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Simplifying Home Electrification with Circuit Controls

CEC Workshop: SB68
August 30, 2022
Josie Gaillard
Tom Kabat
WHAT IS SB68?

• Authored by State Senator, Josh Becker

• Directs CEC to publish best practices for building electrification:

  "It is the intent of the Legislature to reduce the barriers that impede building owners from electrifying their buildings or adding EV charging equipment as a means of accelerating the reduction of emissions of greenhouse gases from the building and transportation sectors."
WHAT IS SB68?

"...the commission...shall gather or develop, and publish on the commission’s internet website, guidance and best practices to help building owners, the construction industry, and local governments overcome barriers to electrification of buildings and installation of electric vehicle charging equipment that include any of the following topics:

(a) Availability of electrical equipment...that can minimize electrical service capacity requirements.

(b) Approaches for energy budgeting to fit electrical replacements and vehicle-charging equipment within the existing electrical service capacity of the building whenever possible...

(c) Technologies that allow the non-coincidental sharing of electrical circuits.

(d) The development of whole building electrification plans to help building owners prepare for future additions of electrical equipment...

(e) Model permit applications...for the most common building electrification, energy storage, or vehicle charging installation projects...to streamline and standardize permitting and inspections."
Information is Power
OUR ONLY PATH REMAINING TO 2°C

Global GHG Emissions (tonnes)

- Actual Global GHG emissions
- Target Global GHG emissions

30-yr gas furnace installed today locks in emissions at today’s levels

RCP 2.6
+2°C
• ~167,000 gas furnaces will be replaced this year in California alone
• Every furnace we fail to convert this year locks in emissions until 2052, absent govt intervention
OUR FOCUS

Existing Buildings

- Single-Family Residential
  - 8,000,000 in California
  - 64% use gas heat

- Multi-family Residential

- Commercial

New Construction
THE CHALLENGE

- Status quo annual HVAC replacements in CA: 167,000 furnaces
- Accelerated replacements (10 vs. 30 yrs): 500,000 furnaces
- Therefore, we need 3x the HVAC workforce: who will do this work?
- Cost to upsize all 8 million service lines and main panels: $24 billion
- That's $24 billion not spent on appliance replacement
- Need ?x the electrician workforce: who will do this work?
THE GOOD NEWS

• We don't need to increase service lines to homes, in the vast majority of cases.

• In our experience, 90% of homes with 100A panels or greater can be fully electrified (including EV charger) without a service line increase.
WHOLE HOME ELECTRIFICATION

Electrification Plans w/ NEC Load Calcs

Power-Efficient Equipment Choices

Circuit controls
"PANEL OPTIMIZATION" for 2,000 sq ft home

- For homes with 100 amp electrical panels
- Helps avoid ~$5,000 electric panel upgrade
- Favors efficient devices w/ low rated amps
- Provides roadmap for building owner
- Helps guide tradespeople
DO TRADES KNOW THIS?

• No, each trade thinks about their appliance, not whole home

• Must either train all trades: plumbers, HVAC, electricians or...

• Train electrification experts who understand how all of home's electric systems work together

• Building code could accelerate this learning by requiring whole-home electrification plans
CIRCUIT CONTROLS

- EV charger installers most knowledgable about circuit controls today...
  - Circuit pausers
  - Smart breakers
  - Circuit sharing devices
  - Smart panels
• Circuit controls are not a panacea...they alone will not solve electrification of existing buildings

• Circuit controls are a valuable tool in the toolkit to close a final gap, if needed
  - First: make a plan
  - Second: choose power-efficient equipment
  - Third: deploy circuit controls
STATE OF TECHNOLOGY

• Rapid innovation happening in circuit controls...driven primarily by EV charging

• Many start-ups... based in Europe & California

• Hard to stay on top of new offerings

• Many (not all) seek UL listing

• Easy to fully electrify a 100A home with controls available today

• Emerging solutions in this space will only make our jobs easier
CIRCUIT PAUSERS

• Pauses circuit when load on panel exceeds 80% of capacity

• Uses CT clamps to sense power

• Can be installed on main panel or subpanel

• EV charger companies starting to integrate them into chargers

• Our most frequently used type of circuit control
SMART BREAKERS

• Often compatible with conventional electrical panels

• Measure current going through themselves and can report via wifi to apps

• When paired with software, can control circuits, dynamically throttling current as needed

• First used in commercial construction applications

• Sometimes used in residential solar/battery applications

• Not currently seeing widespread use in existing homes purely for electrification
CIRCUIT SHARING DEVICES

• Can be hardwired or plug-in

• Plug-in versions can be easy, temporary fix for sharing dryer and EV charger
SMART PANELS

• Shed any of the circuits in the panel if load exceeds 80% of panel capacity

• Priority of circuit shedding set by homeowner

• 100A - 200A capacity

• Rated for indoor and outdoor use
TYPICAL USE OF CIRCUIT CONTROLS

- 100A home in Burlingame, CA
- Converting 4 gas appliances + car to electric
- 1st selected elected power-efficient equipment
- Added one circuit control: SimpleSwitch 240M circuit pauser to EV circuit
- NEC 220.83(B) load calcs
- That's it!
GREATER CHALLENGES WE FACE

• Range anxiety causes new EV buyers to oversize home EV chargers...leaving no room on panel for more electrification

• People installing new gas tankless water heaters - BIG problem and growing

• Electric resistance dryers - need better heat pump alternatives w/ 7.4 cu ft

• Permitting authorities lack basic knowledge about heat pumps, circuit control tech and in some cases NEC load calc methods > leads to permitting problems

• Trades other than electricians (plumbers, HVAC) need easy way to do NEC load calcs so they can switch from installing fossil fuel to electric appliances