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Building Electrification and Load Flexibility

2019 IEPR Joint Agency Workshop on Buildings Policy: Energy Efficiency, Decarbonization and Load Flexibility

Kevin Wood

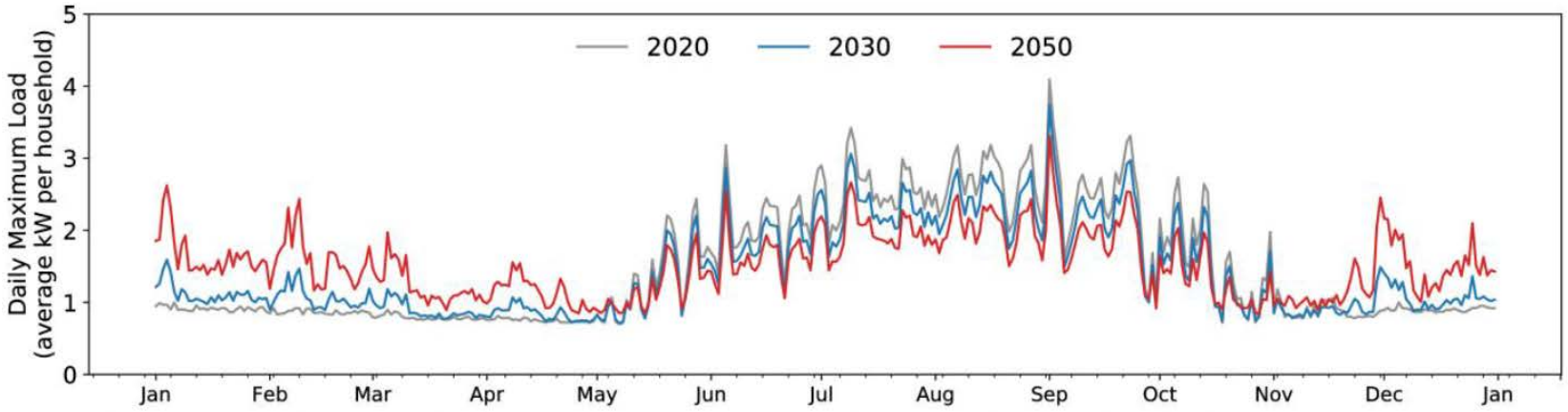
August 27, 2019

Building electrification is a cost-effective approach to meeting California's GHG reduction goals

- SCE's Clean Power Pathway (November 2017) identifies electrification of space and water heating as a cost-effective component of an economy-wide approach to meet California's goals.
- E3's "Deep Decarbonization in a High Renewables Future" (May 2018) identifies heat pumps in the loading order of cost effective GHG abatement measures.
- E3's "Residential Building Electrification in California" (April 2019) shows customer cost savings with electrification.

How do we achieve the benefits of building decarbonization without negatively impacting the grid?

High electrification of residential buildings is expected to improve the grid load factor without exacerbating the peak*



	2020 Penetration (% of stock)	2030 Penetration (% of stock)	2050 Penetration (% of stock)
Share of all-electric low-rise residential homes	0%	26%	86%

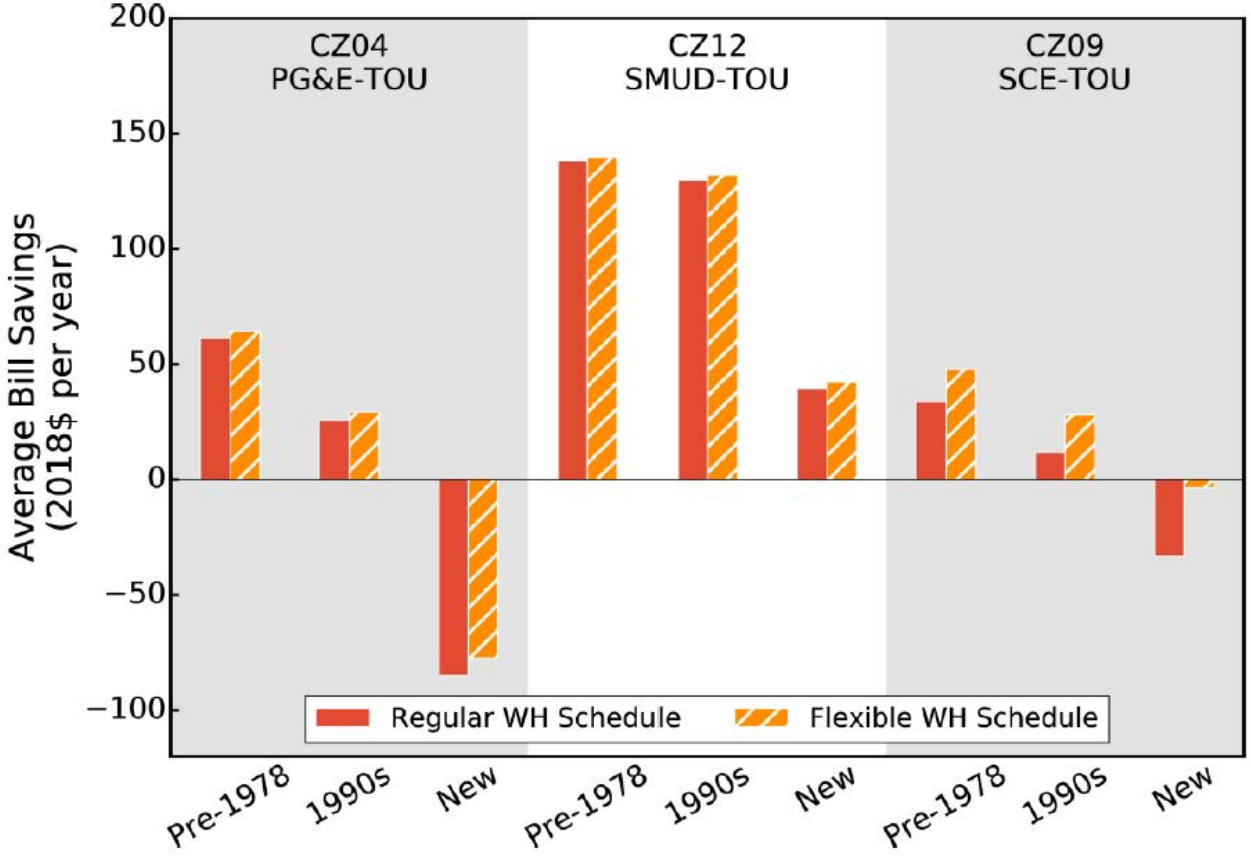
Penetration represents the share of all-electric equipment among the entire stock of all fuel types.

- Slightly lower summer peak due to greater cooling efficiency with HVAC heat pump vs. A/C compressor
- Increased winter demand remains below summer peak demand levels under Typical Meteorological Year (TMY) weather conditions modeled
- Electrification contributes to a better utilization of the bulk power grid, as residential building load factor increases from 19% in 2018 to 26% in 2050
- Localized impacts at regional and distribution-level need to be further studied

*"Residential Building Electrification in California - Consumer economics, greenhouse gases and grid impacts", E3, April 2019

Appropriate TOU rates can encourage customers to use flexible water heating schedules

Average consumer bill savings from a flexible water heater schedule compared to a regular water heater schedule*

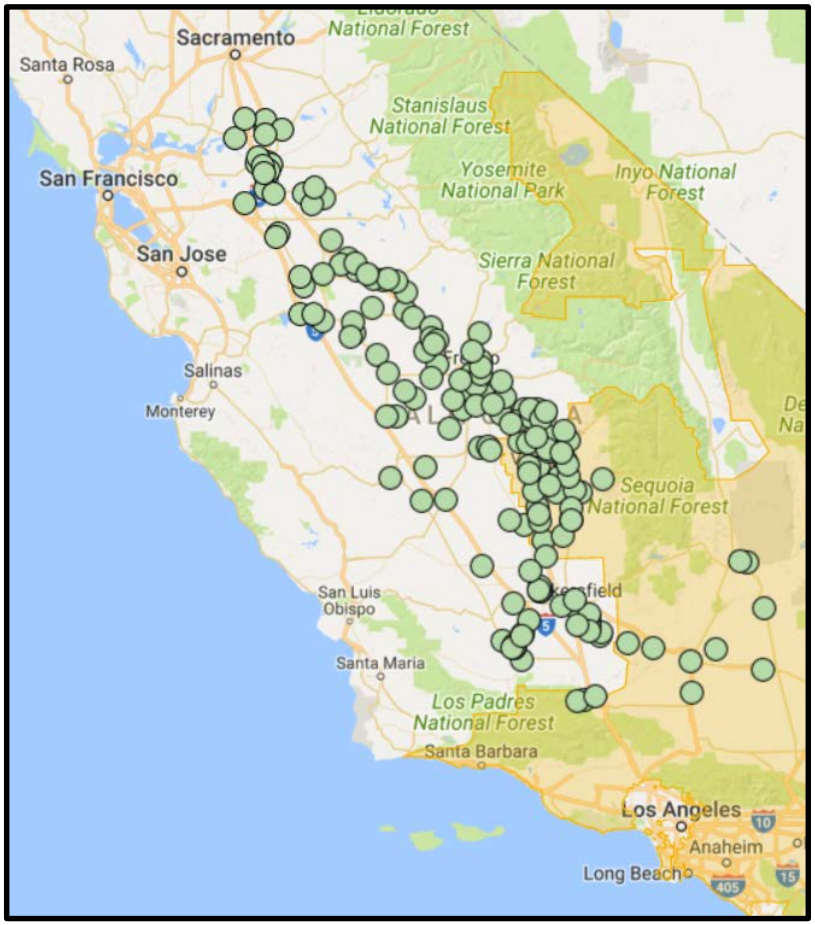


*Assumes water heater runs at minimal power during the peak TOU hours and shifts the water heating to off-peak TOU hours

- Customer bill savings of flexible water heating are highest under the SCE TOU-4-9 rate structure due to the large TOU differentiation ($0.12/kWh) in winter.
- Flexible water heating schedules generate little bill savings under PG&E and SMUD TOU rates, given the small difference (<$0.04/kWh) between on-peak and off-peak
- New rate designs that encourage the use of flexible water heating would have larger differences in TOU periods, particularly in winter when water heating demands are higher.

Pilots will help us design programs and foster technology maturity to support customer load flexibility

- San Joaquin Valley Disadvantaged Community Pilot
  - Three communities, 449 customers, $15.6 M, 2019-2021
  - Residential buildings, elimination of dependency on propane and wood as a fuel source
  - Replace or install where eligible, new electric appliances
  - **Demand Response Pilot**
    - ✓ 299 customers, testing for "shed" DR functionality
    - ✓ Shed strategies are (similar to HVAC systems): turn on/off, compressor cycling, temperature offsets, economy mode
  - **Grid Responsive Heat Pump Water Heater Study**
    - ✓ 12 customers, testing for "shift" DR functionality
    - ✓ Test if grid responsive HPWH can provide flexible load control and hot water storage over various time frames or time-of-use schedules.
    - ✓ Evaluate HPWH controls and the grid-responsive communications technology
- BUILD and TECH Pilots
  - Potential for BUILD "kicker incentives" to be provided for grid-connected appliances
  - Potential to leverage demand response programs to improve utility bill savings – a requirement of SB 1477
- Self Generation Incentive Program
  - August 9, 2019 proposed decision calls for $4M equity budget set-aside for HPWHs
  - "HPWHs may provide for increased participation of equity budget customers in the SGIP and the related provision of grid services and bill reduction benefits because HPWHs are lower cost than most residential battery technologies."



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In summary…

- Move quickly on building decarbonization to capture advantage of lower summer cooling loads with electric heat pumps
- Implement electric rates with sufficient peak/off-peak differential
- Continue with pilots to advance our understanding of how to design programs for the benefit of customers
- Partner with manufacturers to evolve technology
- Continue with aggressive building and appliance Codes & Standards
- Include building decarbonization in statewide customer awareness and outreach campaigns

Thank You!