

DOCKETED	
Docket Number:	23-IEPR-03
Project Title:	Electricity and Gas Demand Forecast
TN #:	248587
Document Title:	Presentation - California Electrification Technology Market Outlook
Description:	3.C Michael Sontag, E3
Filer:	Raquel Kravitz
Organization:	Energy + Environmental Economics
Submitter Role:	Public
Submission Date:	1/27/2023 3:58:32 PM
Docketed Date:	1/27/2023

California Electrification Technology Market Outlook

Building Electrification Market

January 31, 2023



Energy+Environmental Economics

Mike Sontag
Michael@ethree.com

California has aggressive building electrification targets

- + CARB's 2022 Statewide Implementation Plan¹ (federal smog standards) calls for phase out of sales for gas furnaces and gas water heaters by 2030
- + CARB's 2022 Scoping Plan² (state carbon neutrality goals) shows significant ramp up in BE sales
- + CEC 2021 IEPR³ goal of 6 million heat pumps installed by 2030

Figure 4-9: Residential space heating appliance sales in the Scoping Plan Scenario

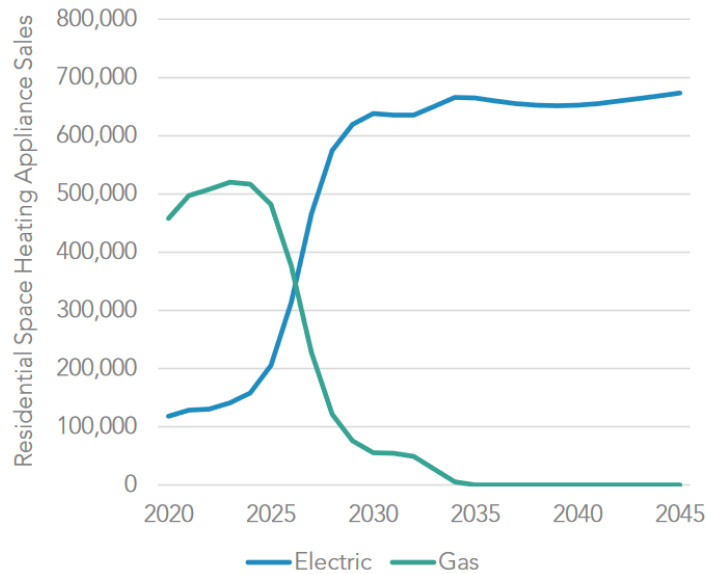
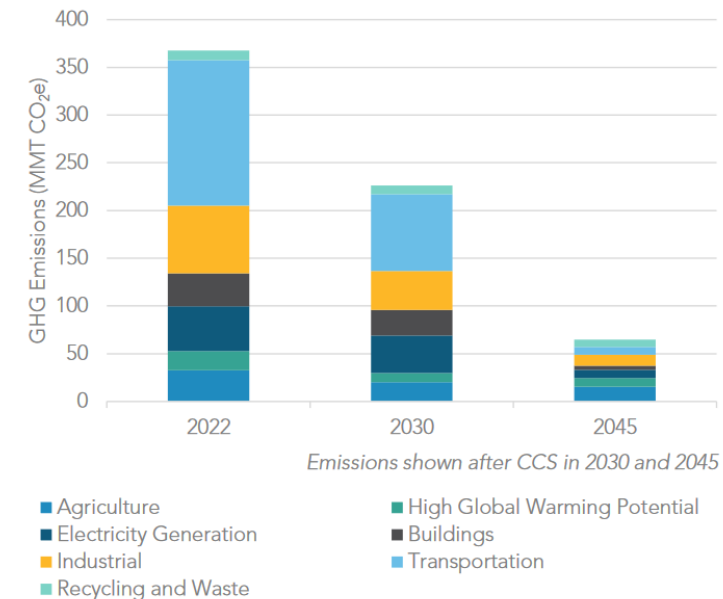
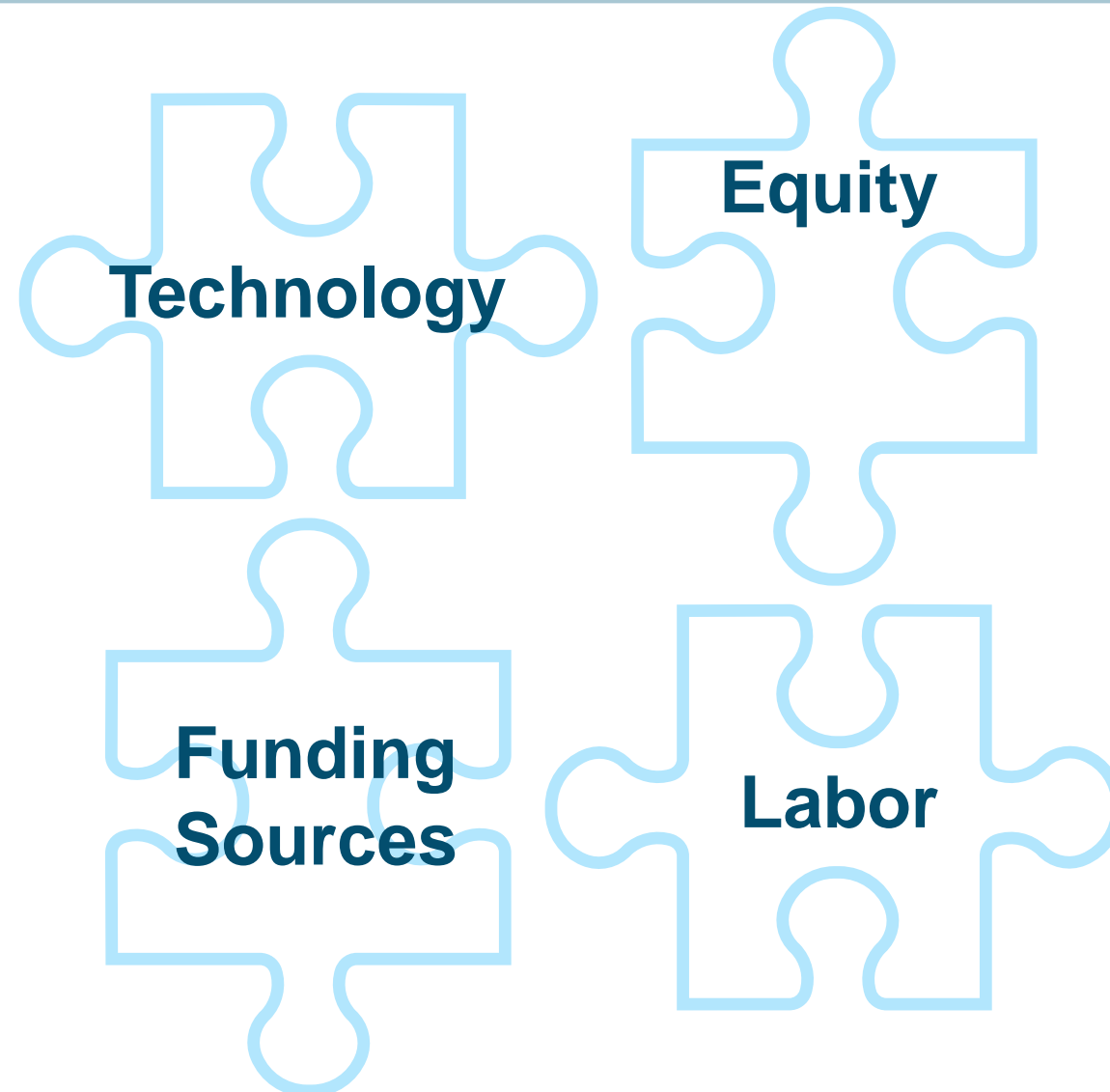


Figure 2-5: Residual emissions in 2022, 2030, and 2045 for the Scoping Plan Scenario¹⁵⁵



1) CARB, 2022 State Strategy for the Statewide Implementation Plan: https://ww2.arb.ca.gov/sites/default/files/2022-08/2022_State_SIP_Strategy.pdf
2) CARB, 2022 Scoping Plan for Achieving Carbon Neutrality: <https://ww2.arb.ca.gov/sites/default/files/2022-12/2022-sp.pdf>
3) CEC 2021 IEPR vol 1 Building Decarbonization: <https://efiling.energy.ca.gov/GetDocument.aspx?tn=241599>

Achieving these targets will require new ambition and coordinated action across sectors



Technology – Core tech is ready for mass adoption in residential sector, small commercial sector

- + **Air Source Heat Pumps (ASHP) for space heating – mature technology**
 - Per AHRI national data, 4M+ heat pumps shipped vs 3.6M gas furnaces in 2022¹ (as of November 2022)
- + **Heat Pump Water Heaters (HPWH) – mature underlying technology, but relatively new form factor**
 - Core technology of compressors not new, but heat pump water heaters are not widely adopted yet
 - 120V HPWHs are recently available
- + **Changes ahead to incorporate Low-GWP refrigerants^{2,3}, and Ultra-Low GWP⁴ refrigerants**
 - Especially important for VRF systems, that have large amounts of piped refrigerants
 - May take time to re-learn tuning of system for HVAC professionals
- + **Medium/large commercial buildings will be more difficult to retrofit with heat pumps**

1) AHRI, <https://www.ahrinet.org/sites/default/files/2023-01/November2022StatisticalRelease.pdf>

2) SB1206, signed in 2022 sets GWP limit for refrigerants at 2200 in 2025, 1500 in 2030 (R401-a), 750 in 2033 (R-134a) in all markets

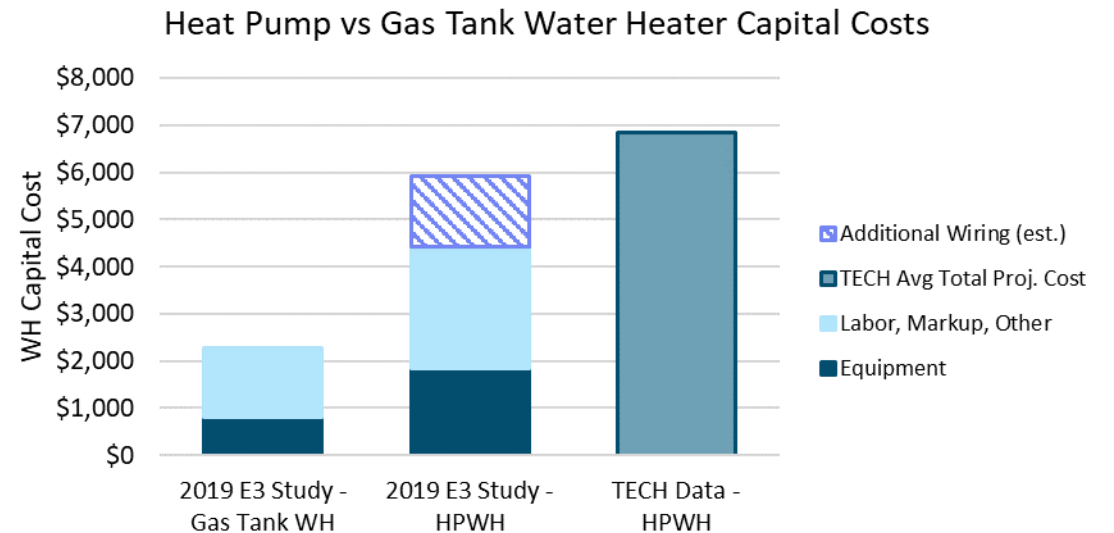
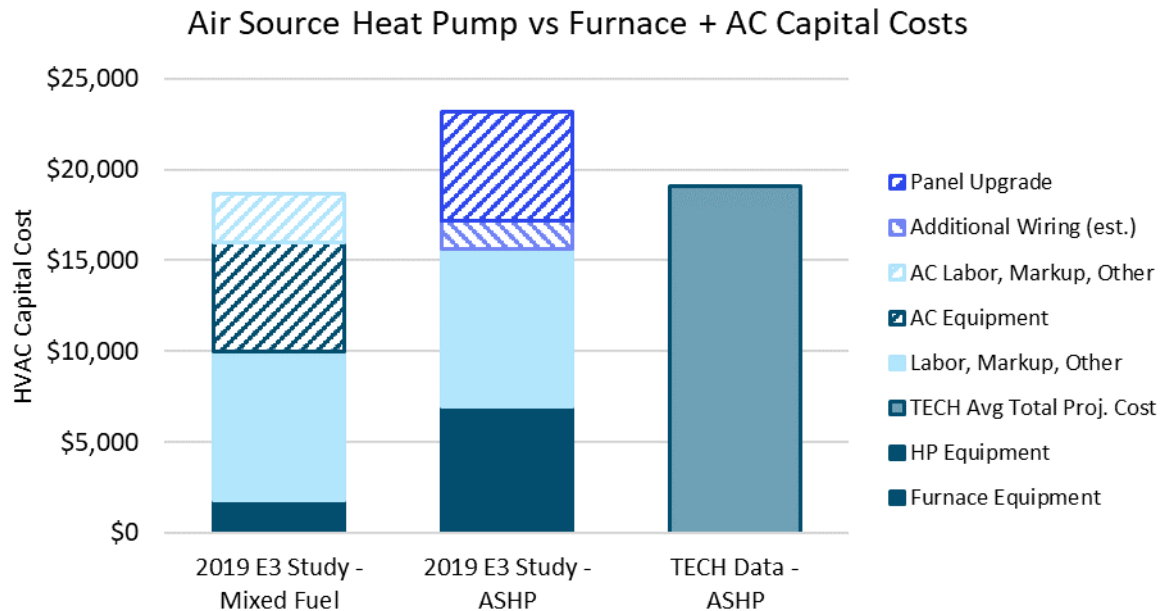
3) CARB 2020 Order on refrigerants sets phase out date of >750 GWP Jan 1, 2025 for Res AC/HP, Jan 1, 2026 for VRF:

<https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hfc2020/frorevised.pdf>

4) AB209, signed in 2022 - CEC/sate fire marshal must commission study in 2023 on use of low and ultra-low GWP refrigerants,

Technology Capital Costs – ASHPs will have mix of challenges/opportunities, HPWHs will benefit from incentives

- Single Family Homes - ASHPs can be more cost effective than gas furnace + AC, but project complications can make incremental costs of electrification much higher
- IRA low-income incentives are substantial (\$8k for ASHP, \$1,750 for HPWH), but may have limited total funding
- IRA tax credit (max of \$2,000 or 30% of project cost) likely to move the needle on HPWH more than ASHP
- TECH data shows actual install costs are a little higher than expected



TECH Program Data Portal. Results filtered to single family homes, with no panel upgrade, split unitary systems for ASHP: <https://techcleanca.com/E3-Residential-Building-Electrification-in-California>. Costs adjusted for inflation to 2022\$.

<https://www.ethree.com/wp-content/uploads/2019/04/E3-Residential-Building-Electrification-in-California-April-2019.pdf>

Funding Sources – need to scale current programs up by an order of magnitude

- + **Statewide total funding gap for Building Electrification is on the order of \$10B - \$40B¹ (present value)**
- + **BUILD (\$80M), TECH (\$120M), SGIP for HPWH (\$84.7M), Equitable Decarbonization fund (\$922M) off to a great start, but more is needed**
 - Ex. California Solar Initiative had a total budget of \$3.3B
- + **Potential sources**
 - Programs and incentives: public-purpose charges, Cap and Trade revenue, rate-based funds, state general fund
 - Public/private financing partnerships, on-bill financing
 - Rate design reform – CPUC pursuing work directed by AB 205², to reform rate design in a way that better reflects marginal cost of service
 - Inflation Reduction Act incentives and tax credits help
- + **Infrastructure funding on utility side will also need to be considered as distribution system capacity is expanded**

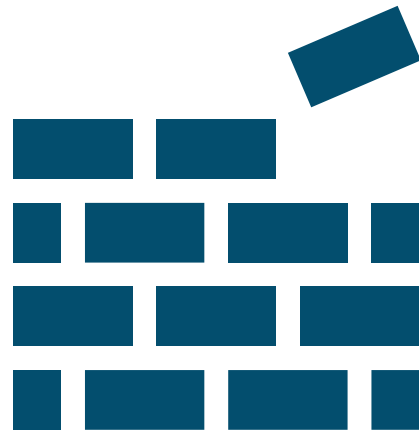


1) Range based on Scenario 9 (100% new construction, 75% RoB)through Scenario 12a (Aggressive Electrification) from CEC Building Decarbonization assessment: <https://efiling.energy.ca.gov/GetDocument.aspx?tn=239311>

2) See <https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M498/K072/498072273.PDF>

Labor – Need to assist HVAC and plumbing professionals to adopt new technologies, expand electrician workforce

- + **New technologies will require time for contractors to gain familiarity**
 - Contractors unfamiliar with new technology may price in additional risk of callbacks
- + **Need job training in electrification technologies for current and future workforce**
- + **Workforce is made up of many small businesses – need to change the hearts and minds of people selling these systems**
- + **Significant electrical work will occur as well (in-home wiring, panel upgrades, service drops, etc.)**

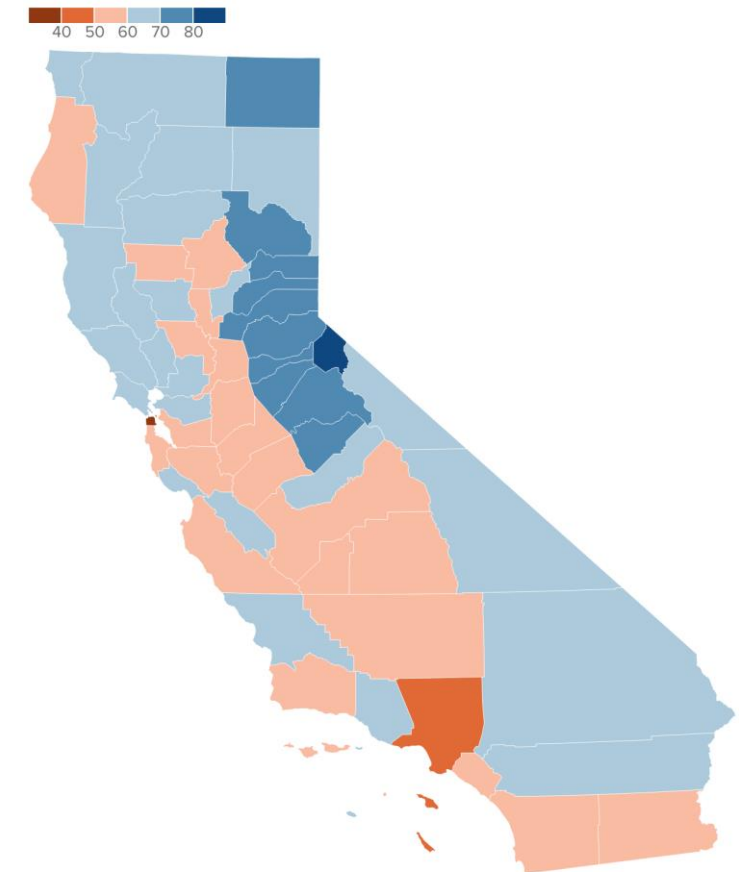


Equity – Significant portion of population has split incentive issue for adopting electrification technologies

- + 42.4% of CA residents live in multi-family or attached unit homes¹
- + 44% of CA residents rent the home they live in¹
- + Need to explore additional mechanisms to increase electrification in this segment
 - Ensure that tenants and low-income households are not overburdened by costs of electrification (energy affordability, rate design, etc.)
 - How to apportion incremental capital costs
 - How to finance electrification retrofits in households without high credit scores

Homeownership rates vary widely across the state

Share of families that own the home they live in (%), 2016-2020



SOURCES: American Community Survey data (2016 through 2020), Census Bureau table DP04.
NOTES: The homeownership rate is the share of occupied housing units that are owner-occupied.
FROM: PPIC Blog, June 2022.

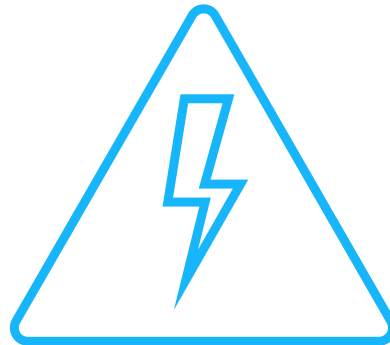
Conclusions

+ California needs to scale up the ambition of existing programs

- More funding through variety of sources
- Strong codes and standards, including for retrofits

+ How do we get retrofit market ready for a 2030 gas appliance phase out?

- Gear up workforce – this is where market transformation will happen
- Tackle equity issues
- Improve regulatory pathways for in-home electrical and grid infrastructure capacity upgrades



Thank you!

Email: Michael@ethree.com



Energy+Environmental Economics