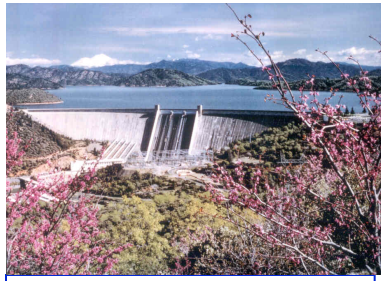
Palo Alto's Path to Carbon Neutrality

a steep a rocky trail

March 2015



100% Carbon Neutral Electricity

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Palo Alto at a Glance

- 26 square miles
- Between Stanford and San Francisco Bay
- 64,000 residents, 29,500 homes
- 100,000 commute daily to work here
- 4,000 businesses, including HP, SAP, Tesla, PARC, Palantir

- Sustainability Goals include:
  - Greenhouse Gas (GHG) reduction
  - Carbon Neutral electricity supply
  - Improved energy and water efficiency
  - "Zero Waste" –diversion of garbage to recycling, composting etc.
  - Bicycle and Pedestrian Master Plan
  - Broad transportation alternatives, including ZEV adoption

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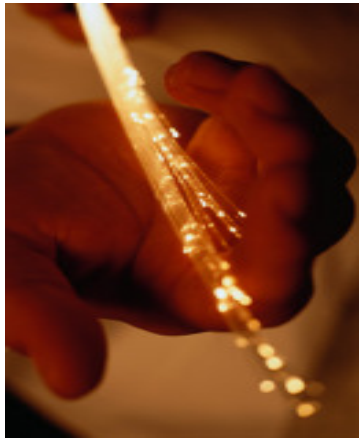
Palo Alto Owns and Operates its Utilities Services

Water - 1896



Fiber - 1996

Electric - 1900

Wastewater - 1898

greenwaste

Storm Drain

Gas - 1917

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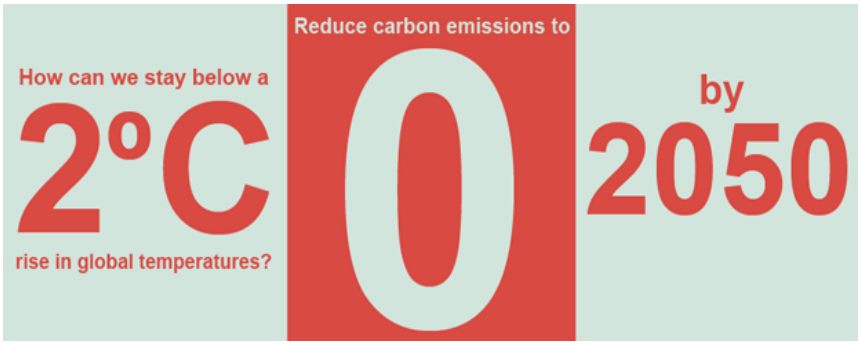
37% GHG reduction from 1990 baseline…

- Strong and early renewables - opportunistic contracts
- Early 2007 Climate Protection Plan
- 150+ sustainability initiatives
- Carbon neutral electricity
- Green Building Code
- Zero Waste Program
- Local Solar Plan
- Urban Forest Master Plan
- Energy/compost facility
- PV permit streamlining
- Bicycle system
- EV readiness



… with initiatives and challenges ahead

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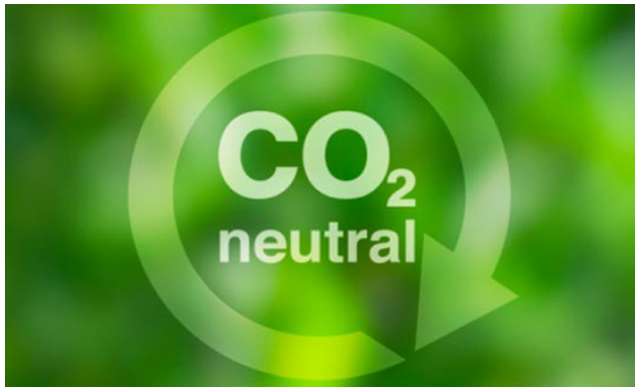
Carbon Neutral Electricity

- Palo Alto Green (2005)
  - 22% of residential voluntary participation
- 100% renewables with offset RECs (2013) - 20% lower rates that CA IOU's
- Fossil-free portfolio by 2017
- Strong efficiency programs
- Program for Emerging Technologies
- Local Solar Programs: 4.0% by 2023
  - Rooftops, Group Buy, Community Solar



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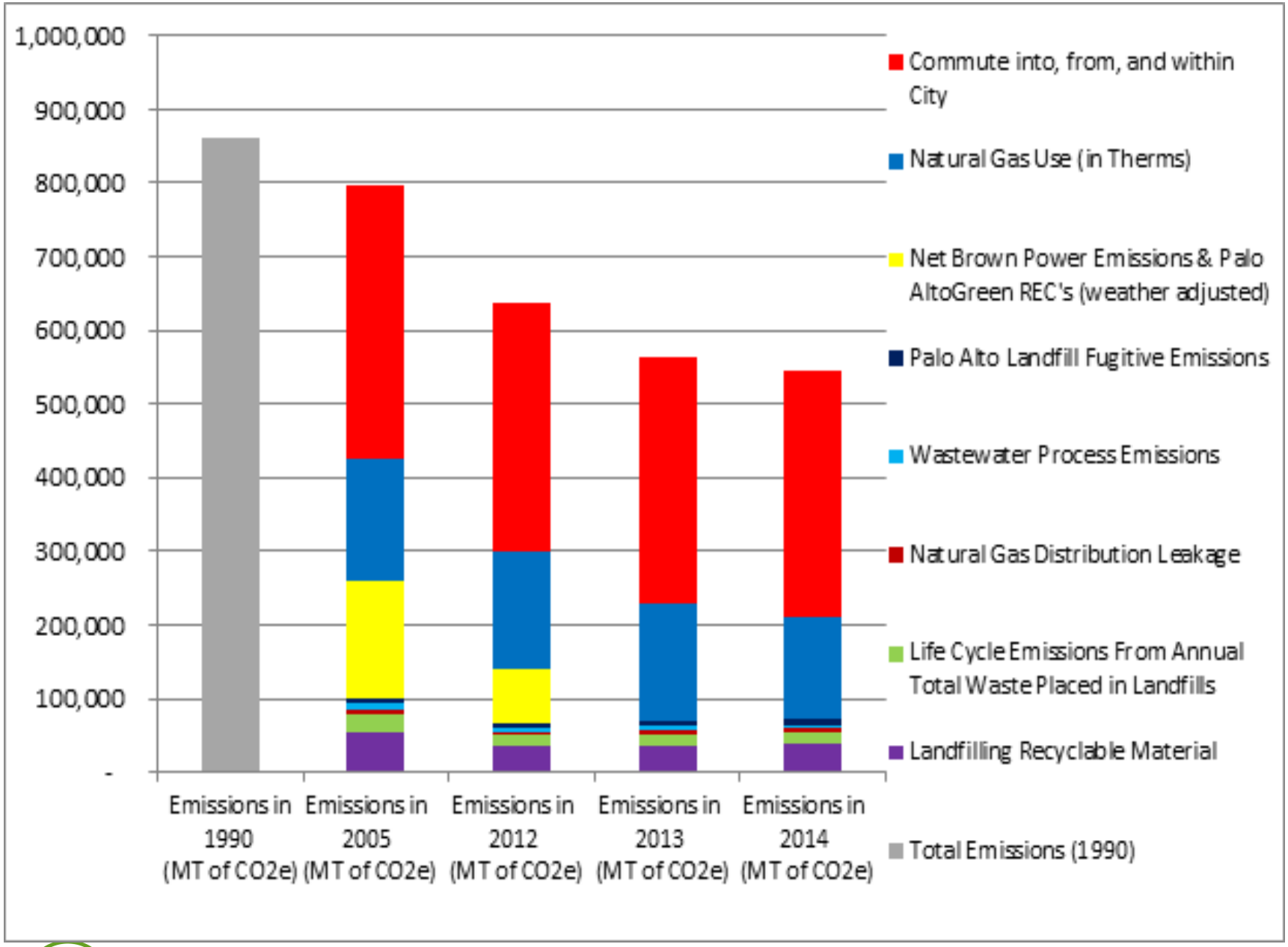

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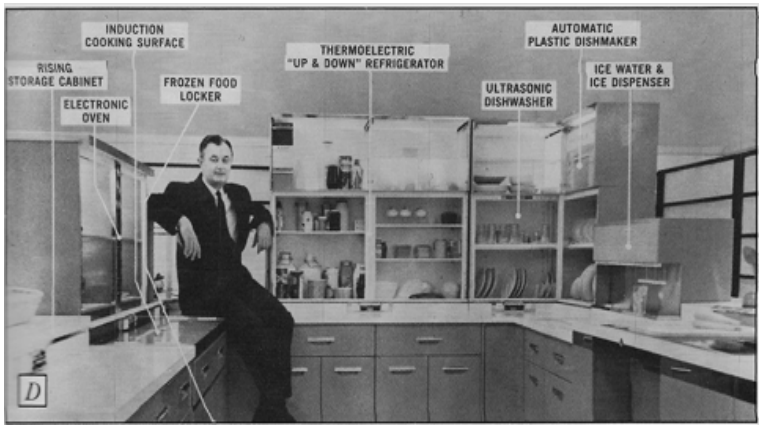
Electrification Fuel Switching

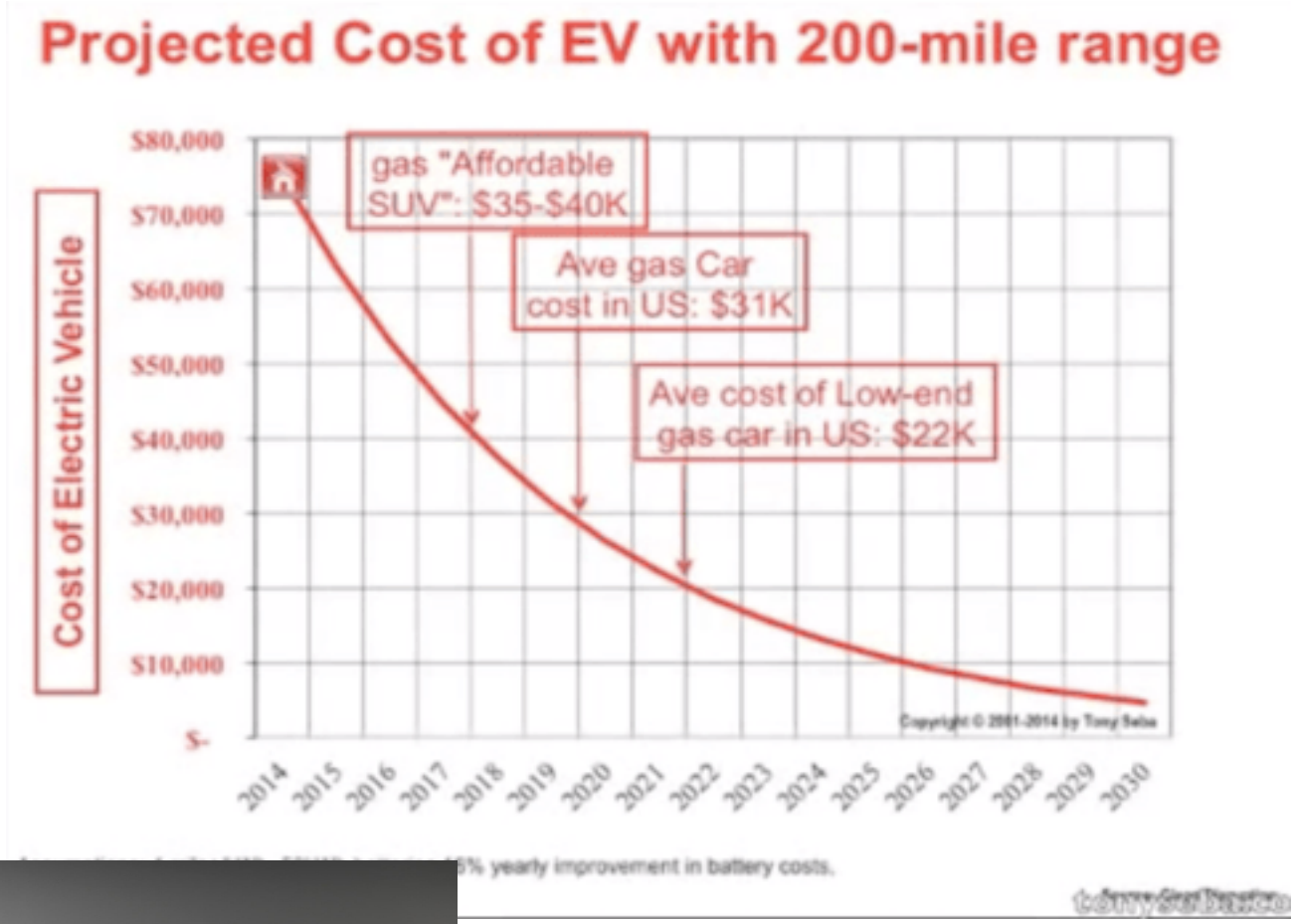
- Over than <u>30% of remaining carbon footprint from natural gas</u>
- Shift from natural gas to clean electricity
  - Opposite of climate-minded coal-powered cities
  - Examining technologies, economics, logistics
  - Who pays for stranded infrastructure under lower gas revenue and customer base?
  - How fast can a switch happen?



Mobility

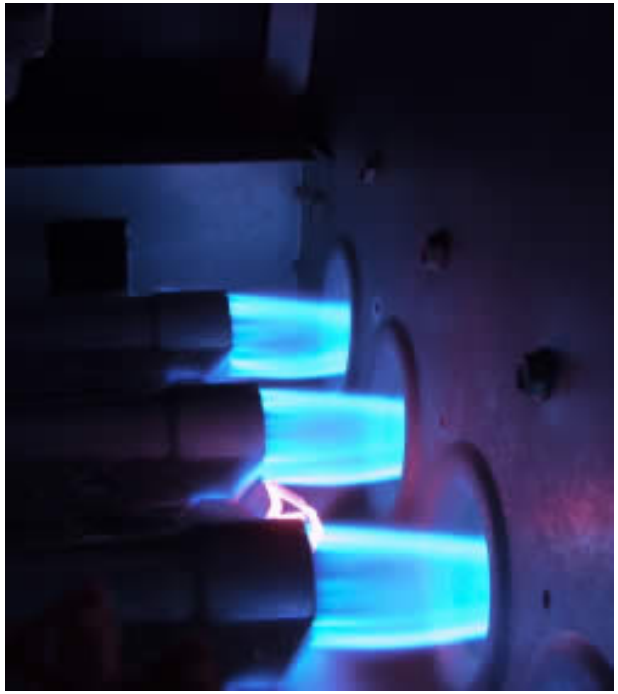
- More than 60% of remaining carbon footprint from transportation: commute + non-commute
- Bicycle boulevards: 44% high school mode share
- PTOD - Pedestrian and Transit Oriented Development
- EV readiness and intrinsic adoption
- Expanded shuttle program
- Expanded rail and bus system
- Mobility as a Service (MaaS)

ZEV Tech & Costs Changing Quickly



Baseline Natural Gas Use

- 44% commercial
- 11% civic/public buildings
- 9% multifamily commercial
- 36% residential
  - 56% space heating
  - 33% water heating
  - 7% clothes drying
  - 7% cooking



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System Design Challenges

- Element by element, not systems
- Aggressive efficiency measures shift the economics
  - Sequences and combinations of measures can make a big difference
- Sensitive to assumptions
  - Technology change
  - Natural gas and carbon prices
  - Relatively stable electricity prices

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Headwind Challenges

- Electric demand and the role of efficiency
  - Grid capacity
  - Smart distribution
  - Time of use vs time of generation
  - Panel size
  - Storage

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And More Headwinds

- Policy
  - Prop 26 - prohibits cross subsidy
  - CEC – case by case cost effectiveness requirements hinder early adoption

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Levers of Change

- Education, engagement, feedback
- New construction vs retrofit initiatives
- City policy & procurement: “default to green”
- Mandates? No new gas hook-ups?
- Utility financial incentives
- Ordinances & regulations

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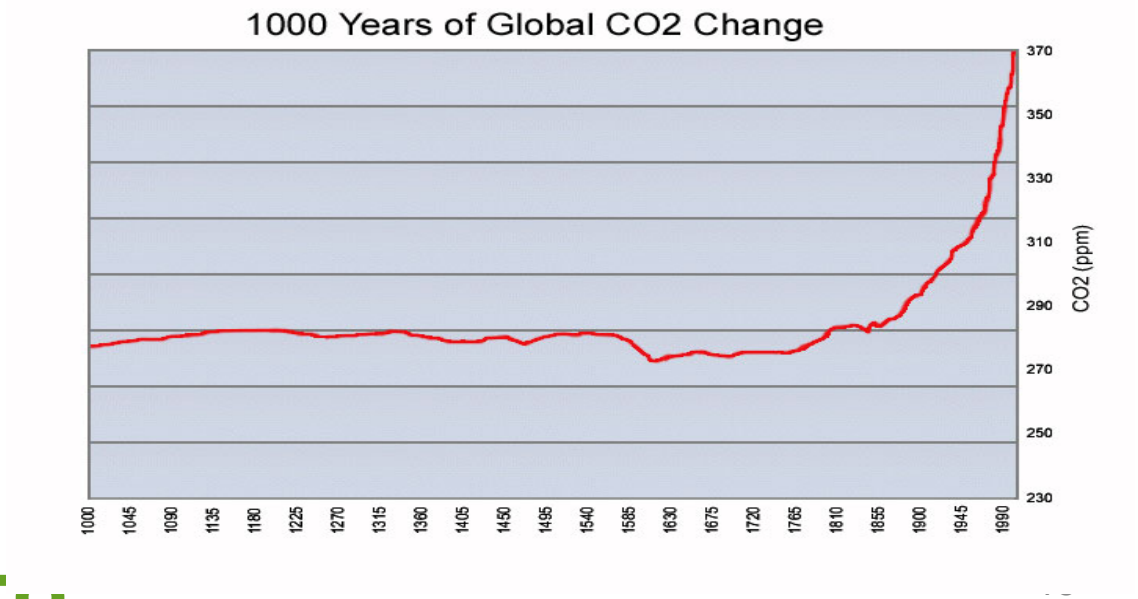
Utility of the Future

- Who's the last customer paying for the natural gas infrastructure? Hockey-stick cost impact.
- Impact on CPAU revenues & business model?
- Business model of the utility of the future?
  - Distributed generation & storage



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How far and How fast?

- California: 80% by 2050
- Fort Collins: 80% by 2030
- Palo Alto Moonshot: 100% by 2030?
- What's feasible? What's desirable?
  - Technically
  - Economically
  - Legally/politically
  - Culturally/behaviorally

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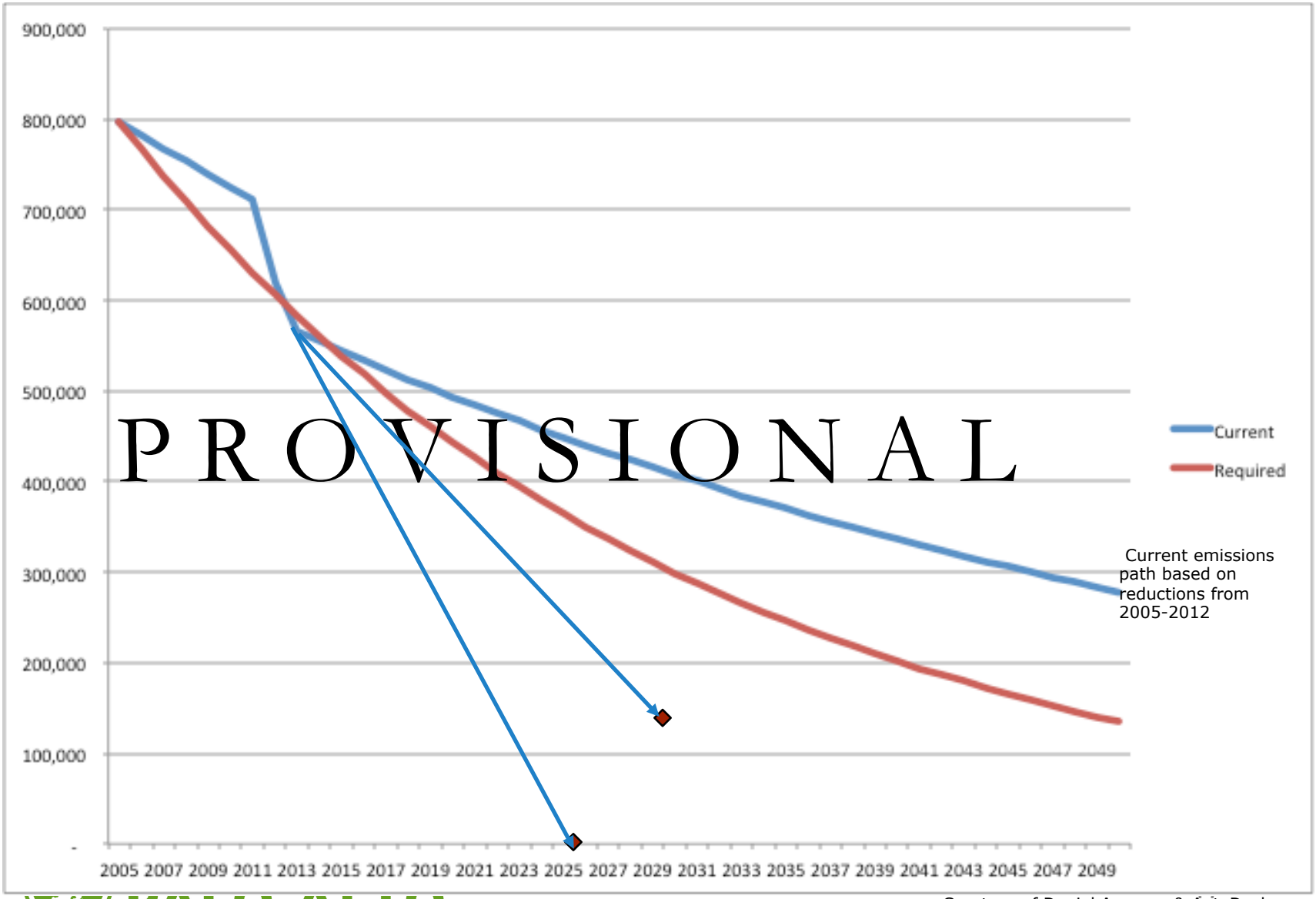
Emissions, Current vs. Required

(2005-50)*



Courtesy of Daniel Aronson & AutoDesk

The Big Questions

- **Carbon-neutral** city, How fast?
- How to reduce or eliminate the 60+% of carbon footprint contributed by **transportation**?
- How will we reduce or eliminate the 30+% of our carbon footprint contributed by **natural gas**?
- How to **adapt to climate change**?
- What about a "new normal" in California's **water** regime?
- **What other sustainability goals**?

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Councilmember Pat Burt

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Optional Slides…

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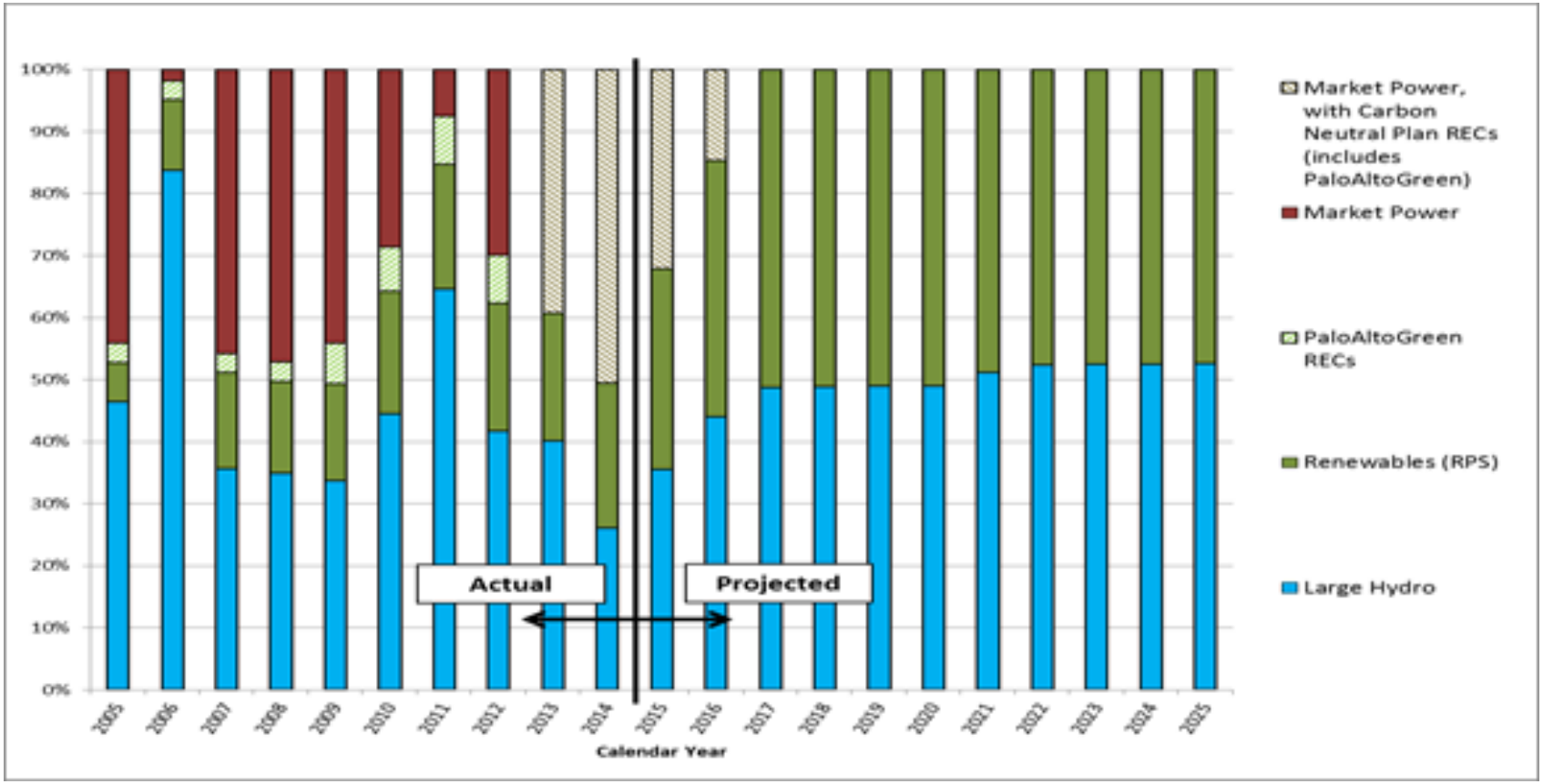
CPAU Electric Portfolio



•Presumes "normal" hydro

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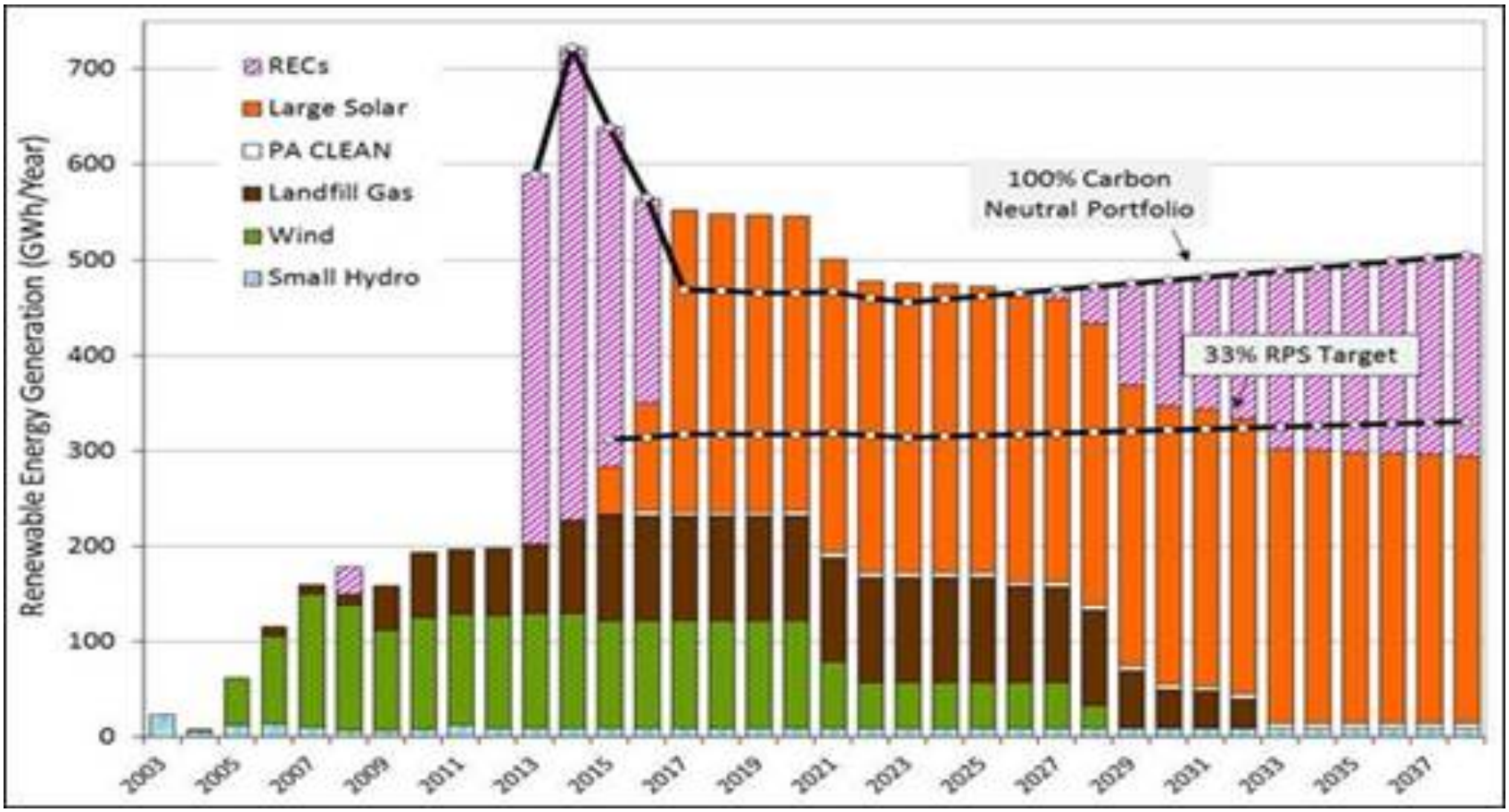
CPAU Electric Portfolio



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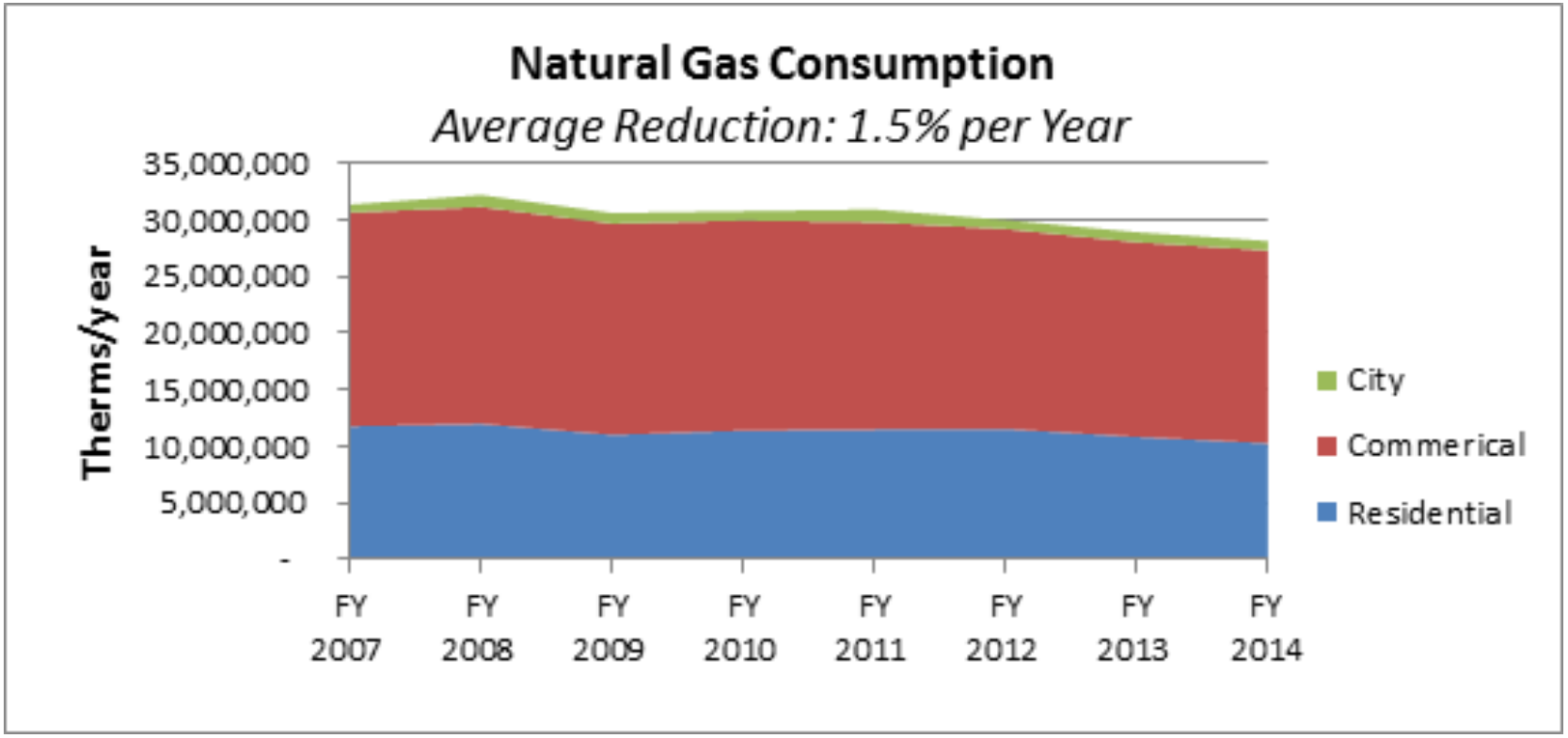

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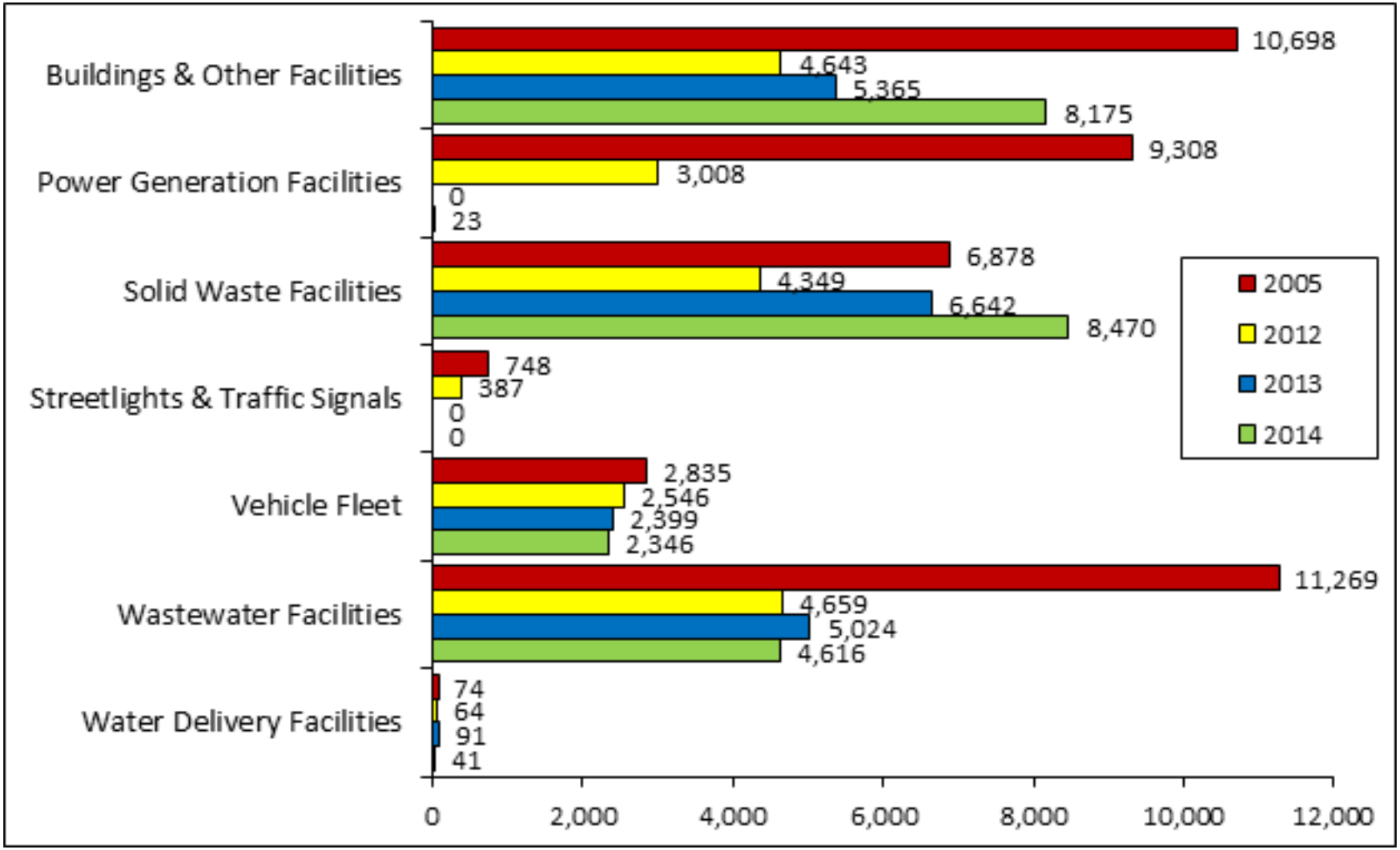

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Global Benchmarks

CITY	KEY MEASURE	GHG GOAL
Barcelona	Open Gov't + Intelligent Energy Network	20% reduction by 2025
Amsterdam	Smart City Investment Funds	40% Reduction by 2025
London	Carbon Measurement + Congestion Pricing + ZEV Taxis	30% reduction by 2025
Ft. Collins	Smart Grid + Efficiency pricing	Carbon Neutral by 2050
Seattle	Integrated transit planning	Carbon Neutral by 2050
Copenhagen	Carbon Free Mobility and Energy	Carbon Neutral—and 75% bicycle commute mode share—by 2025.
California	AB32 Net zero buildings Renewables	80 x 50 New residential 2020, new commercial 2030. 50% renewables by 2030

…with lots more in the pipeline

- Climate neutral utility? Electrification/"Fuel switching"
- Power of the purse—public & private: "Default to green."
- Power of performance: "We go first!"
- Transform transportation: Car-free city?
- Cyclical economy
- Open, transparent, streamlined
- Sustainability dashboard & Open Data
- Green Team
- Process improvement
- Policy directory
- Finance: "total cost of operations" + "cost of externalities"
- "Future generations" policies.
- Water

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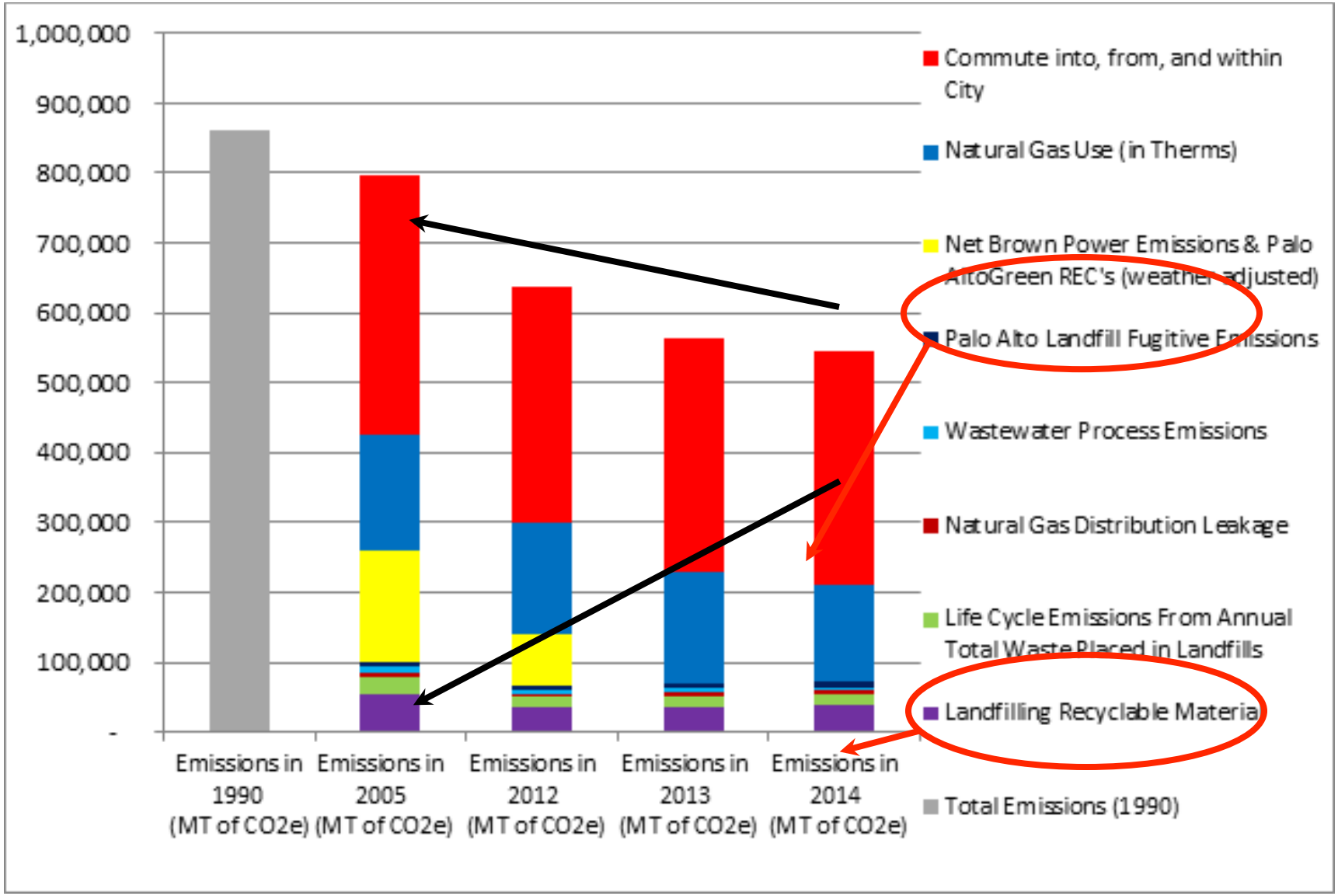

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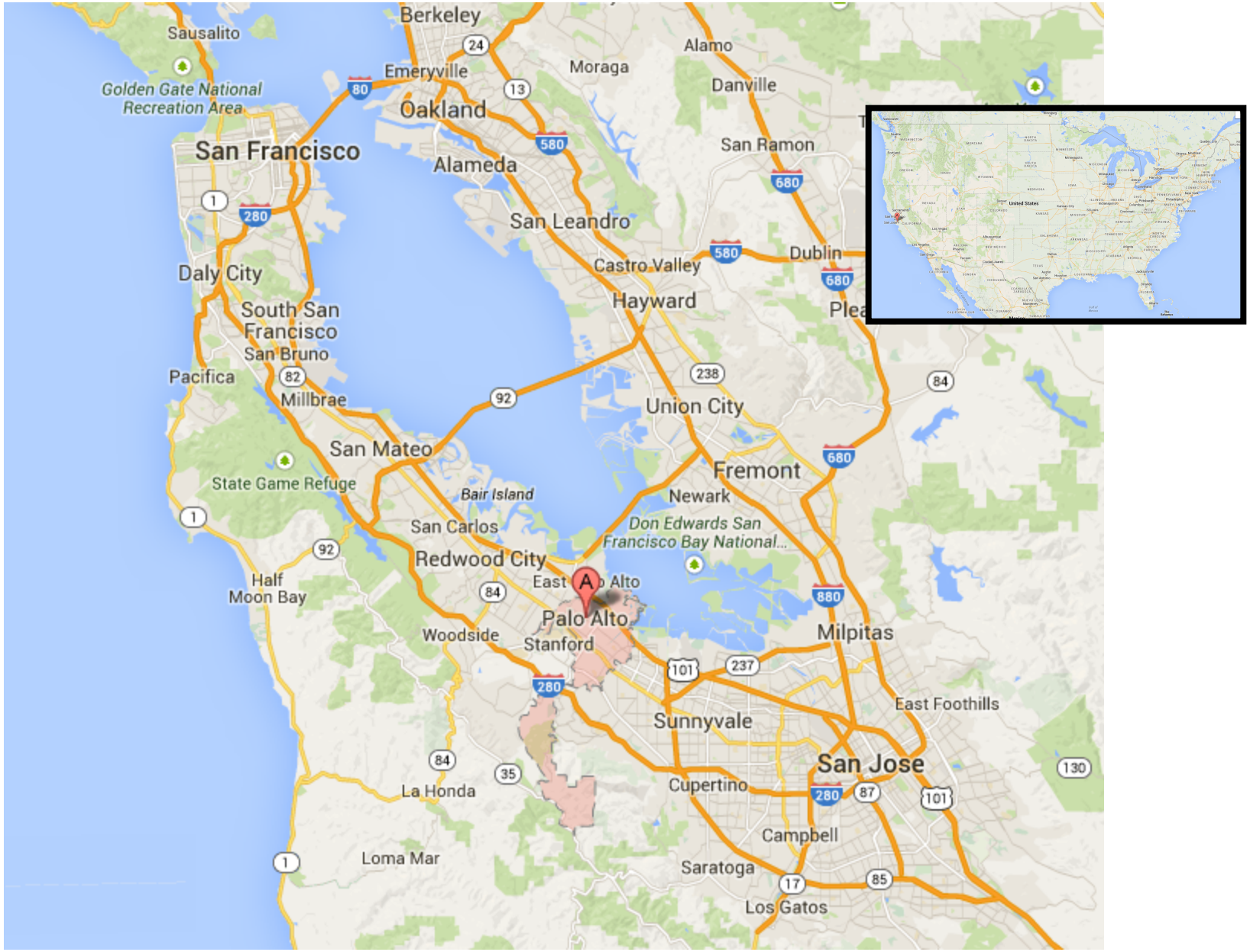

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About Palo Alto

- 66,029 residents
- 148,209 daytime population including Stanford
- Nearly 30% of the residents are over 55
- Located in Silicon Valley between San Francisco and San Jose
- Neighbor to Stanford University
- Regional job center – home to HP, SAP Labs, VMWare, Stanford Hospital

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A “sustainable city” can

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