



CalPlug
October 28, 2019



Greenbank Associates



CalCCA
California Community
Choice Association

Sonoma
Clean Power



TerraVerde
ENERGY
CAL SMACNA



BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT



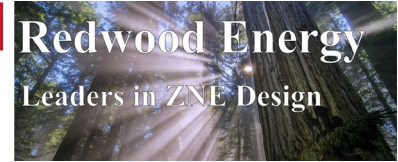
FRONTIER
energy Western HVAC



CLEAResult®



SIEGEL & STRAIN Architects



WRNSSTUDIO GLUMAC



R H T R
RURAL HARD TO REACH
LOCAL GOVERNMENT PARTNERSHIPS'
WORKING GROUP



STOPWASTE
at home • at work • at school

the Energy
Coalition

SPAN.10

Powering forward.
Together.



Gensler



Policy Trends & California's Climate Goals

By 2020

Return GHGs to 1990 levels (*AB 32, 2006*)

By 2030

40% below 1990 levels (*SB 32, 2015*)

By 2050

80% below 1990 levels (*EO's B-30-15 & S-3-05*)

And now...by 2045

100% zero-carbon electricity (*SB 100*) &
carbon neutral economy-wide (*EO B-55-18*)

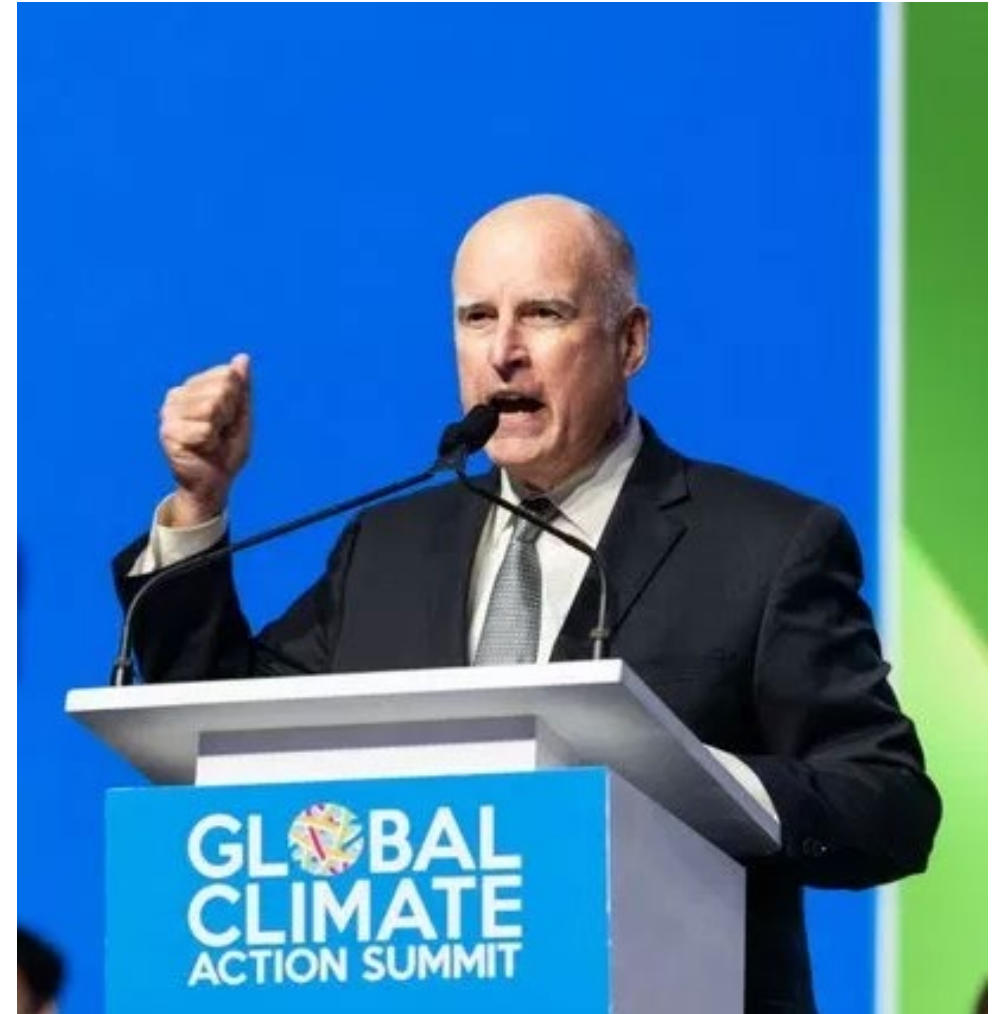
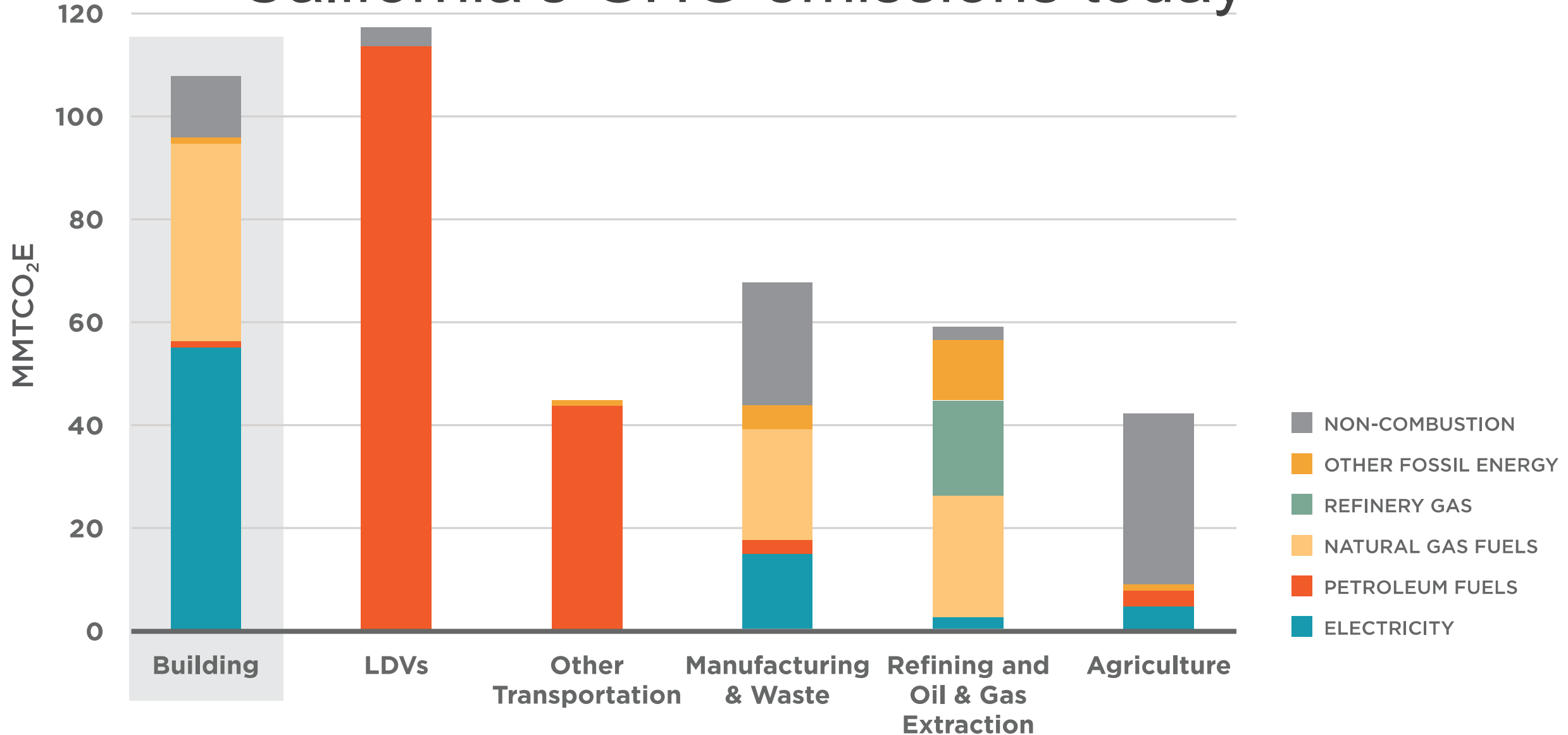
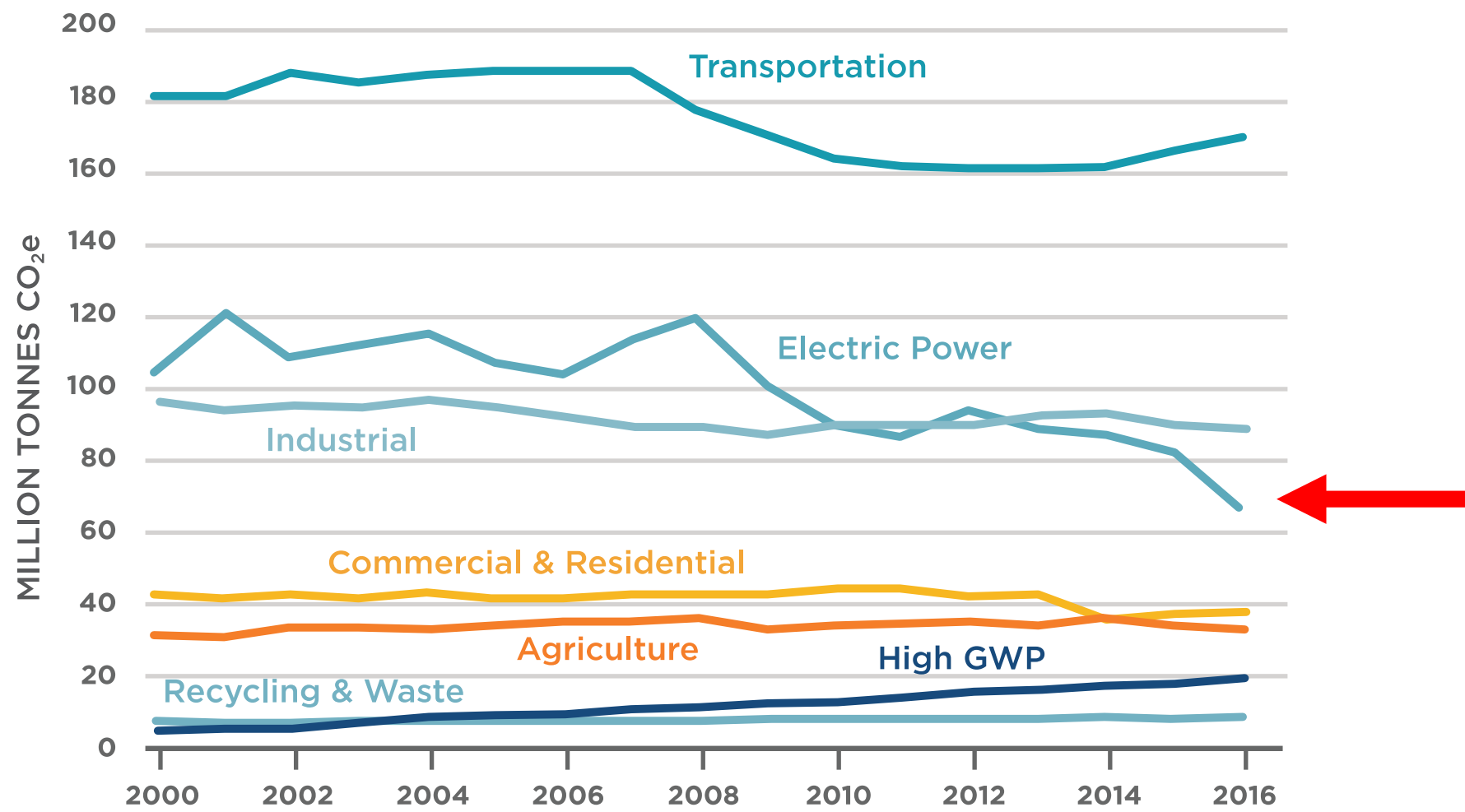


Photo: Associated press

Buildings represent ~25% of California's GHG emissions today



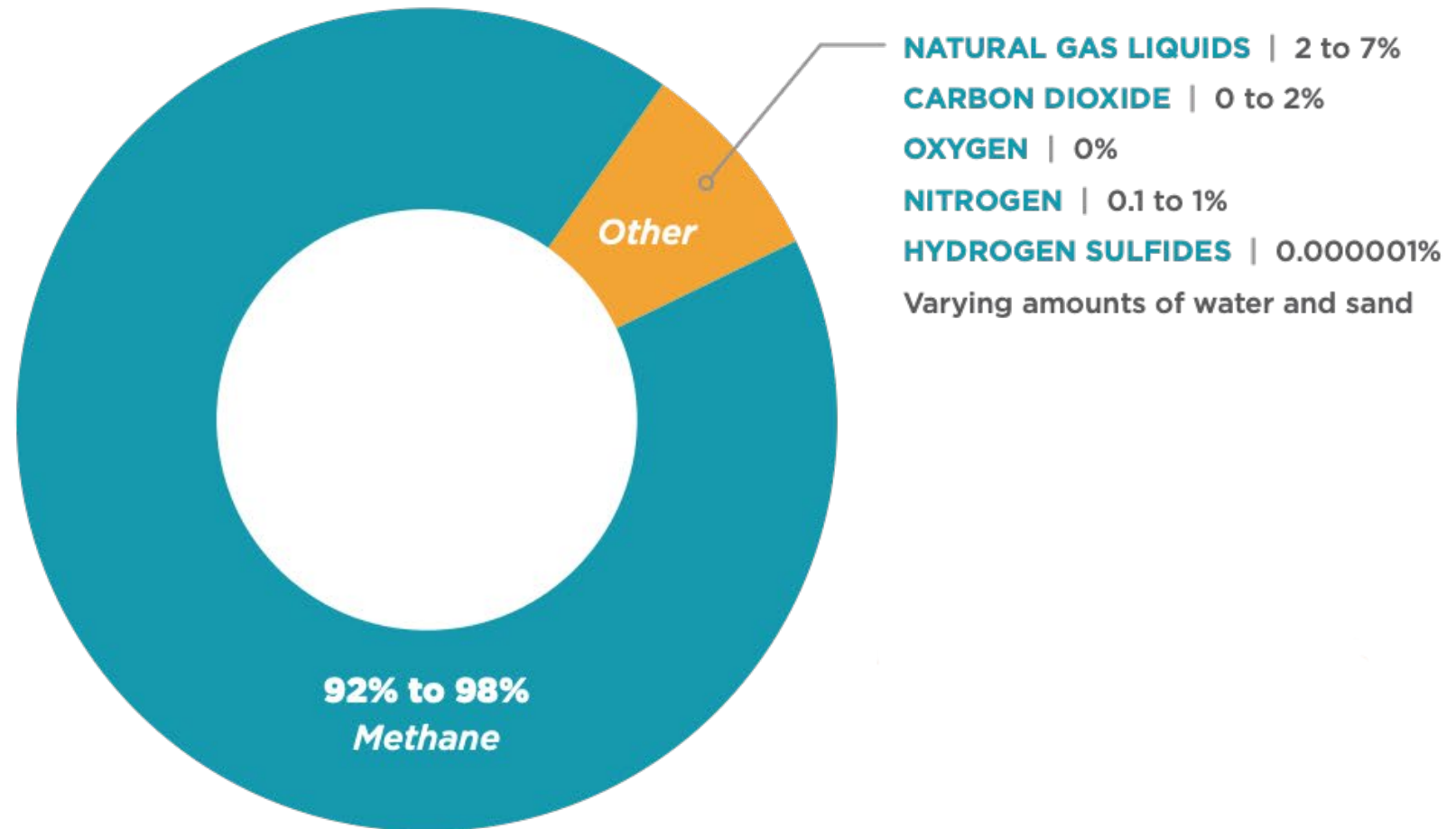
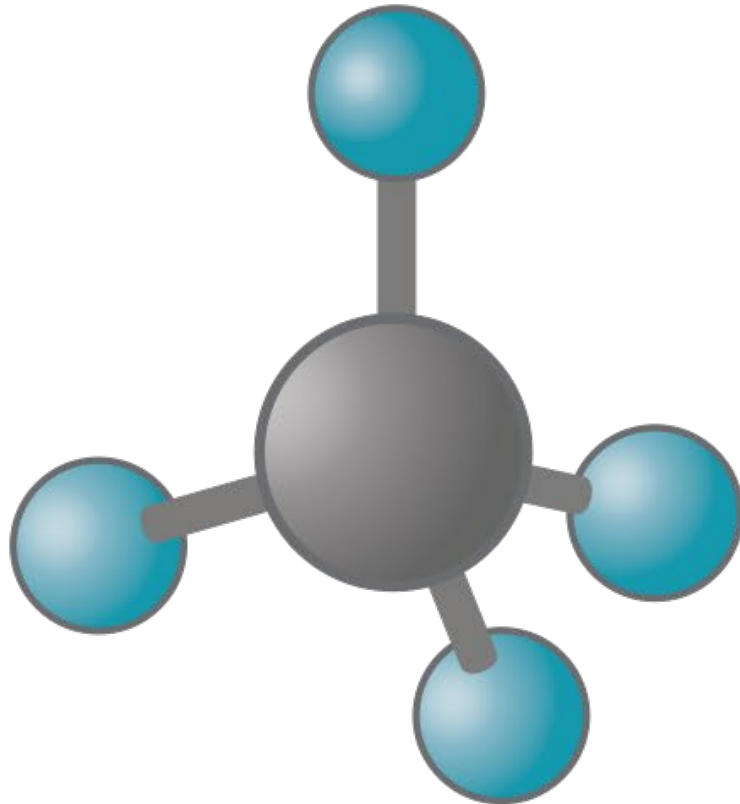
Electricity is getting cleaner,
moving toward 100% carbon-free by 2045



Source: CA Air Resources Board, Emission Inventory 2018.
https://www.arb.ca.gov/cc/inventory/pubs/reports/2000_2016/ghg_inventory_trends_00-16.pdf

~~Natural Gas~~

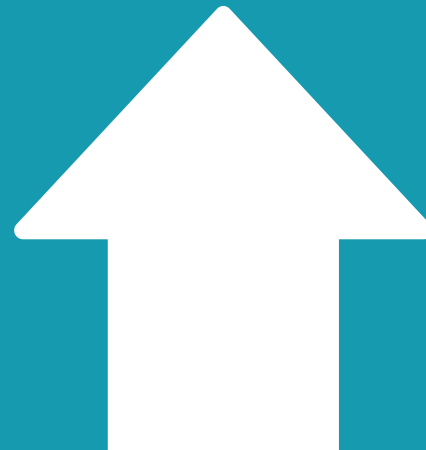
Methane





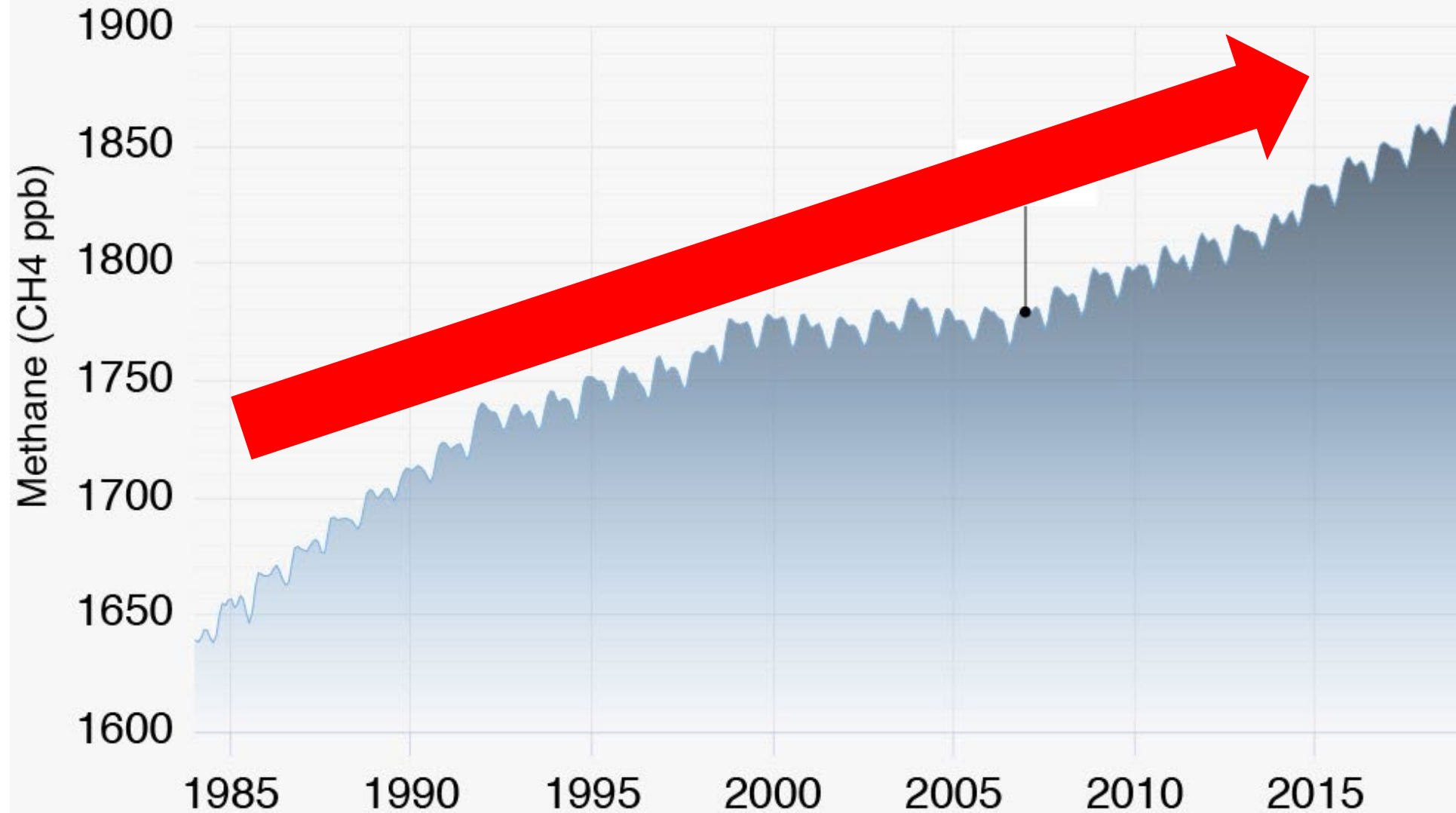
METHANE IS

84x more potent
than CO₂ in the short run



Average Atmospheric Methane Concentrations

Measured in parts per billion, or ppb

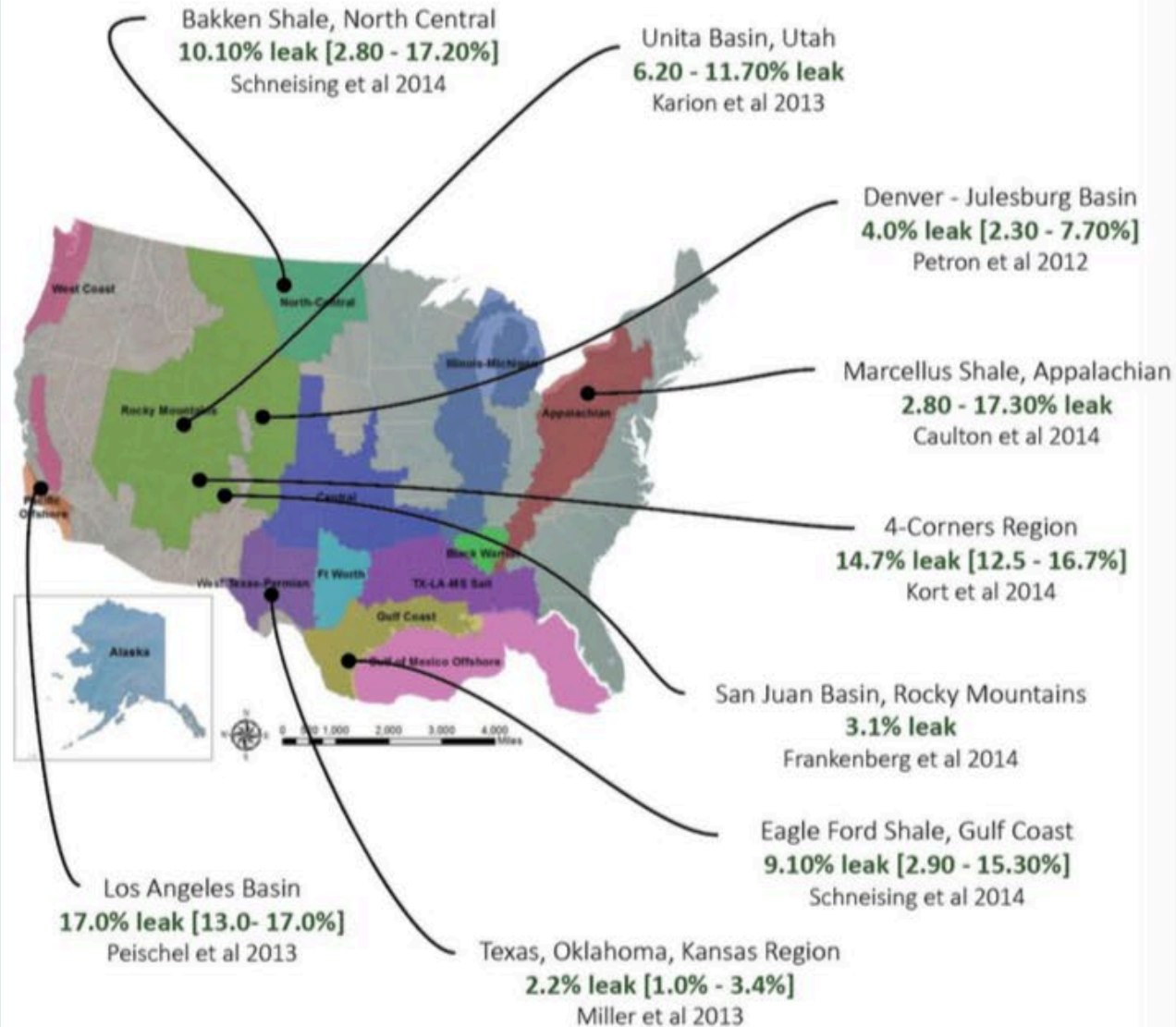


Source: The 2° Institute, www.methanelevels.org

We import
84%
of the methane
we use.



Leakage Varies by Production Zone



Leakage Attributed to California Natural Gas Demand

	Portion of CA Supply	Leak Rate Used (% of Production)	Leak Rate Sources	Total Production in Study Area (Billion Cubic Feet)
Permian	13.0%	2.2% [no range]	Presto 2017	2,000
San Juan	3.0%	3.1% [2.6 - 3.5%]	Kort 2014, Frankenburg 2015	1,300
Anadarko	13.0%	1.6% [0.6 - 2.0%]	Miller 2013, Presto 2017	1,500
Western Canada	0.01%	0.6% [no range]	Atherton 2017	951
Rocky Mountains	31.5%	4.1% [1.1 - 5.6%]	Petron 2014, Petron 2012, Robertson 207	600
Southwest Wyoming	26.0%	0.38% [0.12 - 0.86%]	Brantley 2014, Robertson 2017	516
California	10.0%	CEC full lifecycle used	CEC Study	Lifecycle used.

3.6% [2.4 - 4.3%]



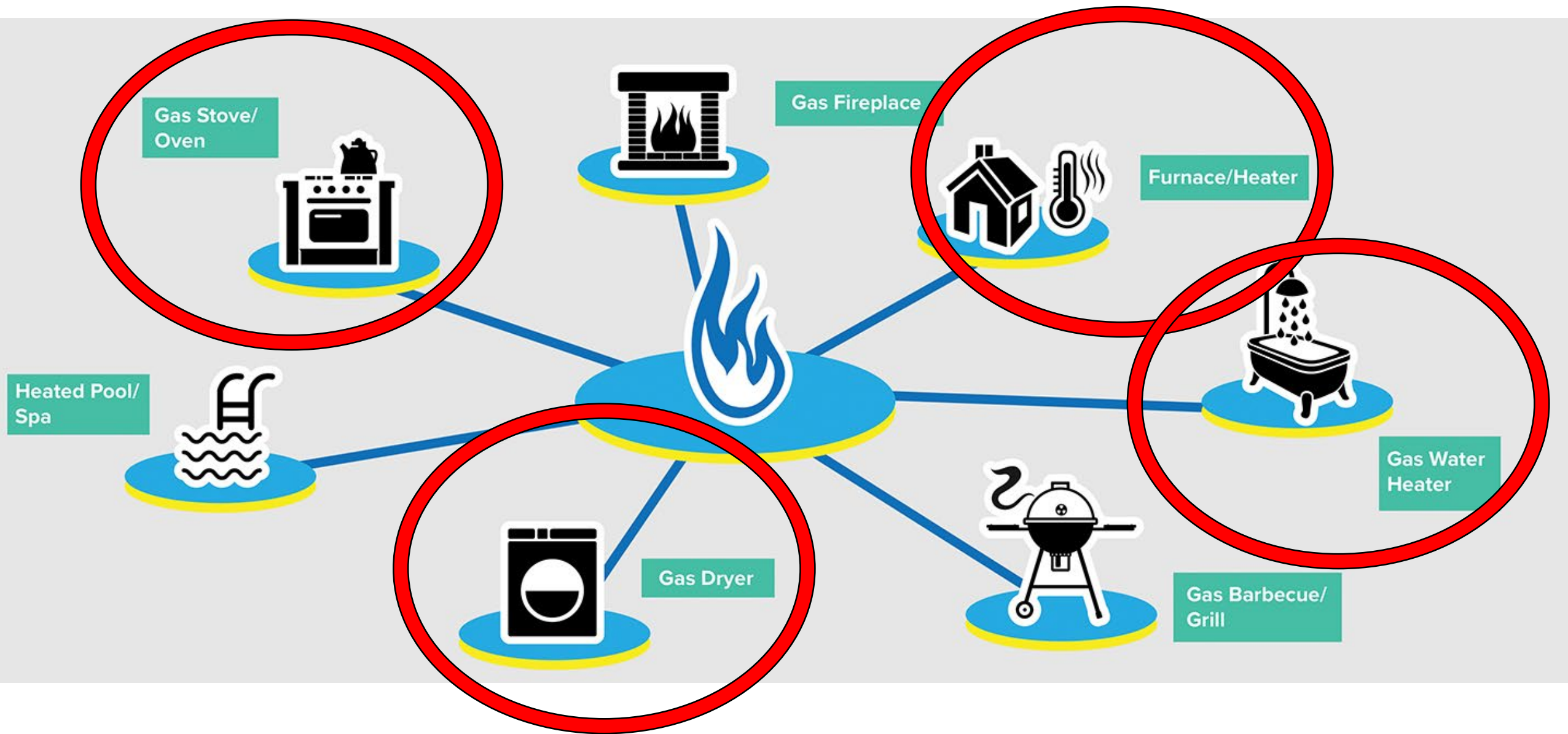


Data gathered from major U.S. East Coast cities, including New York City (above), reveal they are leaking methane at more than twice the previously reported rates. KORT/UNIVERSITY OF MICHIGAN

Major U.S. cities are leaking methane at twice the rate previously believed

By **Sid Perkins** | Jul. 19, 2019 , 2:30 PM

CHOICE



Gas Infrastructure Costs

\$6,000-\$15,000



\$7,000 X 9,897 = ~60,000 families priced out
\$270-\$850
\$750-\$2,400



Every \$1,000 increase
in house price prevents
9,897 California families
from affording
-NAHB, 2019



Impacts of Residential Appliance Electrification

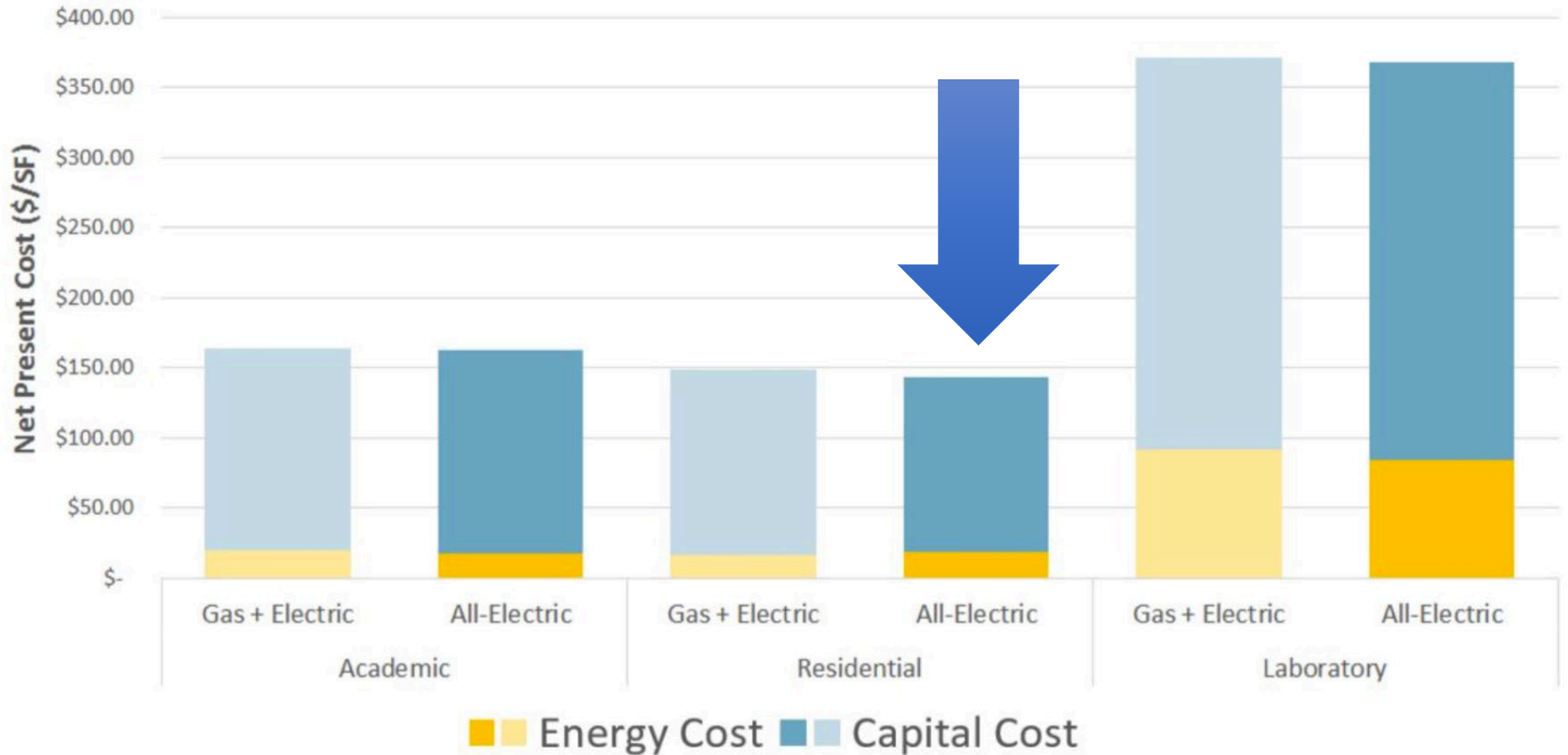
Final Report

Prepared for:
California Building Industry Association



..electric appliances
have similar or lower
costs than natural gas
appliances..

UC Carbon Neutral Buildings Cost Study



Lifting the High Energy Burden in America's Largest Cities:

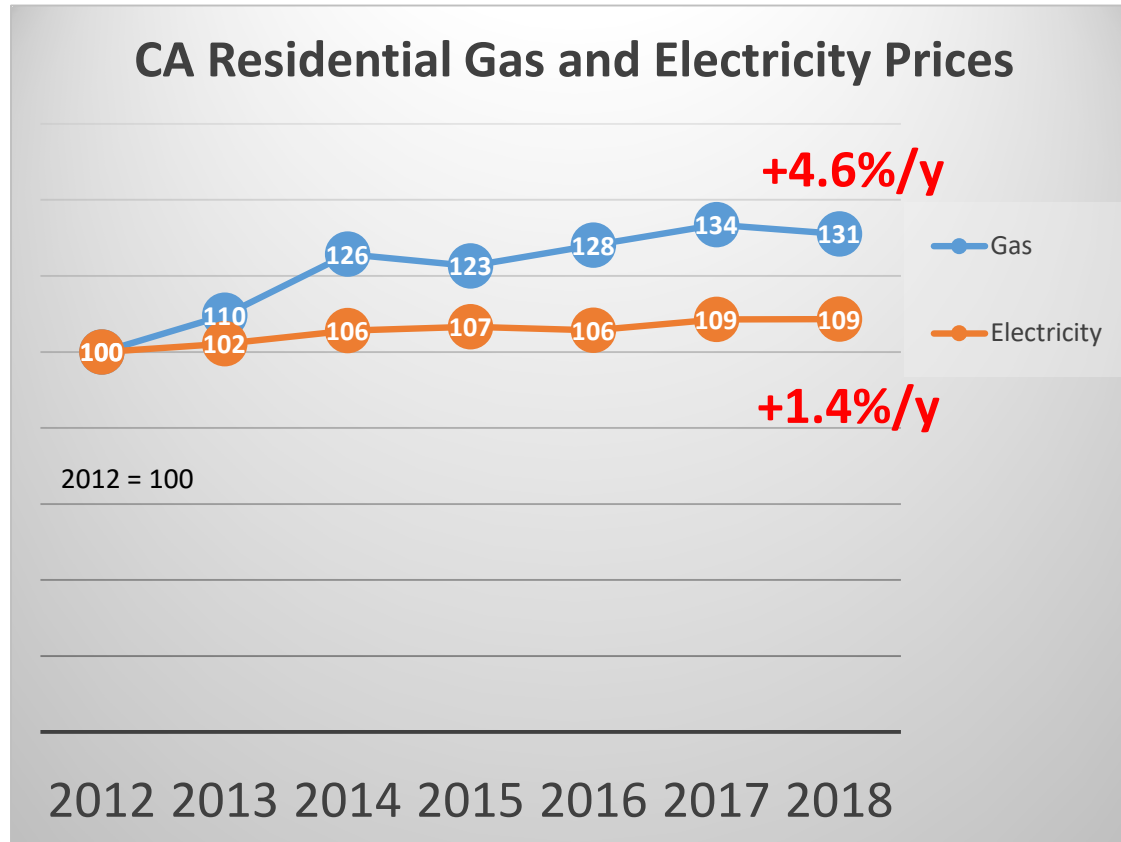
How Energy Efficiency Can Improve Low
Income and Underserved Communities

Ariel Dreobl and Lauren Ross



Residential gas prices are increasing faster than electricity prices

CA residential gas prices increased 3x faster than electricity prices from 2012 to 2018



Trend expected to continue:

- SoCalGas was approved for **25%** revenue increase 2018-2021 (**8% p.a.**)
- PG&E filed for a **26.6%** increase for gas distribution over 2018 (**6% p.a.**)

In comparison:

- SCE filed for 14% by 2020 over 2018 (**7%/y**)
- PG&E filed for a 24% increase for electric generation and distribution over 2018 (**6%/y**), in part due to costs associated with wildfires

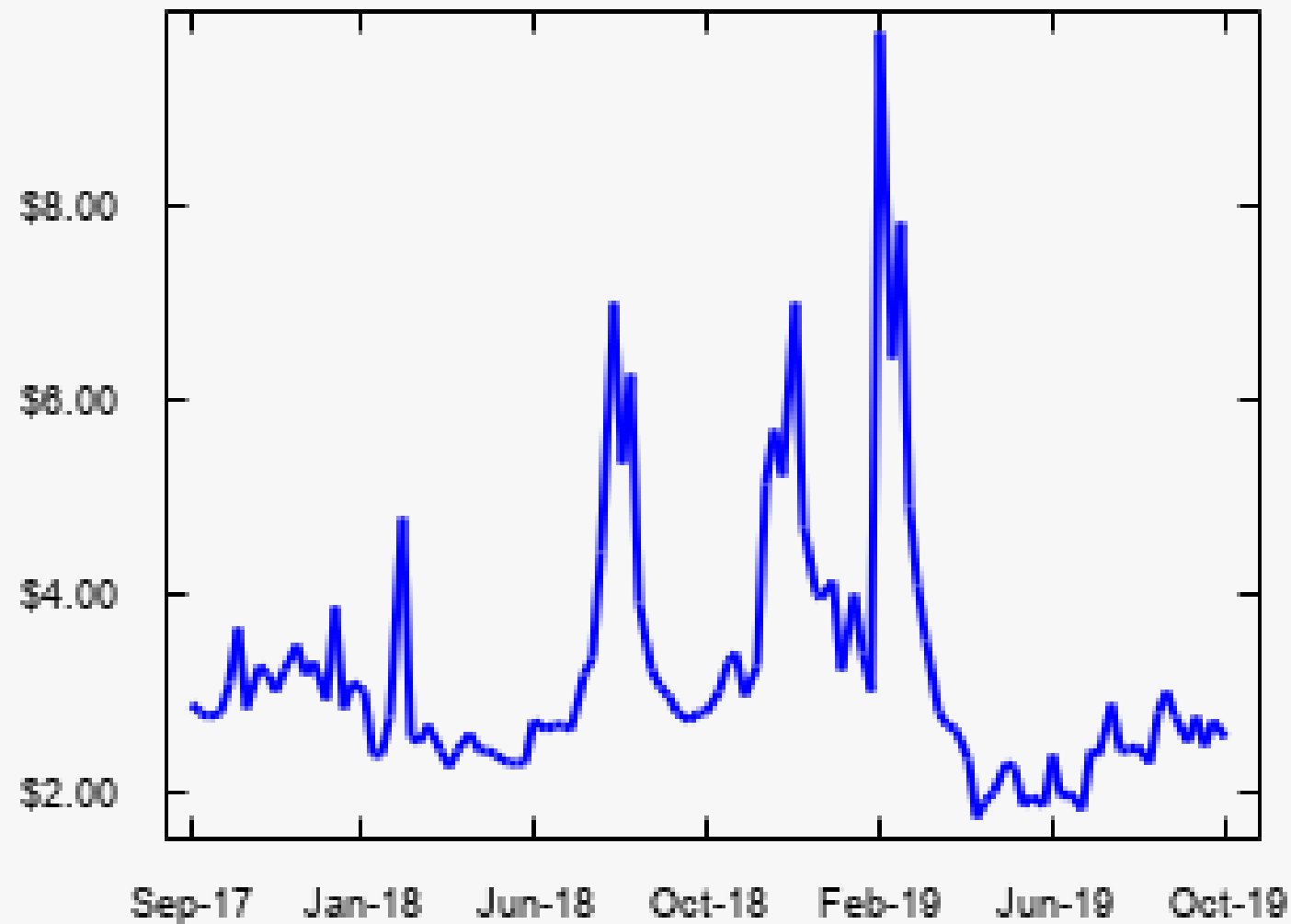
Source: EIA

<https://www.eia.gov/dnav/ng/hist/n3010ca3m.htm>

<https://www.eia.gov/electricity/data/browser/#/topic/7?agg=2,0,1&geo=g&freq=M>

California Regional Avg.

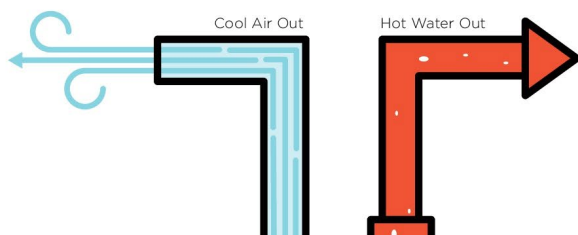
California Natural Gas Prices



Published 10/21/2019



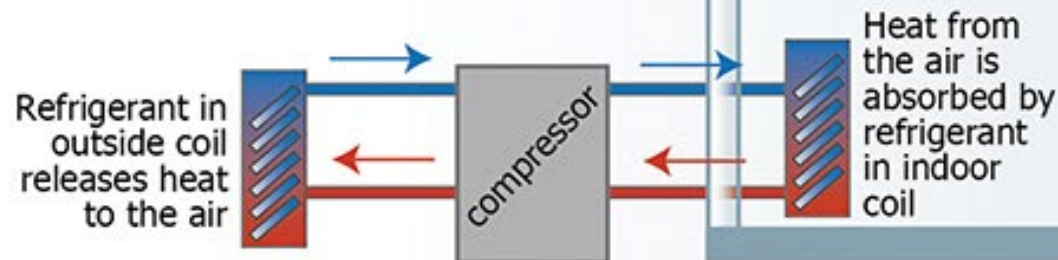
naturalgasintel.com



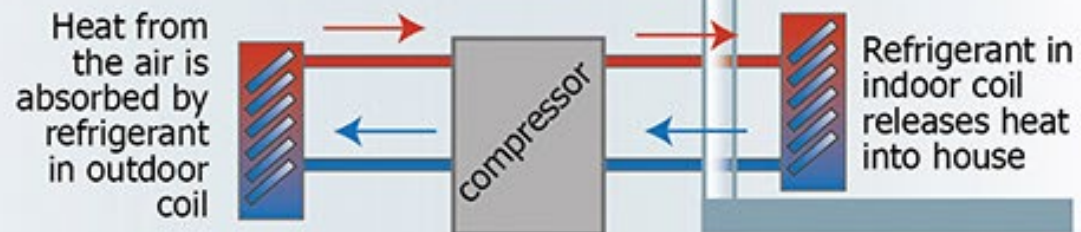
HOW DO HEAT PUMPS WORK?

HOW AN AIR SOURCE HEAT PUMP WORKS

SUMMER

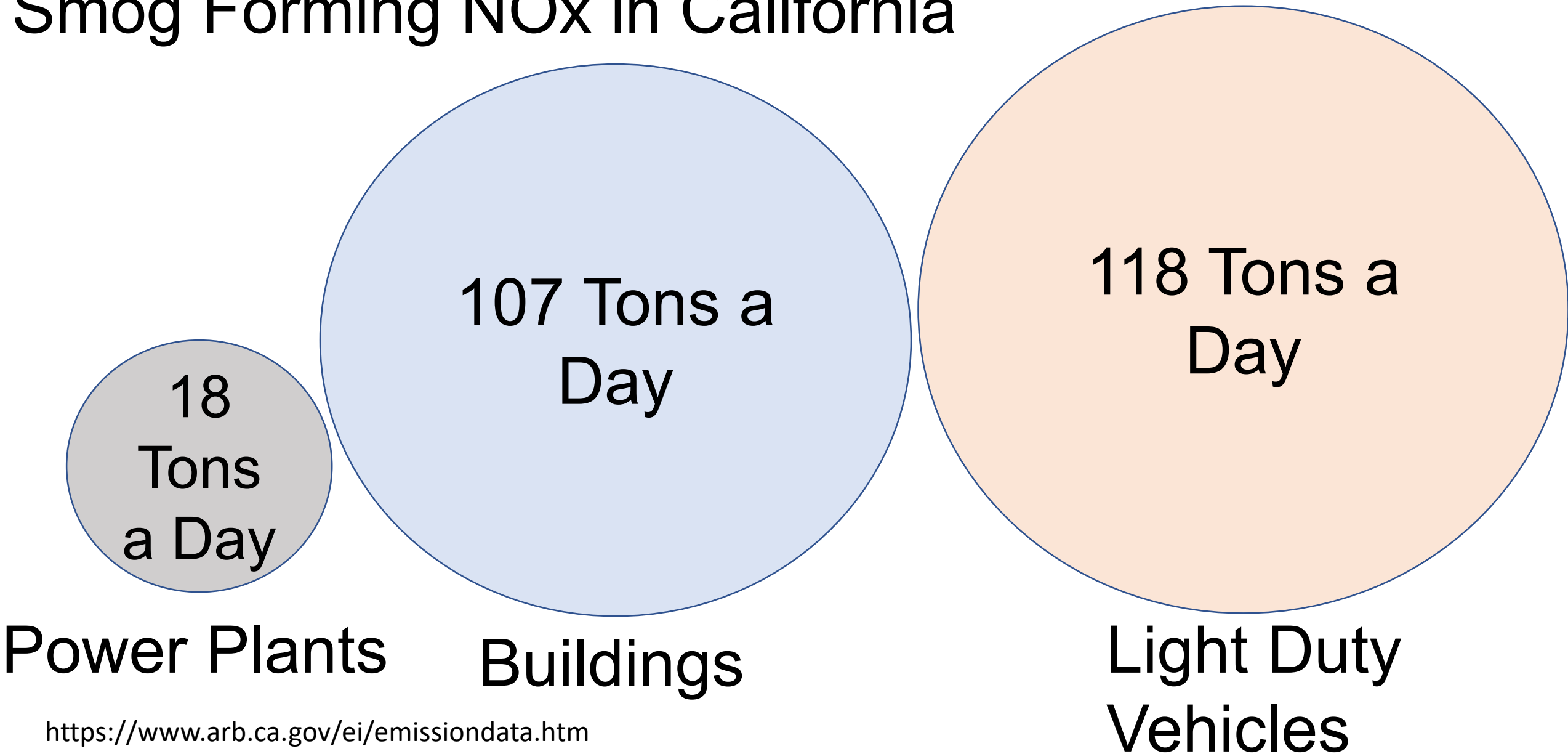


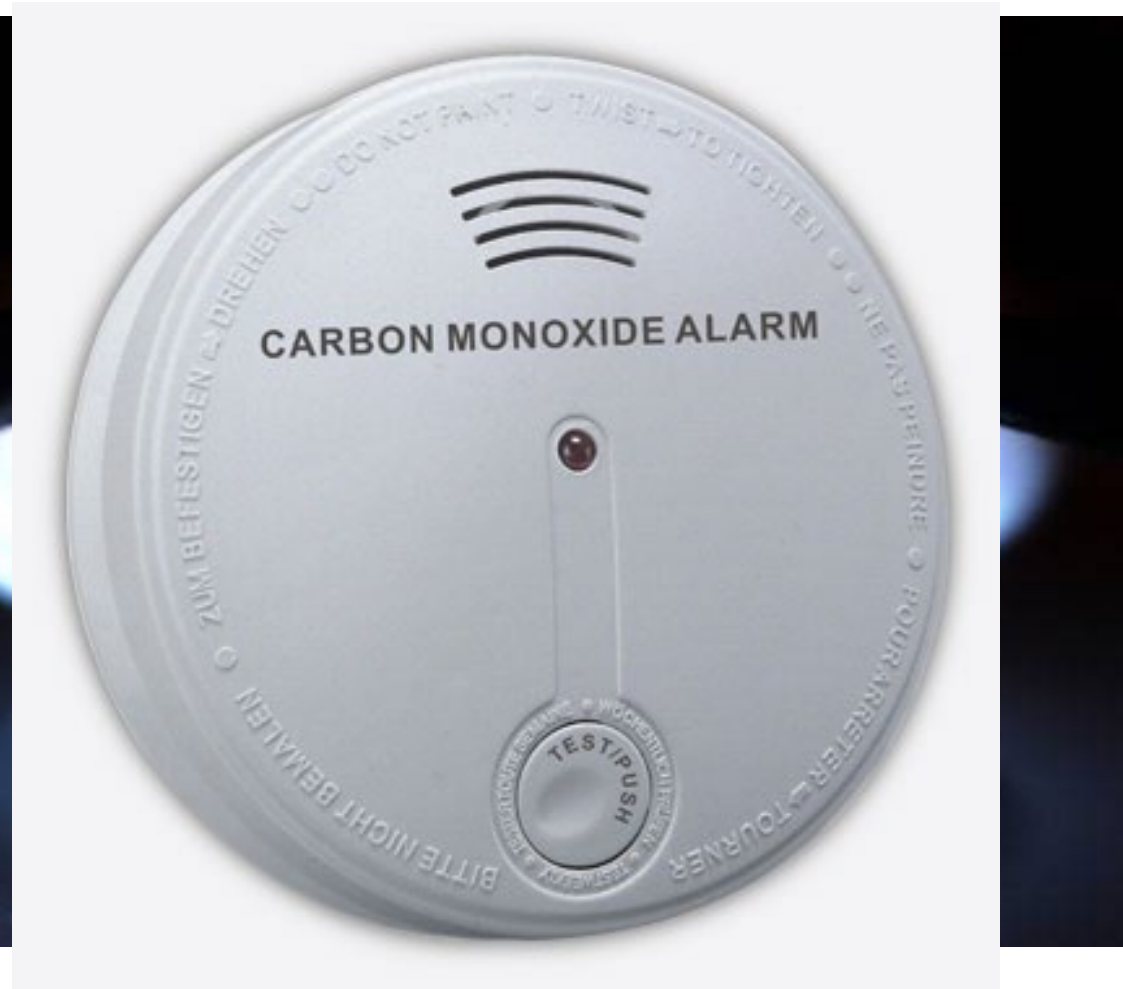
WINTER



© Collaborative Efficiency

Smog Forming NO_x in California






Pollutant Exposures from Natural Gas Cooking Burners: A Simulation-Based Assessment for Southern California

Jennifer M. Logue,^{1,2} Neil E. Klepeis,^{3,4} Agnes B. Lobscheid,¹ and Brett C. Singer^{1,2}, 2014

Cooking with Gas Can Harm Children

*Children living in a home with a gas cooking stove have a **42%** increased risk of current asthma and a **24%** increased lifetime risk of asthma.*



[Cooking with Gas Can Harm Children: Cooking with gas stoves is associated with increased risk of childhood respiratory illnesses, including asthma Andee Krasner, MPH* and T Stephen Jones, MD, MPH](#)



AVERAGE EXPOSURE

Moderate

26 AQI



10

PM_{2.5}

26

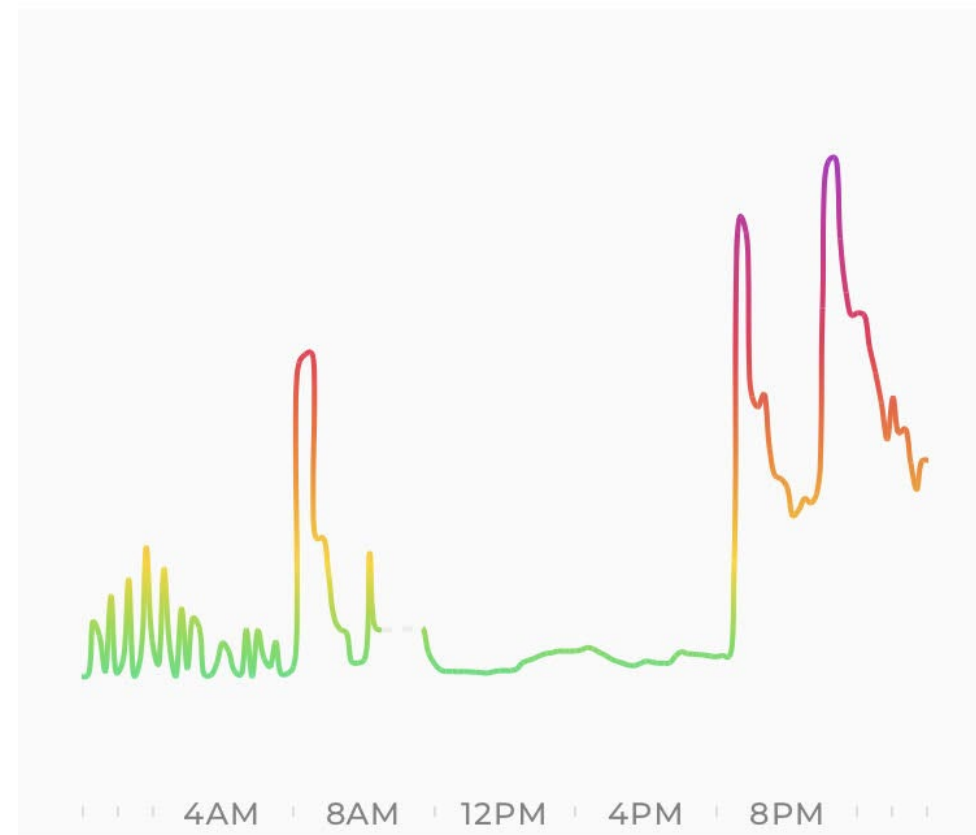
PM₁₀

2

NO₂

14

VOC



Air Board: Residential Cooking Exposure Study Finds Unhealthful Levels

Making a fried chicken dinner produced average indoor nitrogen dioxide levels of up to **400 parts per billion**, which is well over ARB's indoor air quality guideline and ambient air quality standard of **250 parts per billion** for one hour

Indoor formaldehyde levels exceeded **400 micrograms per cubic meter** during oven cleaning in a gas stove. This exceeds the California Office of Environmental Health Hazard Assessment's Acute Reference Exposure Level (REL) guideline of **94 micrograms per cubic meter** for one hour, and exceeds ARB's indoor guideline action level of **100 parts per billion** as well.

Air Board: Residential Cooking Exposure Study Finds Unhealthful Levels

Air Board Advice:

1. Have gas stoves cleaned and properly adjusted annually for carbon monoxide and gas pressure by a trained professional.
2. Use a low-noise range exhaust hood.
3. Use heat-proof side shields along with the exhaust hood.
4. Avoid over-heating food and spilling food on burners.
5. Use the self-cleaning oven cycle only when the house is not occupied and is well ventilated, especially during the first hour or two.
6. Consider microwaving food when possible





Ind



induction zone

Consumer Reports Prefers Induction

Top 9 Ranges for 2018 were electric, top 2 were Induction

Fuel	Model	Rating	Cost
Induction	Kenmore Elite 95073	89	\$1,530
Induction	Kenmore 95103	88	\$1,000
Electric Smoothtop	Samsung NE58F9710WS	85	\$1,800
Induction	GE Profile PHS930SLSS	83	\$2,430
Electric Smoothtop	Samsung NE59J7850WS	82	\$1,300
Electric Smoothtop	Samsung NE59J7750WS	82	\$1,600
Induction	LG LSE4617ST	82	\$3,330
Induction	Frigidaire Gallery FGIF3036TF	82	\$990
Gas	LG Signature LUTD4919SN	81	\$3,000

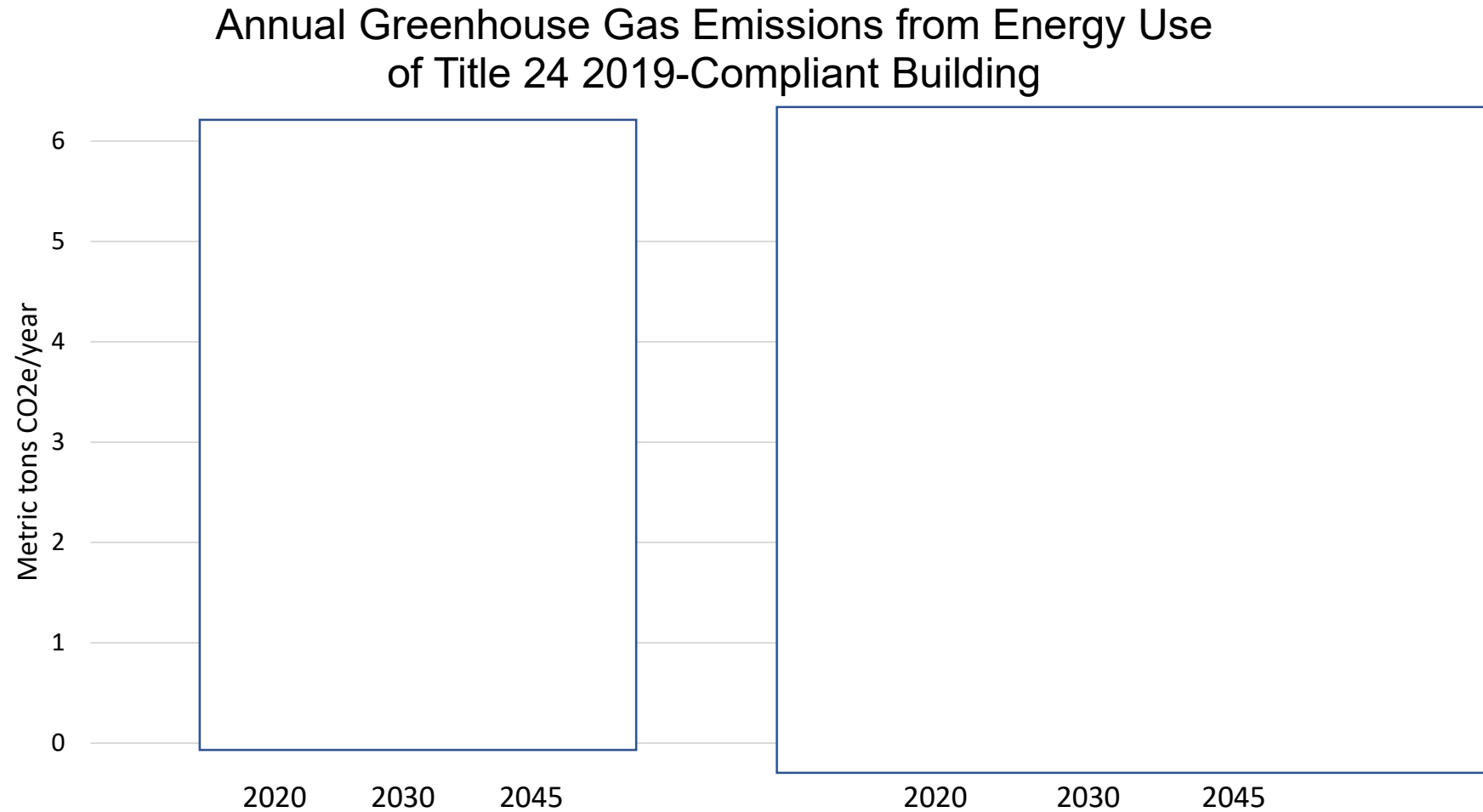


Cleaner
Safer
Better Control
Cooler
Easier to Clean

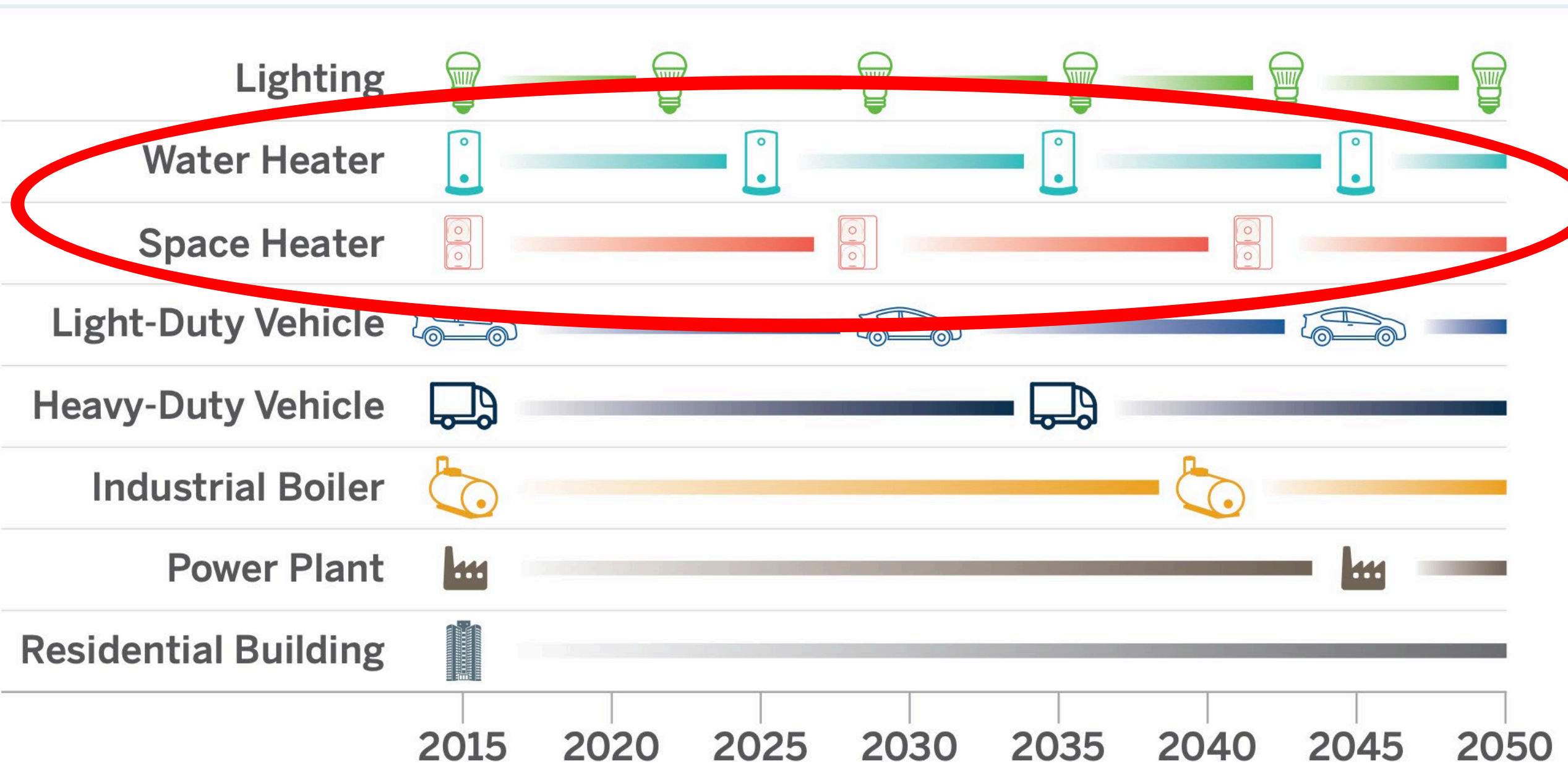




Electric Heat Offers Pathway To Zero Emissions



Stock Turnover



Electric Buildings are ...

Cheaper

More Equitable

Healthier

More Climate Friendly

Safer

Roadmap

- Meetings
 - September
 - November
 - January
- Finished January 2019
- Outreach February-March

Figure 1: D	Sector	
New Buildings	ons	
Retrofits	n the	
	sector	sector
	sector	sector
<ul style="list-style-type: none"> •Increase the heating from in 2030. •Increase the heating from in 2030. 	pace	100 %
	water	100 %

Roadmap Goals

Goal 1: Build customer, builder, contractor and policy-maker awareness and interest in decarbonization.

Goal 2: Ensure that customers receive a good value from adopting building decarbonization measures.

Goal 3: Ensure that building decarbonization provides a better value to builders and contractors than fossil-fuel heating.

Goal 4: Prepare supply-chains and delivery agents are to meet rising demand for carbon-free building technologies with a quality product.

Goal 5: Align Policy to meet other goals.

CPUC Decarbonization Plans

1. All Electric Rates
2. Resource Acquisition:
 - Incentives (eg Rebates)
 - Financing (eg Loans for all-electric customers)
 - Emerging Technology
3. Market Transformation



Overall: Focus goals on GHG emission rather than energy reduction.

California is building the homes of the future, today

Homes built to the new codes will:



BE EXTREMELY ENERGY EFFICIENT

New homes will feature high efficiency windows, appliances, and lighting and heating.



HAVE SOLAR POWER

All eligible residential buildings and homes will have access to renewable energy resources, such as rooftop solar.



INCENTIVIZE SOLAR + STORAGE

In some cases, the rules will allow a limited trade-off between solar + storage and efficiency. The credit is meant to help incentivize on-site energy storage for individual households, an essential tool for achieving emission reductions.

Encouraging All-Electric:

Provisions in the code will encourage more electricity use and all-electric homes to reduce natural gas consumption. Technology such as electric water heaters are becoming increasingly cost effective.

Patterns of TDS and Carbon Emissions are Identical

The bar chart displays the number of people per hour on the beach from Monday to Sunday. The y-axis represents the number of people, ranging from 0.00 to 8.00 in increments of 1.00. The x-axis shows the days of the week: Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday. The chart shows a clear daily pattern with peaks around 6-7 people per hour and troughs around 1-2 people per hour.

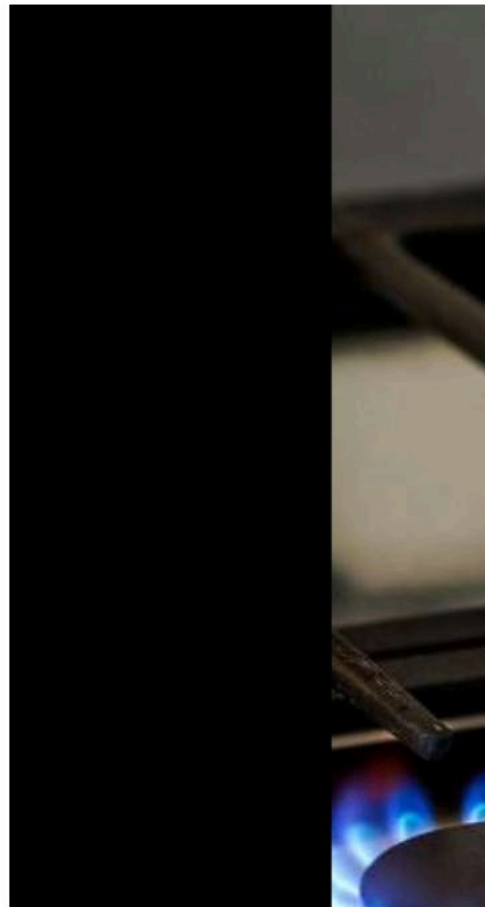
Day	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8	Hour 9	Hour 10	Hour 11	Hour 12	Hour 13	Hour 14	Hour 15	Hour 16	Hour 17	Hour 18	Hour 19	Hour 20	Hour 21	Hour 22	Hour 23	Hour 24	
Monday	5.2	5.5	5.8	6.4	6.5	2.8	1.5	1.2	1.1	1.2	2.5	4.5	6.5	7.0	6.5	6.0	4.8	4.2	4.2	4.8	5.8	5.5	2.5	1.5	1.2
Tuesday	3.5	5.8	6.9	6.9	6.0	4.8	4.2	4.2	4.2	4.8	5.8	2.5	1.5	1.2	1.1	1.2	1.5	3.5	5.8	6.9	6.9	5.8	5.5	4.8	3.5
Wednesday	5.1	5.8	5.5	5.2	5.0	4.2	4.2	4.2	4.2	5.1	5.1	2.2	0.8	0.8	0.8	0.8	0.8	3.5	5.1	5.8	5.8	3.8	2.2	0.8	0.8
Thursday	3.5	5.1	5.8	5.5	5.2	5.0	5.5	5.5	5.8	6.2	6.2	3.8	2.2	1.5	1.5	1.5	1.5	4.5	6.2	6.5	6.5	6.2	6.2	4.5	2.5
Friday	4.2	6.2	6.5	6.2	6.2	6.2	6.2	6.2	6.5	6.5	4.5	2.5	1.5	1.5	1.5	1.5	1.5	4.2	6.2	6.5	6.5	6.2	6.2	5.1	2.5
Saturday	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sunday	0.5	1.5	5.8	5.8	5.2	4.8	4.8	4.8	4.8	4.8	5.1	5.5	5.8	3.8	1.5	0.8	0.5	0.5	0.8	1.5	2.8	7.2	6.9	5.8	5.1

Berkeley natural gas

By Sarah Ravani Updated 7:

Berkeleyside
@berkeleyside

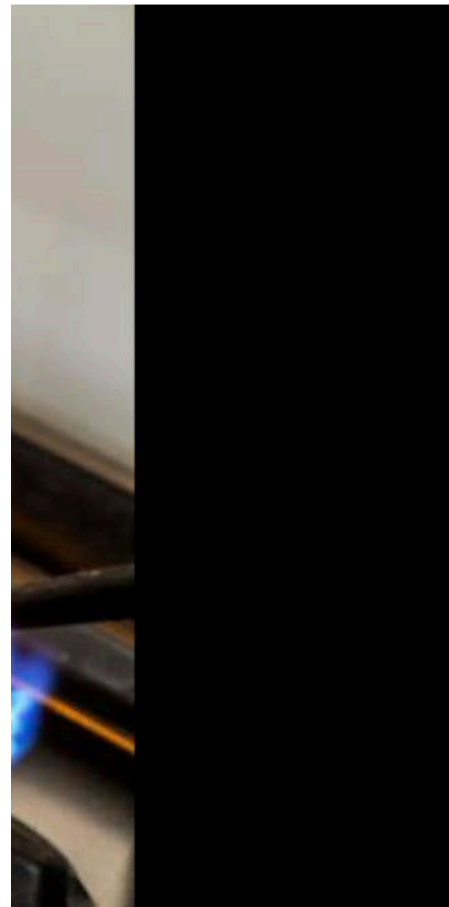
Rep Darin Cline of @PGE4Me says the utility supports all-electric buildings, and invites city officials to visit its all-induction kitchen for a tour. #berkmtg



an



374



Chapter Targets



All new buildings will be net zero carbon by 2030; and 100% of buildings will be net zero carbon by 2050



Reduce building energy use per sq.ft. for all building types 22% by 2025; 34% by 2035; and 44% by 2050

MAYOR GARCETTI LAUNCHED

Targets Countywide

AL

APRIL 29, 2019



OurCounty

2025

All new buildings and 50% of major building renovations to be net zero carbon

2035

75% of major building renovations to be net zero carbon

2045

100% of major building renovations to be net zero carbon

50+ CA Local Governments Actively Exploring Zero-Emissions Reach Codes

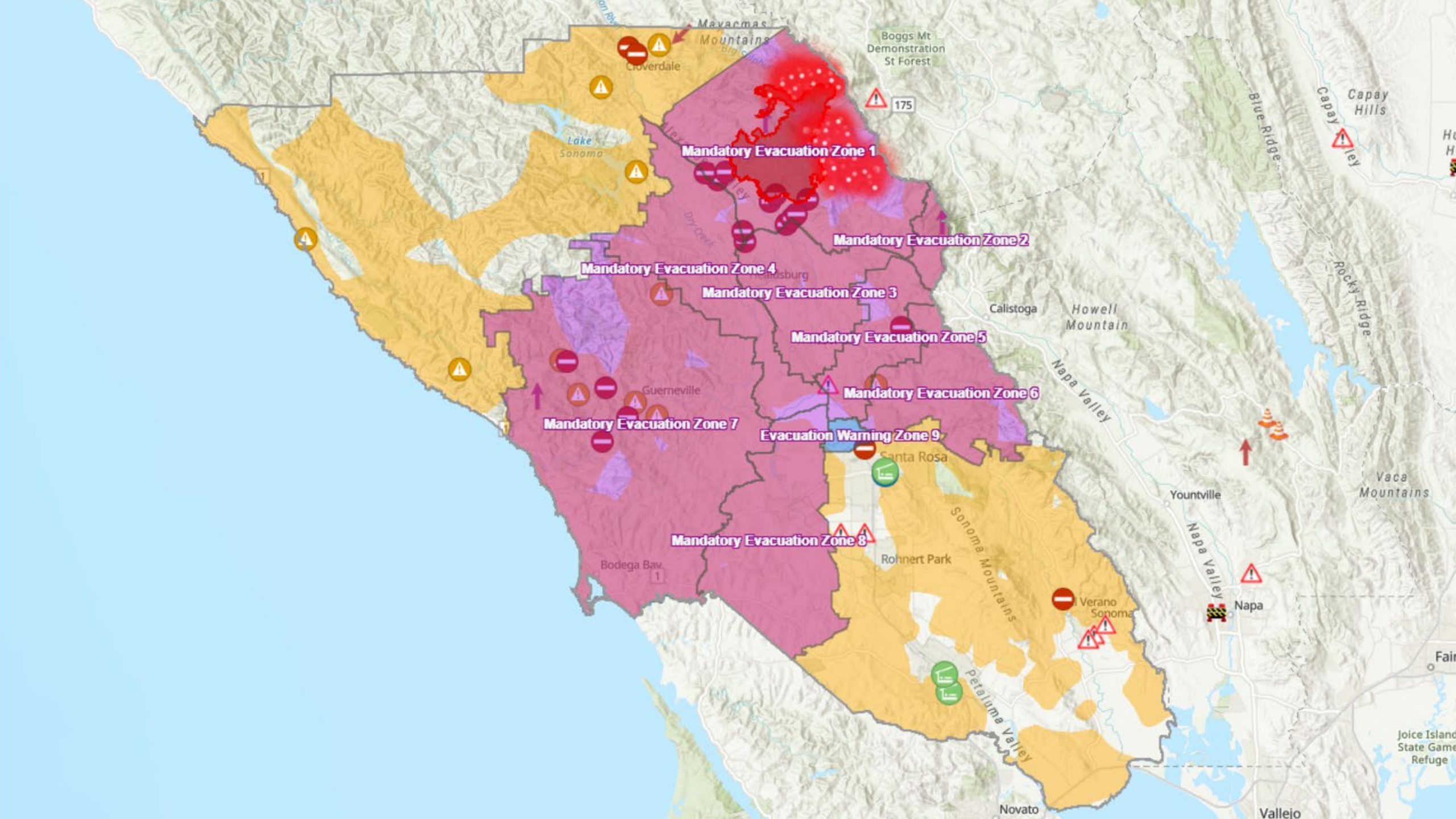
Northern California	Southern California
<u>Bay Area</u> <ul style="list-style-type: none">• Alameda County: Albany, Berkeley, Dublin, Fremont, Hayward, Oakland• Marin County• Santa Clara County: Campbell, Cupertino, Gilroy, Los Altos, Los Altos Hills, Milpitas, Monte Sereno, Morgan Hill, Mountain View, Palo Alto, San Jose, Sunnyvale• San Mateo County: Brisbane, Burlingame, East Palo Alto, Menlo Park, Millbrae, Portola Valley, Redwood City, San Mateo City and County• San Francisco• Sonoma County: Cloverdale, Petaluma, Santa Rosa, Sebastopol, Sonoma, Windsor, Healdsburg <u>Central Valley</u> <ul style="list-style-type: none">• Sacramento, Davis <u>Humboldt:</u> Arcata	<u>Central Coast</u> <ul style="list-style-type: none">• City of San Luis Obispo <u>Santa Barbara</u> <ul style="list-style-type: none">• Santa Barbara, Goleta <u>Ventura</u> <ul style="list-style-type: none">• Ojai, Thousand Oaks <u>Los Angeles</u> <ul style="list-style-type: none">• City and County of LA, Santa Monica, West Hollywood, Malibu <u>San Diego</u> <ul style="list-style-type: none">• Carlsbad (adopted!), Chula Vista, Encinitas, Escondido















Welcome to Santa Rosa

FROM THE
ASHES
WE WILL
RISE



Join us!

Buildingdecarb.org/join





Energy Research and Development Division
FINAL PROJECT REPORT

Deep Decarbonization in a High Renewables Future

Updated Results from the California PATHWAYS Model



Energy+Environmental Economics

California Energy Commission

Edmund G. Brown Jr., Governor

June 2018 | CEC-500-2018-012





Biogas supply & gas demand in 2050

