# OPPORTUNITIES AND HURDLES IN CALIFORNIA:

## A POLICY FRAMEWORK TO DECARBONIZE THERMAL LOADS IN BUILDINGS

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# CA's ambitious climate & energy policies

- 80% GHG reduction below 1990 by 2050

Governor's 2005 Executive Order

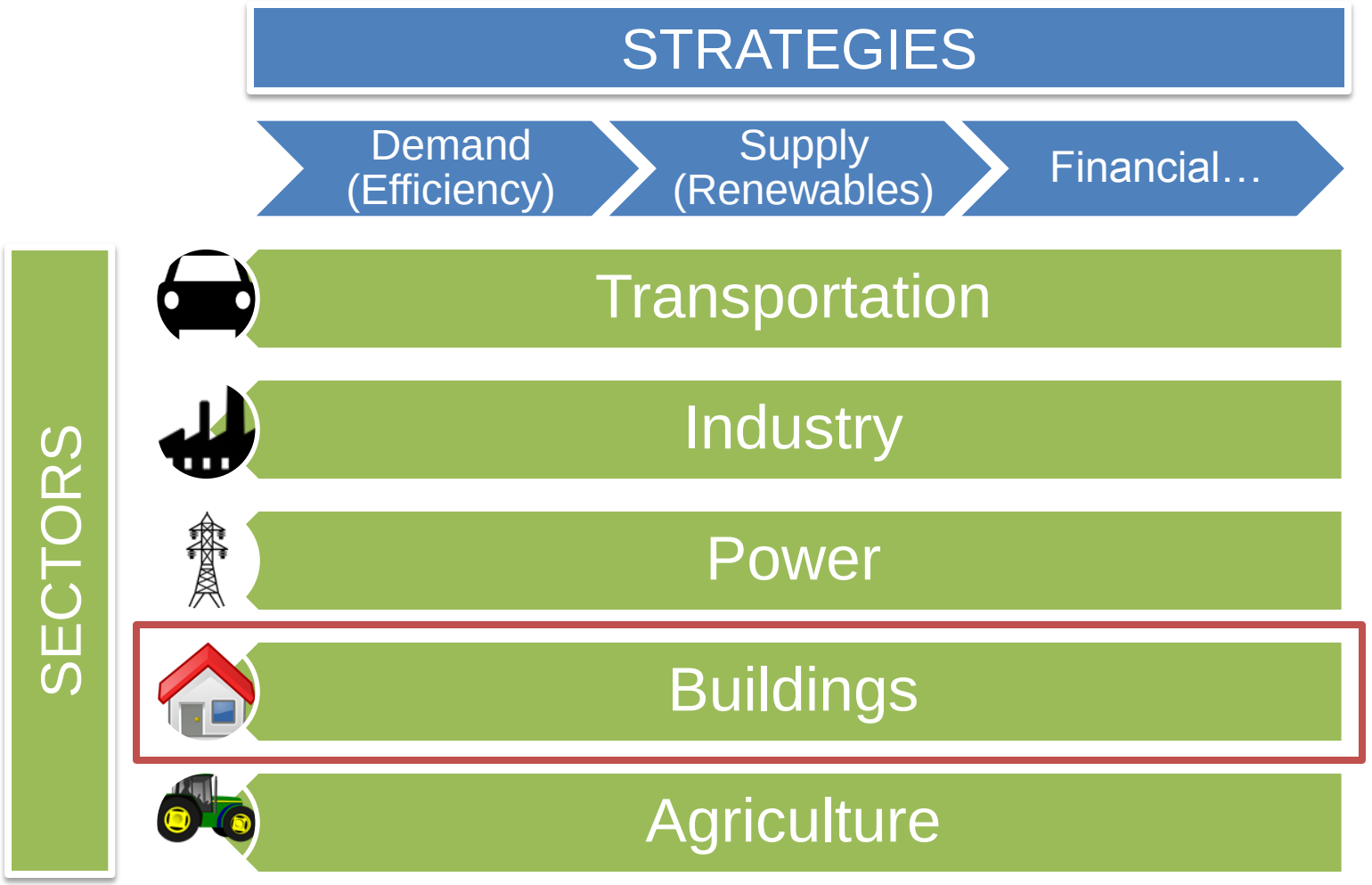
- 50% renewable electricity by 2030
- Double energy savings by 2030

SB 350 (2015)

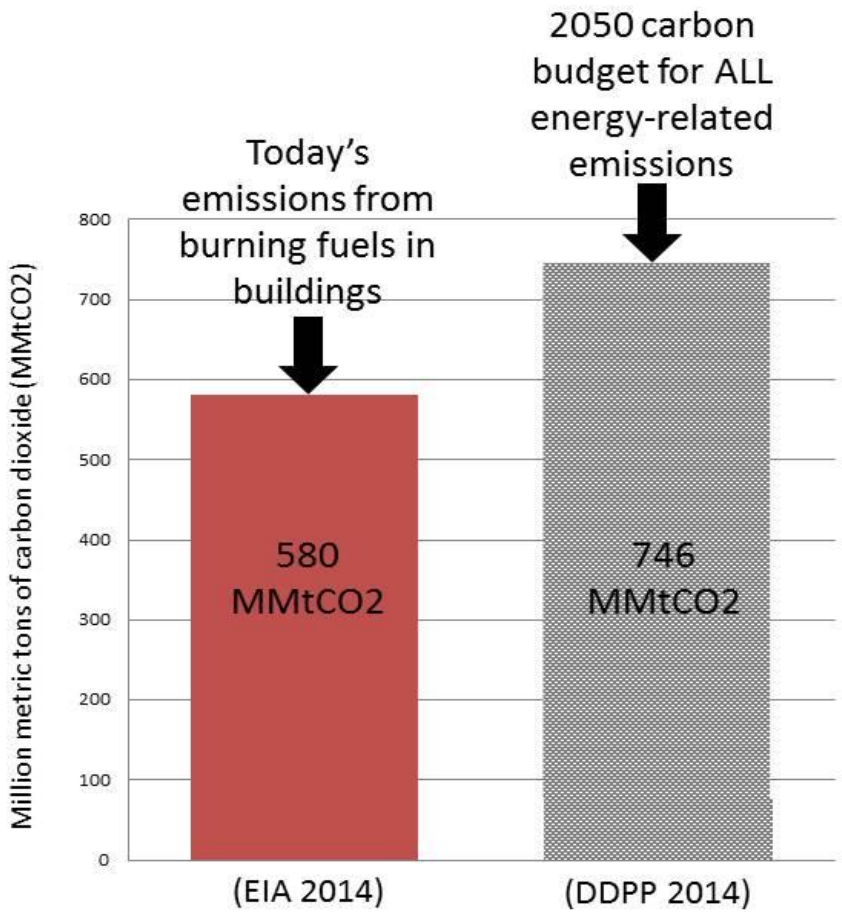
- 40% GHG reduction below 1990 by 2030

SB 32 (2016)

# Decarbonization: The Big Picture

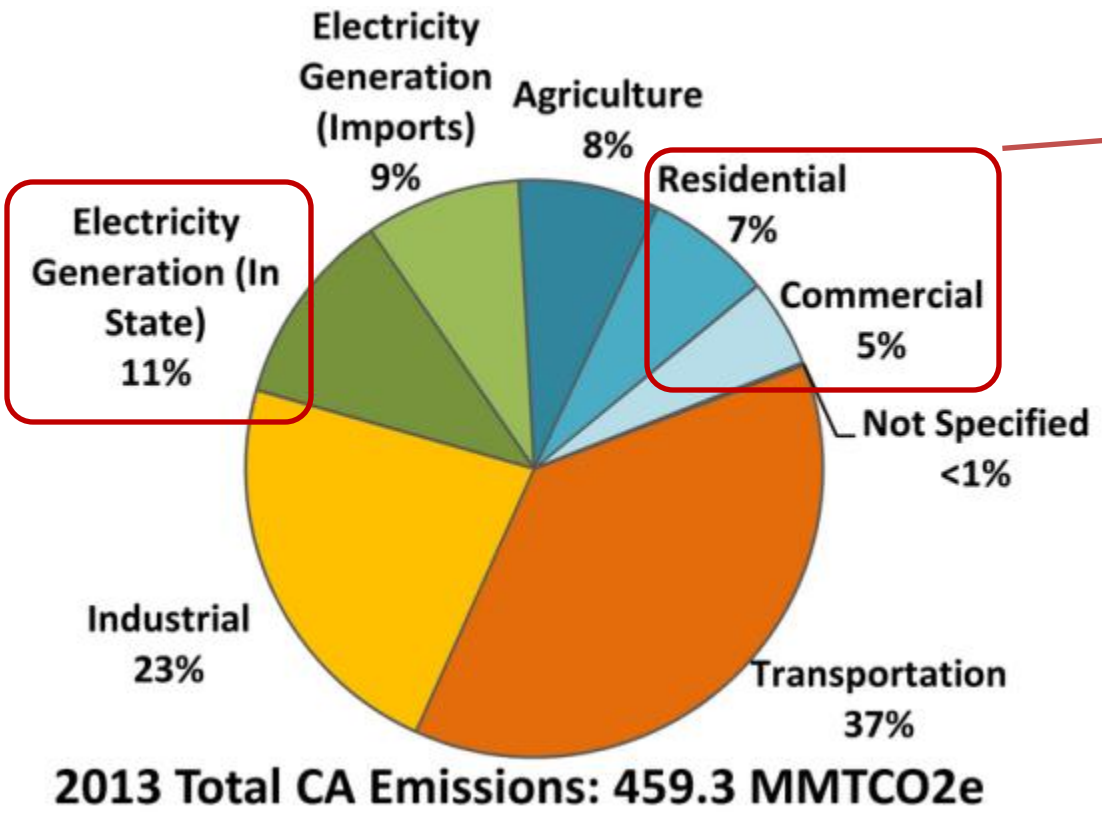


# Building decarbonization: Reducing emissions from direct use of fossil fuel in buildings




**Today's U.S. emissions from buildings versus the 2050 U.S. budget for all energy related emissions given a 80% reduction by 2050 target**

# CA emissions from residential and commercial buildings ≈ emissions from all in-state power plants



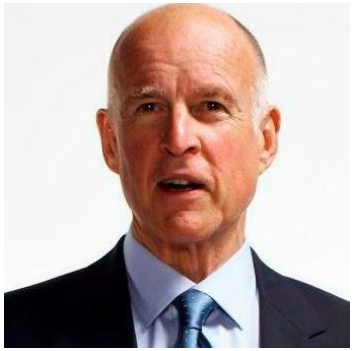

- In CA, 12% GHGs from residential and commercial buildings (mostly from natural gas burned for water and space heating)
- Similar to all in-state power plants!

+ fugitive emissions from gas distribution

+ Industry combustion emissions

Source: [www.arb.ca.gov/cc/inventory/data/data.htm](www.arb.ca.gov/cc/inventory/data/data.htm)

# Need for “cleaner heating fuels”



- Governor Brown highlighted the need to “make heating fuels cleaner” in his 2015 State of the State address
- But to date, little attention has been paid to putting California on a path to clean up the fuels burned in homes and businesses

# NRDC's framework to decarbonize buildings: Two-pathway, fuel-neutral, GHG performance-based

- Clean electricity + high-efficiency electric appliances

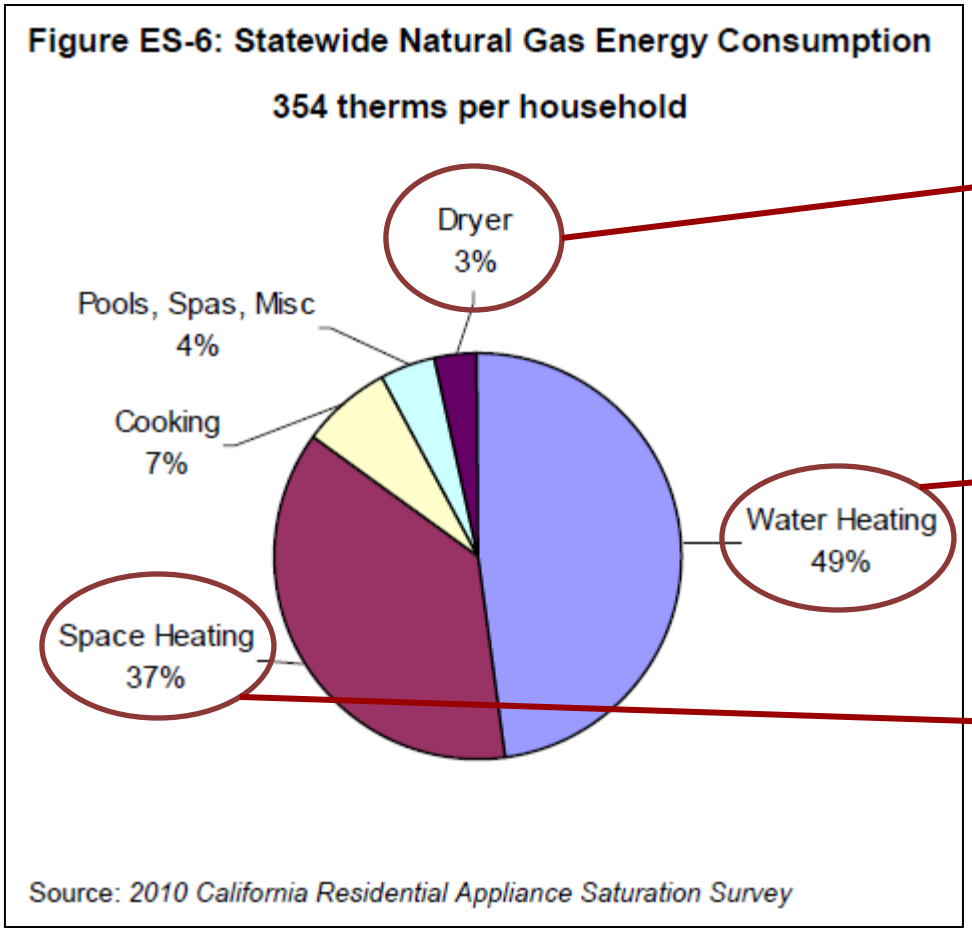
Electrification

- Biogas
- Synthetic gas from renewable electricity ("power-to-gas")

Decarbonized fuels

Energy efficiency

# Heat pump technology available for primary thermal uses



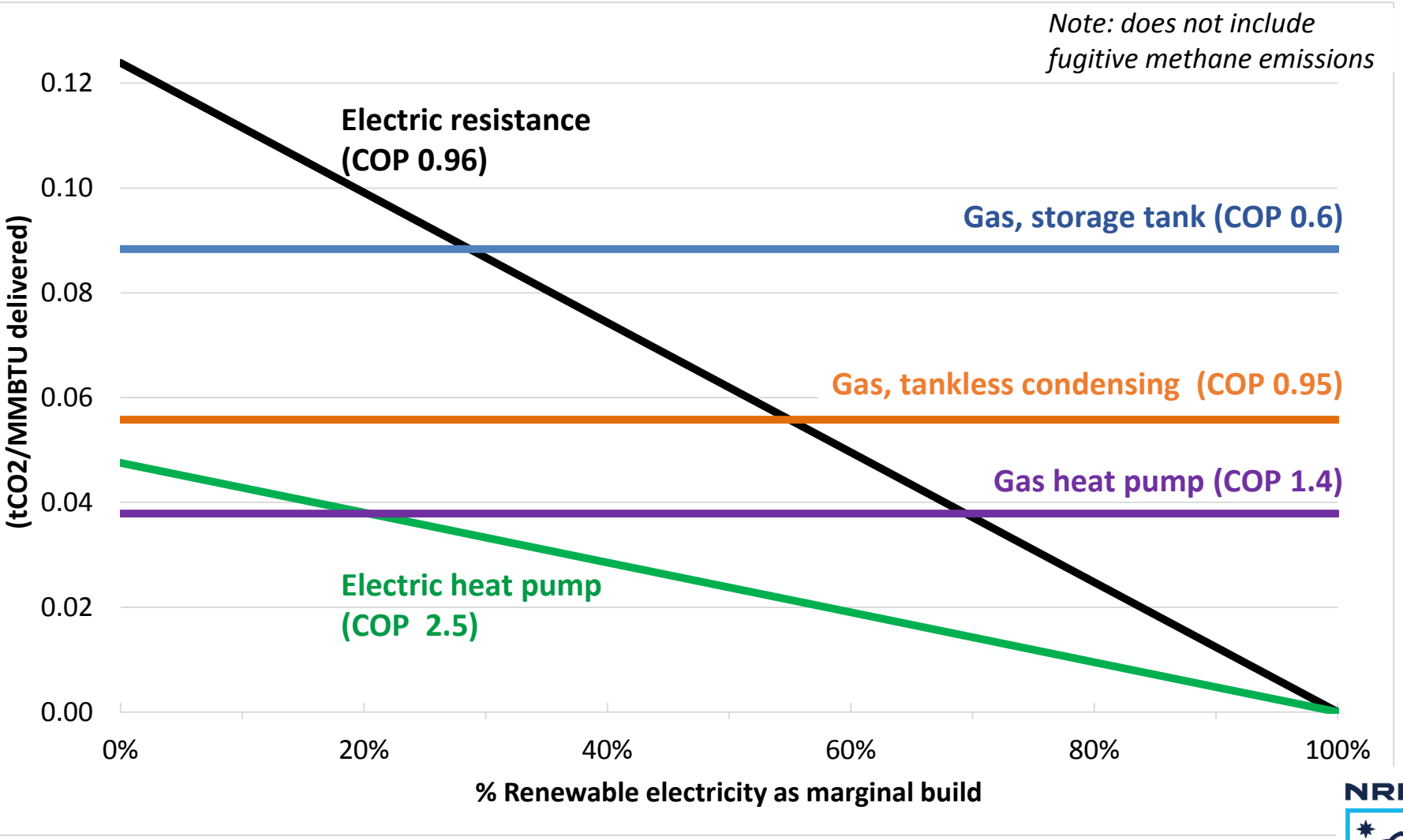

**Heat-pump clothes dryer**

**Heat-pump water heater**

**Heat pump space heating**

**+ heat pump district heating**

# Carbon intensity of water heating technologies



# Barriers: What's preventing progress?

## Baseline water heater

**$1,500**
(installed)

- On truck
- Same day install

## Heat pump water heater

**$4,500***
(installed)

- Special order
- 2-week delivery
- Mail-in rebate
- Need electrician



* Higher than average, but real-world example. For illustration only

# Barriers: What's preventing progress?

## Awareness

- "Heat what?"
- "Clean natural gas"…

## Costs

- Equipment
- Installation
- Operation

## Access

- On-truck
- In-store

## Technology

- Installation flexibility, performance, noise, controls…

## Regulatory

- Building code
- Fuel substitution
- Availability of incentives

# Moving towards market transformation

**Raise awareness**

- **Education:** General public, policymakers, and stakeholders
- **Research and analysis:** knowledge gaps, updated technology and grid projections
- **Coordinate** with a network of CA stakeholders (NGOs, cities, AQDs, CCEs, utilities)

**Remove regulatory barriers**

- **EE incentive programs**: 3-prong test, cost-effectiveness, etc.
- **Building code**: cost-effectiveness, baseline
- **Rates, net metering:** electrification-friendly, like EVs
- **Value societal benefits:** EE + GHGs + load flex

**Market transformation**

- **Set ambitious policy goals**: Governor, legislation, agency goals
- **Funding**: e.g. CSI-like program, R&D
- **Market dev**: manufacturers, retailers, installers, builders.
- **Technology dev:** better products, better test methods, performance specs

# First step… start small where there is opportunity

- Need to move from <1% market share to 5% ASAP... and build on that experience
- Don’t need to solve all market barriers right away, just jumpstart market to drive investment and build capacity
- Target favorable market opportunities:
  - ✓ New construction and large-scale renovation (e.g. MF)
  - ✓ Electric resistance and propane users
  - ✓ New A/C installs
  - ✓ Public buildings
  - ✓ EV and PV owners
  - ✓ Utilities with favorable electric rates

# THANKS! QUESTIONS?

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