

Q&A from December 7, 2023 BayREN Regional Forum - Residential Electrification in the Real World: Navigating Panels and Permits

Disclaimer: We have removed duplicates and edited for readability and to remove personal information but have not fact-checked the content of this document. Answers include responses from attendees as well as presenters.

Question	Answer(s)
<p>Can you suggest resources where homeowners/contractors can get good information about panel optimization and load sharing?</p>	<p>Some resources are being shared in the chat. One good one to check out is the "pocket guide" to electrification from Redwood Energy (see pages 22-23): https://www.redwoodenergy.net/research/a-pocket-guide-to-all-electric-retrofits-of-single-family-homes</p> <p>Also this article has great links: https://www.canarymedia.com/articles/electrification/yes-its-possible-to-electrify-a-home-on-just-100-amps</p>
<p>The 200-amp standard for newer homes - what's "new"? When did this shift generally occur? Thanks!</p>	<p>Seems to have been mostly in the 1980s. Here's an article: https://www.thespruce.com/service-panels-changed-in-the-1900s-1152732</p>
<p>As a mechanical contractor, I have found it challenging to convert some larger gas furnace forced air systems to heat pumps. The furnace may be 75,000 btuh with a 4 ton air conditioner. If I put in a 4 ton heat pump, it typically puts out 48,000 buh heating. I would need to add electrical strip heat to make up the difference, which adds electrical load. Their utility bills will go up if they dont have solar.</p>	<p>I replaced a big old 100,000 btuh furnace with a 5 ton (60k btu) heat pump and it struggled on cold days... until I got rid of my thermostat setbacks and let it keep the house at one consistent temp. Now it works great. I think heat pumps HATE setbacks.</p> <p>One way to look at it with PG&E "Green Button" daily gas usage data is that each ton of heat pump size can deliver the same heat as 2.25 Therms/ peak day of prior gas use if it only ran at rated speed to 15 hours in the peak day (leaving a 9 hour sizing cushion). (2.25 = 12,000 Btu/ton-hr X 15 hours/peak day of the year/ 80% prior furnace efficiency/ 100,000 Btu/Therm). So if the peak day gas use of that hous was less than 9 therms of gas, you could meet it with a 4 ton heat pump with 9 hours of run time cushion between 15 and 24 hours.</p> <p>Running HVAC load calcs, or better yet obtaining actual run data from a smart thermostat, may be used to clarify whether the existing furnace is right-sized or oversized. Using beestat data from our ecobee thermostat, we found the existing furnace could be replaced with a heat pump half the size, and still be comfortable down to an outdoor temperature of 15 degrees. Like Steve recommended, that is with set-it-and-forget-it thermostat setting instead of sizing the heat pump to recover from a deep overnight set-back.</p> <p>From my experience, 75,000 btuh is typically only needed for most homes (1,500 sq ft - 3,000 sq ft) that are very inefficient. Homes that are well air sealed and insulated with upgraded windows typically can heat with closer to 30k - 50k BTU/hr without issue. Curious if you are running Manual J load calcs on any of these homes, especcally after some EE upgrades? Have you ever considered including energy efficiency measures as part of your HVAC upgrade upgrade offerings? Tom's comments are also super valid that the math is not 1:1 on therms/hr to Btu/hr conversion.</p>
<p>In an apartment building, are the smart breakers on the building level or the unit level?</p>	<p>You can have smart breakers at both levels. As Jack mentioned, it matters what is on the unit level panels versus the main panel.</p>
<p>what is the cost comparisons between an upsized panel alone vs. the costs of the different technologies that avoid the need for upsizing the panel? What is typical cost of upsizing a panel and is it justified that doing so is more cost prohibitive than alternatives?</p>	<p>One study completed by NV5/Redwood Energy has estimated costs of upgrading panels/service: https://www.redwoodenergy.net/research/service-upgrades-for-electrification-retrofits-study-final-report-2</p> <p>"The typical costs associated with increasing electrical capacity in residential retrofits fall into three categories - Utility Service Upgrade costs, customer-owned equipment costs, and other miscellaneous project costs which may apply. The total cost for all three categories was reported to range between approximately \$2,000 to well over \$30,000 or more."</p> <p>I just made an example yesterday that had about \$900 premium to reduce the panel load well below 100A vs. a \$4000+ cost and multi-month upsizing adventure to try to avoid power efficiency.</p>
<p>Our company installs a lot of HPWH but we have had pushback from a few cities regarding the 120V plug in models because they don't believe the manufacturers are meeting the NEC. Are there programs available to City Building Departments to educate them on heat pump technology?</p>	<p>This webinar is from 2021, but covers 120 volt HPWH: https://www.youtube.com/watch?v=EngY7FubjNE Also this 2022 Canary Media article with context on the development of the 120v models: https://www.canarymedia.com/articles/heat-pumps/finally-a-heat-pump-water-heater-that-plugs-into-a-standard-outlet I'm not an NEC expert but maybe that helps?</p> <p>Bring a code book and show them the segment allowing manufacturer-installed cord-and-plug. I forget the NEC section right now but it's new to NEC 2020 which is why some inspectors don't know it.</p> <p>The concern has been about plugging in a "fixed appliance" to a shared circuit. Do you know if NEC 2020 addresses this?</p> <p>Shared circuit is not addressed in NEC. I don't know of a provision that prohibits automatically disconnecting water heaters in the NEC, but it's true that some jurisdictions don't allow this since they consider the water heating a "required" load for residential. I haven't heard of issues with inspectors turning down the shared circuit models but if the load calc works...</p> <p>In our experience the city of Campbell has been requiring dedicated circuits for all heat pump water heaters, even plug in 120V models.</p> <p>BayREN has a training on heat pump water heaters for building departments and is adding</p>
<p>What financial incentives / rebates are available and understandable by homeowners to claw back expenditures already made for electrification?</p>	<p>Depending on what you do, some need to be with specific contractors in an incentive program; others just require contractors to be licensed. Check out http://www.switchison.org (an initiative of the nonprofit the Building Decarbonization Coalition) to look up incentives in your zip code.</p> <p>Please visit the Switch Is On. There are also some rebates available through TECH and tax credits under the IRA. There are not as many rebates available for panels as for electrification equipment. A few CCAs also have panel rebates but those are location-specific.</p>

<p>Tom, you mentioned too many high powered EV chargers as a real problem that can be caused by overpowering / unnecessary upgrades, but can you mention some more?</p>	<p>Related: I heard from Pat Burt, former mayor of Palo Alto, that PAU has had to do lots of transformer upgrades because so many residents were putting in very high speed EV chargers. This caused them to forecast a huge cost to upgrade their grid to handle full electrification.</p> <p>Not Tom, but I think he's referring to the fact that most EV drivers do not need to charge back to full every night/day, which requires 50 amp EV chargers to pull from the grid. If 1k homes are all charging at the same time, that's a huge electric draw at once. The vast, vast majority of drivers only need to top of 30-40 miles a day, which is achievable with 12 amp level 1 charging overnight.</p> <p>Understood - just curious about examples of other real problems caused by systemic oversizing.</p> <p>On that 5 end use horizontal bar graph (slide 15) I shared, the common problem is each of the 5 end use categories are being selected and sized for oversized jumbo power consumption (e.g. 30 A Resistance Dryers, 50 Amp Cooktops and separate 30 Amp wall ovens, 30 Amp Water heaters (the most common so far), and oversized HVAC > 3 tons, and oversized > 20 A EV Charging.)</p> <p>A problem is split incentives where the contractor wants to upsize and a lack of programs to incent "better sizing".</p>
<p>who is the best person/group that can make a good electrification plan?</p>	<p>My opinion, having surveyed this field over the past year: QuitCarbon does a great job. SVCE plans to roll out an "electrification concierge" service next year. SwitchIsOn has an "electrification ambassador" service, but I don't think they do complete plans (yet?).</p> <p>Correct, Switch is On Ambassadors are volunteers who are enthusiastic about electrification and some have upgraded individual appliances or whole homes. If you want to meet an Ambassador, you can request an intro via this page: https://switchison.org/speak-expert/ (Frank Vargas at the Building Decarbonization Coalition is our Ambassador liaison). They are not contractors and don't provide formal plans - just individual people who have some experience in electrification. Also check out the SIO email newsletter for ongoing inspiration and resources: https://buildingdecarb.org/newsletter-sign-up</p> <p>I'm a Switch Is On Ambassador who fully electrified his home in San Bruno within eight months. Feel free to ask Frank for me, happy to chat!</p>
<p>A heat pump dryer - does that need more/different ventilation or space than a traditional gas dryer?</p>	<p>I like my large (4.3 cubic foot) 120V combo Washer Dryer from LG. My daughter loves her larger (4.8 cubic foot) 120V combo Washer Dryer fast heatpump version from GE. Both models just plug in there the washer normally plugs in. And they both free up \$10,000 worth of bbay area floor space.</p>
<p>Can we get recommendations for "Smart Panel" providers? I have had SPAN panel upgrade but I am unclear if it is really smart for things like load sharing etc.</p>	<p>I don't have a smart panel myself, but Redwood Energy talks about tools to switch off between things like your EV charger vs. laundry dryer etc. as noted in their Pocket Guide: https://www.redwoodenergy.net/research/a-pocket-guide-to-all-electric-retrofits-of-single-family-homes</p> <p>SPAN is one option, but they cost about twice as much as a regular electrical panel. That said, it could be useful if you avoid other upgrades.</p> <p>I've been looking at the smart panel options. Unclear to me whether any are currently code-approved for service load management. SPAN service load shedding feature (PowerUp) has not been rolled out yet; is scheduled "for release soon to a limited number of users" "with select installers in specific geographies." Lumin says their smart panel is not code-approved for service load management.</p>
<p>Laura said that BAAQMD will require in 2027 that homeowners "switch over" to HPWHs. That is not quite correct. It should be "replace failed HPWHs" beginning in 2027</p> <p>The electrical police will not come knocking on our doors in 2027. Replacing a failed gas water heater will require HPWHs, but not until then.</p>	<p>Thanks for clarifying. More information on the Air District rules is available here: https://www.baaqmd.gov/rules-and-compliance/rule-development/building-appliances</p>
<p>why is progress in electrification of commercial buildings going in the negative direction?</p>	<p>I am not sure it is going in the negative direction. There are challenges - technical and market - that are more difficult in commercial buildings, but there are several notable efforts currently going on. If there is a specific challenge you are referring to, we can discuss further.</p>
<p>For Laura: Is there any work being done currently to establish a set of recommendations to amend the NEC to remove backed-in biases to overestimate load more than necessary to protect safety?</p>	<p>Yes, Brennan Less at LBNL put in a set of recommendations to National Fire Protection Association for updating the 2026 NEC</p>
<p>If customer has a full electrical panel (no available knockouts for additional circuits. Can I use one breaker for a sub panel and mount subpanel next to main panel? This gains me more space for additional circuits.</p>	<p>Yes! And when the slide deck comes out see my slide (26) on 11 ways to free up panel spaces. Adding a sub panel is one of those.</p>
<p>What efforts are being made to "make the grid ready" or "keep up with" mass building electrification? Can the grid handle the increase in power usage? And how will electrification increase the occurrence of blackouts/power outages?</p>	<p>BayREN's June 2023 forum covered this topic in depth; see recordings here https://www.bayren.org/events/grid-what-it-and-should-it-shape-policy-all-electric-buildings-2023-06-21</p> <p>My personal summary from attending that was: yes, the grid can handle it, as long as PG&E gets a heads up about large new developments at the planning stage (not when they're newly built) and by shifting load to off-peak times (like Time of Use rates that incentivize running your dishwasher, water heater, dryer, etc. when power is cheap and clean at noon with solar on the grid and not at night 4-9 pm when there is a peak and less solar in California).</p>
<p>The concern has been about plugging in a "fixed appliance" to a shared circuit. Do you know if NEC 2020 addresses this?</p>	<p>I think of that concern as a conflation of needing to count fixed (attached mechanically to the building by screws or plumbing) appliances in the NEC 220.83 load calculation separately, and the use of code assumption that general light and plug loads are already assumed to be 3 Watts per square foot of conditioned space.</p> <p>But logically a shared circuit fixed appliance should have its load counted in the calculation and should be allowed to stay on a shared circuit.</p> <p>A lot of building departments are very concerned with following the letter of the law when it comes to NEC which creates hurdles for installers. We've even had to remove a HPWH from a customer's home due to these requirements. BeyREN tends to be reputable enough to smooth out concerns for the inspectors so any resources are very much appreciated.</p>

<p>For an uneducated homeowner, who is best able to HELP them navigate the choices of appliances/technology and the different issues involved in making these choices?</p>	<p>There are several programs across the Bay Area that can help with incentives including those by BayREN.</p> <p>The Switch is On campaign is a good starting place to see resources in your area. https://switchison.org/</p> <p>Home Energy Analytics and QuitCarbon are two examples of 'concierge' type services available.</p> <p>TRC is working with SPUR and BIG on a 'Decision Guide' to walk homeowners through the process and inputs necessary to make the right decisions.</p>
<p>I'm a homeowner looking to electrify. Can BayREN help me to build an electrification Plan? I'm on 100AMP and trying to avoid a panel/service upgrade. I get conflicting advice. Would love to work with Tom!!</p>	<p>BayREN does not currently provide electrification plans. BayREN's Home+ program provides rebates for energy efficiency and electrification projects, that can be combined with other incentive programs like TECH (statewide) and (for Marin residents) Electrify Marin. Our office just finished a webinar series on electrification you might find useful, we have the recordings here: https://www.marincounty.org/depts/cd/divisions/sustainability/learning-resources. Beyond that, others have mentioned services like QuitCarbon and HomeIntel, which are services that can help homeowners navigate electrification projects.</p>
<p>Why are licensed contractors allowed to do unpermitted work? It has always seemed strange to me that homeowners carry sole responsibility here, when the contractor is usually the only one who has the domain knowledge.</p>	<p>Both homeowners and contractors are at risk. Contractors are subject to fine of up to \$5k per violation if caught, and disciplinary action up to loss of license. https://cslb.ca.gov/Newsletter/2018-Summer/Building_Permits.asp</p>
<p>For Menlo Park CAP: was there a date set for accomplishing the 95% goal of electrifying existing buildings?</p>	<p>The goal is by 2030</p>
<p>Which state program provided Menlo Park with \$4.5mil for equitable electrification?</p>	<p>It came through State Senator Josh Becker's office. https://sd13.senate.ca.gov/news/in-the-news/july-7-2022/45-million-grant-the-state-sparks-menlo-parks-conversion-to-all#:~:text=State%20Sen.,residents%20in%20electrification%20conversion%20projects.</p>
<p>Why not allow street parking overnight?</p>	<p>Different jurisdictions have different reasons -- sometimes narrow streets, sometimes aesthetics</p>
<p>Do you have any research on heat pumps with low decibel ratings? City of Santa Monica is trying to do a very similar zoning amendment as Menlo Park and we received many questions from our Planning Commission, particularly on the availability/feasibility/pricing of very quiet heat pumps</p>	<p>The only really quiet one out there that I'm aware of is the SanCO2. Also probably the best on the market from a global warming perspective.</p> <p>For the HVAC heatpump equipment the noise levels are more available. Tom Kabat shared a list with us including: Mr. Cool 1-4 ton that were below 50dB and some Mitsubishi units that would comply; and some LGs that would comply (but at the setbacks). For HPWH, Rheem was able to provide their dB ratings over the phone, but they and other manufacturers have removed this from their product specifications.</p> <p>For Mitsubishi Electric heat pumps, the sound level range for most of our residential outdoor units is 50-55 dB. All are under 60 dB. If more information on the ratings or how we test would be helpful, please reach out. cbradt@hvac.</p> <p>For heat pumps - if they are ducted they can be almost silent in my experience. The bigger challenge is heat pump water heaters. They can be ducted to outside to reduce noise, but that is costly and not always possible depending on water heater location.</p>
<p>What is the name of that place in Santa Rosa where we can see all the different heat pump water heaters?</p>	<p>The Advanced Energy Center owned by Sonoma Clean Power. A great facility!https://scpadvancedenergycenter.org/</p>
<p>The SanCO2 heat pump is not currently eligible for the TECH-MF program.</p>	<p>Correct. SanCO2 units are not able to connect to WiFi or a TOU schedule, which is the new requirement to qualify for TECH</p>