

California's Race to Decarbonize

Steps to get Carbon out of Buildings

California Energy Alliance
April 15, 2020

Scott Shell, FAIA, LEED® AP BD+C, CPHC®
Principal

ehdd.



City College of San Francisco Chinatown North Beach Campus

San Francisco, California



2014 LEED® Gold

2012 Award of Merit: Safety



University of California, Santa Cruz Coastal Biology Building

Santa Cruz, California



2018 LEED® Gold

2018 Architectural Record Feature



KQED Headquarters

San Francisco, California



EHDD Zero Energy Buildings



The David & Lucile Packard Foundation



The Exploratorium at Pier 15



Boulder Commons



IDEAs Office

EHDD Zero Energy Buildings



Golden Gate Park Tennis Center



Mark Day School



Marin Country Day School



Lick Wilmerding School

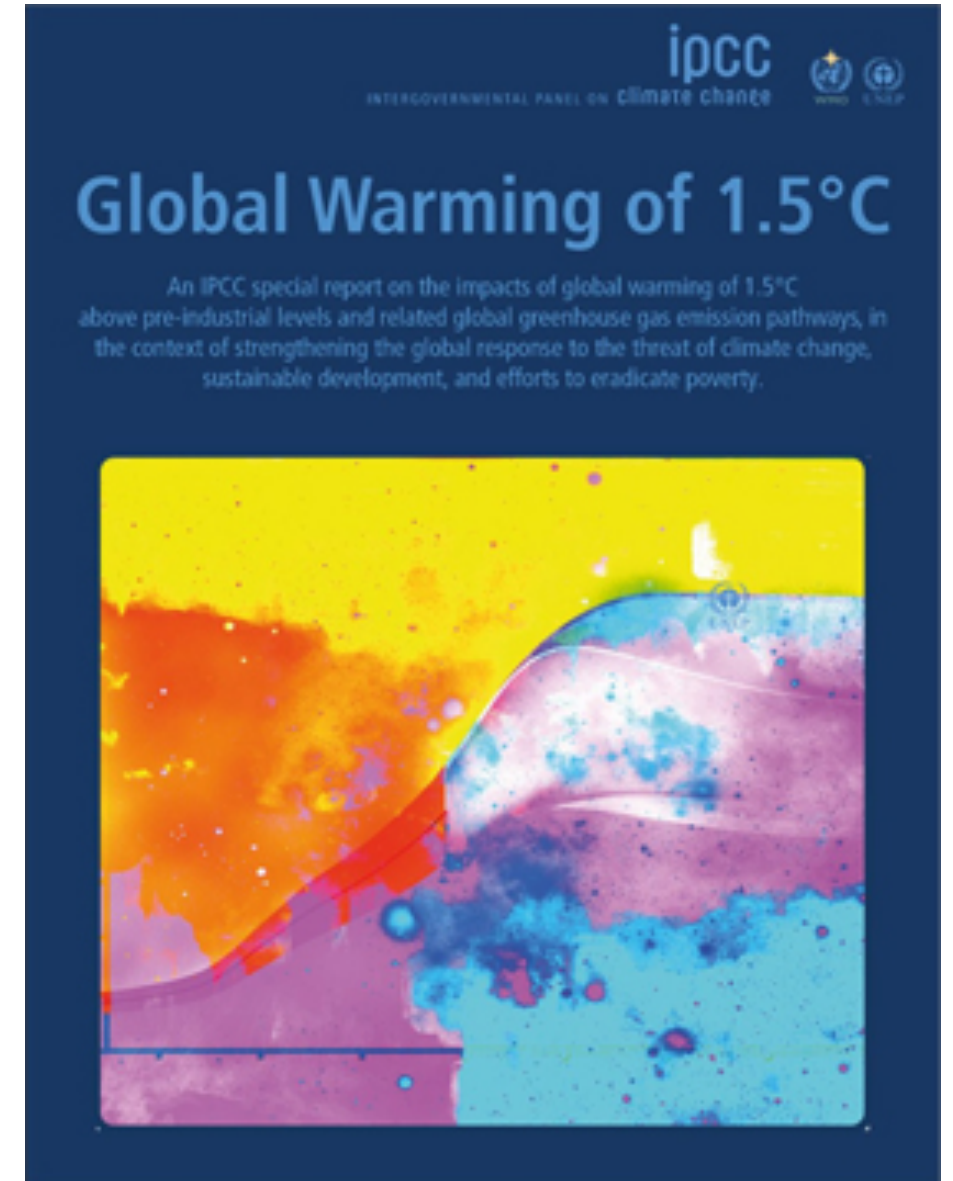
Zero Energy Buildings

An aerial photograph of a modern building complex with solar panels installed on the roofs. The buildings are multi-story and have a mix of light-colored and dark-colored facades. The surrounding area includes other buildings, trees, and a clear blue sky.

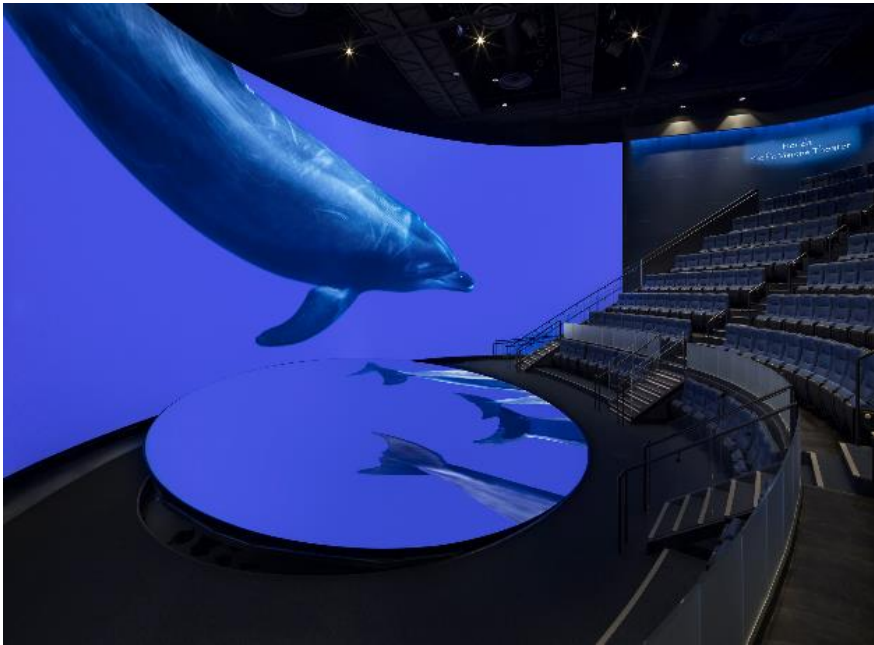
- 1. Efficient Design**
- 2. All Electric**
- 3. 100% Renewable Energy**

“1.5° C requires rapid, far-reaching and unprecedented changes”

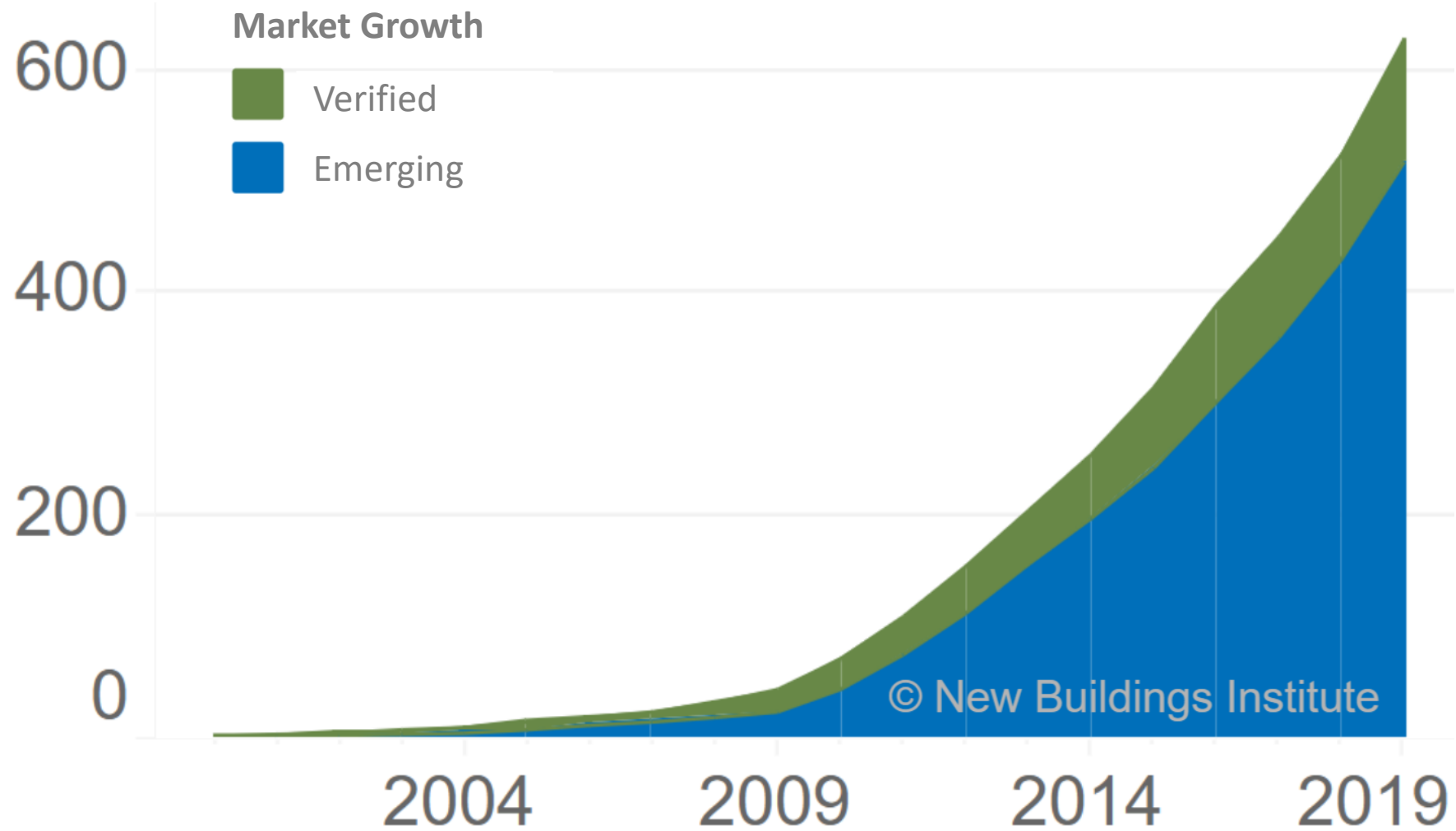
“CO2 needs to fall by ~45% by 2030”



EHDD not-Zero Energy Buildings

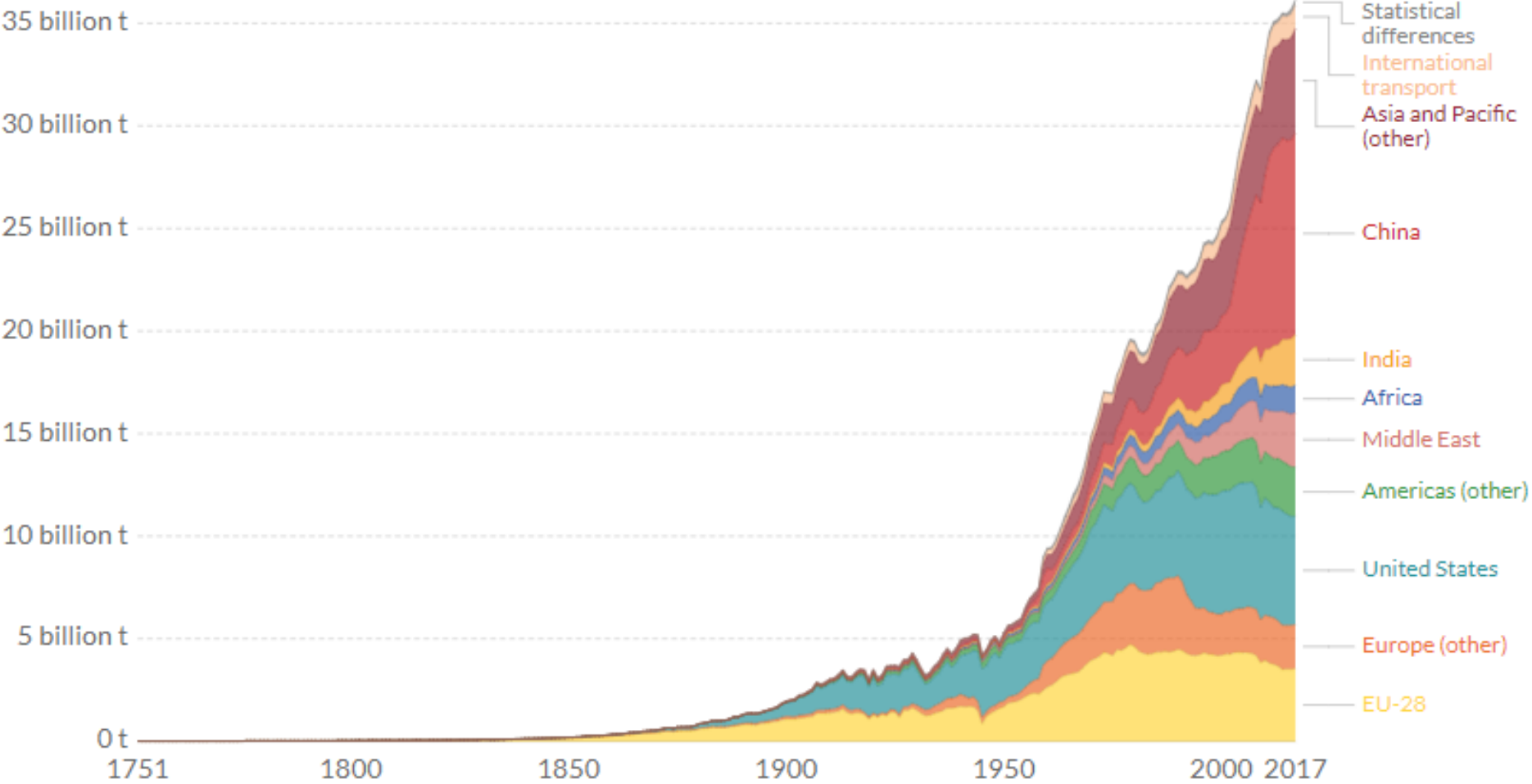


Getting to Zero Buildings Database



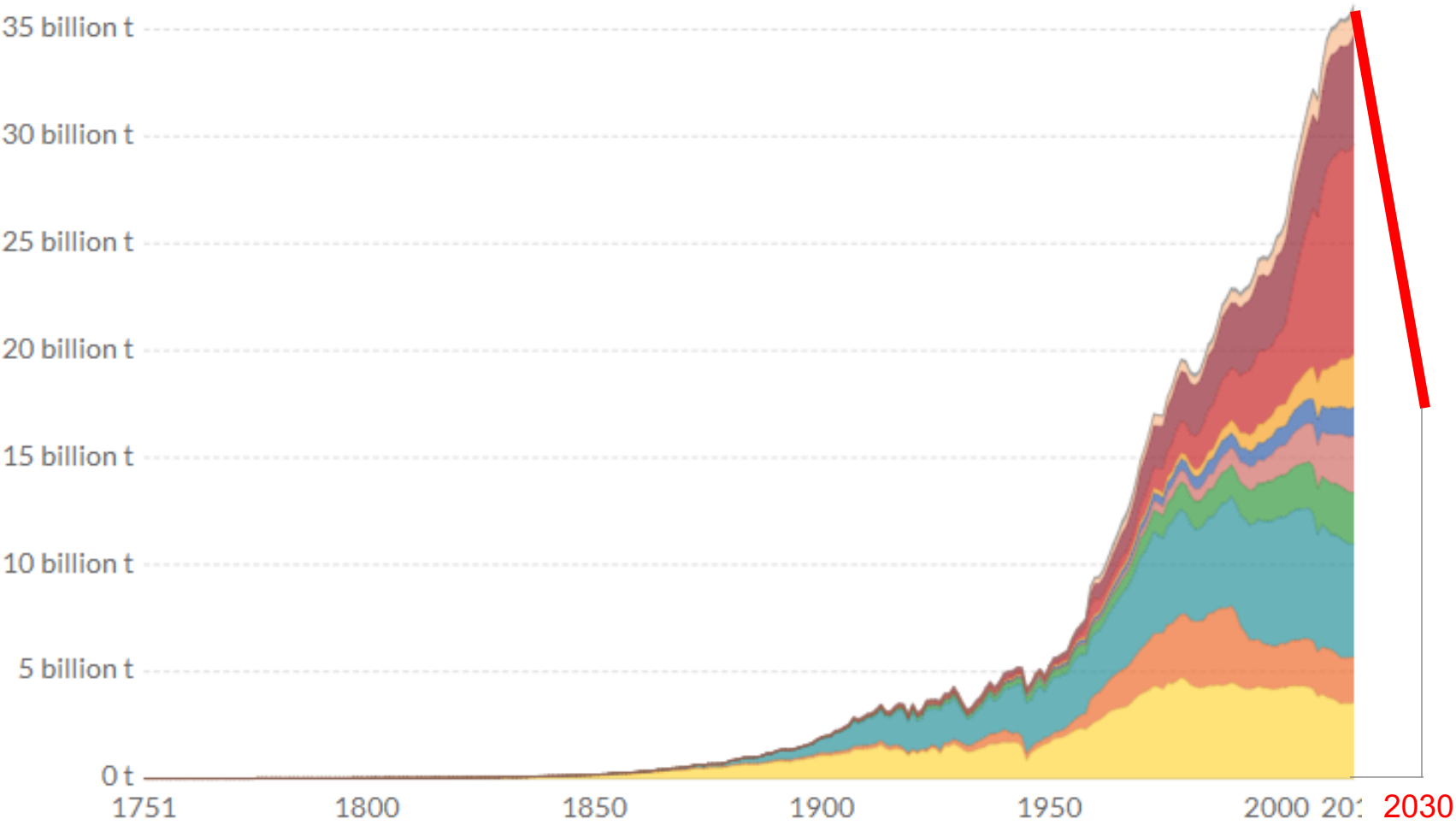
© New Buildings Institute

Annual total CO₂ emissions, by world region



Source: Carbon Dioxide Information Analysis Center (CDIAC); Global Carbon Project (GCP)
Note: The difference between the global estimate and the sum of national totals is labeled "Statistical differences".
OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY

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OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY

Zero ~~Energy Buildings~~ Emission Policies

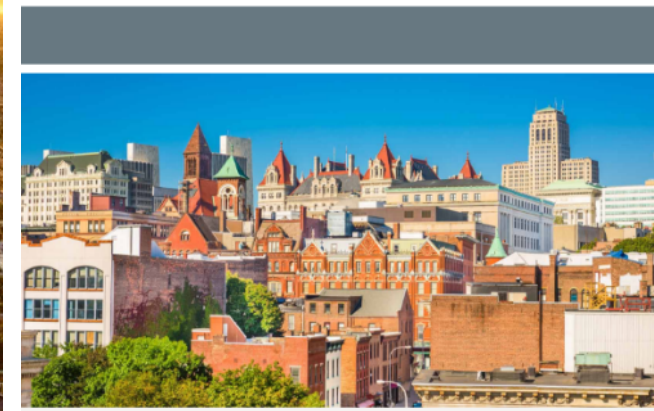
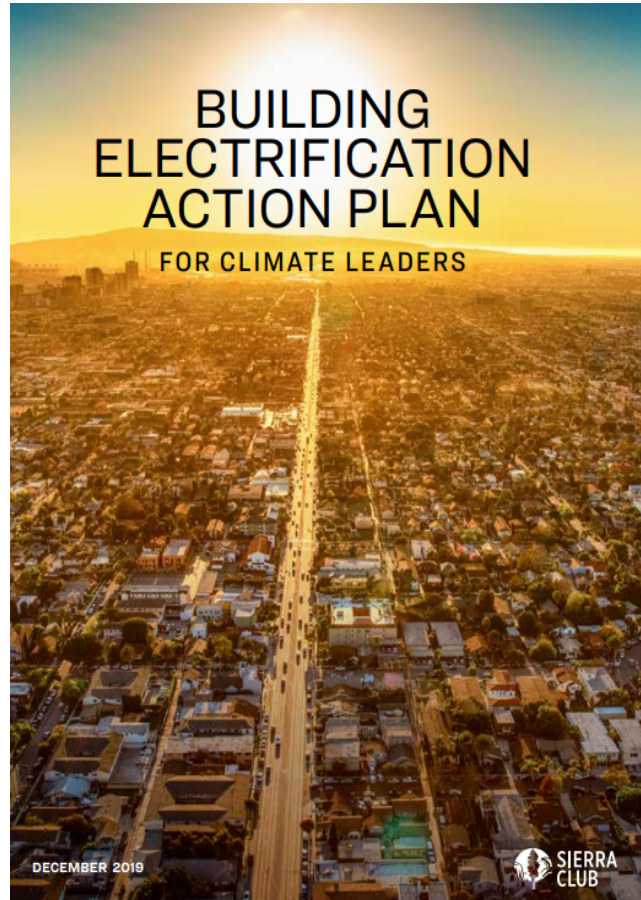
1. Efficient Design required by code
2. All Electric required by code
3. 100% Clean Energy required

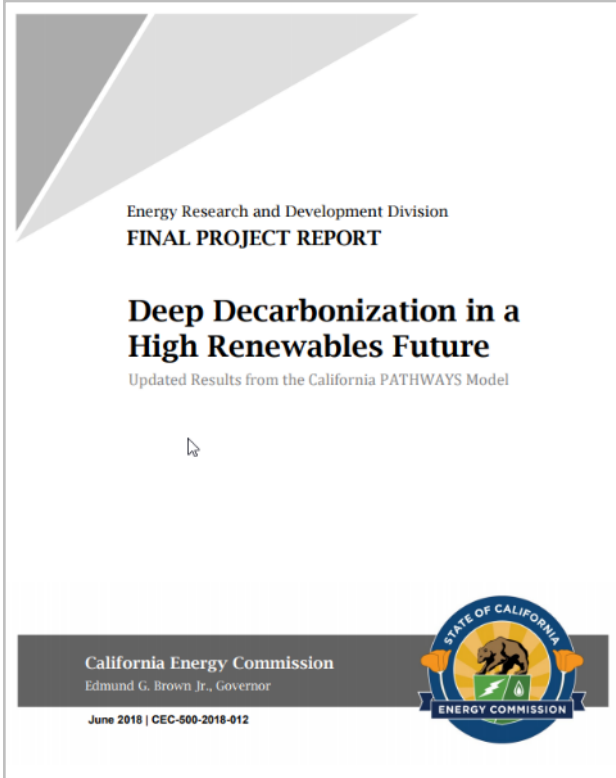


A 5-Step Roadmap to Zero-Emissions Buildings in CA

February 19, 2019 | Pierre Delforge

California has laid a strong foundation for energy efficiency in new buildings. Now the state needs to figure out how to help the entire building sector meet a carbon-neutral future by 2045. A new report offers a five-point path forward, addressing barriers that have held back progress toward clean energy homes and businesses.





Key Take-aways on Building Design

+ Energy efficiency is still critically important

- As we decarbonize electricity, energy efficiency becomes more about reducing utility bills than reducing GHG emissions. Utilities bills are important!
- Building shell, space and water heating, opportunities for district thermal

+ Fuel choice in buildings is the biggest decision affecting the GHG intensity of the building over its life

- Will 'all-electric' become synonymous with environmentally friendly?
- Continued retirement of coal plants in next 5 years nationally will lead to significantly lower GHG content of electricity

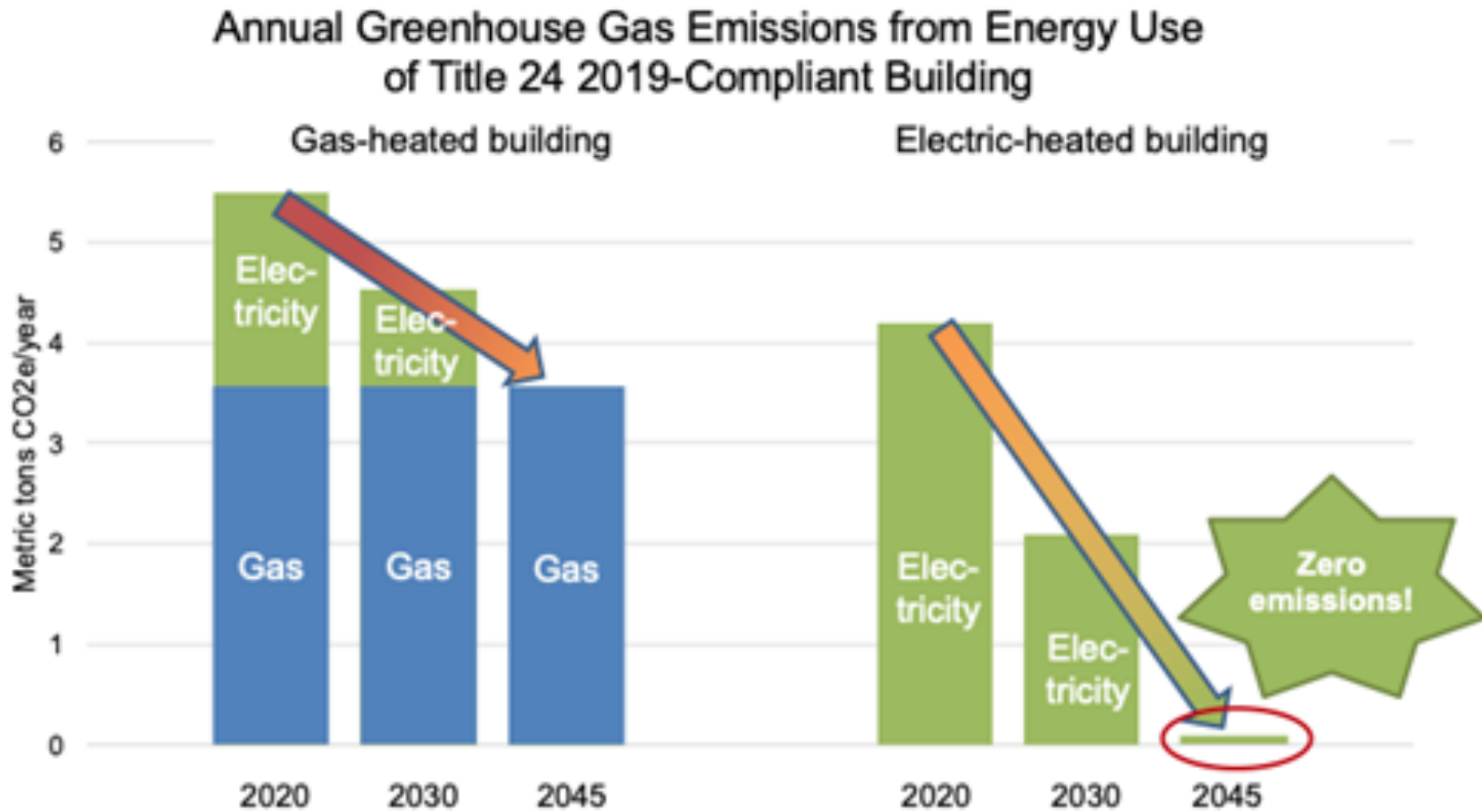
+ California and other states with aggressive climate policy will look hard at policies to electrify new buildings and retrofit existing ones

- Incentives for retrofits, training, market transformation policy to drive consumer adoption

+ Products can still improve for all-electric buildings

- Cost, ease of install, cold weather performance, refrigerants, training and talent
- Challenges: res stoves and clothes dryers, non-residential heat pumps, cooking

Building Electrification as Pathway to Zero Carbon

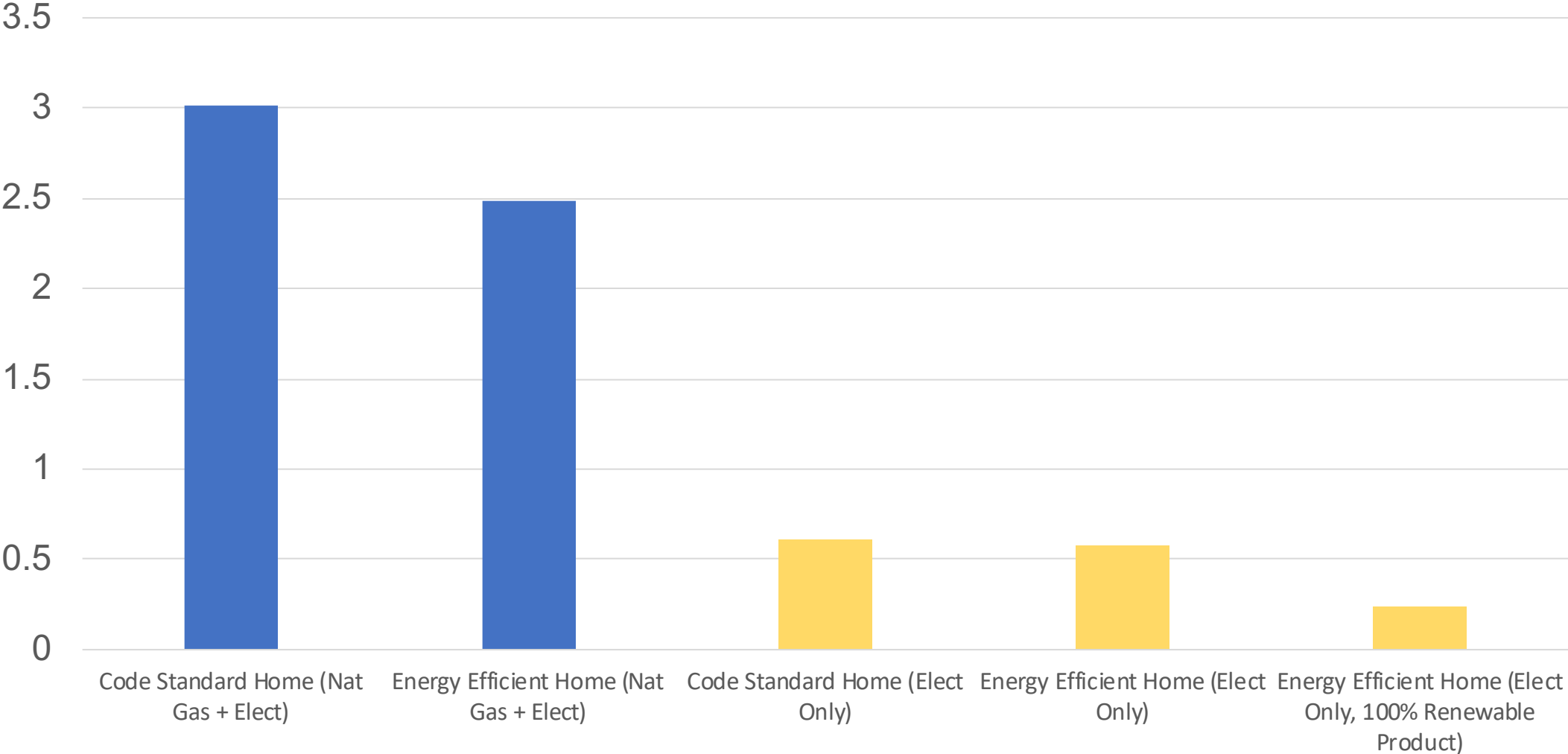


NRDC analysis, climate zone 13 (Fresno) with rooftop solar. Including methane leakage



Why Electrify?

Yearly Per Home Emissions (MT CO2e)



Are All Electric Buildings Feasible?

Are We Ready For All Electric Buildings?

Interviews with Seven Leading Engineering Firms

Ted Tiffany & Steve Guttman
Guttman & Blaevoet

Eric Solrain
Integral Group

Hormoz Janssens
Interface Engineering

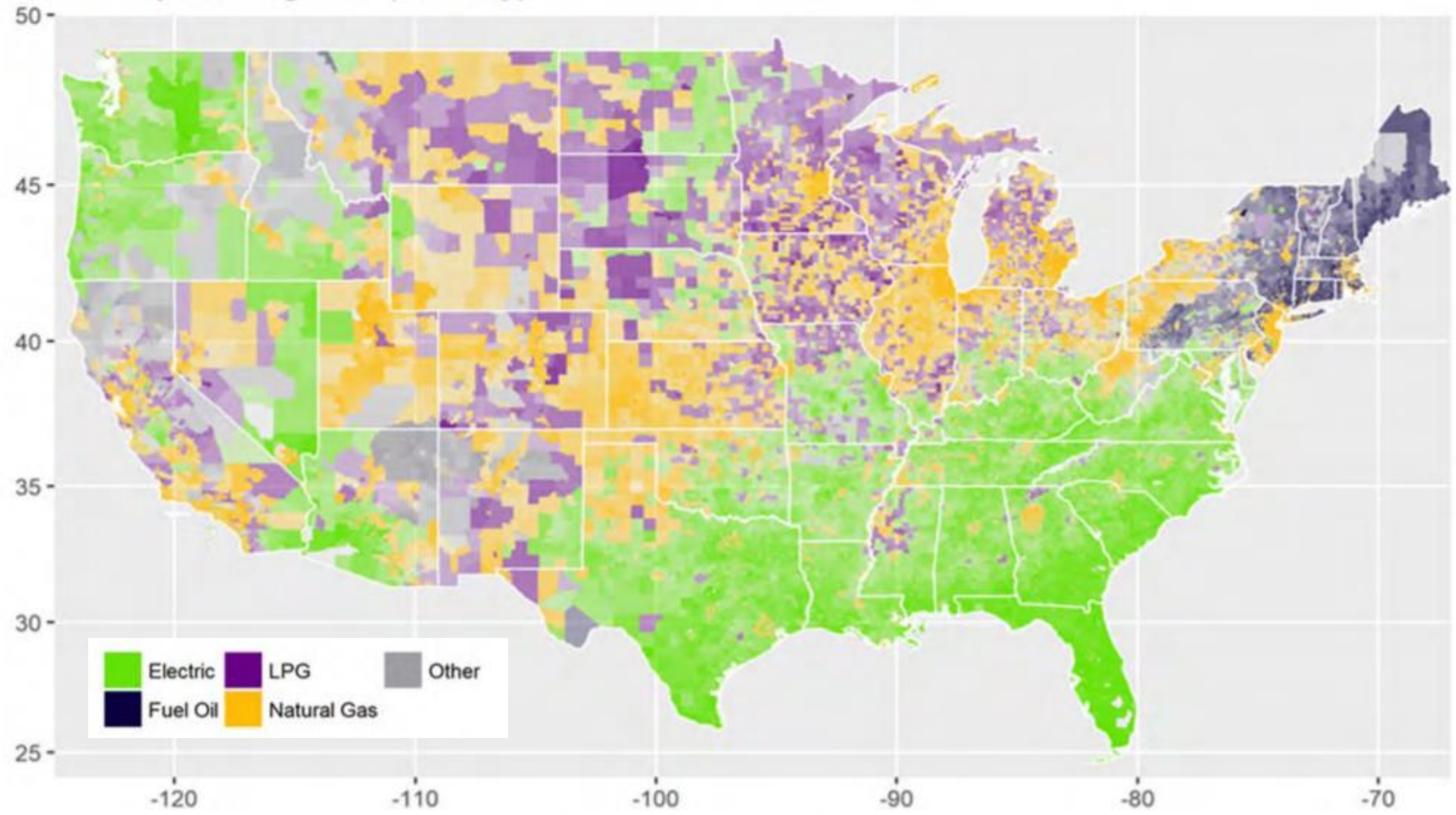
Kent Peterson
P2S Engineering

Peter Rumsey
Point Energy Innovations

Sean Armstrong
Redwood Energy

Meg Waltner, Alisdair McGregor, Raphael Sperry
ARUP

Primary Heating Fuel (Plurality)





Casa Adelante, 2060 Folsom, San Francisco



Hunters Point Shipyard Block 52, San Francisco



Santana Row Lot 11



Maceo May Veterans Apartments, Treasure Island



Hunters Point Shipyard Block 54, San Francisco



UC Davis Webster Hall Replacement



Balboa Upper Yard Family Apts, San Francisco



681 Florida, San Francisco



American Geophysical Union



UC Santa Cruz Student Housing West



UC Irvine Student Housing West, Developer ACC



Quetzal Gardens, San Jose



270 Brannan, San Francisco



UC Riverside Dundee Residence Hall, Developer ACC



Valley Glen, Dixon



Chatam University Dining Commons



Plaza Point, Arcata



Cloverdale, Corporation for Better Housing



Colonial House Apartments, Oxnard



Atascadero, Corporation for Better Housing



Cascade Apartments, Seattle



4700 Brooklyn Ave NE, Seattle



Edwina Benner, Sunnyvale



Stoddard Housing, Napa



380 N. Pastoria, Mountain View



David Shell
Energy Sales Supervisor at
Gulf Power Company



All electric market share:

- 100% of multi-family projects
- 80% of single family projects
- 70% of commercial projects
- 60% of restaurants

Electrification Policies



California Universities Are Transitioning to All-Electric Buildings

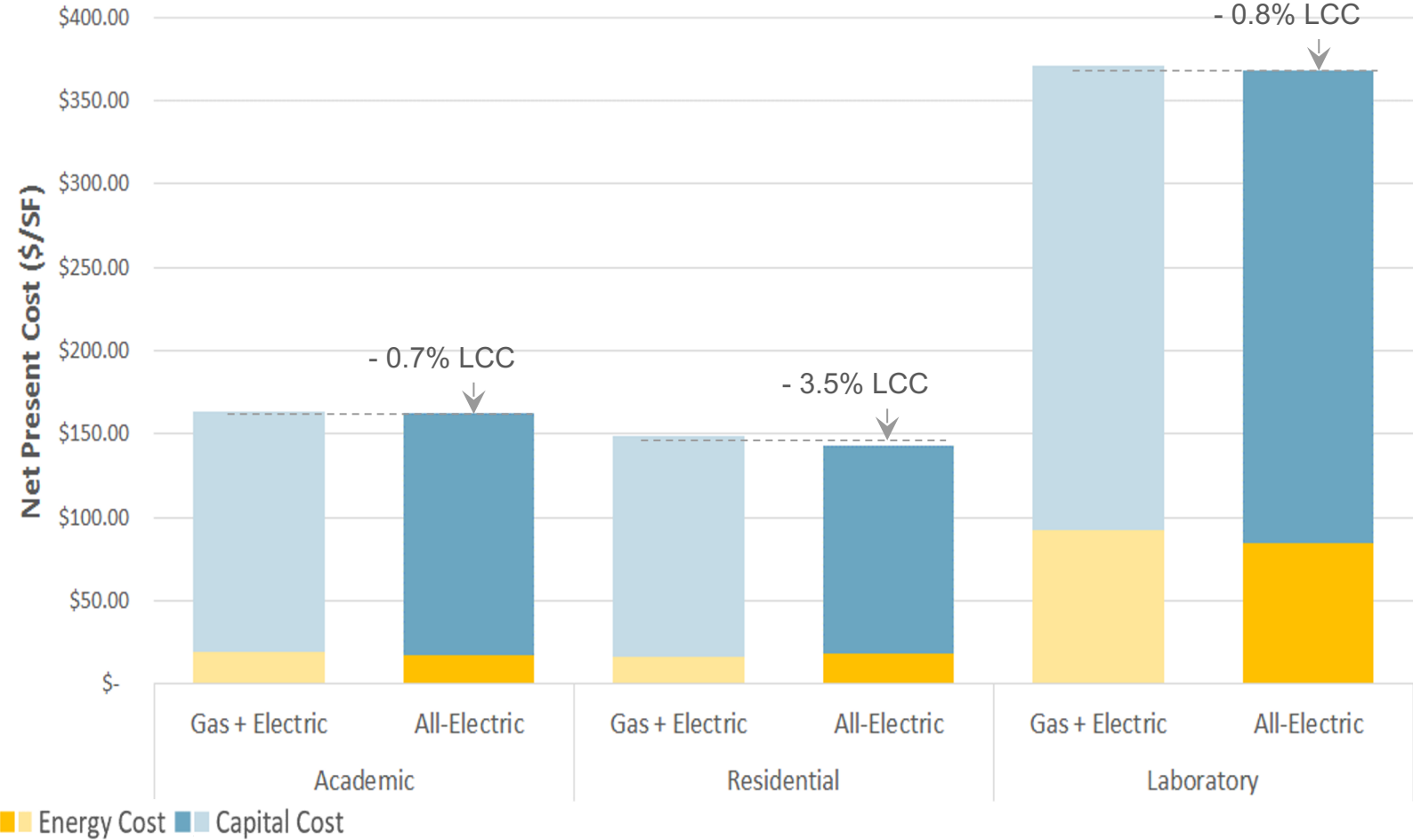
The University of California system and Stanford University are making all-electric buildings the default in new construction.

JUSTIN GERDES | SEPTEMBER 24, 2018

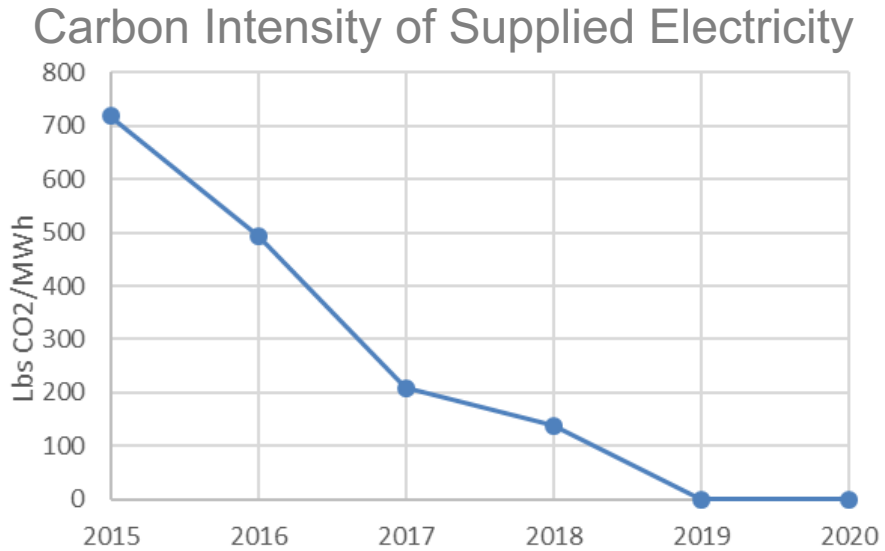


“No new UC buildings or major renovations after June 2019, except in special circumstances, will use on-site fossil fuel combustion, such as natural gas, for space and water heating”

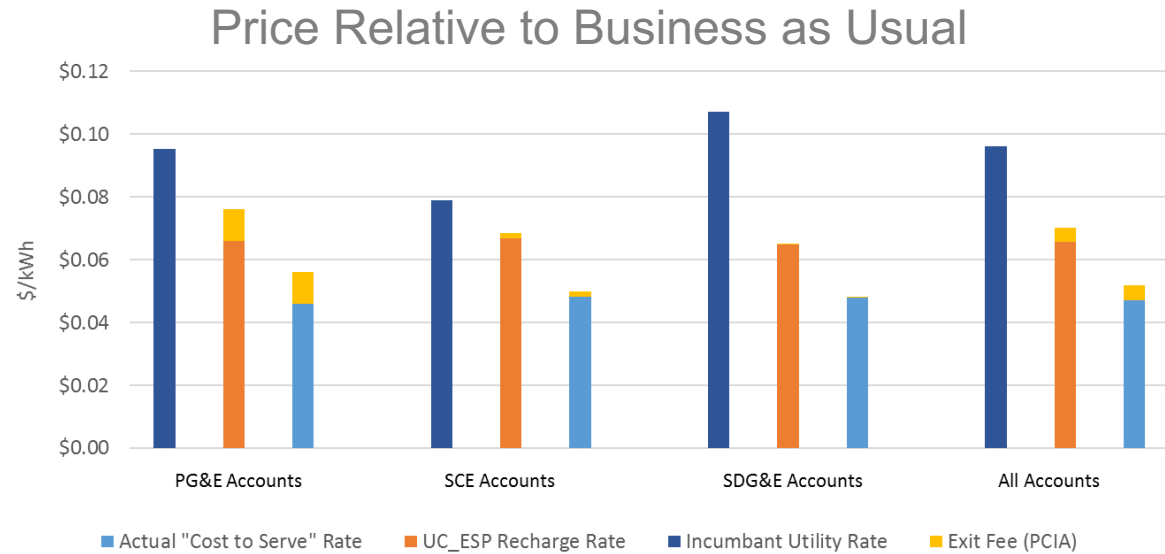
20-year Total Life Cycle Costs (LCC) are comparable



UC's Wholesale Power Program Results



UC's electricity supplies will be carbon neutral in 2019...



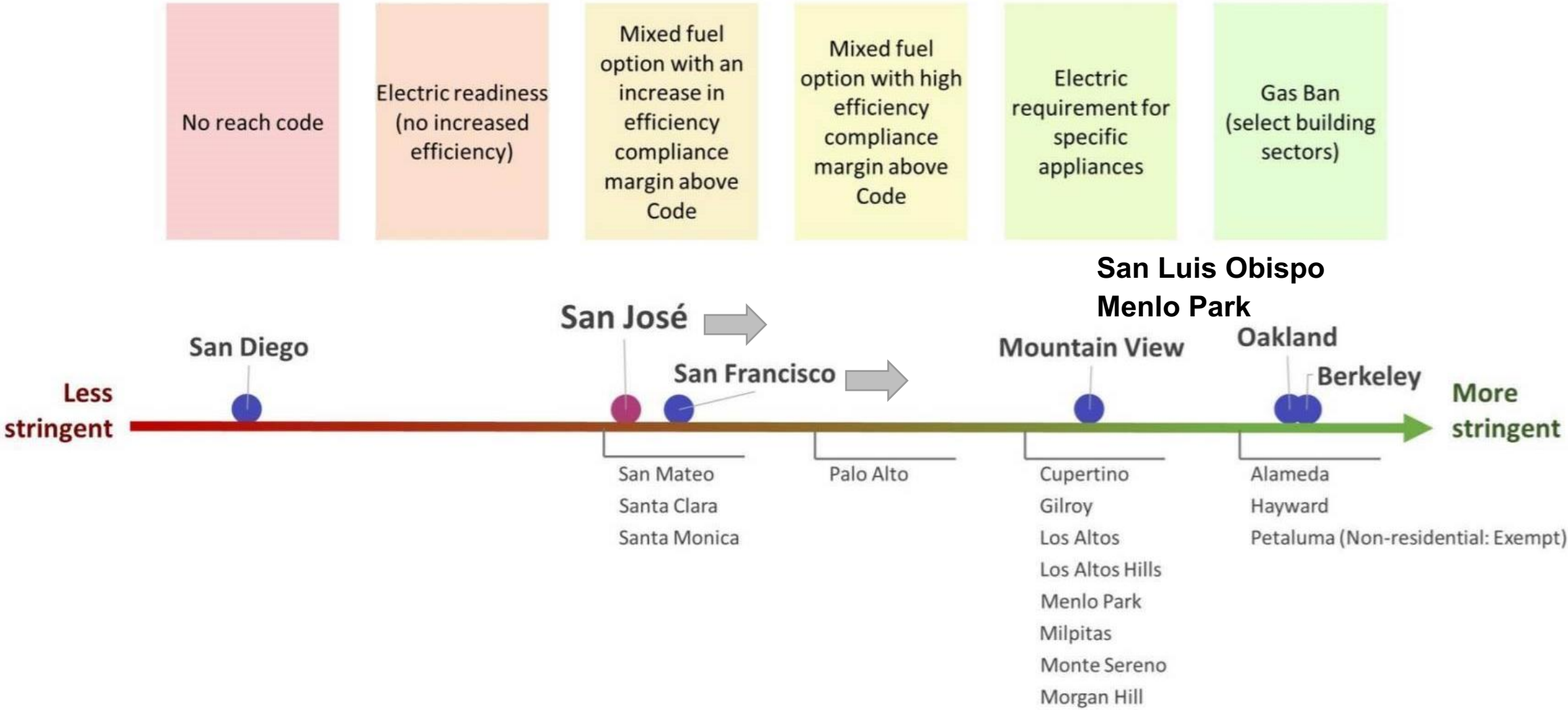
...and costs will be less-expensive than traditional utility services

Electric Reach Codes

Jurisdiction	Approach			Systems			Building Types							Add-Ons			
	Natural Gas Infrastructure Moratorium	All-Electric Reach	Electric-Preferred	Whole Building	Water Heating	Space Heating	Low Rise Residential	City-Owned Properties	High Rise Residential	Hotel	Retail	Office	Restaurant	Life Sciences	Additional Solar	Electric Vehicles	Natural Gas In Lieu Fee
Alameda	X			X				X									
Berkeley	X		X	X			X	X	X	X	X	X	X				
Brisbane*		X			X	X	X	X	X	X	X	X					
Campbell		X			X	X	X									X	
Carlsbad	X	X			X		X								X		
Cupertino		X		X			X	X	X	X	X	X				X	
Davis			X	X			X										
Hayward		X	X	X			X	X	X	X	X	X	X	X	X		
Healdsburg		X			X	X	X	X	X	X	X	X	X	X			
Los Altos Hills		X			X	X	X	X	X	X	X	X					
Los Gatos		X		X			X									X	
Marin County			X	X			X	X	X	X	X	X	X	X		X	
Menlo Park*		X			X	X	X	X	X	X	X	X			X	X	
Mill Valley			X	X			X		X							X	
Milpitas			X	X			X	X	X	X	X	X	X				
Morgan Hill	X			X			X	X	X	X	X	X	X				
Mountain View*		X		X			X	X	X	X	X	X			X	X	
Pacifica		X			X	X	X	X	X	X	X	X			X	X	
Palo Alto*		X	X	X			X	X	X	X	X	X	X			X	
Richmond		X		X	X	X	X	X	X	X	X					X	
San Francisco	X		X	X			X	X	X	X	X	X			X	X	
San Jose*	X		X	X			X	X	X	X	X	X	X	X	X	X	
San Luis Obispo			X	X			X	X	X	X	X	X	X	X			X
San Mateo			X	X			X				X				X	X	
San Mateo County		X		X			X	X	X	X	X	X				X	
Santa Monica			X	X			X	X	X	X	X	X	X	X			
Santa Rosa		X		X			X										
Saratoga		X			X	X	X	X	X	X	X	X	X			X	
Windsor		X		X			X										



City Reach Codes – Building Electrification



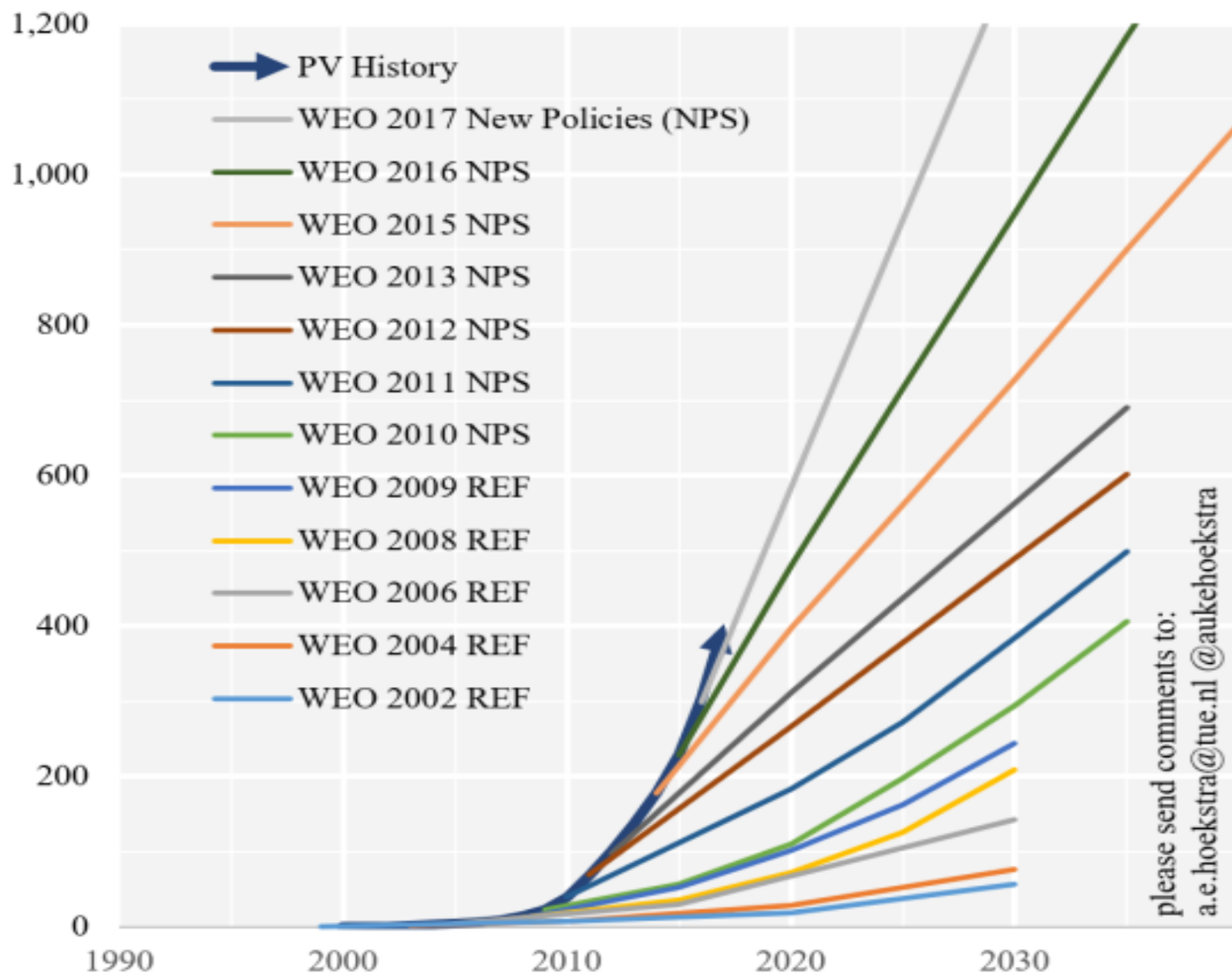
Note: All information in this chart is tentative, based on information obtained to date.

Can Renewable Energy Scale?



Cummulative PV capacity: historic data vs IEA WEO predictions

In GW of total installed capacity - source International Energy Agency - World Energy Outlook



Local CCA's are Driving Change Community Choice Aggregators



100% carbon free by 2021



50% renewable
100% carbon free



12 Cities at 100% Renewable



38% renewable
85% carbon free

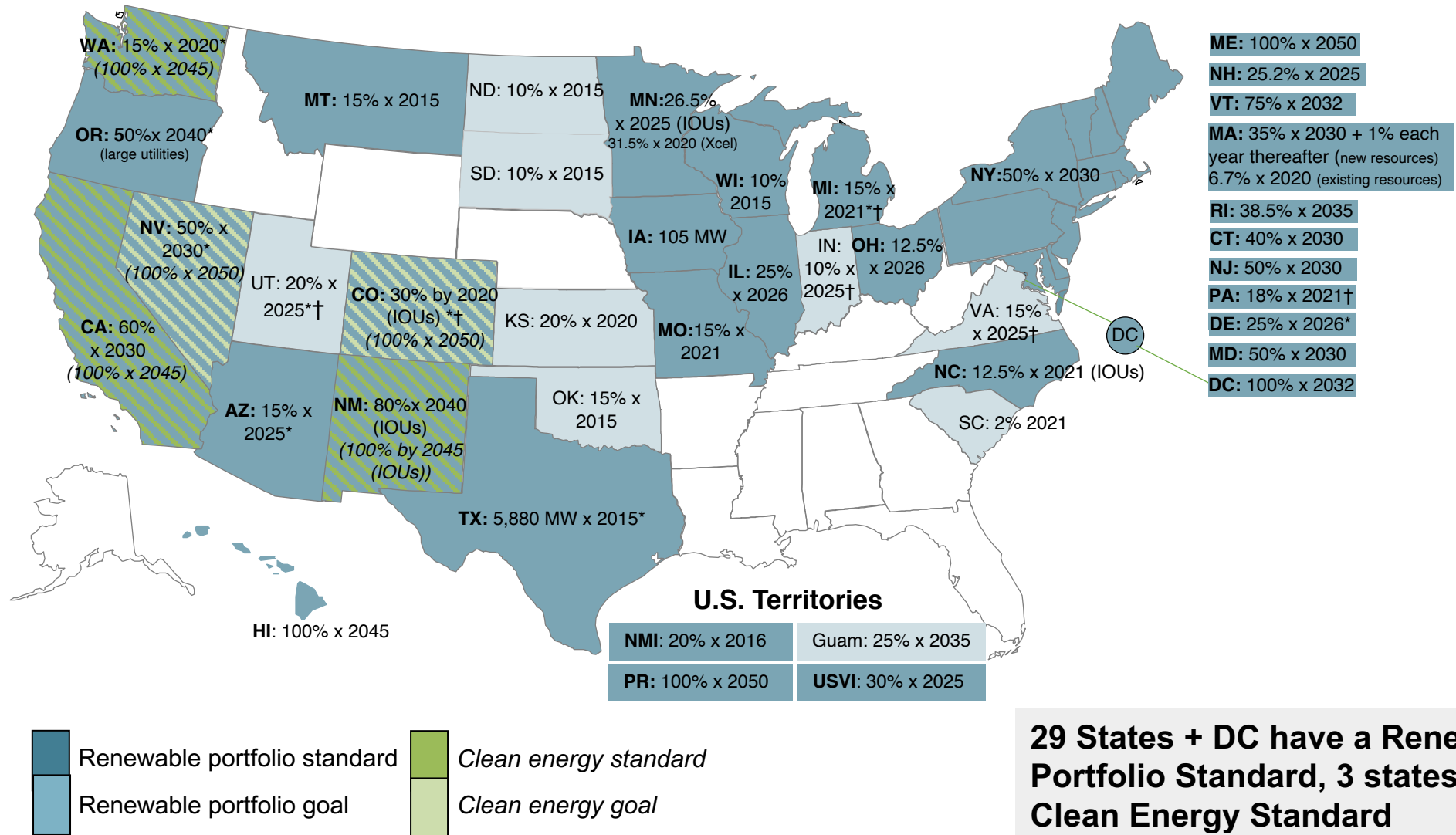


60% renewable



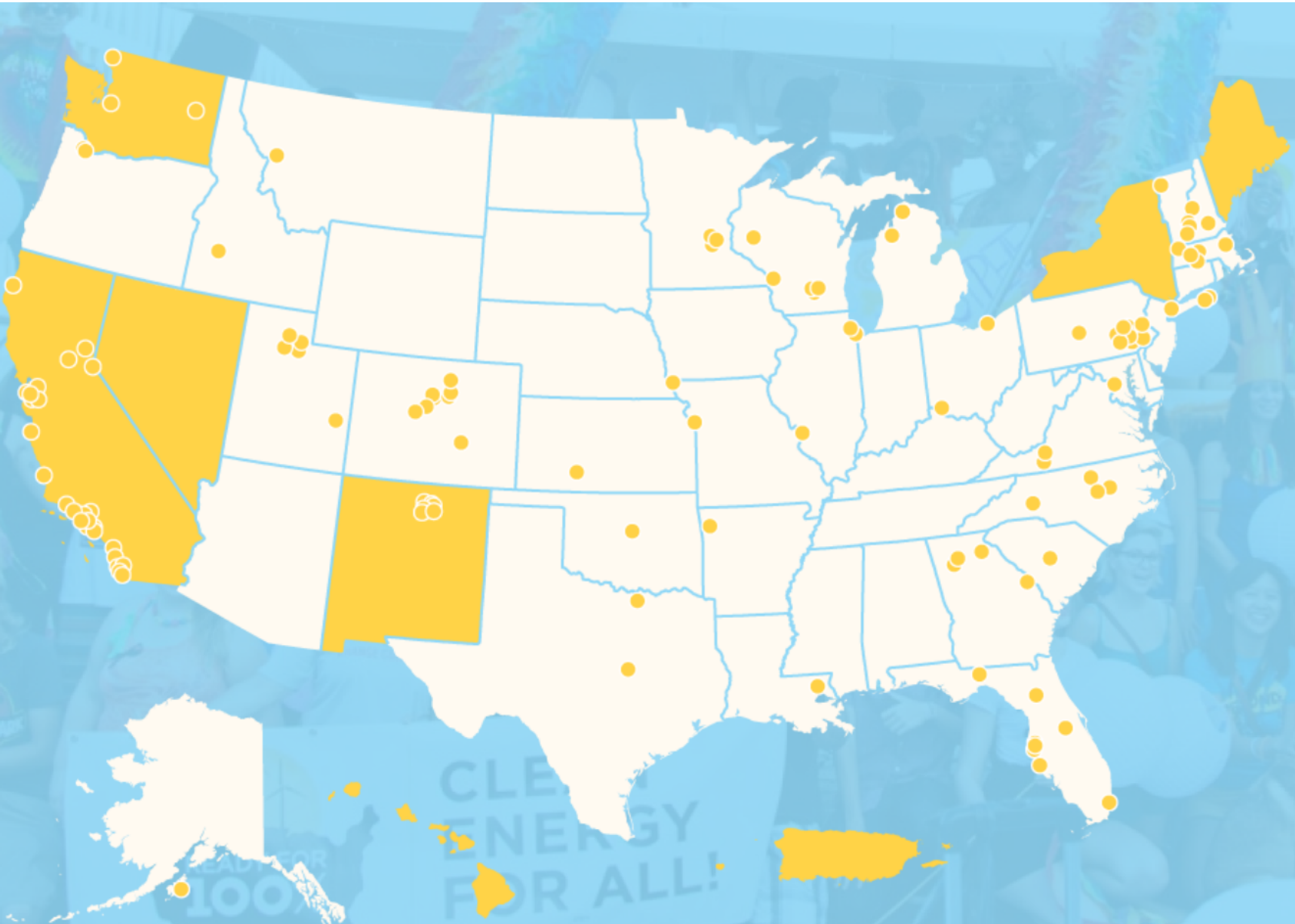
100% renewable for S.F. starting with
Large Commercial Buildings in 2022

Renewable and Clean Energy Standards



29 States + DC have a Renewable Portfolio Standard, 3 states have a Clean Energy Standard
(8 states have renewable portfolio goals, 2 states have clean energy goals)

Ready for 100 Campaign: Cities Committed to 100% Clean Energy



1 *in* 4

people in America now live in a community committed to a transition to 100% clean, renewable energy.

[LEARN MORE](#)

RE

100

230 RE100 companies have committed to 100% renewables

JPMORGAN CHASE & Co.



Steelcase

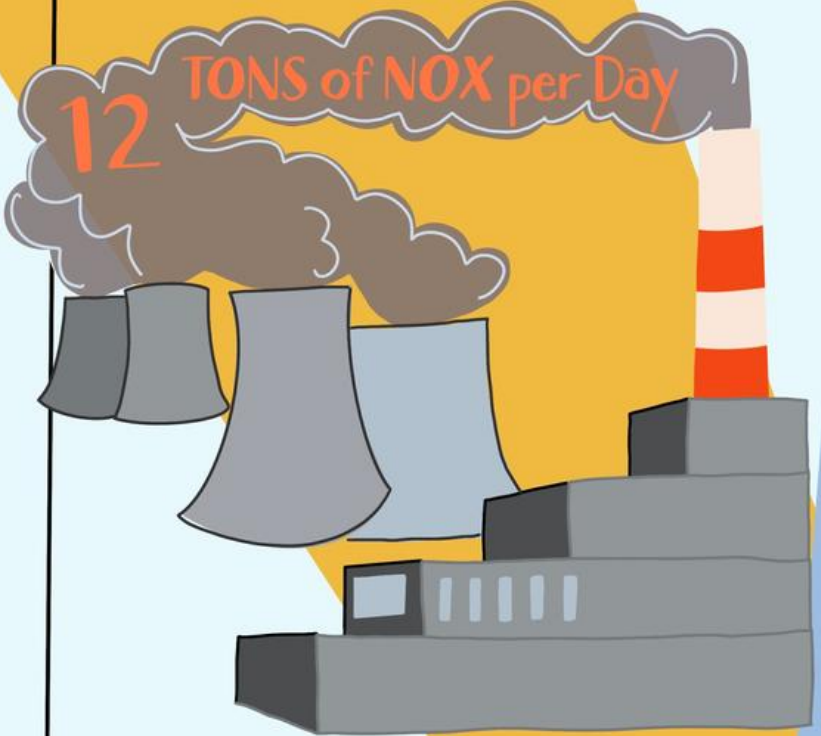


Morgan Stanley

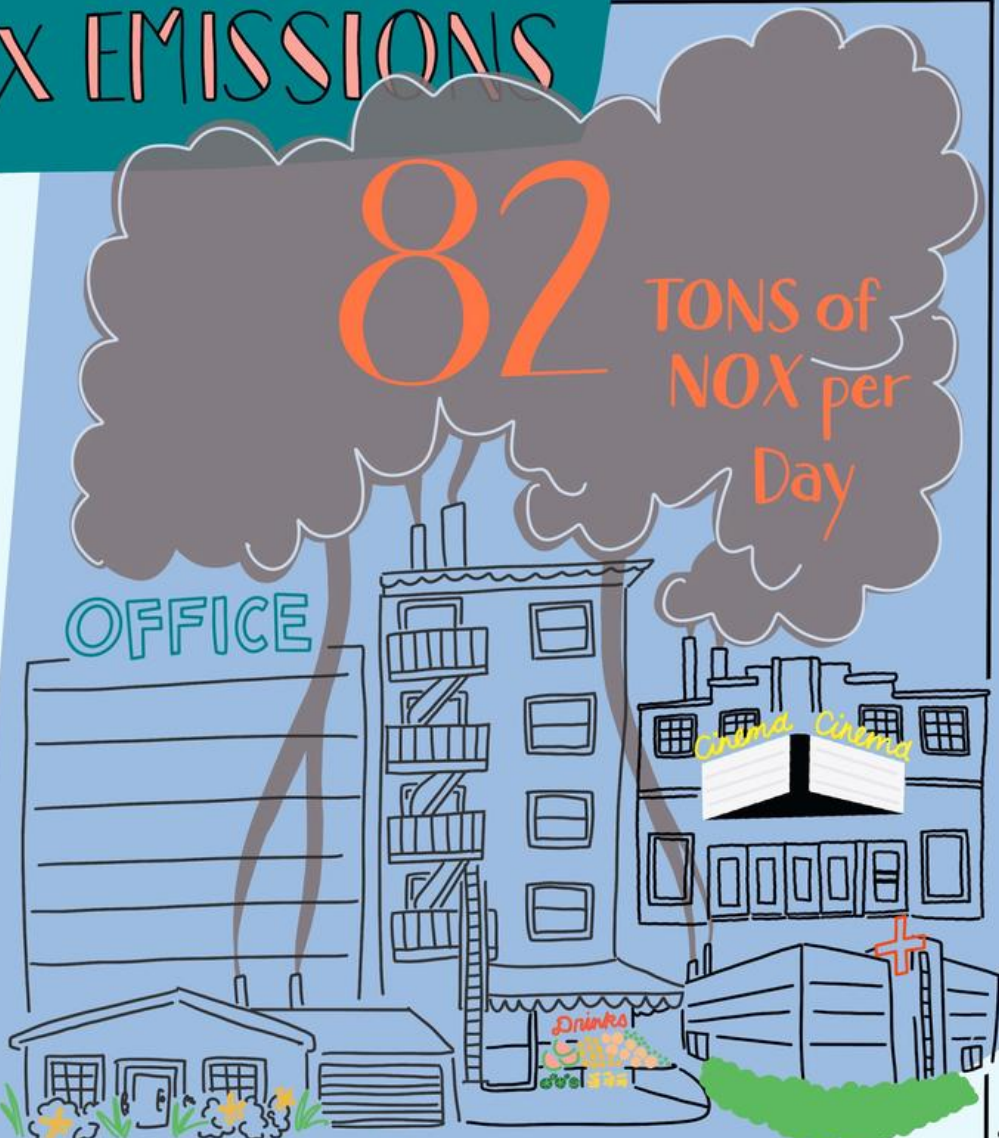




NOX EMISSIONS



POWERPLANTS
BURNING GAS



HOMES & COMMERCIAL
BUILDINGS BURNING GAS

JESSICA RUSSO, NRDC

SOURCE: CALIFORNIA AIR RESOURCES BOARD 2019 NO_x EMISSIONS ESTIMATES

Outdoor Air Quality: Burning Fossil Fuels in Buildings is a Big Part of California's Smog Problem

Nitrous Oxide (NO_x) in California



Source: California Air Resources Board

Most Polluted Cities

By Ozone

- #1: Los Angeles-Long Beach, CA
- #2: Visalia, CA
- #3: Bakersfield, CA
- #4: Fresno-Madera-Hanford, CA
- #5: Sacramento-Roseville, CA
- #6: San Diego-Chula Vista-Carlsbad,
CA
- #7: Phoenix-Mesa, AZ
- #8: San Jose-San Francisco-Oakland,

By Year Round Particle Pollution

- #1: Fresno-Madera-Hanford, CA
- #2: Bakersfield, CA
- #3: Fairbanks, AK
- #4: Visalia, CA
- #5: Los Angeles-Long Beach, CA
- #6: San Jose-San Francisco-Oakland,
CA
- #7: Pittsburgh-New Castle-Weirton,
PA-OH-WV

By Short-Term Particle Pollution

- #1: Bakersfield, CA
- #2: Fresno-Madera-Hanford, CA
- #3: Fairbanks, AK
- #4: San Jose-San Francisco-Oakland,
CA
- #5: Missoula, MT
- #6: Yakima, WA
- #7: Los Angeles-Long Beach, CA
- #8: Salt Lake City-Provo-Orem, UT

Is a single energy source smart with power shutoffs?
All new gas appliances require electricity:



Resources

A Zero Emissions All Electric Multifamily Construction Guide: <https://fossilfreebuildings.org/ElectricMFGuide.pdf>

Social Equity, affordable housing, and net zero energy: <https://rmi.org/social-equity-affordable-housing-and-the-net-zero-energy-opportunity/>

The economics of electrifying buildings: <https://rmi.org/insight/the-economics-of-electrifying-buildings/>

Are we ready for all electric buildings?: <https://tinyurl.com/y3unn3r4>

Decarbonization of heating energy: <https://www.synapse-energy.com/sites/default/files/Decarbonization-Heating-CA-Buildings-17-092-1.pdf>

The smog in your kitchen: <https://www.fresnobee.com/opinion/readers-opinion/article222726175.html>

All electric commercial food service: <https://drive.google.com/open?id=1CjrN62JqgffTzri3zeE3hwDqW9Zu80ws>

All electric restaurant kitchens: <https://www.foodserviceandhospitality.com/why-induction-cooking-is-the-hottest-trend-to-hit-restaurant-kitchens/>

Zero carbon commercial construction: <http://sanjoseca.gov/DocumentCenter/View/82909>