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## Buildings in California's Low-Carbon Future

Getting to Zero Forum  
Policy and Legislative Drivers for Decarbonization in California

October 10<sup>th</sup>, 2019

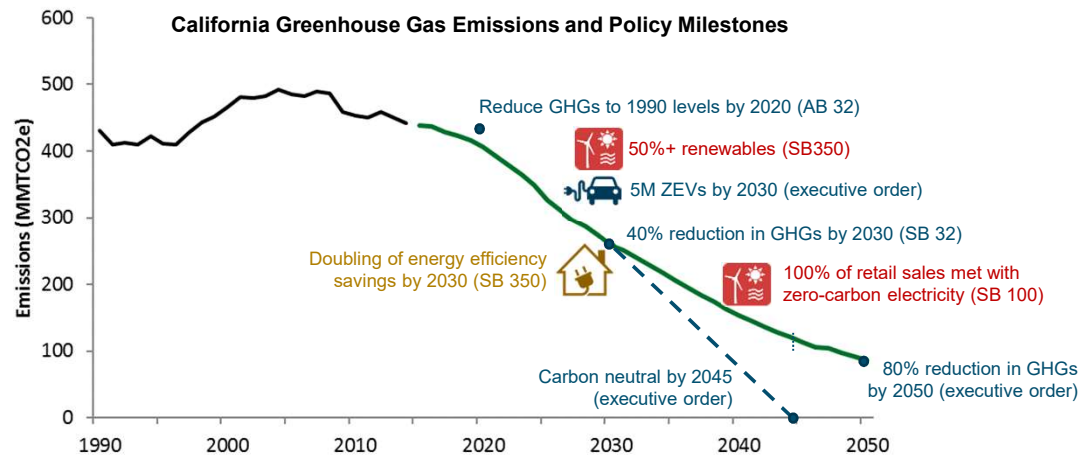
Amber Mahone

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## Meeting California's Ambitious Climate Goals

+ Achieving CA's climate goals will require at least a 40% reduction in building sector GHGs by 2030, and an 80% reduction by 2050 – achieving carbon neutrality will likely require deeper reductions



Source: E3 report on "Deep Decarbonization in a High Renewables Future" June 2018, CEC-500-2018-012

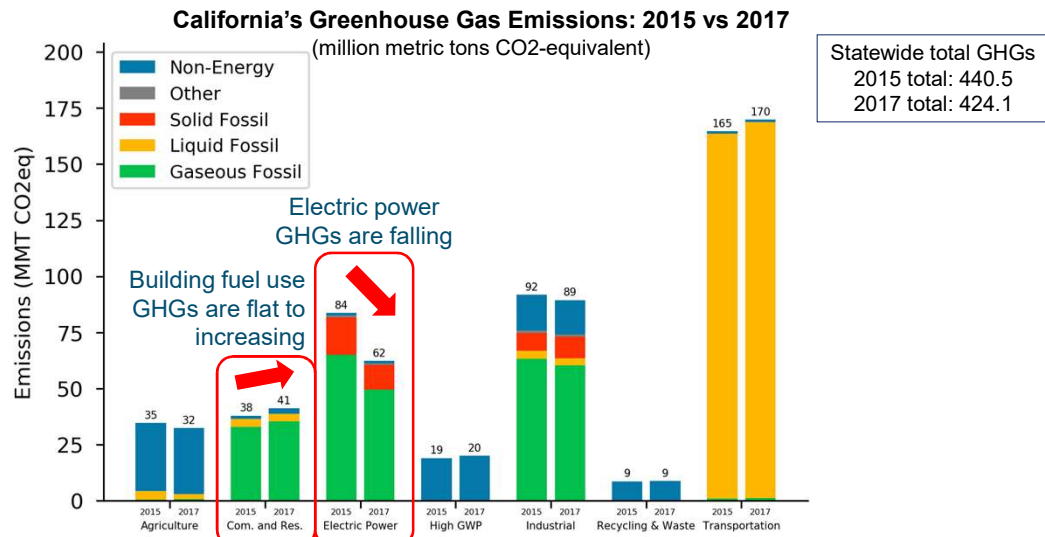
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## Buildings represent ~25% of California's GHG emissions today, considering electricity, fuel use, and other GHGs



Source: E3. Data are from the 2017 California Air Resources Board Greenhouse Gas Emissions Inventory

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## Four Key Strategies to Decarbonize Buildings



### Energy efficiency & conservation

- ✓ Smart-growth: higher density housing in transit-oriented communities
- ✓ Energy efficiency retrofits & new construction codes
- ✓ Electric heat pumps displacing resistance heat



### Electrification

- ✓ Heat pump HVAC
- ✓ Heat pump water heaters
- ✓ Induction stoves
- ✓ Electric clothes dryers



### Low-Carbon Fuels

- ✓ Zero-carbon electricity
- ✓ Biomethane
- ✓ Renewably produced hydrogen
- ✓ Zero-carbon synthetic natural gas



### Reduce non-combustion emissions

- ✓ Prevent methane leaks in homes and gas pipelines
- ✓ Replacement of high global warming potential gases ("F-gases") in air conditioners and heat pumps

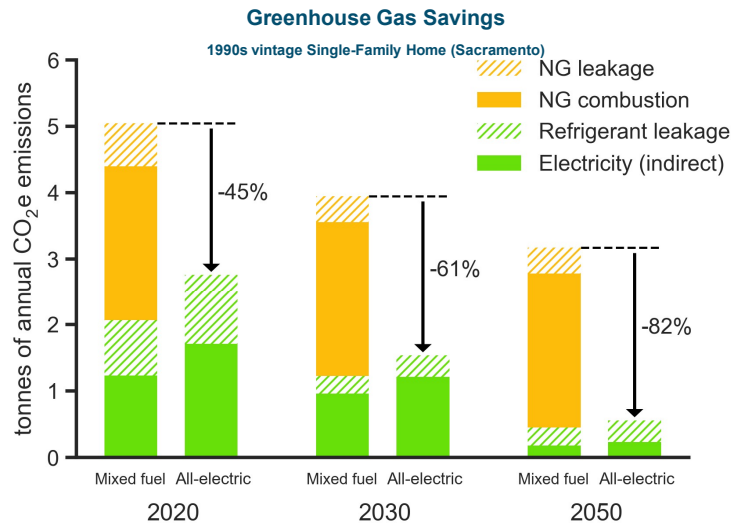
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## Building electrification reduces GHGs today, savings will increase as the grid gets cleaner



Source: E3 report on "Residential Building Electrification in California" April 2019.

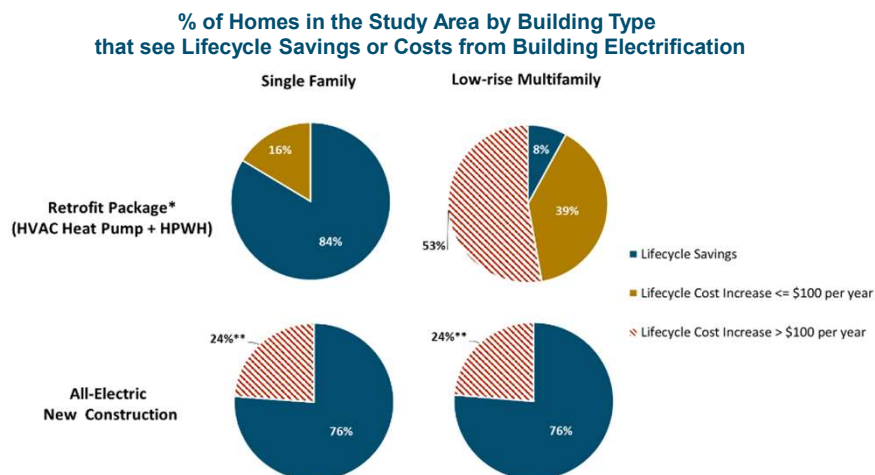
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## Heat pumps generate lifecycle savings in many low-rise residential retrofits & new construction homes already



\* We assume that all consumers in retrofit homes have or would install air conditioning in the mixed fuel baseline.

\*\* This category corresponds to buildings modeled in San Francisco (Climate Zone 3) that we assumed would not install air conditioning in the gas baseline home. 100% of all-electric new construction single family and low-rise multifamily homes that include air conditioning show lifecycle savings.

Source: E3 report on "Residential Building Electrification in California" April 2019.

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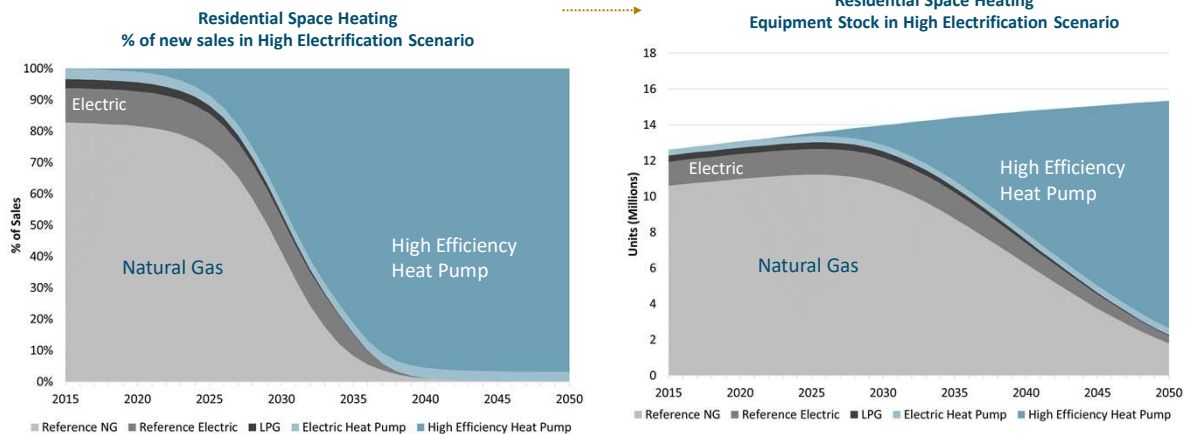
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## Slow turnover of building equipment means transformation must begin as soon as possible

- + Achieving high electrification in buildings will require significant retrofits to existing buildings, in addition to targeting new construction



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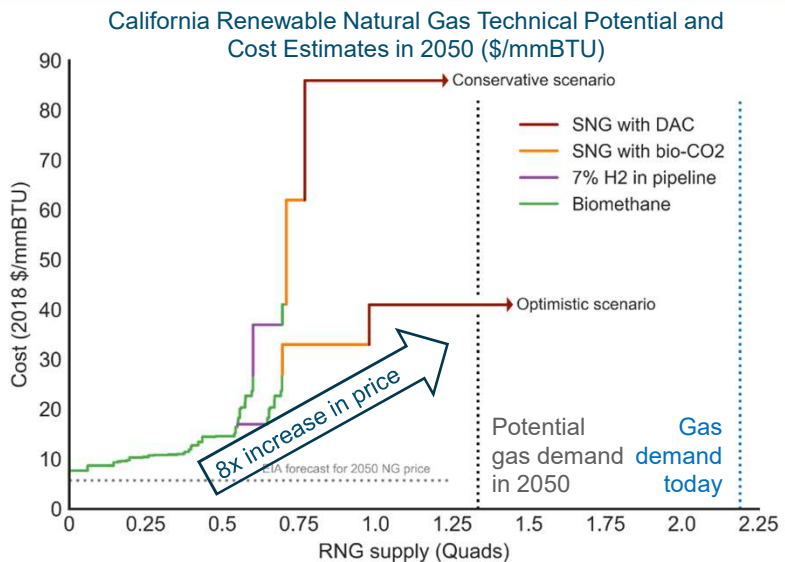
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## Limited Supplies of Low-Cost Renewable Natural Gas (RNG)

- + Best uses for biofuels/RNG may include: Trucking, industry, aviation and off-road transportation
- + Even assuming optimistic RNG costs, RNG will be expensive for use in most buildings



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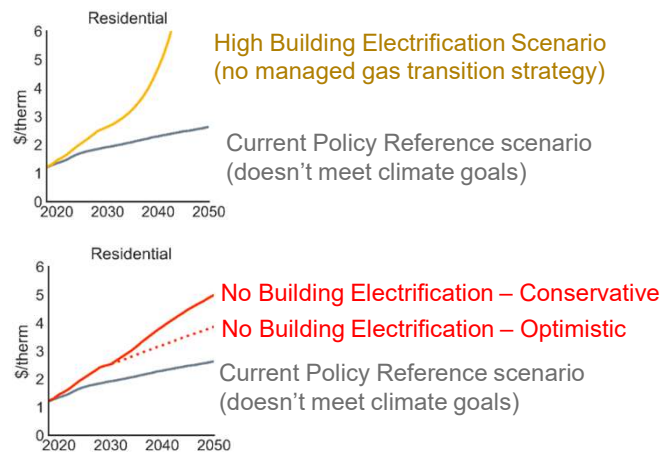
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## Gas Rates are Anticipated to Increase in any Low Carbon Future

- + Gas rates are increasing in near-term due to pipeline safety upgrades and ongoing maintenance and operations
- + Gas rates may increase in long-term:
- + Due to lower gas demand
  - E.g. High Building Electrification scenario
- + Due to cost of decarbonized gas
  - E.g. No Building Electrification scenario
- + A managed gas transition strategy could help to mitigate these rate impacts, particularly to low-income & vulnerable groups

Residential Delivered Gas Rates by Scenario, \$/therm (2020 – 2050)



Source: E3 Draft report on "Natural Gas Distribution in California's Low-Carbon Future" (CEC 2019, forthcoming)

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## Summary

- + Achieving California's climate goals will require deep GHG reductions in buildings
- + Building electrification saves carbon, and can be cost-effective to some customers today
  - Most promising near-term options in all-electric new construction, and HVAC retrofits in homes with A/C
- + Building electrification appears to be a lower-cost, and lower-risk strategy that relying on large quantities of renewable natural gas to reduce GHG emissions in buildings
- + But lots of work remains to be done to reduce costs and ensure an equitable transition!
  - Market transformation, low-income programs, customer education, contractor awareness, etc.



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Image from CARB Scoping Plan Executive Summary p.24

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**Thank You**