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R1901011

California Public Utilities Commission

R.19-01-011 Phase 4A Staff Proposal

CPUC ENERGY DIVISION STAFF

July 18, 2024

Table of Contents

Acronymns & Abbreviations

Amp	Ampere
BUILD	Building Initiative for Low-Emissions Development
CARB	California Air Resources Board
CPUC	California Public Utilities Commission
D.	Decision
DER	Distributed Energy Resource
EV	Electric Vehicle
GHG	Greenhouse Gas
HPWH	Heat Pump Water Heater
IOU	Investor Owned Utility
kWh	Kilowatt Hour
LBNL	Lawrence Berkeley National Laboratory
MSA	Meter Socket Adatper
NBT	Net Billing Tariff
NEC	National Electrical Code
NFPA	National Fire Protection Association
PG&E	Pacific Gas & Electric
PTO	Permission to Operate
PV	Photovoltaic
R.	Rulemaking
SB	Senate Bill
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric
TECH	Technology and Equipment for Clean Heating
WNDRR	Wildfire and Natural Disaster Resiliency Rebuild

Tables & Figures

1 Executive Summary

This Phase 4A Staff Proposal provides Energy Division Staff's recommendations for preventing unnecessary main electrical service panel and service line upsizing, which are costly to both the individual customer triggering the service panel upsizing and to ratepayers who pay for any service line upsizing costs borne by the IOUs through electric rates. The cost for distribution grid impacts is determined typically through the IOU GRC. Unless strategically directed, these investments could be unequitable and risk leaving behind low-income customers, who would be responsible for bearing a portion of the cost of electrification in high-income neighborhoods, where early adoption of electric vehicles (EVs) and other building electrification measures is comparatively higher. Overcoming these barriers will help accelerate statewide building decarbonization efforts to achieve California's goal of three million climate-ready and climate-friendly homes by 2030 and seven million climate-ready and climate-friendly homes by 2035,[1] and to help achieve California's wider climate goal of carbon neutrality by 2045.[2]

Regardless of income, service line upsizing and any associated distribution system upgrades should be avoided as much as possible to minimize the costs to all ratepayers. Staff believe that facilitating alternatives to service line upsizing will reduce the overall cost of building decarbonization measures for customers and will lower the cost burden to ratepayers. Alternatives to service line upsizing are especially important for low-income customers, for whom service line upsizing may be cost-prohibitive, and who already spend a much higher percentage of their household income on energy costs.[3]

This Staff Proposal identifies two recommendations to help customers avoid service line upsizing. The first recommendation seeks to make it simpler for customers and contractors to identify existing electrical demand on a home's electrical panel and service line. Staff recommend that the IOUs list a home's peak demand, over 15-minute intervals, for the previous 30 days and previous year, if applicable, on a customer's monthly bill and online customer portal. This information, when readily available, will make it much easier for contractors to use a provision in California's Electrical Code, California Code of Regulations, Title 24, Part 3, to gauge how much remaining electrical capacity exists on a panel and service.

[1] Governor Gavin Newsom's letter to CARB Chair Liane Randolph, July 22, 2022. See: https://www.gov.ca.gov/wp-content/uploads/2022/07/07.22.2022-Governors-Letter-to-CARB.pdf.
[2] Executive Order B-55-18, issued September 10th, 2018. See: https://archive.gov.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf.
[3] "How High Are Household Energy Burdens?," ACEEE, September 2020. https://www.energy.gov/sites/default/files/2021-12/ACEEE%2C%20Household%20Enegy%20Burdens.pdf.

Meter data from a sample size of residential utility customers show that most residential panels and services average 34% utilization of full capacity, meaning that many homes likely have sufficient capacity to add electrical loads associated with building electrification.[4] Providing a customer's peak demand will make it much easier for contractors to accurately assess a home's actual demand and potentially add electrical loads without upsizing. Staff also recommend that IOUs collect customer's service line capacity when conducting any visits to customer premises, and to gather such data in a database and report on customer bills, to further aid customers and contractors to work within existing capacity constraints when electrifying and avoid unnecessary upsizing.

The second recommendation seeks to widen the pool of technologies available to customers to help avoid electrical service and panel upsizing. Specifically, Staff recommend that the CPUC authorize the IOUs to use previously approved funding for evaluating electrical isolating devices, which currently has ample remaining funds, to recover costs for evaluating the safety and reliability of meter socket adapters (MSAs) and other technologically similar devices that interface with utility equipment, for situations where additional load is added to the incoming service line without isolating the premise from the electric grid. Once assessed, these devices could be approved for electrification end-uses. MSAs connect to the existing service line between the meter and the main breaker of the electrical panel and can serve a variety of purposes, including interconnecting solar photovoltaic (PV) systems and adding load. MSAs can prevent the need to upsize a home's electrical service by tapping directly into service line (on the line side, behind the meter) and bypassing the electrical panel. Because devices connected to the MSA do not supply or draw power via the main service panel, the MSAs can help add PV, energy storage, or additional load without needing to alter the main service panel.

Currently, R.19-09-009 ("Rulemaking Regarding Microgrids Pursuant to Senate Bill 1339 and Resiliency Strategies"), via Ordering Paragraph 9 of D.21-01-018, approved IOU cost recovery of up to $3 million for implementing a process for evaluating electrical isolating technologies, the majority of which have been MSAs.[5] The decision, however, did not grant explicit cost recovery for non-electrically isolating devices. Because MSAs interface with meter sockets and utility meters, the IOUs must assess and approve their use before customers can install them. No cost recovery mechanism currently exists for evaluating and

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[4] Home Energy Analytics. See: https://onedrive.live.com/?authkey=%21AE2eAgVkTO4ssWY&cid=428E7D625E39DE0E&id=428E7D625E39DE0E%21995&parId=428E7D625E39DE0E%21993&o=OneUp.

[5] See: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M361/K442/361442167.PDF.

approving MSAs for situations where disconnection from the grid is not desired. Staff believe that expanding approval for MSAs for non-electrical isolating use cases, such as solar PV and building and transportation electrification use cases will add an important tool to the growing list of strategies for avoiding service upsizing.

The recommendations in this Staff Proposal are intended to provide customers and contractors with tools to help buildings stay within the existing capacities of their electrical panels and electrical services, even as such buildings transition to all-electric end-uses. These recommendations are intended to (1) reduce the costs of building and transportation electrification for customers and make these measures more accessible to low-income households; (2) reduce delays for customers by eliminating the need to obtain permits and inspection approvals, and remove the need to coordinate with utility staff for upgrades to utility infrastructure; and (3) reduce ratepayer impacts by avoiding additional utility spending for service line upsizing and further upstream distribution infrastructure.

2 Background

This section first describes what electrical panel and electrical service upsizing comprises, the costs and barriers associated with these types of projects, the nuances of calculating electrical loads of existing residential buildings, and why these methods can impact building electrification efforts more broadly. Second, it describes several potential use cases for MSAs (though not an exhaustive list) and how MSAs can help avoid panel and service upgrades for customers seeking to add additional electrical load or behind the meter DERs to their homes.

2.1 Electrical Panels and Service Upsizing

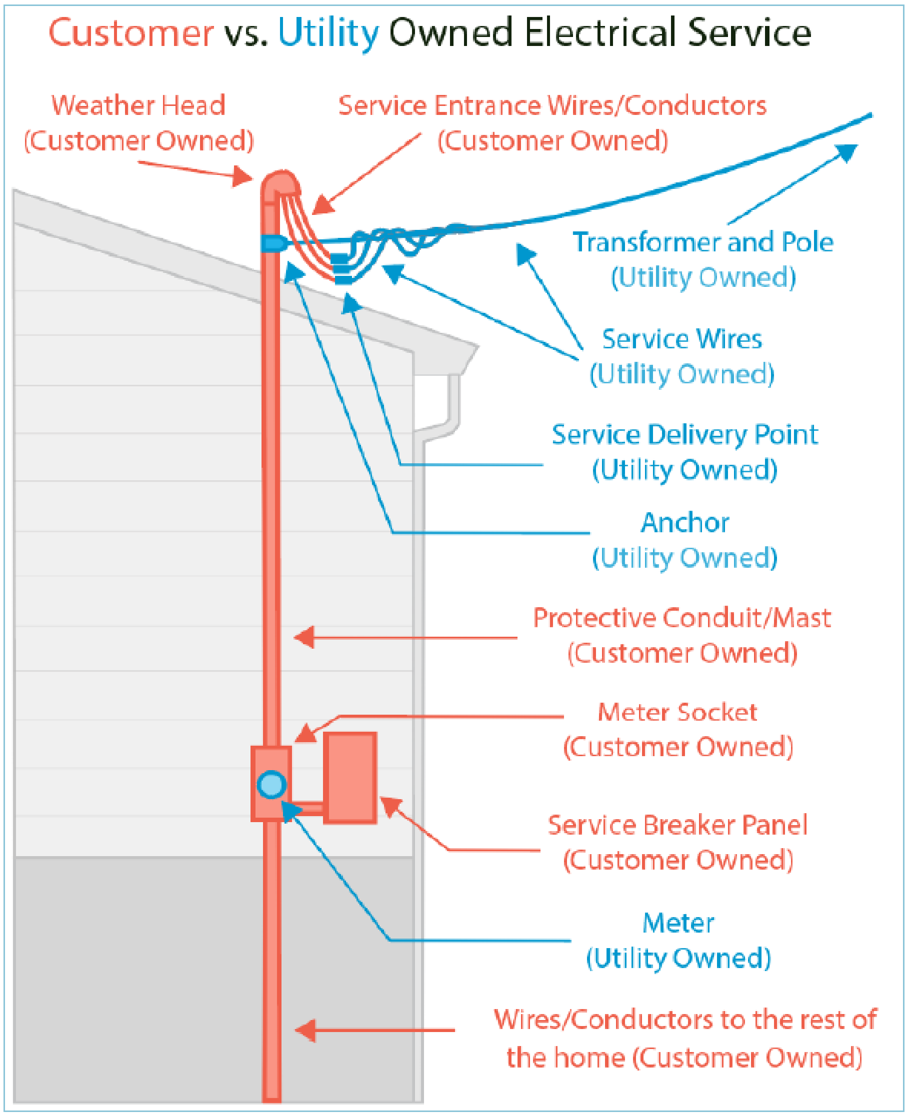
An electrical panel is a piece of customer-owned equipment that connects a building to utility electrical infrastructure and distributes grid electricity to different circuits in the building to power lights and appliances. Electrical panels have amperage ratings, which indicate the level of electrical current in amperes ("amps") that can safely run through the panel's physical components without causing fire or shock hazards. Most residential main electrical service panels in California are rated between 50 amp and 400 amps, with roughly half of all residential electrical panels rated to accommodate fewer than 200 amps.[6] Since its 2019 cycle update, the California Building Energy Code, Title 24, Part 6, also referred to as the California Energy Code, has required 200-amp main electrical service panels for single-family homes.[7] The 2019 Energy Code update took effect January 1, 2020.

An electrical service refers to the conductors, cables, and other equipment that transfer electricity from the electric grid to the premise's utility meter, and from there to the electrical panel. A building's electrical service also has a service rating that indicates the amount of current that can safely run through the service wire and related components. The main electrical panel's amperage capacity is generally sized to match the building's electrical service capacity.

[6] "Solving the Panel Puzzle," SPUR, May 2024, p.8. See: https://www.spur.org/sites/default/files/2024-05/SPUR_Solving_the_Panel_Puzzle.pdf . This paper references a forthcoming study, "Electrical Service Panel Capacity in California Households with Insights for Equitable Building Electrification," ACEEE and data from the Electric Power Research Institute's research on electrical panel upgrades needed across the U.S. See here for more information on the latter: https://www.epri.com/research/products/000000003002026736.

[7] See: https://energycodeace.com/site/custom/public/reference-ace-2019/index.html#!Documents/section11010mandatoryrequirementsforsolarreadybuildings.htm.

Figure 1 illustrates the components of an electrical service and how it connects to a building's main electrical service panel (referred to below as a "service breaker panel"). A sub-panel is generally located away from the main panel and is not depicted as part of Figure 1. The term "electrical panel" can be used to refer to either a main panel or a sub-panel.



Courtesy of Emily Higbee, Redwood Energy Research Director

Figure 1: Components of an Electrical Service[8]

[8] "Service Upgrades for Electrification Retrofits Study Final Report," NV5, May 2022, p.1. See: https://pda.energydataweb.com/api/view/2635/Service%20Upgrades%20for%20Electrification%20Retrofits%20Study%20FINAL.pdf.

A building owner may opt to replace an electrical panel for a variety of reasons. The panel may present safety hazards, either because the equipment is old or degraded, or because the equipment has known defects that can lead to increased fire or shock risks. It may have insufficient circuit breaker slots to connect new loads, such as an EV charger or a new heat pump appliance. Most relevant to this proposal, a main panel may not have sufficient electrical capacity to handle any additional electrical load or addition of distributed energy resources, such as solar PV and battery energy storage systems. Similarly, a building owner may replace an electrical *service* for safety reasons or because the service capacity is insufficient to meet the electrical needs of a building. Often, increasing the electrical capacity of a main panel triggers the need to increase the capacity of an electrical service.

This proposal does not use the terms "panel upgrade" and "service upgrade," terms that are commonly used in the discourse around building decarbonization but can be confusing, since they can refer to different types of modifications to the panel and service. Instead, the terms "panel replacement" and "service replacement" are used to refer to a like-for-like replacement of equipment with the same or lower ampacity rating (e.g., for safety reasons), and "panel upsize" and "service upsize" are used to refer to an increase in the panel or service ampacity rating (e.g., from 100 amps to 200 amps).

Panel Replacements

Panel replacements are necessary for buildings with electrical panels that have documented safety risks; this type of work should be prioritized, especially if additional load will be added to homes with this equipment. Such panels include older brands of panels with faulty circuit breakers that do not trip when overloaded, leading to overheating and fire hazards.[9] While the Consumer Product Safety Commission has recalled a few products, it is important to note that their recalls are reactive, and generally only reflect instances where numerous complaints have already been made by the public, and only after lengthy investigation.[10] Some contractors have drawn attention to panels that have not been officially recalled, but still have a known track record of safety issues.[11] Panel replacements that proactively eliminate these safety

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[9] Such brands include Zinsco, certain panels manufactured by Federal Pacific or Federal Pacific Electric, Challenger, and Pushmatic. See: https://www.pennaelectric.com/unsafe-outdated-electrical-panels/.

[10] See the Consumer Product Safety Commission's website for details on recalled products: https://www.cpsc.gov/Recalls?tabset=on&search_combined_fields=panel&field_rc_date_value=&field_rc_date_value_1=&field_rc_hazards_target_id=All&field_rc_recall_by_product_target_id=180&field_rc_manufactured_in_value=&page=1.

[11] See: https://www.pennaelectric.com/unsafe-outdated-electrical-panels/.

hazards should be prioritized. Additionally, panels that are old, in disrepair, and present any type of safety hazards should be replaced.

Necessary and Unnecessary Service and Panel Upsizing

Necessary panel and service upsizing in the context of building electrification and electric vehicle charging is defined as upsizing that is pursued after all other methods have been exhausted to safely, and in compliance with NEC, avoid panel and service upsizing while still allowing the home to fully electrify its end uses and add electric vehicle charging. This includes exploring the use of circuit pausing or sharing, circuit controllers, smart panels, meter socket adapters, or other available technology to avoid upsizing; exploring the use of power-efficient devices such as 120-volt water heaters; considering multifunctional equipment such as combination cooktops and ovens; considering the use of moderate- or low-speed EV charging; and strategically employing different NEC methods for calculating a building's total electrical load (discussed in more detail below).

Unnecessary panel and service upsizing is when the above methods have not been thoroughly considered and pursued and a customer upsizes their equipment despite there being a safe, compliant, and viable alternative pathway to full home electrification and electric vehicle charging. Additionally, panels that are in disrepair, or otherwise present safety hazards should be replaced or relocated.

Costs of Panel Upgrades and Service Upsizing

Panel and service replacements and upsizing can be costly for building owners and electric ratepayers, the latter of whom foot the bill for utility-side costs related to electrical service modifications and any upstream distribution infrastructure that must also be replaced or upsized.

If a building owner wishes to replace or upsize a main electrical panel, this will likely cost the owner between $1,000 and $14,000, excluding the costs for service upsizing (discussed below).[12] The actual cost depends on a variety of factors, such as whether a panel needs to be moved or if construction work needs to be done to access the service conductors.

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[12] The lower end estimate is based on TECH data, which found that a panel upgrade added about $1,500 (+/- $500) to an HVAC electrification project cost. (Source: "TECH Panel Upgrade Analysis, Preliminary Findings" presented by VEIC on September 8, 2023, to the Panel Optimization Work and Electrical Reassessments group.) The upper end of the estimate comes from PG&E (Source: "Benefit-Cost Analysis of Targeted Electrification and Gas Decommissioning in California," Energy + Environmental Economics, December 2023, p.30. https://www.ethree.com/wp-content/uploads/2023/12/E3_Benefit-Cost-Analysis-of-Targeted-Electrification-and-Gas-Decommissioning-in-California.pdf).

Service replacements or service upsizing can add significantly to the costs of panel upsizing. Utilities provide electric line extension allowances, which cover costs up to a pre-determined value for service line modifications and potential distribution line modifications. Currently, for residential customers, the electric line extension allowance is $3,255 for PG&E, $5,718 for SCE, and $3,981 for SDG&E.[13] While these allowances may cover some or all of the costs of upsizing, a variety of factors can greatly increase the costs of a service line replacement or upsizing, requiring the customer to pay for work in excess of the allowance.

On average, Pacific Gas & Electric (PG&E) reports the average cost for overhead service (before allowances) as $26,286 and for underground service as $23,275.[14] PG&E's historical data show that the majority of underground projects fewer than 400 amps (55%) range between $2,500 to $10,000; of the remaining projects, 20% cost less than $2,500, 20% cost between $10,000 and $31,000, and 5% of projects cost more than $31,000. For overhead projects, PG&E reports that the majority (55%) of overhead projects fewer than 400 amps cost between $3,000 to $13,000; of the remaining projects, 20% cost less than $3,000, 20% of projects cost between $13,000 and $40,000, and 5% cost more than $40,000. PG&E cites the need

[13] PG&E Electric Rule 15, p.8; SCE Electric Rule 15, p.7; and SDG&E Electric Rule 15, p.5.
[14] Data response submitted to CPUC from PG&E on October 3, 2023.

to obtain right of way or easements and additional infrastructure or upgrades as the primary reasons for higher costs.[15]

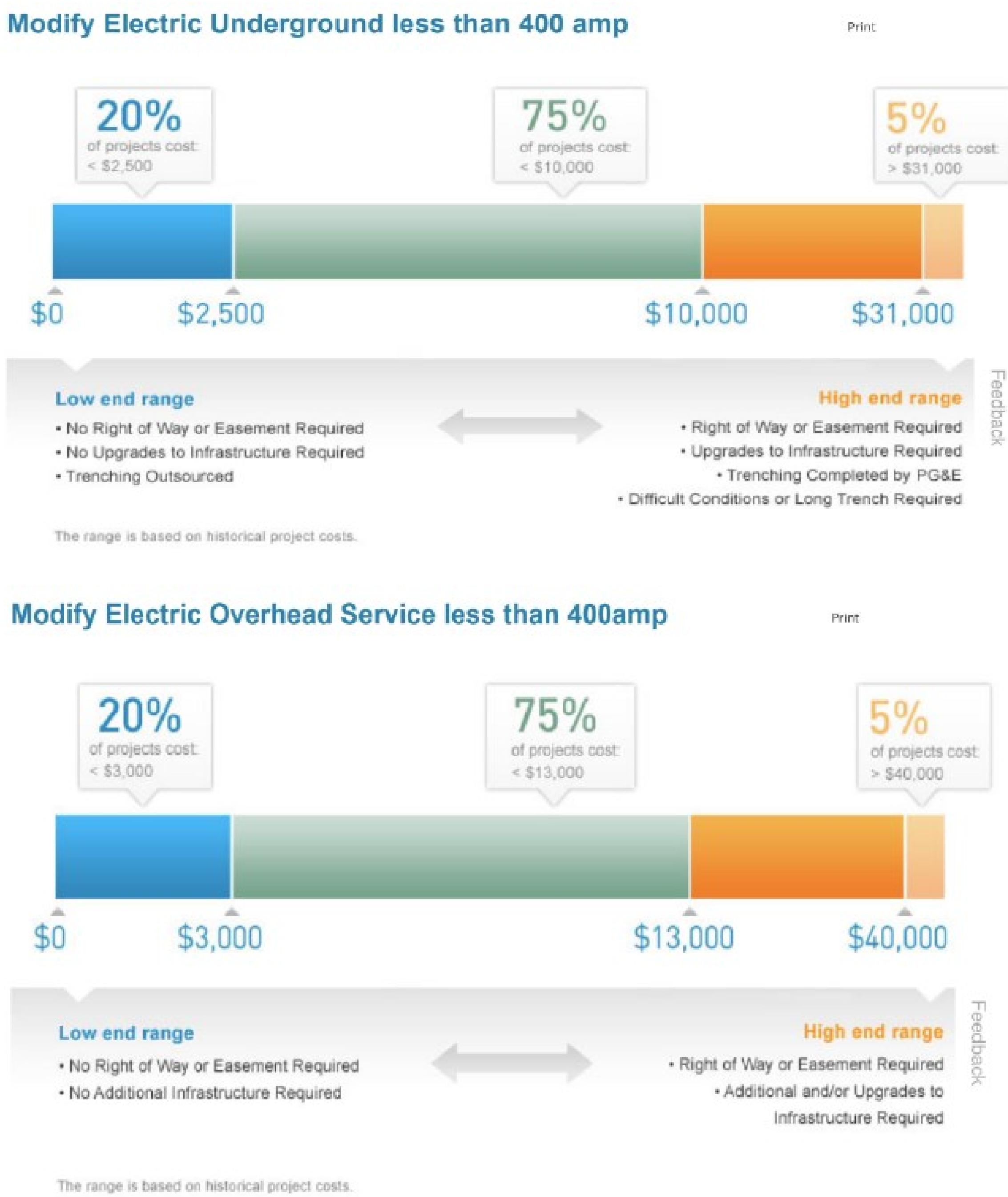

Figure 2: PG&E Estimated Service Modification Costs[16]

Southern California Edison (SCE) and San Diego Gas & Electric (SDG&E) report the following costs for overhead and underground service line modifications, delineated between customer and utility costs:[17]

Table 1: SCE and SDG&E Costs for Overhead and Underground Services

	Average Costs for Overhead Service Work			**Average Costs for Underground Service Work**		
	Customer Cost	Utility Cost	**Total Cost**	Customer Cost	Utility Cost	**Total Cost**
SCE[18]	$17.13	$881.66	$895.99	$557.23	$2,544.40	$3,075.32
SDG&E[19]	$736.13	$1,045.07	$1,781.20	$762.51	$1,575.56	$2,338.07

The costs of additional work, such as transformer upsizing and pole replacements, can add thousands of dollars more to a service line upsizing project. The table below demonstrates the range of costs for various aspects of service line replacements or upsizing in PG&E and SDG&E territories.[20]

[15] "Solving the Panel Puzzle," SPUR, May 2024, p.5. https://www.spur.org/sites/default/files/2024-05/SPUR_Solving_the_Panel_Puzzle.pdf.
[16] Ibid.
[17] PG&E reported that it did not have a similar breakdown of customer and utility costs for service modification requests. Data response submitted to CPUC from PG&E on October 3, 2023.
[18] Data response submitted to CPUC from SCE on September 26, 2023.
[19] Data response submitted to CPUC from SDG&E on September 26, 2023.
[20] This particular study was conducted by PG&E and SDG&E, hence the data reflects only these two service territories. "Service Upgrades for Electrification Retrofits Study Final Report," NV5, May 2022, p.32. See: https://pda.energydataweb.com/api/view/2635/Service%20Upgrades%20for%20Electrification%20Retrofits%20Study%20FINAL.pdf.

Cost Description	Average cost	Transaction
Transformer Upgrade	$6,000 - $8,000	Homeowner → Utility
Pole Replacement	$9,000 - $11,000	Homeowner → Utility
Total New or Upgraded Utility Equipment Service	$10,000 - $30,000	Utility → Contractor
Overhead line, service line only	$2,850 - $4,500 (Utility supplies materials)	Utility → Contractor
Overhead line with a new Utility pole	$11,000 - $13,000 (Utility supplies materials)	Utility → Contractor
Overhead to underground conversion	$13,000 - $18,000 (Utility supplies materials)	Utility → Contractor
Trenching for underground upgrades	$180 to $200 per llinear foot (Utility/Public Property)	Utility → Contractor

Figure 3: Cost Ranges for Electrical Service Modifications: PG&E and SDG&E[21]

These cost estimates indicate that panel and service upsizing can place a significant cost burden on individual property owners as well as ratepayers (via utility side costs) who shoulder a majority of the costs for service upsizing. However, the above cost estimates do not factor in the additional upstream costs for the distribution grid that will inevitably be needed as California continues to rapidly electrify its transportation sector and buildings. In 2021, California's Building Decarbonization Assessment report (CEC)[22] predicted significant increases in demand caused by building decarbonization, potentially necessitating additional investment in distribution and transmission infrastructure compared to what is already planned to serve the base case load forecast. In 2023, the IEPR recognized the infrastructure constraints created due to accelerated electric vehicle deployment over the past several years.[23] These upgrades may come at great cost to ratepayers but can be mitigated through measures discussed herein.

[21] Ibid.
[22] See p.A-114: https://efiling.energy.ca.gov/GetDocument.aspx?tn=239311.
[23] 2023 Integrated Energy Policy Report, p.2: https://efiling.energy.ca.gov/GetDocument.aspx?tn=254463.

However, it may be possible to avoid a huge portion of these costs through policies that consider DERs, electric grid, and the gas grid cohesively.

Inflated costs from unnecessary panel and service upsizing may also unfairly disadvantage under-resourced neighborhoods. For example, in SCE's 2023 Grid Needs Assessment and Distribution Deferral Opportunity report, filed in the High DER proceeding, a zip code's propensity to add EVs is assumed to have a direct correlation with income, wherein households above $150,000 are assumed to have an EV, and that zip code's load forecast and grid load needs are assessed accordingly. [24] If infrastructure upgrades in lower income households and geographies are not prioritized, and not provided assistance in cases where the homeowners cannot afford the cost of service upsizing, then under a business-as-usual scenario, these under-resourced customers are in danger of not only being left out, but bearing the remaining cost of the state's gas system.

The state's push for rapid electrification, including rulemakings initiated by the California Air Resources Board (CARB) and local air quality management districts, means that millions of homes will need to switch from gas to electric end uses..[25] A study released in 2024 estimated that 49% (around 3.7 million) of the state's 7.6 million single family homes have panels rated under 200 amps, which is the standard that new single-family homes have been built to since 200-amp panels became a Title 24 requirement effective January 1, 2019 and which are generally considered to be more than sufficient for full-home electrification.[26] If all 3.7 million homes follow the prevailing logic that electrical panels and services need to be upsized to 200 amps to accommodate EV charging and home electrification measures, this could mean burdening ratepayers with significant additional capital costs in the next few decades.

To avoid this scenario, this Staff Proposal recommends that the CPUC actively encourage alternatives to panel and service upsizing wherever possible, though the CPUC does not discourage panel and service replacement for safety reasons. Building decarbonization advocates have assembled a growing list of so-called "panel optimization" strategies to avoid panel upsizing, including (but not limited to) using

[24] Southern California Edison's Narrative 2023: "Grid Needs Assessment & Distribution Deferral Opportunity Report"; August 2023, pp.22-23. R.21-06-007 Docket. http://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=517610166.
[25] See Bay Area Air Quality Management District's Rulemakings on Rules 9-4 and 9-6: https://www.baaqmd.gov/rules-and-compliance/rule-development/building-appliances. South Coast Air Quality Management district is considering similar alterations to rules 1111 and 1121: https://www.aqmd.gov/home/rules-compliance/rules/scaqmd-rule-book/proposed-rules/rule-1111-and-rule-1121. And finally, CARB is considering zero-emission space and water heater standards: https://ww2.arb.ca.gov/our-work/programs/zero-emission-space-and-water-heater-standards.
[26] "Quantifying the electric service panel capacities of California's residential buildings," Fournier et al, 2024 . See: https://www.sciencedirect.com/science/article/pii/S0301421524002581.

power-efficient appliances, smart panels, and/or circuit splitters and pausers.[27] Through this proposal, Staff hope to expand this list of strategies available to property owners and contractors and avoid unnecessary panel and service upsizing throughout the state making MSAs and other non-electrically isolating devices as an option to consumers and contractors.

Timelines for Panel Upgrades and Service Upsizing

Upsizing or replacing a panel or service can add months to an electrification project. If a customer wants to modify their panel, this may entail:

- Selecting a contractor;
- Requesting a panel upgrade from the utility;
- Having a utility employee conduct a site inspection/visit;
- Requiring the utility to issue a work order;
- Having the contractor pull a local work permit;
- Disconnecting the home from utility service;
- Conducting construction to remove the old panel and rewire a new panel;
- Obtaining local inspection approval; and
- Reconnecting utility service.[28]

This entire process for panel replacement generally takes at minimum three weeks, though wait times can be far longer if design review is required.[29] If a customer's panel needs to be moved to a different location, such as if the panel does not meet requirements for clearance from gas equipment[30] or working

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27 "Solving the Panel Puzzle," SPUR, May 2024, p.11. See: https://www.spur.org/sites/default/files/2024-05/SPUR_Solving_the_Panel_Puzzle.pdf.
28 "Service Upgrades for Electrification Retrofits Study Final Report," NV5, May 2022, pp.27-30. See: https://pda.energydataweb.com/api/view/2635/Service%20Upgrades%20for%20Electrification%20Retrofits%20Study%20FINAL.pdf and SDG&E's Renewable Meter Adapter page and video detailing this process: https://www.sdge.com/residential/savings-center/solar-power-renewable-energy/renewable-meter-adapter.
29 "Solving the Panel Puzzle," SPUR, May 2024, p.6. See: https://www.spur.org/sites/default/files/2024-05/SPUR_Solving_the_Panel_Puzzle.pdf.
30 Each utility has set certain standards dictating the minimum clearance between electrical panels and gas service equipment. For example, PG&E's Greenbook requires a 36-inch radial clearance from the gas vent and a 10-foot vertical clear zone. See: p.3, https://www.pge.com/content/dam/pge/docs/account/service-requests/TD-7001M-B011.pdf. SDG&E requires similar clearance. See: p.392, https://www.sdge.com/sites/default/files/SG2024v0607e.pdf. SCE's requirements can be found here. See: p.148, https://edisonintl.sharepoint.com/teams/Public/Misc/Shared%20Documents/Forms/AllItems.aspx?id=%2Fteams%2FPublic%2FMisc%2FShared%20Documents%2Fdocuments%2FRegulatory%2FSCE%2DManuals%2FESR%2Epdf&parent=%2Fteams%2FPublic%2FMisc%2FShared%20Documents%2Fdocuments%2FRegulatory%2FSCE%2DManuals&p=true&ga=1.

requirements,[31] this type of project may require additional review from the local utility and often also from the local building department, consequently costing more time, money, and hassle for customers.

Service upsizing often requires even more coordination with the utility and may require the customer to apply for a service upgrade with their utility, receive engineering review, obtain permits and easements, coordinate with local authorities to perform inspections, and schedule crews to perform energization. The figure below shows the steps and timelines for service upsizing or replacements from PG&E and SDG&E[32]:

Two key differences between PG&E and SDG&E, highlighted in green, are that PG&E conducts more inspections than SDG&E and that SDG&E can communicate the time frame for each of its steps in the service upgrade process, whereas PG&E cannot.

PG&E	SDG&E
Start: Customer applies for service upgrade.	**Start:** Customer applies for service upgrade.
PG&E assigns a staff member (job owner) to understand the project.	**4–8 weeks** SDG&E fields the job and assigns final submittal date.
Customer pays an engineering advance.	**5–7 days** SDG&E creates service order with fees and job package.
PG&E conducts engineering reviews and develops estimate.	**1–7 days** Customer pays SDG&E. Varying additional time: if necessary, customer obtains local permits, right-of-way, and trench inspections.
Customer signs a contract with PG&E for the work.	**1–2 days** SDG&E schedules crews.
3 days–6 months Customer completes any work on their end, such as trenching; then PG&E conducts two inspections.	**2–6 weeks** SDG&E performs energization.
9 days–13 weeks Customer obtains local permits and schedules disconnect; PG&E conducts inspection in collaboration with the authority having jurisdiction, then performs energization.	**1–3 days** SDG&E reconciles the job in its billing system and job is complete.

Figure 4: Steps and Timelines for Service Upgrades by PG&E and SDG&E[33]

[31] The 2023 National Electrical Code (NEC) Section 110.26 requires a minimum clearance around electrical equipment, including electrical panels, to ensure adequate working space to access such equipment.
[32] This data came from a study commissioned jointly by PG&E and SDG&E. SCE did not participate in this study, so the data from SCE is not available.
[33] Ibid.

A survey of customers in PG&E and SDG&E territories found that the majority faced significant delays from utilities and occasional delays with local permitting authorities.[34] Such delays can add costs to a project and can be frustrating for customers and contractors.

Additionally, service upsizing can have indirect timeline impacts on other utility customers. The additional volume of service upsizing requests can delay other customers who may be waiting for service energization or other actions by a utility's service department. This is because a utility's service department has limited capacity, and an influx of service upsizing requests may add to the backlog of requests being processed by the service department. Furthermore, if a service panel upsizing would be required as part of an interconnection request for additional DER generation by an existing customer, that DER generator's interconnection could be delayed by the service upsizing process required by the utility service department in parallel with actions by the utility interconnection department. Permission to Operate (PTO) and consequent timely customer benefits, solar output, and generation to support the grid can all be delayed by a panel or service upsizing.

Electrical Load Calculations and Panel Sizing

Decarbonizing buildings means homes would be encouraged to transition away from gas appliances and toward their electric counterparts. Full-home electrification without strategic decarbonization (energy efficiency and grid-responsive measures, including load-shifting, demand response and deployable storage) will thus likely increase a building's electricity power consumption, also known as its electrical load.

When adding load to an existing building, such as a new HPWH or EV charger, an electrician or contractor must determine whether the building's electrical equipment is able to safely handle the additional electrical load from the new appliance. This includes the building's main electrical panel and service conductors (wires leading from the utility grid to the building), which need to be appropriately sized to handle the potentially increased amount of electric current (measured in amperes, or "amps") that will flow through this equipment to power the end-use appliance. As more current flows through a conductor, heat is generated; if conductors or a panel's physical components are not properly sized, they are at risk of overheating and causing fires or shock hazards.

[34] "Service Upgrades for Electrification Retrofits Study Final Report," NV5, May 2022. https://pda.energydataweb.com/api/view/2635/Service%20Upgrades%20for%20Electrification%20Retrofits%20Study%20FINAL.pdf.

The National Fire Protection Association (NFPA) oversees NFPA 70, also known as the National Electrical Code (NEC), which provides guidance on how to safely install such electrical equipment and wiring in buildings to avoid these risks. The NEC is the most widely adopted standard for electrical safety in buildings in the United States and is the code adopted by California as Part 3 of Title 24. The code is voluntarily adopted and enforced by local jurisdictions, usually at the state-level, but occasionally at the county and municipal level. The NFPA updates the code every three years, and the 2023 NEC is the most recent version. California adopted the 2020 NEC as part of its 2022 California Electrical Code and will likely update the 2023 NEC in the next update of the California Electrical Code. The NEC is first and foremost a safety code and does not explicitly focus on advancing energy efficiency or decarbonization goals.

Section 220 of the NEC contains provisions for calculating the electrical load of an existing residential building and how to safely add new load. There are two primary options available for existing residential buildings.

The first method, in Section 220.83 (for single-family dwellings) and Section 220.84 (for multi-family dwellings), prescribes an alternative bottom-up calculation of accounting for loads such as lighting and appliances. This method may only be used for residences served by a 120/240 volt or 208Y/120 volt 3-wire service, which is the case for most residences.

The second method described in Section 220.87 and is a "top down" calculation that determines existing loads based on observed usage, usually through metering data.

NEC Section 220.87, or the "Top-down" Approach: The top-down approach of determining existing loads uses metering data to determine a building's actual energy usage. Within the top-down approach, there are two options:

1) The NEC allows using peak load data over a one-year period to determine existing load; the 2023 code is ambiguous about the time interval for this data. The building's observed load is then multiplied by a safety factor of 1.25 to arrive at a building's final existing load. When factoring in new loads into the load calculations via the top-down approach, all new load is added at 100% of each appliance's nameplate rating in load calculations, that is, the maximum power the device draws under standardized conditions.[35]

[35] Section 220.83, National Electrical Code.

2) The NEC also permits using a building's peak load over a 30-day period, using 15-minute interval meter data, to determine the building's current load. However, a building that has "renewable energy systems (i.e., solar photovoltaic or wind electric) or employs any form of peak load shaving" may not use this method.[36]

NEC Sections 220.83 and 220.84, or the "Bottom-up" Approach: The bottom-up approaches described in Sections 220.83 and 220.84 estimates load based off the nameplate ratings of currently installed appliances instead of actual measured electrical demand. The NEC specifies how to add up all existing individual loads (e.g., from lighting, stove, laundry units) and apply demand factors, which are essentially estimates of what percentage the load is expected to be on at the same time. This method of calculating is a more conservative estimate of a building's actual load and does not factor in the real-world operation of the home, such as changes in the number of occupants or occupant behavior.

The figure below demonstrates a sample load calculation via Section 220.83 for a single-family home. In this approach, all new loads are added at the nameplate ratings of the new appliances (first section). Per Section 220.83 (B), the first 8,000 watts are counted at 100% of their value, and the remainder is counted at 40% (second section). Heating and cooling loads are added separately at 100% of their nameplate ratings and the remaining load (HPWH) is added at 40%.[37]

[36] Ibid.
[37] Ampere (amps) is a unit of measure for the flow of current. A volt is a unit of measure for electric "pressure" – or the difference in electrical potential between two different points. A watt is a measure of power, or how much electricity is consumed over a period of time. These units are related via the following equation: Watts = Volts * Amperes.

Load Type	Amps	Volts	Watts
Kitchen Circuit	12.5	x 120	= 1500
Kitchen Circuit	12.5	x 120	= 1500
Laundry Circuit	12.5	x 120	= 1500
Refrigerator	10	x 120	= 1200
Dishwasher	10	x 120	= 1200
Garbage Disposal	5	x 120	= 600
Lights + Plugs	(3 watts / sq foot)		= 6000
First 8,000 watts @ 1.0 coincidence factor			= 8,000
Remaining 5,500 watts @ 0.4 coinc. Factor			= 2,200
HVAC 4,080 watts @ 1.0 coincidence factor			= 4,080
HPWH 2,880 watts @ 0.4 coincidence factor			= 1,152
		Total	**= 15,432**

Amperage = 15,432 with 240V = 65 amps

Figure 5: Sample Load Calculation Using Section 220.83 for a Single-Family Home[38]

Comparing Load Calculation Methods

These two methods offer different advantages based on the scenario. The top-down approach calculates a home's existing load more accurately and usually results in a smaller calculated existing load for the building. This means that the home may have more available capacity to add new load within the constraints of existing electrical equipment and wiring. One disadvantage is that an electrician or contractor needs to obtain metering data from a customer and convert that to peak load, which can be cumbersome, confusing, and prone to calculation errors. Additionally, this method only permits adding load at 100% of its

[38] "Good Stewardship of the Panel Webinar" presentation, Tom Kabat, January 23, 2024. https://techcleanca.com/documents/4159/Panel_Symposium.pdf.

nameplate value and does not allow exclusion of loads that will be replaced or removed from the final load calculation.

The bottom-up approach, on the other hand, does not require metering data, but does require that all appliances' nameplate values be collected, which can be time-consuming to gather. This approach usually results in a larger existing load calculation than that calculated via Section 220.87. However, the bottom-up approach allows for the addition of more new load than the top-down approach. This is because the bottom-up approach allows most new loads to be added to the total load calculation at less than 100% of the new load's nameplate rating.[39] The bottom-up approach also allows subtracting out the loads that will be removed or replaced.

Typically, the top-down approach is the best option when adding a couple of loads or adding loads over time. The bottom-up approach is the preferred approach when adding many additional new loads, or when metering data is not readily available.

Importantly, either method can be used to comply with the NEC's existing load calculations and customers can rely on whichever method is most advantageous to their electrification needs.

Existing Load Observations

Preliminary research indicates that peak demand in residential buildings rarely reaches the maximum capacity of existing electrical panels. This means that electrical panels may have a significant amount of electrical capacity to add additional load.

Figure 6 illustrates the peak demand of 22,442 homes in PG&E's service territory. Over the period of a year, 98% had a peak demand of fewer than 88 amps, 86% had a peak demand of fewer than 50 amps, and 48% had a peak demand of fewer than 30 amps.

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[39] New loads in this method are generally added at 40% of the nameplate rating, with the exception of heating, ventilation and air conditioning equipment, which are added at 100% of their nameplate ratings. This 40% discount is called a demand factor. Demand factors effectively reduce the calculated load that new appliances will add to a building, to reflect how these appliances will realistically be used in a building. For example, it is unlikely that the clothes dryer and stove will be on all the time. Hence, it does not make sense to add these loads at 100% of their nameplate rating. By reducing how much these new loads add to the existing building's load, demand factors helps to reduce oversizing of electrical systems in homes.

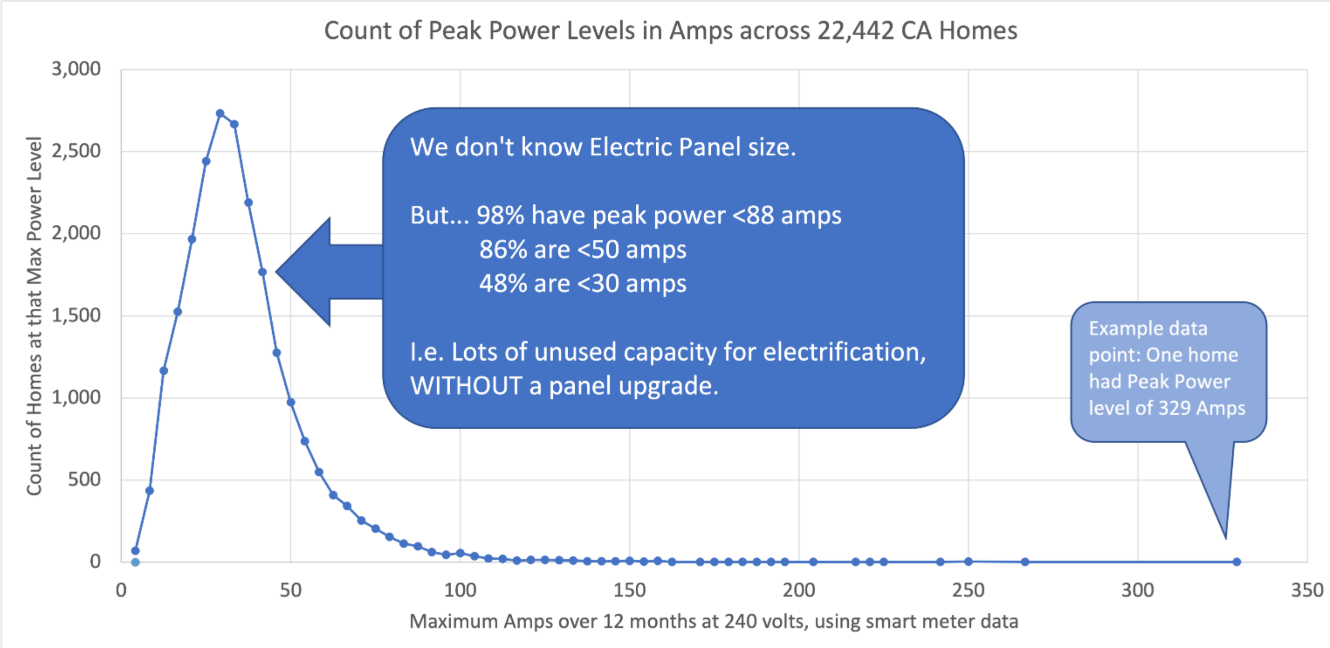


Figure 6: Peak Power Levels for a Sample of PG&E Homes[40]

Figure 7 offers insight into the relationship between electric demand and panel size for 1,480 homes in PG&E territory. It shows that peak demand often only represents 34% of a panel's full capacity. The X-axis represents the number of homes, and the Y-axis represents the panel's rated capacity (in amps). The blue areas demonstrate the used capacity (i.e., peak demand of the home), and the orange areas represent the remaining capacity on the panel. As the graph illustrates, the vast majority of homes with main panels sized

[40] Home Energy Analytics: https://corp.hea.com/home-electrification.

100 amps or greater have ample capacity to add load (orange shaded area).

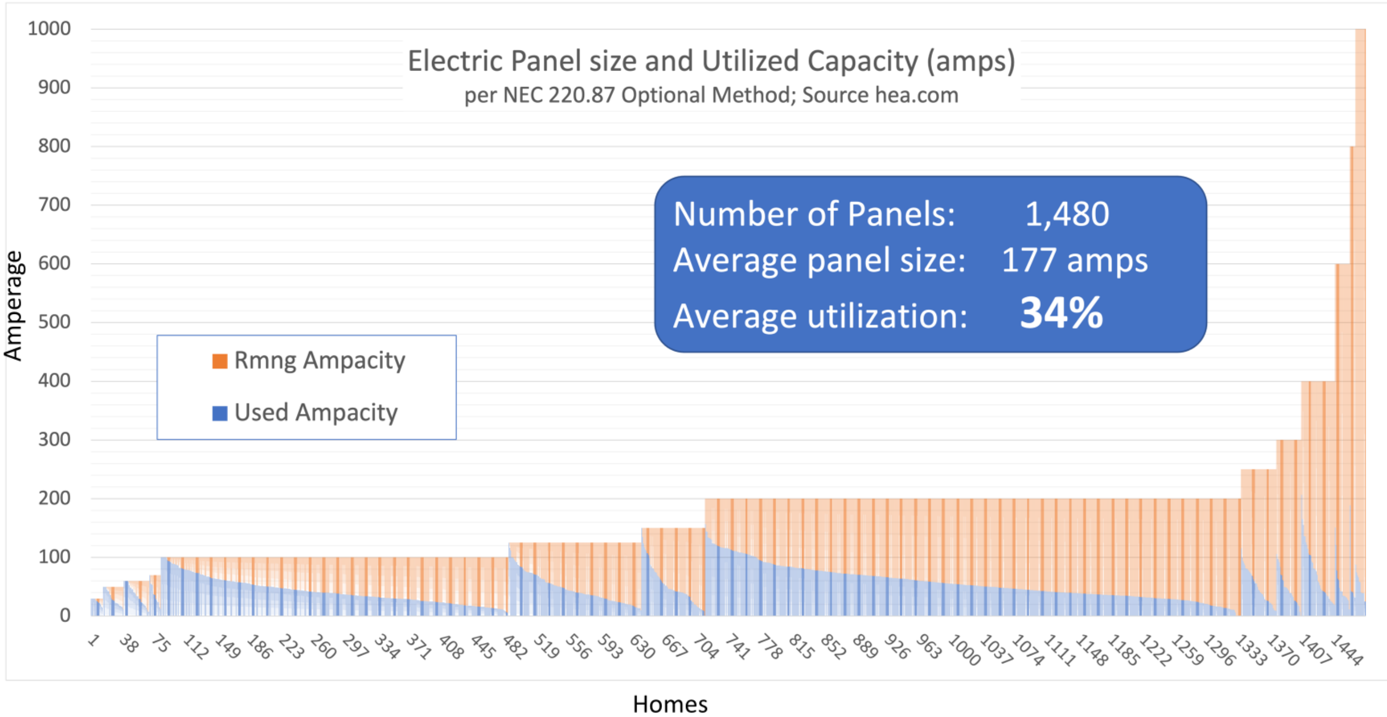
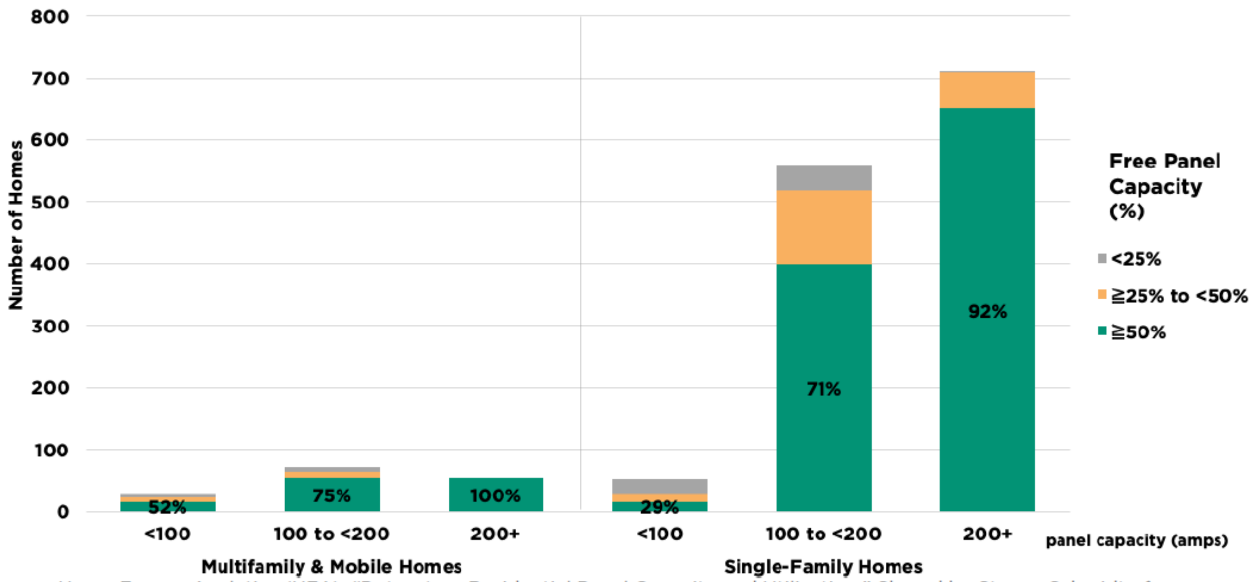


Figure 7: Panel Size vs. Actual Utilization[41]

Figure 8 below presents similar data, illustrating that 71% of single-family homes with 100- to 200-amp panels in PG&E territory have 50% or more of their panel's capacity available. Of single-family homes that have panels smaller than 100 amps, 29% still have over 50% of their panel's capacity available. In multi-family and manufactured homes, 75% of homes with 100- to 200-amp panels have 50% or more of their panel's capacity available for adding loads. These data indicate that most homes with 100- to 200-amp panels may be able to avoid panel and service upsizing through the "top-down" calculation method (Section 220.87) and/or panel optimization strategies.

[41] Home Energy Analytics public data folder: https://onedrive.live.com/?authkey=%21AE2eAgVkTO4ssWY&cid=428E7D625E39DE0E&id=428E7D625E39DE0E%21995&parId=428E7D625E39DE0E%21993&o=OneUp. Staff annotations added.



Source: Home Energy Analytics (HEA), "Dataset on Residential Panel Capacity and Utilization." Shared by Steven Schmidt of HEA.

Note: Data are from 1,477 homes in PG&E service territory.

Figure 8: Available Panel Capacity for 1,477 PG&E Homes[42]

A broader, national study conducted by the Lawrence Berkeley National Lab (LBNL) arrived at similar conclusions, finding that most homes' peak demand (over 15-minute intervals) are only a fraction of typical panel capacities.[43] Figure 9 below shows that, of their sample of homes, the median value of maximum demand was only 37.5 amps (9 kilowatts at 240 volts). Only 1.8% of homes reached a maximum demand of 100 amps (24 kilowatts at 240 volts), and only 0.2% reached a maximum demand of 200 amps (48 kilowatts at 240 volts).

[42] "Solving the Panel Puzzle," SPUR, May 2024, p.10. See: https://www.spur.org/sites/default/files/2024-05/SPUR_Solving_the_Panel_Puzzle.pdf.

[43] See: DOE webinar "Intersection of Energy Codes and Electrical Codes on the Road to Decarbonization," Slide 71, by Brennan Less, Lawrence Berkeley National Lab. https://www.energycodes.gov/sites/default/files/2024-04/Intersection_energy_electrical_codes.pdf.

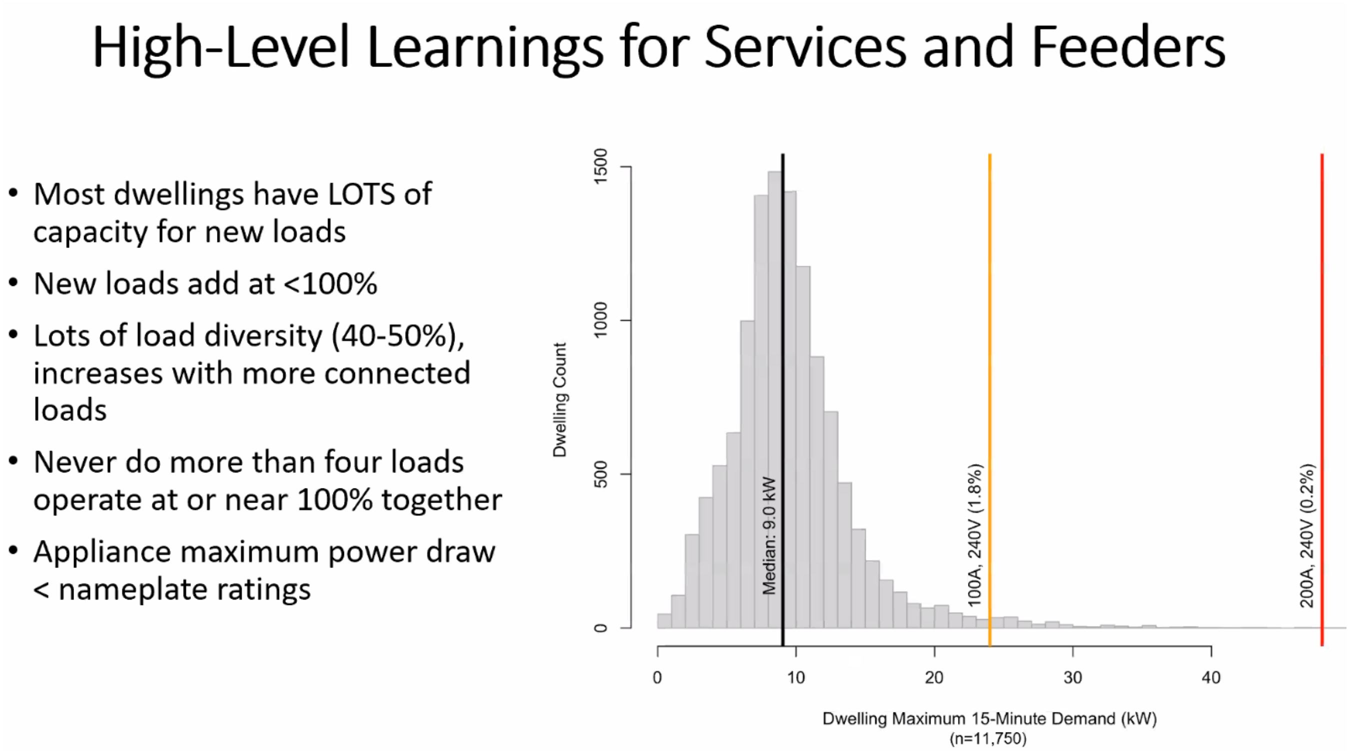


Figure 9: Maximum Demand for Dwellings[44]

This suggests that even homes with 100-amp panels and service likely have ample capacity to add load without upsizing.

2.2 Meter Socket Adapters

"MSA" is a generic term for a device that is installed between the utility meter and the meter socket in the customer's service entrance equipment. These devices have been around for decades and have a variety of applications. Examples of use cases include, but are not limited to, converting meter types or the orientation of meters, electrical isolation of a home from the utility grid, connecting backup generation, interconnecting solar PV generation systems, and adding load (e.g., electric vehicle chargers). MSAs for

[44] See: DOE webinar "Intersection of Energy Codes and Electrical Codes on the Road to Decarbonization," Slide 71, by Brennan Less, Lawrence Berkeley National Lab. https://www.energycodes.gov/sites/default/files/2024-04/Intersection_energy_electrical_codes.pdf.

DERs are an emerging technology that can assist with building decarbonization, since MSAs can greatly reduce the cost of DER installations and help meet the state's policy and climate goals.

The image below shows a sample MSA installation, with a junction box attached to the top, connected to flexible conduit containing conductors that can connect to external load or a solar PV system.

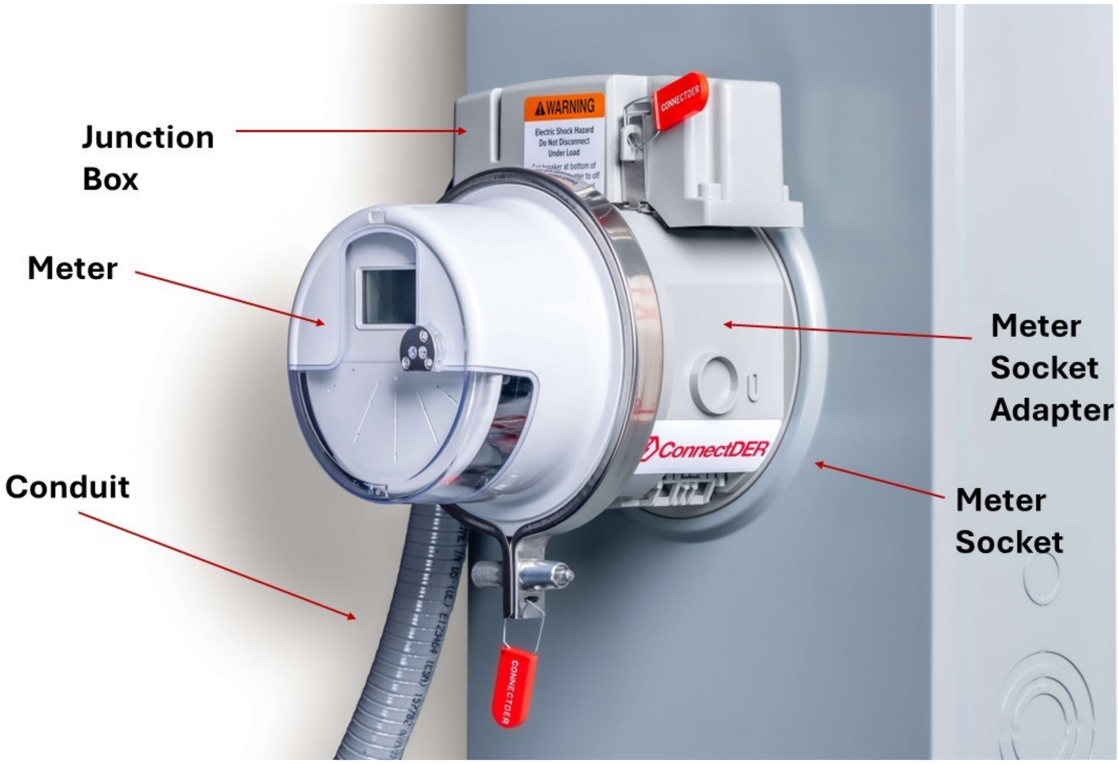


Figure 10 : Sample Meter Socket Installation[45]

Electrical Isolating versus Non-Isolating MSAs

This staff proposal makes a distinction between electrically isolating MSAs and non-isolating MSAs. Electrically isolating MSAs have a built-in switch that can "island" a building from the grid, disconnecting a building from receiving or sending power back to the utility grid. Because the isolating MSAs prevent backfeeding of power to the grid, they allow a building to safely use back-up power from distributed generation or a storage resource during grid power outages or any disconnection from the utility grid. Thus, isolating MSAs play an important role in deployment and commercialization of microgrids for resiliency measures.

[45] Image source: ConnectDER, with Staff annotations added.

Non-isolating MSAs, in contrast, are MSAs that do not have this electrical isolating capability.

Isolating capabilities and additional functions, such as adding PV, storage, or additional load, are not mutually exclusive. That is, an MSA with an additional branch circuit for adding EV charging loads, *can* also be capable of electrical isolation. However, MSAs for adding EV or other building electrification loads that are *currently* commercially available do not have electrical isolation capabilities.

The distinction between isolating versus non-isolating MSAs is important because only isolating MSAs are currently being evaluated by IOUs for approved use in buildings. This will be discussed in Section 3.2.

Meter Socket Adapter Use in Solar Photovoltaic Interconnection

Utility-owned MSAs for PV solar are already offered by PG&E, SCE, and SDG&E (collectively, IOUs) as an alternative interconnection option for solar PV systems.[46] The IOUs developed these products to help shorten the standard solar PV interconnection process, as discussed below. An MSA in this context connects the solar PV system to the home's electrical system behind the utility meter (on the "load side"), but in front of the main panel circuit breaker (on the "supply side"). Figure 11 shows how a PV MSA is connected to the grid and a home's existing electrical system.

[46] PG&E offers a Green Meter Adapter: https://www.pge.com/assets/pge/docs/account/service-requests/094684.pdf. SCE offers a Renewable Meter Adapter: https://www.sce.com/sites/default/files/inline-files/%23126256_Generation%2BMeter%2BAdapter.pdf. SDG&E offers a similar Renewable Meter Adapter: https://www.sdge.com/residential/savings-center/solar-power-renewable-energy/renewable-meter-adapter.

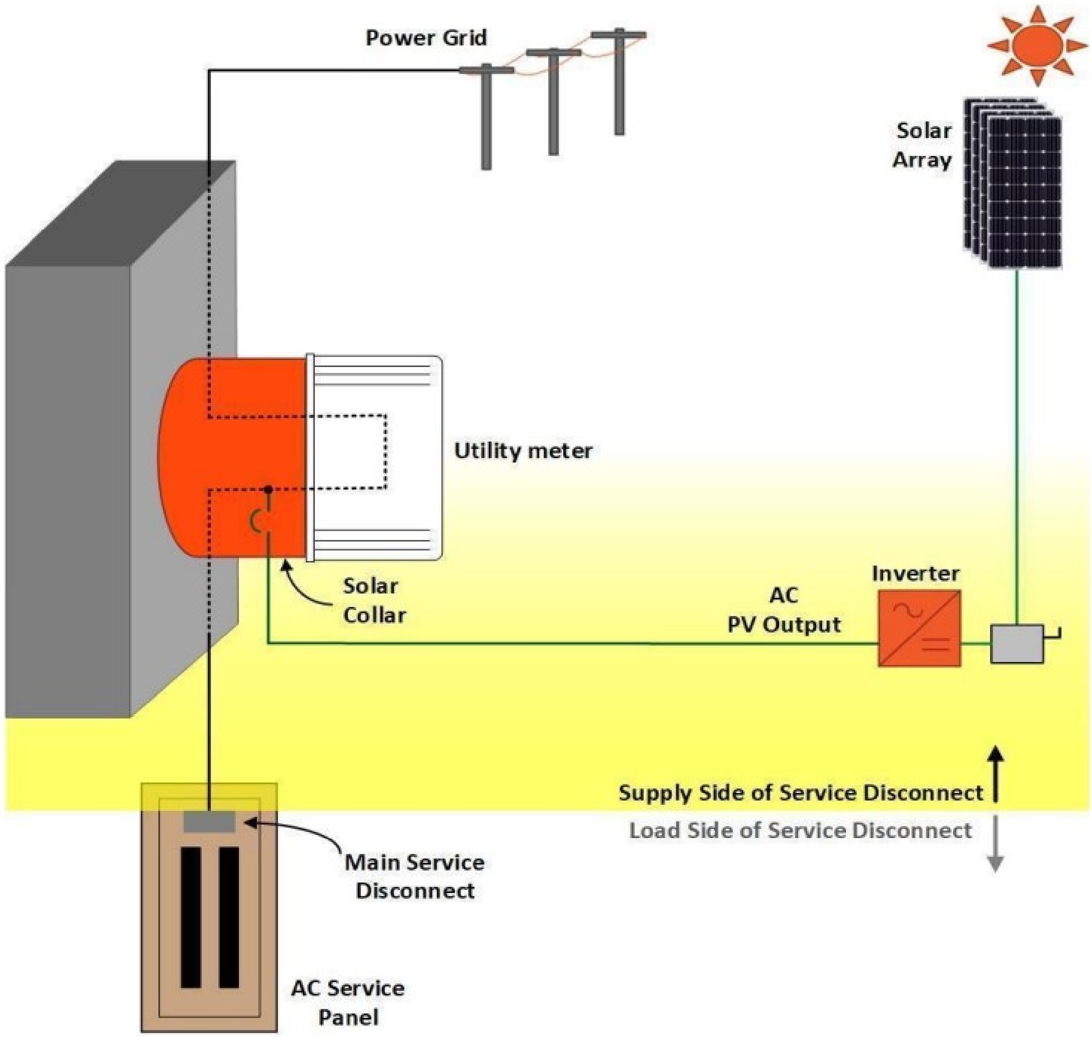


Figure 11: MSA for Solar PV Applications[47]

The MSA allows PV to be added to a home without altering the main panel; no additional circuit breaker space is needed, nor does the panel need to be upsized.

In typical PV installations, a PV system is connected to a building and the grid behind the electrical panel main breaker, on the load side. In this configuration, the electricity generated from the PV system must flow through the electrical panel (via a new circuit on the panel) to deliver power to either the other

[47] Source: ConnectDER Solar MSA v. 5.1 installation manual: https://connectder.com/wp-content/uploads/2023/08/ConnectDER_Solar_MSA_v5.1_Installation-Manual-v1.0f.pdf.

loads on the electrical panel, or back to the grid. This means that the panel has to have sufficient physical breaker space and amperage capacity to handle this extra flow of electricity.

MSAs, however, allow the PV system to bypass the electrical panel as it supplies electricity to the grid. This is because the PV system is connected to the building behind the utility meter, but in front of the electrical panel's main breaker; this connection is called a line or supply-side connection. Electricity generated by the PV system flows to the electrical panel (and connected loads) without requiring extra circuit breaker space, and electricity sent to the grid does not need to pass through the electrical panel at all.

This benefit of MSAs is particularly important, as PV systems are often the main triggers for panel and service upsizing.[48] By avoiding costly panel upsizing, and potentially service upsizing, the MSA saves the customer and utility time and money.

Meter Socket Adapter Use in Battery Storage

MSAs can also be used to connect battery storage systems to a home's existing electrical infrastructure. MSAs can provide a cheaper and speedier alternative to main panel upgrades if storage is being added to a home or additional storage is being added to an existing solar system. As mentioned above, isolating MSAs can provide a mechanism that allows a home to isolate from the electrical grid, thus allowing a home to use solar and battery storage to power the home when electricity from the grid is unavailable.

MSAs can support the addition of storage in homes that have PV solar systems. In R.20-08-020, the Rulemaking to Revisit Net Energy Metering Tariffs, D.22-12-056 (approved on December 15, 2022) established a net billing tariff (NBT), to update incentives for PV solar installations and promote the adoption of such systems paired with battery storage. By mandating high-differential time-of-use rates (i.e., electrification rates), the NBT incents customers to store the electricity produced by PV during the middle of the day and use it for self-consumption during the evening instead of importing high-cost electricity from the grid.

The future growth of NBT solar-paired-storage is an explicit state policy goal. D.22-12-056 establishes a future "glide path" for the expected growth of NBT solar-paired storage and states that "the adopted glide path should encourage sustainable market growth during the transition from a predominantly

[48] "Service Upgrades for Electrification Retrofits Study Final Report," NV5, May 2022, pp.21-22. See: https://pda.energydataweb.com/api/view/2635/Service%20Upgrades%20for%20Electrification%20Retrofits%20Study%20FINAL.pdf.

stand-alone solar system program to one that encourages the adoption of solar paired with storage systems."[49]

Meter Socket Adapter Use in Building Electrification and Transportation Electrification

In the last few years, the market has seen growing commercial availability of MSAs with the ability to add load to a building. These types of MSAs have an additional branch circuit that allow the addition of interruptible loads such as EV charging equipment or HPWHs. Some of these MSAs have a built-in load control systems that stop flow of current to the MSA-connected load when the MSA detects that the load from the main panel reaches a certain threshold.[50] This built-in load control mechanism means that the combined amperage draw from the MSA-connected load and the main panel will not exceed the rating of the utility service conductors. One commercially available MSA also offers a supplementary circuit breaker in front of the main panel's main breaker, offering additional overcurrent protection. These provisions mean that neither the main panel nor the utility service needs to be altered to accommodate MSA-connected loads. Figure 12 demonstrates how a load-adding MSA is connected to the grid and a home's existing electrical infrastructure.

[49] D.22-12-056 at 124. See: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M500/K043/500043682.PDF.

[50] The ConnectDER EV MSA has an embedded load control system that shuts off power flow to the load connected to the MSA when it detects that the load exceeds 80% of the main electrical service rating. For example, if a home's electrical service is rated at 100 amps, and the MSA detects that the home's load reaches more than 80 amps, the MSA will shut off power flow to the EV charger or HPWH that is connected to the MSA.

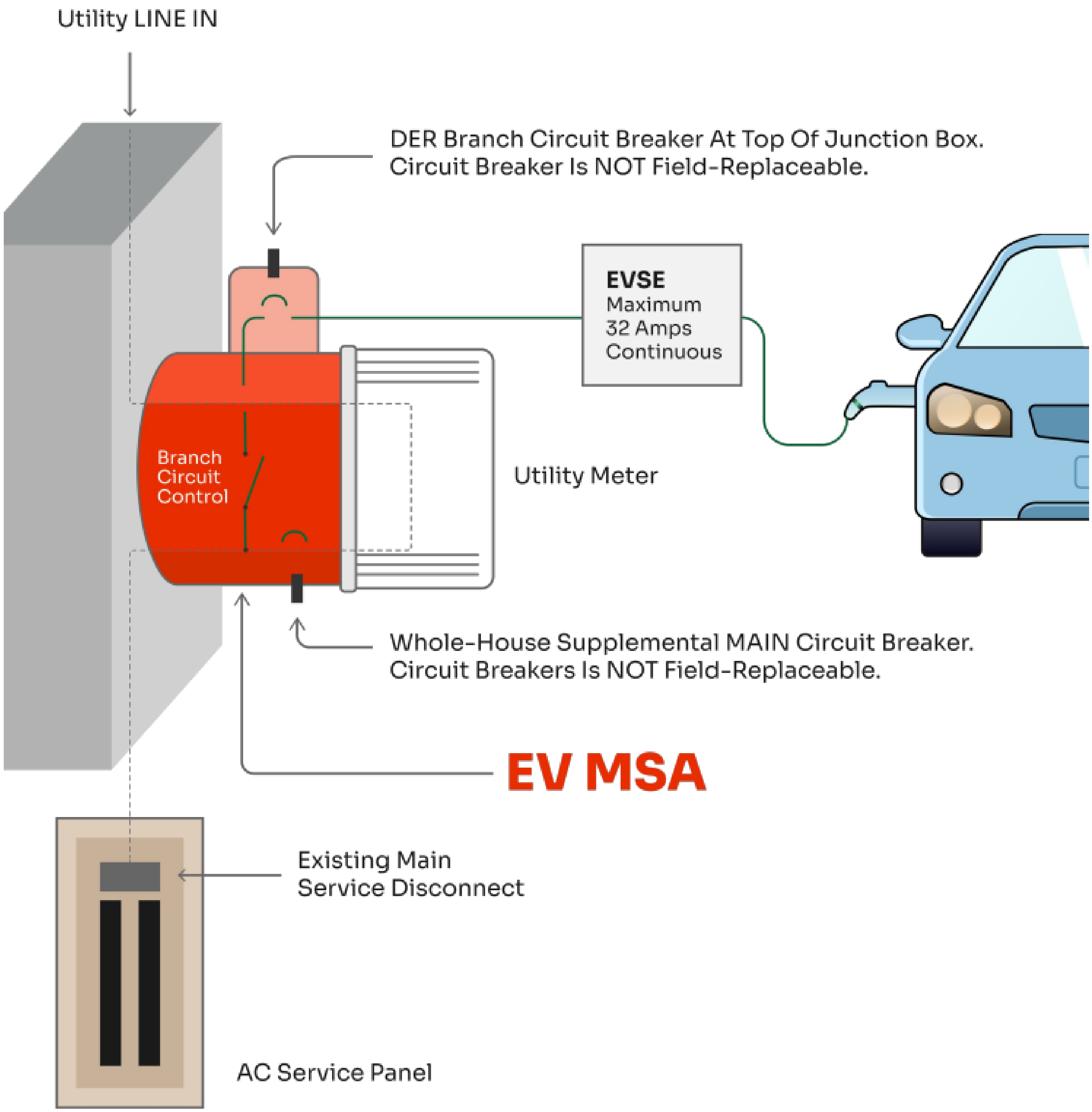


Figure 12: MSA for Adding Loads, Such as EV Chargers[51]

[51] ConnectDER EV MSA – Technical Specifications manual: https://connectder.com/wp-content/uploads/2024/03/ConnectDER-EV_MSA_V1.0-Technical_Specifications.pdf.

Additionally, customers using these types of MSAs can avoid the cost and hassle of adding a subpanel or replacing their main panel if their current one lacks physical breaker space. The MSA has its own built-in branch circuit that can connect to devices, so the added load does not require an additional branch circuit to be added to the main panel itself. Because these MSAs can avoid rewiring or panel replacements or upsizing associated with adding loads such as HPWHs or EV charging equipment, these MSAs can be a lower-cost option for customers looking to electrify their homes with limited panel capacity and/or breaker space.

Meter Socket Adapter Advantages Over Panel Upsizing or Replacement

MSA installation is simpler and faster than replacing an electrical panel and service. These projects do not require removal of the panel, shutting off and on utility power, or local building department inspection. Installation only requires meter removal, installation of the MSA, minor wiring work, and re-installation of the meter on top of the MSA. Although the installation does currently require utility staff to remove and reinstall the meter, the work can be completed in as little as an hour.[52]

Installing and maintaining these MSAs costs less than panel upsizing (resulting from electrical capacity constraints) or adding a subpanel (resulting from breaker space constraints). As mentioned in Section 2.1.2, panel upsizing usually costs anywhere from $1,000 to $14,000. The costs for installing subpanels is slightly lower; a 2024 CPUC-led survey of electricians statewide landed on an average of about $2,211 for this type of project.[53] In contrast, the PV MSAs offered directly by IOUs costs customers $500 in SCE territory,[54] $1,047 for PG&E,[55] and $1,326 for SDG&E.[56] Third party MSAs used for DER applications are still in development, and therefore there is limited publicly available price data, but conversations with one company indicated that the cost for an EV MSA (not including installation costs) cost less than $900 as of April 2024.[57] The same 2024 CPUC-led survey referenced above found that meter collar installation by electricians on average cost $1,832.[58] Even at the upper end of these cost estimates,

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52 https://www.sdge.com/residential/savings-center/solar-power-renewable-energy/renewable-meter-adapter
53 "Fuel Substitution Infrastructure Cost Market Study" summary slides. See: https://pda.energydataweb.com/api/view/3948/CA%20IOU%20Fuel%20Sub%20Preliminary%20Results%20Presentation_FINAL_2024-04-04.pdf.
54 See: https://www.sce.com/sites/default/files/inline-files/%23126256_Generation%2BMeter%2BAdapter.pdf.
55 See: https://www.pge.com/en/about/doing-business-with-pge/interconnections/net-energy-metering-program.html#accordion-8a141835ac-item-9a34edc3ff.
56 See: https://www.sdge.com/residential/savings-center/solar-power-renewable-energy/renewable-meter-adapter.
57 CPUC communications with ConnectDER, February 16, 2024.
58 See: "Fuel Substitution Infrastructure Cost Market Study" summary slides: https://www.cpuc.ca.gov/about-cpuc/divisions/energy-division/building-decarbonization/fuel-substitution-in-energy-efficiency.

customers will likely save anywhere from a thousand to several thousand dollars by opting for MSAs over panel upsizing or subpanel installations.

3 Challenges

This section addresses the barriers facing customers and contractors who want to use alternative methods of calculating a home's existing electrical load. It addresses the current limitations on cost recovery for IOUs to expand their evaluation process for non-electrical isolating, utility-interfacing devices, including non-isolating meter socket adapters.

3.1 Contractors Lack Information Necessary to Assess Amperage Needs

Currently, if contractors want to use the "top down" load calculation method described in Section 220.87, they must ask customers to provide energy usage data. This requires the customer to download the data from their utility to share with the contractor. The contractor then needs to (1) determine the metering interval (e.g., 15-minutes or one-hour), (2) the period over which this data was collected (e.g., 30 days or one year), and (3) the highest energy consumption over this period, which is usually represented in kilowatt hours (kWh). The contractor must then convert this consumption data to peak demand (in amps). While these data are usually available, these steps make it much more difficult for contractors to employ the top-down load calculation method. Such calculations may also be subject to errors.

The consequence of these barriers is that contractors may turn to the more common load calculation methods of Sections 220.83 and 220.84, which will generally estimate a higher existing load for a dwelling than if calculated via Section 220.87. As a result, when adding new electrification loads, a contractor may end up with a final load calculation that may be greater than the actual new peak demand of the home. Consequently, these load calculations may push a contractor to recommend upsizing a building's main panel and electrical service conductors unnecessarily.

Additionally, customers do not have a way to easily discern their service line capacities. IOUs do not have this data readily available. This information is important for customers and contractors to understand how much existing capacity they have on their service line, and to potentially work within these constraints when electrifying their buildings.

As mentioned in the previous section, unnecessary panel and service upsizing can result in burdening customers with thousands of dollars in costs per building and add significant upward rate pressure in the coming decades.

3.2 Scope of Cost Recovery for Meter Socket Evaluation is Overly Restrictive

MSAs interface with the meter, a utility-owned piece of equipment, and therefore they must receive explicit IOU approval before customers can install these devices.

The CPUC has already approved a detailed process to assess the safety and reliability of emerging electrical isolation technologies, which can include isolating MSAs serving this specific function. On January 14, 2021, D.21-01-018 (R.19-09-009, "Regarding Microgrids Pursuant to Senate Bill 1339") directed PG&E, SCE, and SDG&E to file Tier 2 advice letters to define the criteria and evaluation process to test electrical isolation technology and devices in an effort to reduce barriers for microgrid deployment.[59] This decision also allocated $3 million across the IOUs to implement the reliability and safety evaluations.[60] These funds are to be recovered via distribution rates via an Annual Electric True-up advice letter. As of June 2024, PG&E has spent $232,879, SCE has spent $250,759, and SDG&E has spent $81,827 for a combined total of $565,465 spent of the $3 million allocated for these evaluations.[61]

The Commission approved a final process for IOUs to follow in Resolution E-5194. The joint advice letters submitted by the IOUs and Resolution E-5194 describe in detail the evaluation process, including how third parties should submit technologies for testing, what additional testing the IOUs will conduct, how IOUs should communicate feedback to third parties, justification for repeating testing already completed by a Nationally Recognized Testing Laboratory as part of certification to a national standard, and timelines for completion of the evaluation.[62]

Thus far, all devices evaluated via this process have been MSAs, though the process stipulated by the Commission is agnostic to specific device types.

From a technical perspective, this evaluation process could be applied to similar technologies that do not provide electrical isolation functionality, such as the aforementioned load-adding MSAs. However, the IOUs are currently only authorized cost recovery for conducting such evaluations on electrical isolating technologies, and are not currently evaluating non-isolating MSA products. This means that the MSAs that

[59] See: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M361/K442/361442167.PDF.
[60] See D.21-01-018, p.79.
[61] Data responses received from SDG&E (June 5, 2024), SCE (June 4, 2024), and PG&E (May 29, 2024).
[62] See: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M489/K665/489665658.PDF.

lack a grid isolating function, though highly similar to MSAs that do have this function, and which could undergo the established IOU evaluation process, are not being evaluated in practice. As discussed above, some commercially available MSAs with the ability to add a branch circuit for connecting interruptible loads do not have electrical isolation capabilities. Thus, under the current situation, while such non-isolating MSA products may receive third-party certifications and safety approvals, without IOU approval they still cannot be installed in customers' homes.

4 Recommendations

This section recommends that IOUs provide customers with peak demand information on their bills. Additionally, it recommends that the CPUC approve expanded cost recovery for IOU evaluation processes of utility-interfacing devices to include applicable, non-electrically isolating devices.

4.1 Mandate that IOUs Provide Additional Data on Customer Bills

Given that utilities currently have smart metering data readily available, staff recommend that IOUs report the peak energy consumption (in kWh) and peak demand (in amps) over a 15-minute interval for two time periods: the last 30 days and the last year (if applicable) from the billing date. IOUs should report this data clearly on a customer's monthly electronic and paper bill, including the period over which the data was collected and interval (i.e., 15 min or 1 hour) of data, and also make this data easily accessible on a customer's online account.

This information can be readily used by electricians to calculate a home's load via the "top down" Section 220.87 method, without the hassle of downloading customer electricity usage data and additional calculations. Such smart meter data should be acceptable to use within Section 220.87. Utilities should implement these billing changes within one year of the release of a proposed decision, and coordinate this change with other pending and anticipated updates to their billing systems to the greatest extent possible.

Staff also recommend that IOUs collect service line capacity (in amps) for customers and report this information on customers' bills. This information is not readily available from IOUs currently, but would be helpful for contractors and customers to understand the existing constraints/capacity of the service line and find ways to work within this existing capacity. This information should be tied to meter locations and stored in a database. Such service line capacity data should be collected alongside whenever utility staff visit customer premises for other purposes, such as meter inspections or if any on-site work needs to be conducted.

The Commission has historically been strongly supportive of strategies and technologies to optimize existing panels, with the end goal of reducing costs for customers interested in electrifying and reducing upward pressure on rates. Facilitating the use of an alternative load calculation method that can more accurately estimate existing loads and help avoid unnecessary panel and service upsizing helps to further support the overarching goal of cost savings for ratepayers.

4.2 Authorize IOU Evaluation of Non-Isolating Devices

Staff recommend that the IOUs begin using the existing safety and reliability evaluation process for electrical isolation technologies adopted in Resolution E-5194 to evaluate other highly similar technologies and devices that do not provide electrical isolation, but for which the existing evaluation process is applicable from a technical perspective. It is expected that most, if not all, of the latter devices will likely be MSAs, though the evaluation process for non-isolating technologies should remain neutral to specific technology types. Staff also recommend that IOUs be authorized to use any remaining funding from the $3 million previously allocated across IOUs in D.21-01-018 for the recommended evaluation of non-isolating technologies.

Providing a formal cost recovery pathway obligates the IOUs to evaluate non-electrical-isolating technologies like (but not limited to) MSAs with expanded DER capabilities. This will add another useful tool to a growing list of electrification strategies aimed at avoiding unnecessary panel and service upsizing and saving customers and electric ratepayers money.

Expanding DER access via MSAs or other devices that may benefit from this evaluation process) can also facilitate achieving the goals set out in the CPUC's Distributed Energy Resources Action Plan 2.0, which aims to ensure that DER policy implementation helps meet climate goals and is coordinated across CPUC proceedings.[63] That is, expanding DER access via MSAs, or other devices that may benefit from this evaluation process, contributes simultaneously to the goals of several different CPUC proceedings and processes, including Building Decarbonization, Transportation Electrification, High DER, Streamlining Interconnection, Energization, and the Self-Generation Incentive Program.

[63] See: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M467/K470/467470758.PDF.

5 Conclusion

Building decarbonization is an essential strategy to help California meet its goal of carbon neutrality by 2045. Ensuring that all buildings in California switch to all-electric end uses will not be a cheap endeavor, however. Ratepayers may have to cover substantial distribution system upgrade costs to meet the growing electricity demand from the rapid electrification of buildings and vehicles. With electric rates climbing higher each year, it is imperative that the CPUC seek to reduce any unnecessary costs in the push for building decarbonization. Higher electric rates will discourage electrification by pushing up customer bills as they move off gas and increase their electricity consumption. This has particularly detrimental impacts on low-income households, who already spend a disproportionately large percentage of their income on energy costs.

Helping customers avoid electrical panel and service upsizing has the dual benefit of reducing costs of electrification to individual customers while also reducing utility spending (for service upsizing), which reduces upward rate pressure. This proposal's recommendations aim to support strategies that allow customers to electrify their homes and vehicles within the existing capacities of their electrical panels and electrical services. By providing customers with peak demand data that is readily available to IOUs, Staff aim to make it easier for contractors to advise against panel and service upsizing. Additionally, expanding cost recovery for IOUs to expand their approval process for MSAs and similar non-electrical isolating devices can help add another "tool" in the toolkit of panel optimization strategies.