

Q&A From the County of San Mateo's Costs to Decarbonize Single-Family Homes Webinar

Question: How can we scale this study, so that every resident has the same guidance, support, and contractor qualifications list?

Answer: I recommend that each County and or each CCA also try to repeat this study in their territory because it is a valuable learning experience for: the entity, the consultants, the contractors, and the participants. It surfaces and suggests solutions for the problems we will encounter as we get more serious about climate preservation. -Tom

Question: Re-plan: are these HP WH only or include furnace?

Answer: includes HPWH, HP heat and cool, Cooking, Drying and EV charging all for decarbonization. We also showed solar and batteries as options to make electrification even more affordable.

Question: why is 200A is the target, and how many years into the future will 200A be sufficient? Especially say if people get multiple EVs and AC due to climate change.

Answer: by our calculations 100A is sufficient for most homes under 2,800 sqft in size. This includes the use of EV charging for up to (2) EVs charging per evening. 200A would be sufficient for most parcels with one home on the property for as long as I can imagine. -Blake. Tom adds: 100A provides up to 24 kW of power and that's enough to power a big lifestyle including over houses up to 2,800 sqft with driving and cooking etc. As time goes by devices are getting more efficient and smarter and having integrated batteries so it's getting easier to fit more lifestyle onto 100 Amp panels. -Tom

Question: Tom--was that including EV charging in the 15 minute interval?

Answer: Yes, the loads shown are for either 15 minute or 60-minute intervals and they include EV charging if the customer had it. We see larger EV chargers tend to set the house peak (because they are often larger than the prior house peak), while smaller EV chargers can partially add to the house peak that is set by cooking while heating and drying, etc.

Question: Regarding your point about the unused capacity -- did you also account for single instant peaks that could potential trip breakers but would only last a few seconds or so?

Answer: Breakers have time delays for short duration excursions of a few seconds or minutes that doesn't overheat wiring. It seems extremely rare that homes trip the main disconnect (and create that nuisance trip). I have only heard of one case, and then the owner just had to turn off a couple of devices before restarting.

Question: Does the contractor create the plan and draw the schematics?

Answer: For the County study, we created the plan, equipment list and drawings and sent them as the quote request packet.

Question: but do you know for a fact any of the data WERE charging at the time?

Answer: No. We know the total load for each house at the highest peak interval of the year, but not any of the individual loads that were turned on in that time interval.

Question: For the furnace replacement for the Mitsubishi HP, did you need to make any upgrades or improvements to the duct system?

Answer: Sometimes as needed due to poor duct quality. But to save \$6,000 per home we focused on sizing the HP under 3 tons (36,000 Btu/hr = 36 kBtu) so the existing furnace ductwork could deliver the air needed to deliver the heating and cooling. The smaller the heat pump the better so 2.5- and 2-ton systems are even better.

Question: what was the model of the 30" induction cooktop?

Answer: It was like most 2022 240V 30amp induction cooktops. The new radically different Impulse brand 120V battery induction cooktop was not available at the time, but it may be a cost-effective product in cases where it's costly to get a new circuit to the kitchen. We saw kitchen circuits priced around \$1,000 to \$1,500 within the bids.

Question: Are there loads besides the EV charger that can be shed? Have you seen municipalities approve those in load calculations?

Answer: Water heater reheat, and heat pump space heating can be shed without interrupting family fun. Shedding is for the couple of minutes per year that all 4 burners and everything else in the house was on for the giant winter cookie baking party.

Question: For the Wallbox Pulsar EV charger with adjustable amps, if you set the current lower, can you reduce the nameplate rating in NEC calculations? Or would you have to use the NEC calculation method based on previous year's load?

Answer: You can use the DIP switch settings you chose when installing it. You can use them in either NEC calculation method [220.83(B) bottom up or 220.87 top down]

Comment: Please comment: a lot of the scary, panic stories that electrification opponents shout about, are more about the home being old: Equipment wears out, insulation is lacking, etc.

Answer: I also notice folks wanting to add other projects onto electrification projects and then hang the cost of those other projects on electrification. That's not an accurate way to talk about electrocution costs. But some cases needed some attic insulation added to avoid the cost of putting in a larger heat pump and larger ducts. That was fair to spend \$2k on added insulation to avoid spending \$3k on enlarged ductwork to accommodate a larger heat pump. -Tom

Question: Does having a plan help residents to address the ability to oversize their solar system compared to their historical energy needs?

Answer: Yes, it helps them choose a size and show they have intention of using it. NEM 3 allows 150% solar sizing compared to current loads.

Question: what did you recommend in the case the home has mostly or all knob and tube electric wiring? (i.e., homes circa 1920's 30's?) and how much does replacement cost (if recommended)?

Answer: We design the electrification for the 5 new loads (Water heating, Heating/ Cooling, Cooking, Drying and Car Charging with new conduit enclosed circuits. We don't put any new load on the old wires. So, knob and & tube homes are fine for electrifying. Also, this brings up a common practice of contractors and homeowners interested in growing the job to solve more problems around the property. Keep one eye on electrification and let the other eye look at other home improvements in a different ledger.

Question: How can an average homeowner go about having an electrical plan created? Are there any contractors who provide this service?

Answer: Yes, there are services and concierges. Some are: Quit Carbon, Home Intel, and Emerald Eco. I see more joining in soon.

Question: did you exclude homes with solar panels from this study? We went through some of these considerations when we replaced our solar panels 2 years ago. Don't solar panels and time of use affect the decisions you are talking about?

Answer: Some homes included solar from before and some did not. We analyzed the cost effectiveness and cash flow using the EV-2A rate after an EV is included.

Question: How long did it take to develop an electrification plan for a home, from site assessment to getting a customer a quality quote?

Answer: Let's talk more about that at the end. There is a wide spectrum of plans that can be made for one home. It can be as simple as a list of the most efficient equipment models and size estimates for them. That might leave lots of extra space on the panel and the grid. Or you can do more work to make a plan that saturates your panel and uses all its ampacity. So that might be 1 hour to 10 hours for the plan. Then extra hours to get a quote from a contractor. In calendar time it could be 2 to 20 days depending on responsiveness of consultants and contractors.

Question: Can you expand on the process of using gas bill data vs a Manual J calc?

Answer: Manual J is an area (sqft) based heat loss calculation for all building surfaces, windows etc. and for infiltration heat loss estimates using design temperature data (e.g., about 32 F in parts of SM County). The daily gas bill data method has us subtract the average summer daily use from the highest winter day's use in therms and multiply that by 100,000 Btu/therm and by the furnace efficiency (say 80%) and divide by 12,000 Btu/ton-hour of heating to get ton hours of heating needed (by the home and ductwork) on the peak day last year. E.g. 30 ton hours. Then divide the number of ton-hours by about 12 hours to pick a conservatively large sized heat pump that could meet the peak day's needs while only needed to work half the day long. (e.g. 2.5 tons = 30/12)

Question: Did you consider using smart thermostat data for heat pump sizing rather than gas bill data?

Answer: No. I'd like to look at that if you have some. -Tom

Question: are there any provisions for low- or limited-income homeowners to make any of these changes?

Answer: Yes. There are low-income assistance programs available and there are discounted electric rates available through the CARE and FERA programs that make these changes more economic for low-income customers. The net costs were figured out for low, medium, and high incomes, and the cash flow graph was presented for a low-income case.

Comment: www.zerocarbon-home.com

Answer: This is the web site for the web App Josie and her son made that distills shared engineering insights and enables easier data organization and automatic calculations.

Question: The Energy Code requires Manual J load calcs for Altered HVAC. How are you getting around this code requirement by using the gas meter history? (150.2(b)1.C, refers to 150.0(h)1)

Answer: For the study, we compared the results of Manual J and our peak day gas usage and found we could pick the same size equipment by using an assumption of 12-14 full load hours of operation on the peak day. We did not apply for permits. The study stopped at handing over the plans and reports and

contractor bids to the homeowners. Then the regular contractor and customer can proceed from there the normal way.

Question: Do you have data on the INCREASE in home value for upgrading to electric? I'm sure the resale value is improved.

Answer: Logically it would seem the electrified home value should increase by the cost saved by not having to do the project in the future. And even just having a plan can increase the value of a home by the amount by which a plan can allow lower cost electrification (e.g., \$3k-\$30k by not having to do a panel upsizing, or by the cost of getting such a plan)

Question: So, can we make our home zero carbon (adding solar and batteries) and EV charging without upsizing the 100amp panel?

Answer: Yes, for homes under about 2,800 square feet. Over that size is also possible but would take even more attention to power savings like, added insulation using one or more of the following: a combined washer/dryer machine, 120 V plug-in 80-gallon HPWH(s), a 120 V battery assist cooktop. Etc.

Question: How does the new NEM v3.0 change your study results on costs or on payback?

Answer: The difference NEM 3 makes is that it makes the battery more important at improving the solar economics. The cashflow line for the battery plus solar is unchanged by NEM 3. But the cashflow for naked solar is less attractive with NEM 3.

Question: Can you talk about the timeline for submittal of this study to policymakers? More outreach and input to the consultants probably needed.

Answer: Currently this study is more informative for industry professionals. No current plans of submitting this to policy makers now. We plan on building on the findings of this study and hope to determine what that looks like soon.

Question: Big? What kind of costs for the system? How much money can I save on the right system?

Answer: If you are asking about HVAC sizing, systems 1-3 tons cost less than 4 tons.

Question: Are there similar rebates like PCE's in other CCA territory? EBCE? IF not, why not?

Answer: Some do, some do not. I am unsure whether EBCE has an additional rebate for single-family home HPWH. Each CCA has a limited funding pool and needs to decide where to put their funding.

Question: Did you consider the CA Energy Smart Homes Whole Electrification incentives? Do these stack? https://www.caenergysmarthomes.com/wp-content/uploads/2022/11/Energy-Smart-Homes_SingleFamilyAlterations_FS.pdf

Answer: CA Energy Smart homes cannot be stacked with other CPUC funded incentives such as BayREN.

Question: Do these costs include any drywall, new framing, or wall finishes? If not, what would those costs be?

Answer: We saw that little or no drywall work was needed. But for panel upsizing you may need stucco work etc. if the panel is recessed.

Question: For the gas-to-gas replacement average cost of \$13,000, does that include replacing or adding air conditioning?

Answer: A couple of bids for gas furnace plus central air conditioning were about \$13k on their own (before water heater, cooktop and dryer). High (95%) efficiency gas furnaces and an air filter were about \$8k. Lower (80%) efficiency gas furnaces were about \$5k.

Question: Sorry if I missed this but if a home has a 100amp panel and want to use a load pausing or load sharing smart device instead of upsizing the panel, what is the typical installed cost of one of these loads sharing/pausing smart devices?

Answer: Around \$1000 for the hard-wired pausing sort, that eliminates the charger load from the panel peak load, and about \$350 for the plug-in circuit sharing device that has the charger wait until the dryer is done. That one eliminates the smaller load (e.g., dryer load) from the panel peak load.

Question: What energy cost escalation rates did you use in your projections?

Answer: That's all on slide 70. Energy cost annual escalation rates*:

Natural gas: A 6.0%

Electricity: A 3.2%

Gasoline: A 5.4%

*California Public Utilities Commission Report entitled "Utility Costs and Affordability of the Grid of the Future: an Evaluation of Electric Costs, Rates and Equity Issues, Pursuant to P.U. Code Section 913.1", February 2021, p. 73.

Question: What % interest was used to calculate the electrification loan amounts?

Answer: That's on slide 70:

PCE Electrification loan term: 10 yrs.

PCE Electrification loan interest rate: 0%

Electrification loan max: \$10,000

Solar/battery loan term: 20 yrs.

Solar/battery loan interest rate: 5%

Market rate loan term: 10 yrs.

Market rate loan interest rate: 6%

Question: Do you break this down without the EV - just focused on the home decarb that this session is focused on?

Answer: We included the EV. It's easily separable from capital costs by simply selecting the after-incentives cost-premium to the counter-factual gas car that would not be bought. It's currently embedded in the cash flow as a capital wash. This basically assumes the user would have bought a similar class of equally enjoyable (features and status) gas car. A future project could explore cash flow w/o EVs. Other entities can produce the cash flow analysis using all their own assumptions. There are thousands of permutations.

Question: How much can solar capacity exceed current pre-decarbonization electrical use under current NEM 2.0? I want to submit plan to expand current solar under NEM 2.0 to cover replacement of gas water heater, cooktop, and add EV charging. Need to submit plan to utility prior to April to stay on NEM 2.0. Thanks for great info and webinar.

Answer: To secure NEM 2 treatment you would need to execute a solar contract before about April 13th, 2023. Your contractor can help you. I don't know how to secure NEM2 with DIY solar.

Question: Can we talk through the GHGs over the 30-year projection?

Answer: In our client territory San Mateo County inside Peninsula Clean Energy (covered by its current 100% carbon free portfolio going toward 99% of time matched 24X7 with carbon free sources, and the remaining 1% matched with carbon free sources before or after the load) we treated the electric emissions as carbon free. For the fossil fuel emissions, we counted the stack emissions and the upstream scope 2 emissions just like we did for electricity.

Question: Tom and Josie, I imagine you're familiar with PCE's conclusion that the difference in operating costs for heat pumps vs gas alternatives is negligible for PG&E customers. Have you investigated why your results are so different?

Answer: Our fuel cost savings start with the EV gasoline savings and the very small heat pump savings compared to grid electric heat pump operation costs being an approximate wash at the start. But then we look out further and over time the CPUC 6% rate rise in natural gas grows the heat pump savings and the solar system can lower the electric costs, while the electric grid rates are rising at 3.2%.

Question: Would be curious to see this analysis for cash flow and annual home energy costs with EV costs (to buy vehicle) included and gasoline savings taken out- would that significantly affect cost savings in the model?

Answer: I'm not sure I understand. That sounds like a scenario where someone buys an electric car and does not drive it but continues to drive their gasoline car to incur the gasoline costs.

Question: How do you address the concern for grid blackouts to not go electric?

Answer: We show that homes with solar and batteries have better cash flow than homes that stayed on fossil fuel. We assume the solar and batteries would make the home perform better than the neighbor gas home that could not run its furnace or AC or tankless water heater or dryer or any other electric appliances.

Question: Are there any trainings for planning/building staff that already exist?

Answer: BayREN has training for Planning and Building Staff.

Question: Would Tom want to share the link to the home-owner presentation that he just gave on this topic?

Answer: Here's a link to Tom's recent presentation for homeowners on How Electrification is Getting Easier. <https://greenblueandyou.org/home-electrification-january-2023/>

Question: How many of these homes have completed projects. Are there any take aways from projects?

Answer: A couple of the homes have completed projects in solar and HPWH. The clients are sounding confident about contacting contractors now that they have plans in hand.

Question: And could we get a list of contractors to contact to do a home plan?

Answer: It's in the presentation that will be sent to you in a follow up!

Comment: I love this pairing idea, Tom! It'd be wonderful to have a platform allowing us to "band together".

Answer: Agreed! Perhaps using Next Door would be a good experiment to gather one or more nearby neighbors as shopping buddies. Does someone want to start a post saying something to the effect of: I'm looking for a heat pump shopping buddy to join me in shopping for our best bulk buy deals?