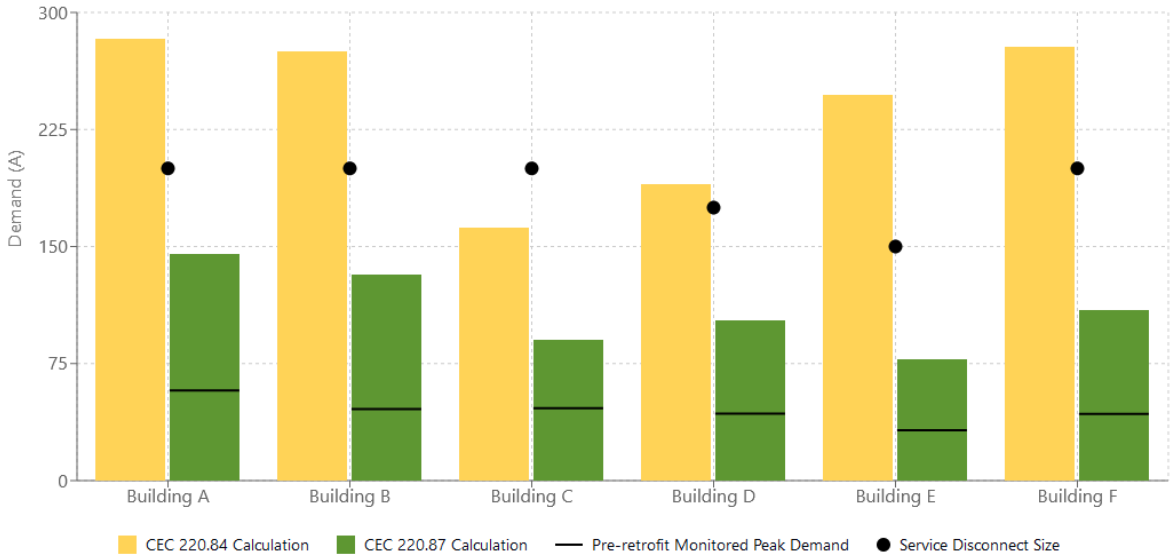

Figure 1: Full Electrification Calculated Electrical Load. The figure shows the difference between the results of NEC 220.84 and 220.87 when used to calculate the electrical load of 6 buildings fully electrified with the equipment specified in Table 2.

The NEC 220.87 calculation results are between 31% (Building E) and 55% (Building C) of the NEC 220.84 counterpart calculations. NEC 220.87 calculated peak demands are well below the service disconnect ratings for all buildings; thus, full electrification is well within the service capacities of all the buildings, even without service upgrades.

Due to budget constraints and concerns about utility feeder capacity, the buildings were not fully electrified during the first phase of work. Instead, the existing gas heating systems were removed in all units and replaced with heat pump for heating and cooling, while the gas water heaters remained. Circuits for the future installation of HPWHs were installed, along with passive ventilation in all water heating closets to prepare for the HPWHs.

After the heating was electrified in the six buildings, electrical demand was monitored again, using the same equipment and logging interval as the pre-retrofit monitoring. The buildings were monitored between October 2025 and January 2026, during peak heating season a couple of months after the new space conditioning systems were installed. Because the monitoring is completed at the building level, there is no insight into actual operation of the individual space conditioning systems. The peak demand after heating upgrades was then extracted from the data and compared to the estimated electrical loads calculated using 220.84 and 220.87 for just electrified heating for the buildings (Figure 2).

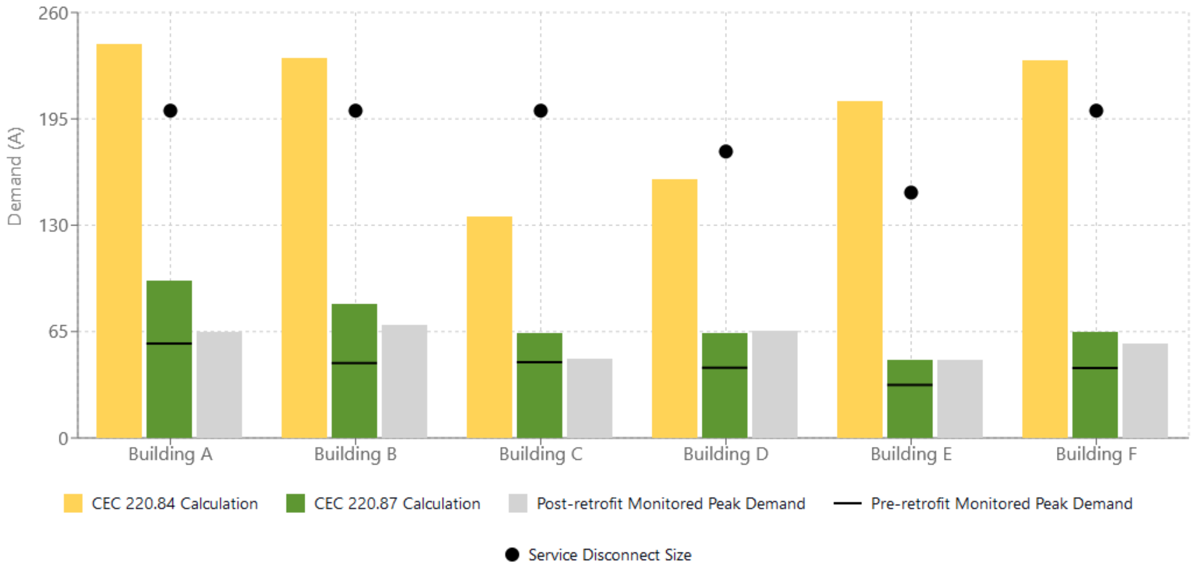

Figure 2: Peak Building Demand with Electrified HVAC. The plot above compares the 220.84 calculated maximum demand, the 220.87 calculated maximum demand, and the actual monitored demand post retrofit for Buildings A-F. As in Figure 1, the service size is represented by a black dot in each cluster, and the black line shows the pre-retrofit monitored peak demand.

In four of the six buildings, the post-retrofit monitored peak demand is lower than the peak that was estimated using the NEC 220.87 calculation. In Building D, the actual peak demand was 2A higher than the NEC 220.87 result, while the actual monitored peak was equal to the NEC 220.87 anticipated peak for Building E. It is evident in Figure 2 that NEC 220.87 result is significantly closer to the actual monitored peak demand for all buildings than the other methods.

These six buildings undertook a phased approach to electrification where the loads calculated for full electrification, enabled implementation of electrification readiness measures: panels were moved to code compliant locations within the units, future loads were accounted for in the panel specification and replacement in the current phase of work, and the circuit for the future HPWH was run while the wall was open for panel relocation. This investment in readiness scope reduced capital costs for the owner, mitigated impacts on the residents for future days of work in the unit and will also allow for easier replacement of the gas water heater, whether through planned replacement or in an emergency.

Findings

These 23 projects demonstrated value in strategic load calculations and advanced planning and electrification readiness to mitigate electrical upgrades, enabling benefits today and reducing future project costs. High-level key learnings included:

Phased approaches to electrification were novel to the property owners, engineers, and contractors. Piloting this approach revealed that the market is not equipped to adopt this strategy for lack of owner familiarity and contractors able to advise on phasing. Conversations with these owners indicated that they had not previously considered this type of phased strategy despite there being multiple rationales for phasing identified through the pilot. Receiving technical support also was an effective opportunity to build contractors' capacity on strategies to electrical capacity evaluation. None of the contractors had a model to accommodate this level of scope development. One electrician with over 25 years of experience, who was initially uncertain and unfamiliar with this approach, is now looking forward to pursuing more projects of this nature. Without this support these projects would have followed a business-as-usual approach and have either been left behind due to the cost burdens of unnecessary electrical service capacity upsizing or incur significant increases in retrofit costs due to delays attributed to coordination with the utility and costs for utility upsizing and upgrades.

Financial and technical support for the electrification readiness measures and engineering support were critical for these projects to move forward. Electrical infrastructure work (defined as upgrades and/or upsizing to electrical infrastructure downstream of the meter) to apartment sub-feeders, main breakers, and main and subpanels—or the studies required to avoid upsizing—were a main expense with limited alternative funding sources. Electrical upgrades that were funded included upgrading the equipment, location, or feeders without requiring an increase in electrical capacity. Understanding how to undertake monitoring and complete appropriate load calculations was complicated, a new approach which required time and analysis by professionals. This pilot took the approach of bringing an additional engineer onto the project team to support calculations to demonstrate effectiveness while minimizing the financial and time burden on the project team. In addition, readiness measures such a ventilation for future heat pump water heaters would not have been installed without program requirements and funding to support the measure.

Electrification Readiness measures result in savings for future retrofits. For one of the TECH pilot projects, the contractor estimated savings of $8,000-$9,500 per unit for completing readiness scope of work today. These savings are based on the costs to electrify the future loads that were not planned for in the initial scope including replacing the panel again because it was not sized for future loads, opening and patching walls and ceilings again to run circuits for the appliance. The cost savings vary significantly based on scope of work, readiness measures, and complexity, but regardless, if a contractor can avoid revisiting scope again in the future, there will be some element of savings.

Projects were not utilizing strategic electrical calculations to mitigate financial and load impacts. Technical support identified lack of knowledge or resistance to utilization of the NEC Optional method and Section 220.87. The review of electrical load calculations for these 23 projects highlighted inaccurate calculations using the standard and optional methods and less strategic calculations that led to upsizing and increased costs, rather than evaluating options to mitigate these impacts. The inaccuracies, which resulted in inflated loads, included wrong assumptions of equipment, misapplying load diversity factors for multifamily, and misapplying allocation of existing loads. In addition, engineers and contractors did not develop scenarios utilizing low power equipment to solve infrastructure constraints as demonstrated by the seven projects that were successful after technical assistance to revise load calculations and select power-efficient equipment. Yet, as the data demonstrated, accurate and strategic approaches were necessary for these projects to move forward.

Recommendations

Strategic load calculations including monitored data, specifying power-efficient equipment, and implementing readiness measures are strategies that can work in a number of scenarios to facilitate cost-effective electrification. Given the successes demonstrated with the projects and strategies, three key challenges exist to expanding and scaling accessibility: funding, education and awareness, and access to data.

Electrifying affordable multifamily housing will require funding sources to pay for analysis and engineering, electrification readiness measures, and electrical infrastructure upgrades and limited upsizing. Funding for design and analysis and readiness measure implementation are necessary. Without funding to cover the specific costs of evaluation of electrical infrastructure in the planning phase, projects may have taken on a much more limited scope or no scope at all as illustrated by pilot projects. Upfront design costs often get engineered out to maximize owner investment unless there is a preponderance of evidence to demonstrate the value of owner upfront investment to lower retrofit costs and increase benefits. Contractors have not developed a model to accommodate this level of scope development.

A broad definition of allowable costs under electrification readiness should include electrical infrastructure scope for future appliances, as well as space modifications, will truly enable future installation of electric appliances and allow owners to more easily navigate emergency replacements. Programs should continue and expand investment in electrical infrastructure upgrades and mitigating upsizing, while also accommodating the costs of engineering and readiness measures to limit owner risk and create an environment for flexible solutions. Programs would need to develop a level of investment for this scope given the lack of savings that can be claimed for the implementation of the measures.

Education and awareness are necessary to shift approach to engineering and analysis, as well as retrofits. There is a gap in knowledge of property owners, contractors and engineers. Building workforce capacity to change how projects are evaluated electrically—which can mitigate impacts of added loads—is especially important. This is evident by the seven projects who were able to avoid electrical upsizing with a technical review of load calculations and power efficient equipment. Well-executed load calculations and leveraging 220.87 can mitigate electrical upgrades and upsizing. Project specific technical assistance coupled with training is needed to focus on electrical infrastructure, electrical analysis, and strategies for phasing electrification through readiness measures to increase market capacity. Approaching an electrification retrofit holistically can provide flexibility in navigating timelines, access to capital, and reduce future capital costs. Having standards for analysis and strategies would provide tools and resources for owners and contractors to effectively deploy this strategy.

Improve and create access to data, which will help mitigate upfront costs and time needed to complete electrical analysis. As demonstrated in this paper, utilizing peak demand from a 30-day monitoring study, for 220.87 in CEC is an effective strategy. Multifamily building evaluations require data at the unit level and at the building level. Gathering unit-level data is often prohibitively labor-intensive and building level data is not available in any format. The monitoring efforts for these projects required extensive resources, time, and technical capacity at a level that is not scalable. Additionally, some multifamily service configurations mean the necessary monitoring is not always possible. Therefore, the challenges to data access need to be addressed to scale this approach in multifamily. If utilities provided peak demand data at both a unit and building level, that dataset would remove significant barriers to electrification for multifamily properties. This change requires engagement with agencies and support from other organizations to identify a policy that could direct the standard and method of accessing necessary data from the utilities. In the meantime, education and training on 220.87 will need to focus on the 30-day monitoring methodology until there is a more elegant and efficient way to obtain building and unit level peak demand data.

Future Research

There is the opportunity to expand this analysis to include the following:

- Cost evaluation of electrification readiness measures versus incremental electrification.
- Evaluate projects over time who employed electrification readiness measures to document how the proposed future scope gets implemented. At this stage of the work, only the planning element is visible.
- Engage with contractors and owners of these 23 projects to understand if they have changed their approach to electrification retrofits.

To address barriers and continue to expand the capacity within the multifamily sector, the current TECH Clean California GGRF offerings are taking this work another step forward through the Electrification Readiness Enhanced Support Pathway. This incentive offering will include the following:

- Technical assistance on analysis, scope development, and equipment selection,
- Required electrical infrastructure analysis with review,
- Required training on monitoring protocols and analysis,
- Required load calculations with review,
- Monitoring installation and analysis support and resources if 220.87 is undertaken, and
- Incentives for engineering, broad electrification readiness measures, infrastructure, monitoring equipment and heat pump technologies.

This new initiative is underway after receiving 29 applications, yet based on budget, only a fraction of the projects will be served. Because this stage is moving toward more standardized structure, requirements, and offerings, it allows for the continued testing and refinement of strategies to complete the evaluation of electrical infrastructure, working with utilities, contractors, and electrical engineers to show impact and funding needs.

Multifamily properties complete electrification scopes during substantial or gut renovation tied to 15-to-20-year funding cycles, planned or unplanned capital work, and incentivized appliance replacement. To that end, having a funded approach for an electrification retrofit project that can evaluate existing infrastructure and define a scope of work for full electrification that may be implemented today or over time is paramount to ensure the hard-to-reach sector of multifamily can electrify and residents and owners can experience the benefits.

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AI Disclosure

AI-assisted tools used: Anthropic's Claude AI

Used for: Plotting data.
Extent: Generating bar charts.
Human review: The authors reviewed and verified the accuracy of the data presented in the bar charts.