Electrification of Transportation while Decarbonizing the Grid in California

Asia Clean Energy Forum June 2017

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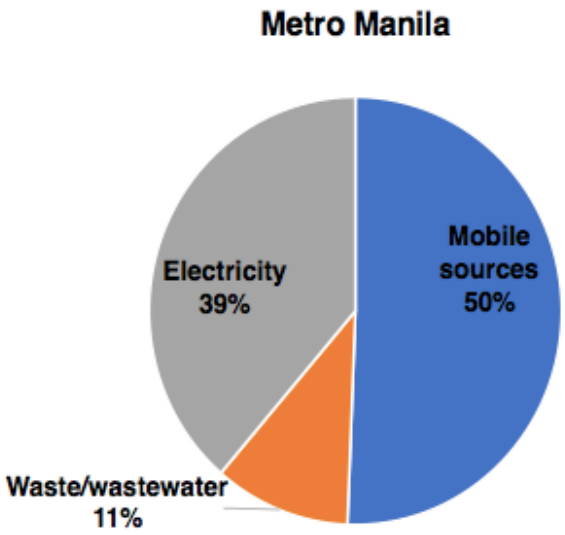
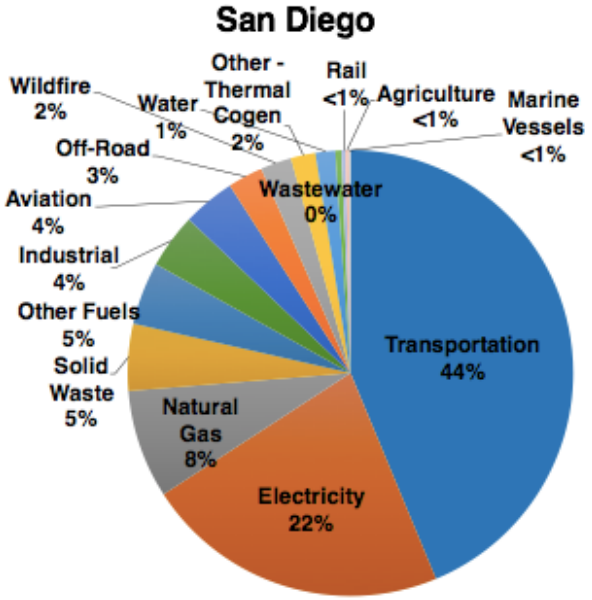
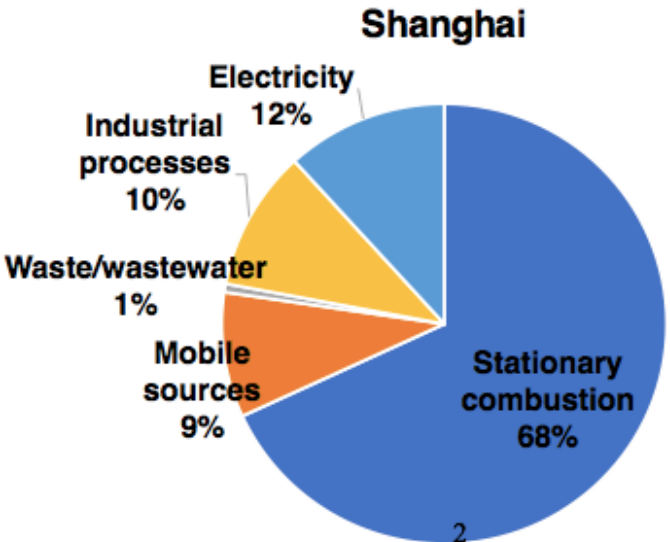
Urban Greenhouse Gas Emissions by Sector

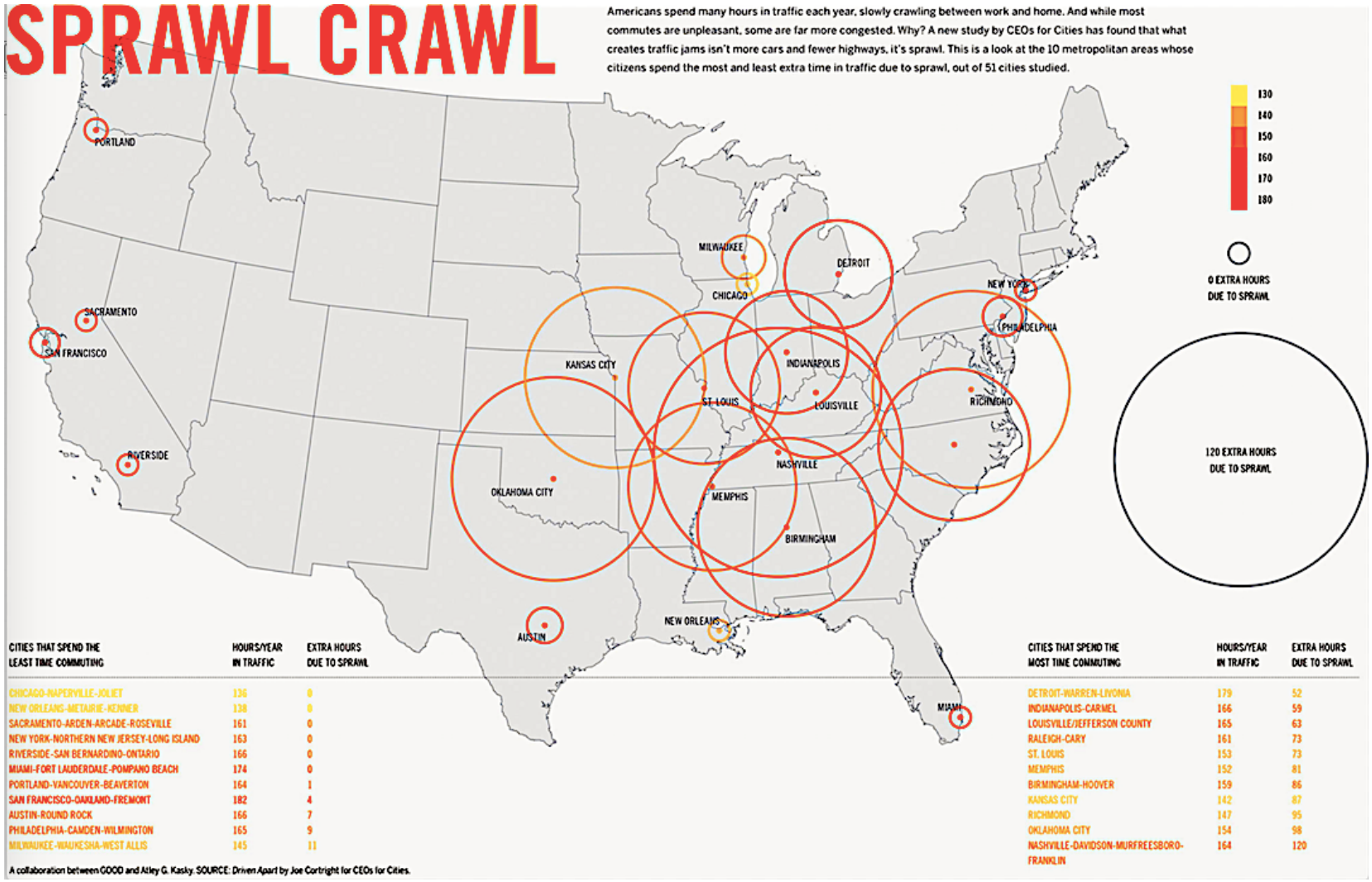






Sprawl + Low Density + High Income = more GHGs + pollutants

High GHGs/capita



CITIES THAT SPEND THE LEAST TIME COMMUTING	HOURS/YEAR IN TRAFFIC	EXTRA HOURS DUE TO SPRAWL
CHICAGO-NAPERVILLE-JOLIET	136	0
NEW ORLEANS-METAIRIE-KENNER	138	0
SACRAMENTO-ARDEN-ARCADE-ROSEVILLE	161	0
NEW YORK-NORTHERN NEW JERSEY-LONG ISLAND	163	0
RIVERSIDE-SAN BERNARDINO-ONTARIO	166	0
MIAMI-FORT LAUDERDALE-POMPANO BEACH	174	0
PORTLAND-VANCOUVER-BEAVERTON	164	1
SAN FRANCISCO-OAKLAND-FREMONT	182	4
AUSTIN-ROUND ROCK	166	7
PHILADELPHIA-CAMDEN-WILMINGTON	165	9
MILWAUKEE-WAUKESHA-WEST ALLIS	145	11

CITIES THAT SPEND THE MOST TIME COMMUTING	HOURS/YEAR IN TRAFFIC	EXTRA HOURS DUE TO SPRAWL
DETROIT-WARREN-LIVONIA	179	52
INDIANAPOLIS-CARMEL	166	59
LOUISVILLE/JEFFERSON COUNTY	165	63
RALEIGH-CARY	161	73
ST. LOUIS	153	73
MEMPHIS	152	81
BIRMINGHAM-HOOVER	159	86
KANSAS CITY	142	87
RICHMOND	147	95
OKLAHOMA CITY	154	98
NASHVILLE-DAVIDSON-MURFREESBORO-FRANKLIN	164	120

https://www.good.is/infographics/transparency-the-cities-where-sprawl-makes-commute-the-worst#open

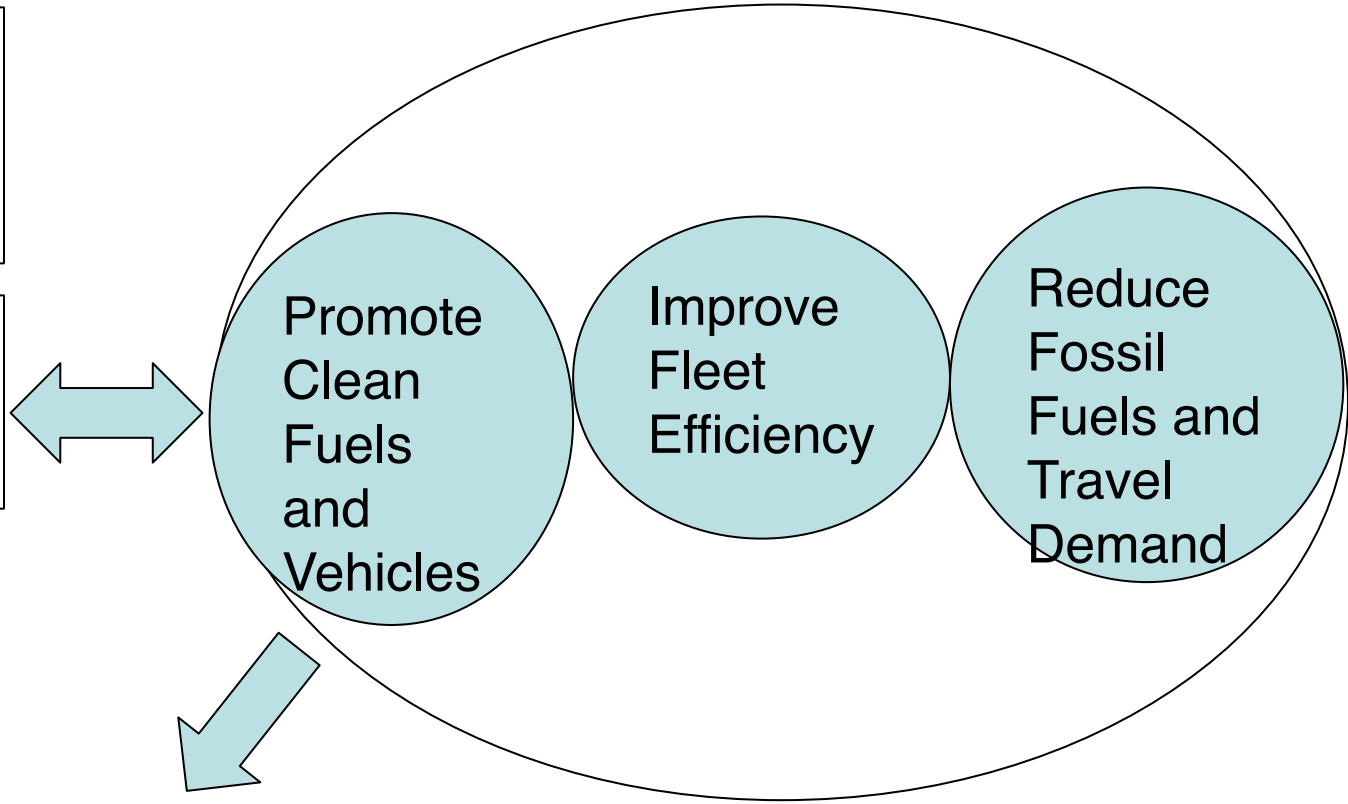
Sprawl + Density + Low Income = more GHGs + air pollutants

Lower GHGs/capita

California's Approach to Energy Transition
Focus Transportation

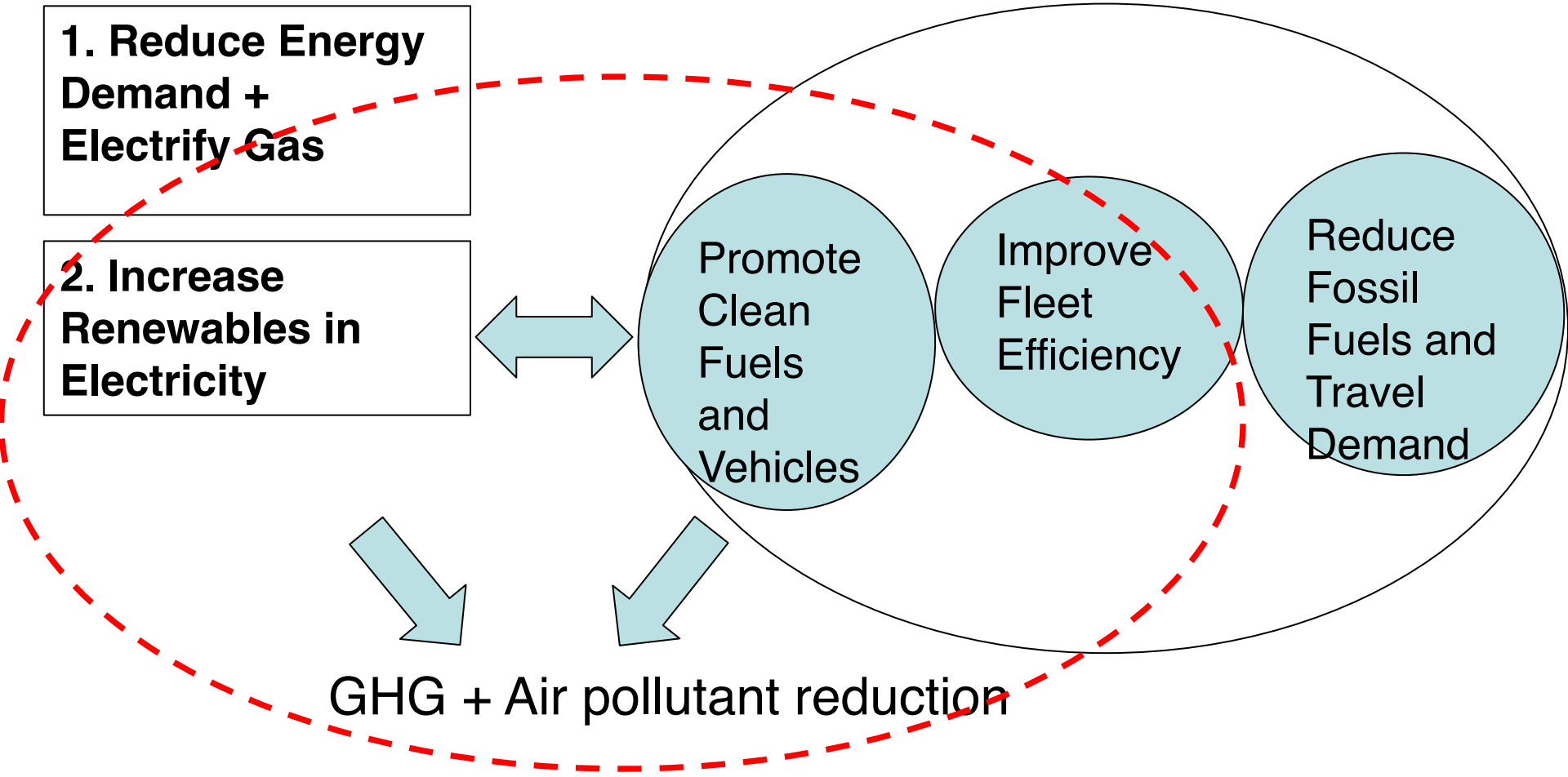
1. Reduce Energy Demand + Electrify Gas

2. Increase Renewables in Electricity

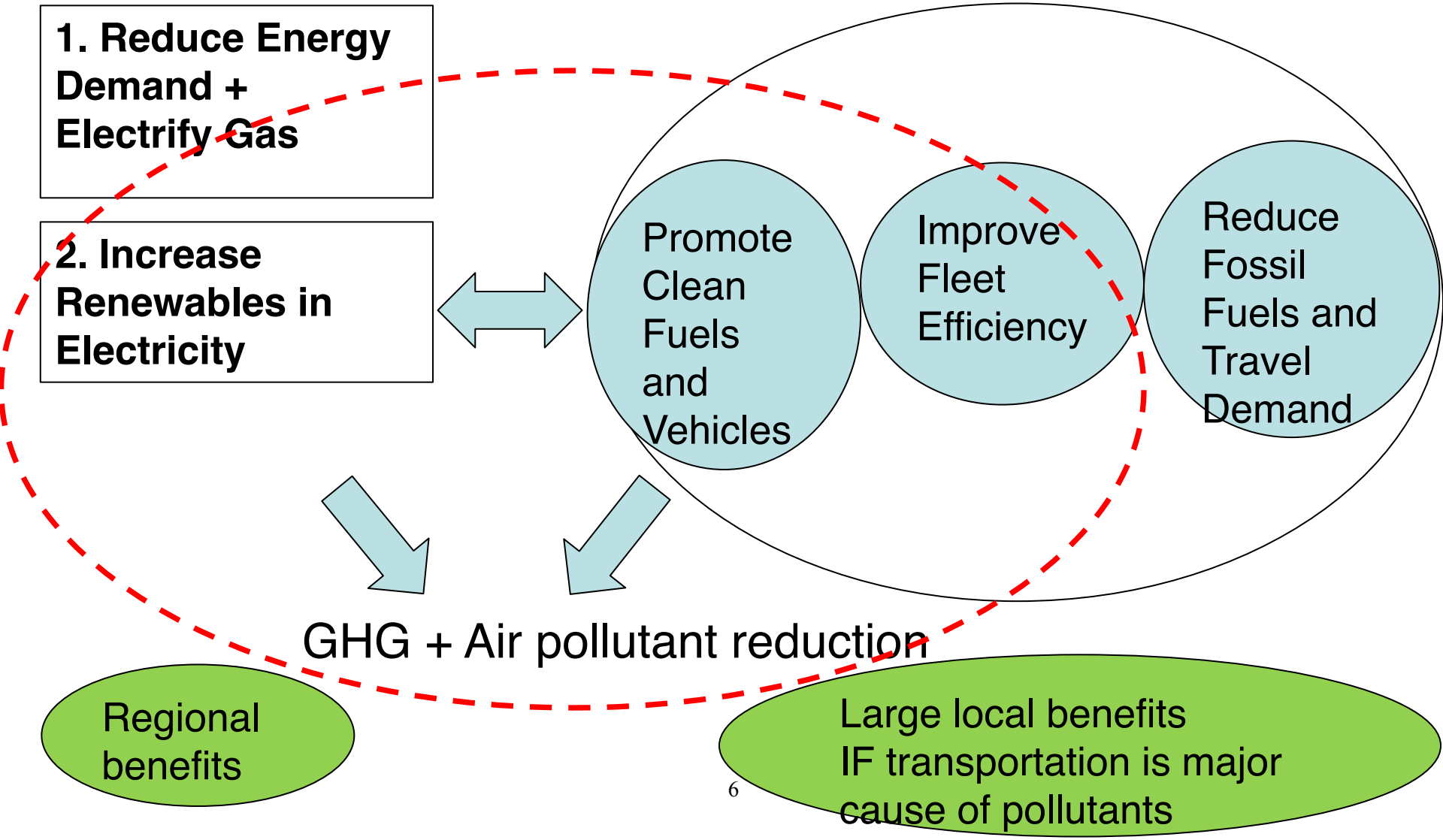


GHG + Air pollutant reduction

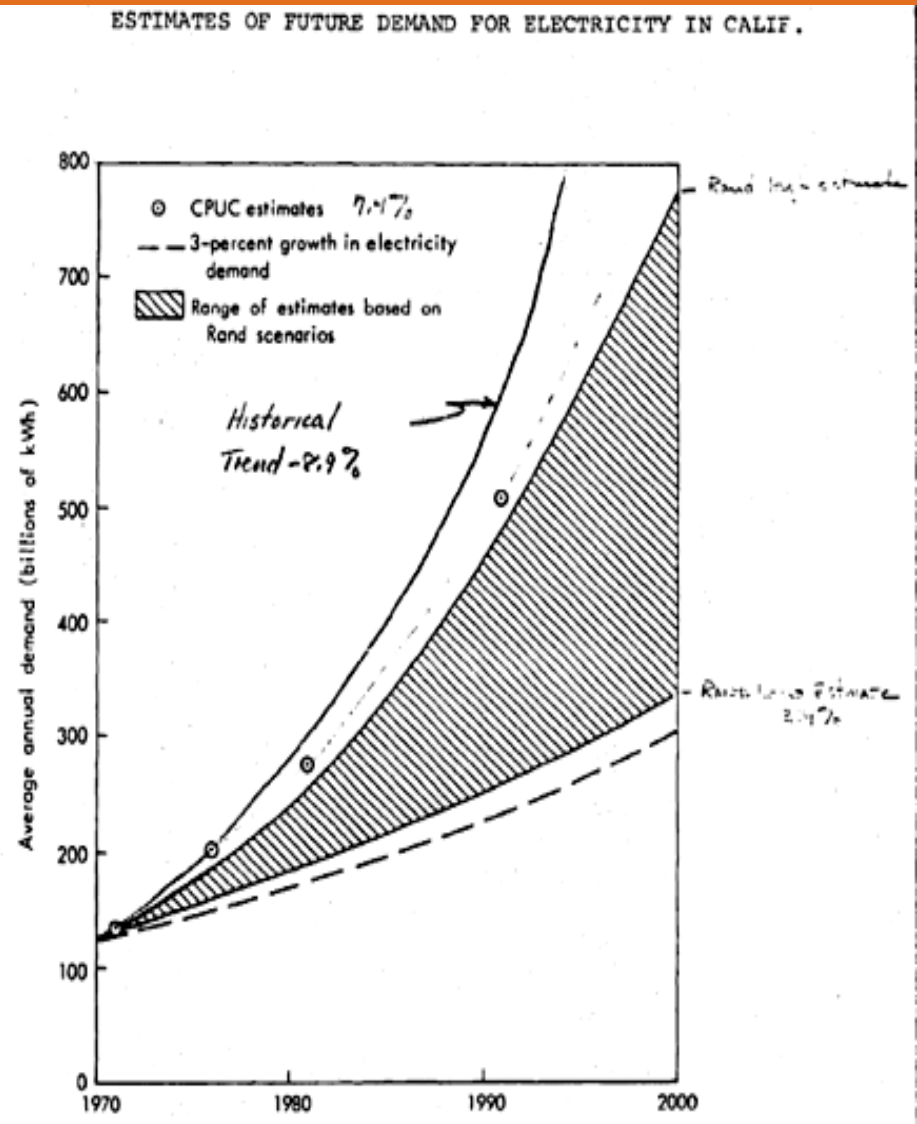
California's Approach to Energy Transition
Focus Transportation

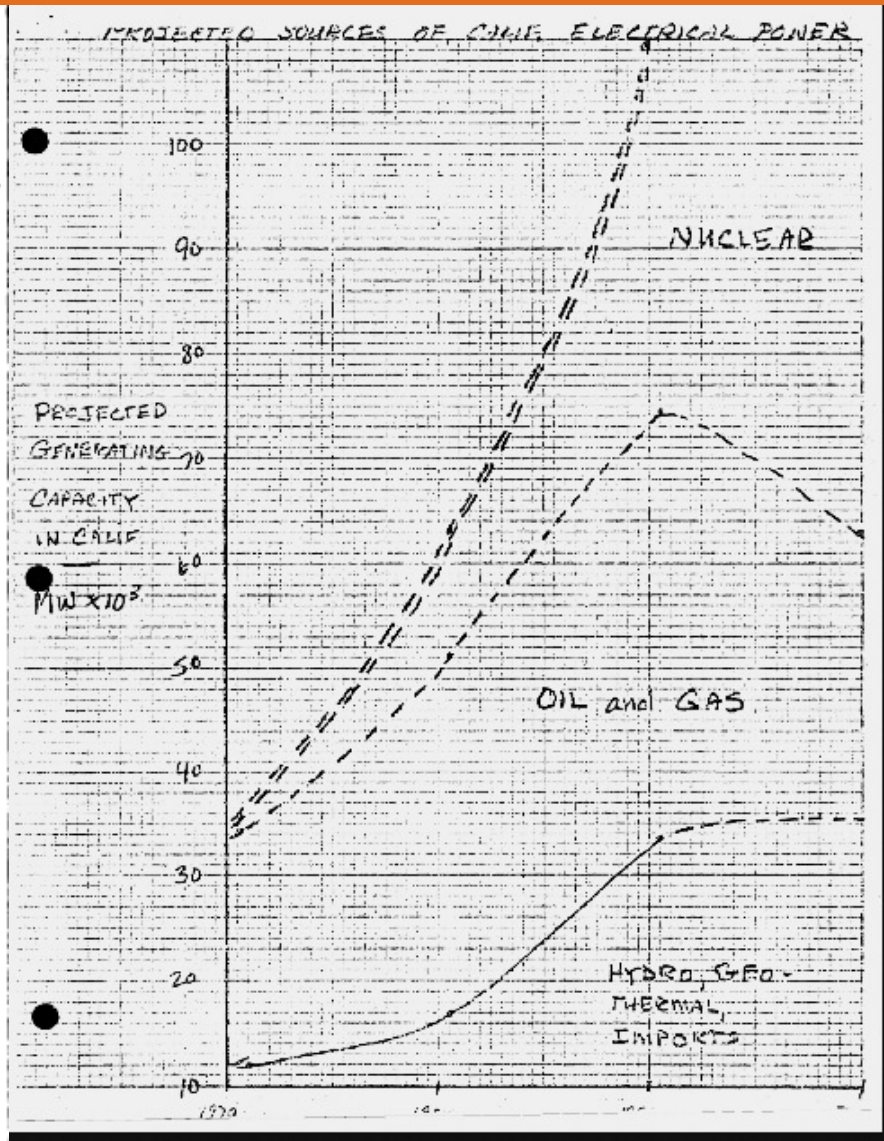


California's Approach to Energy Transition
Focus Transportation



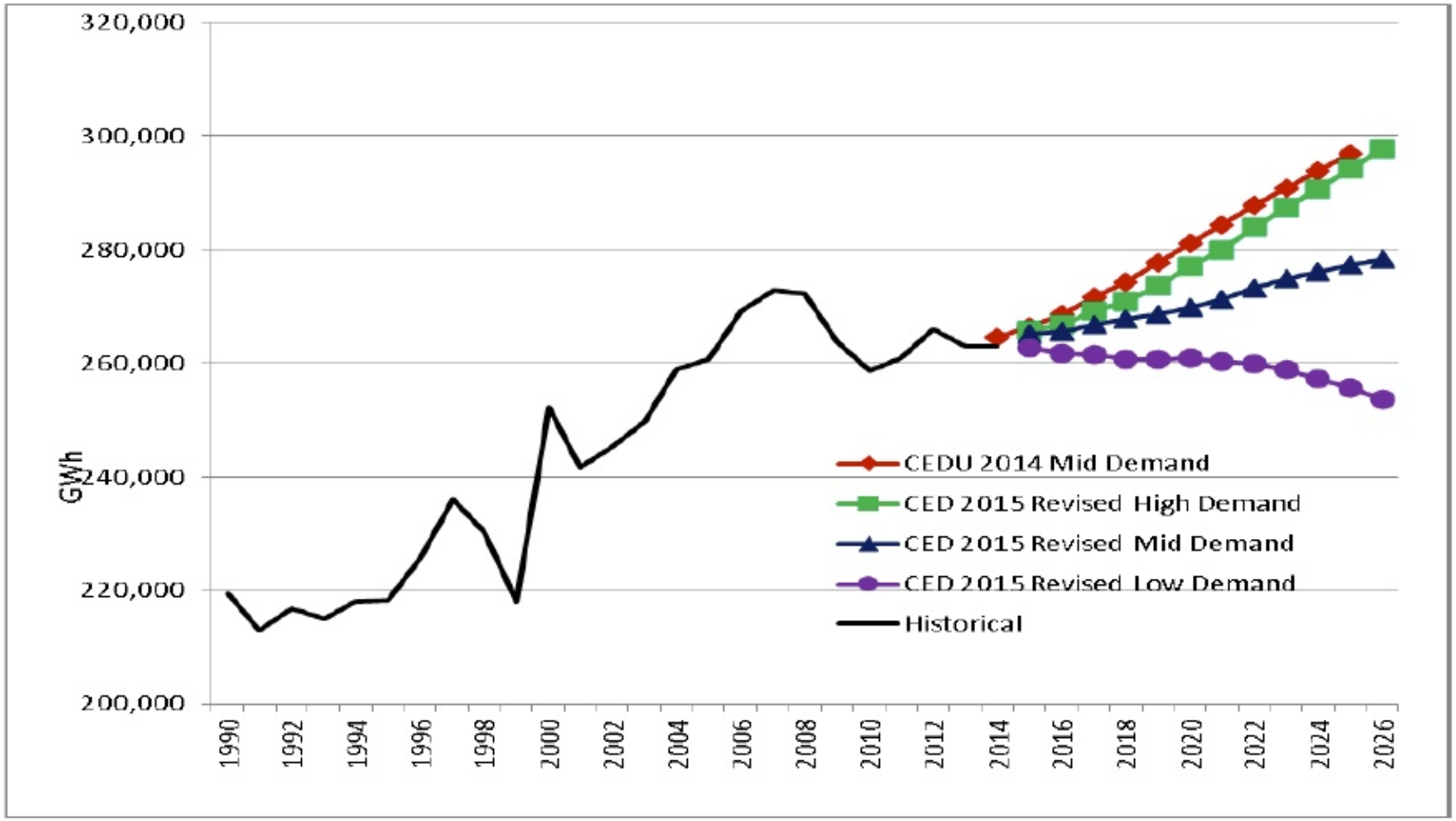
California 1973
Electricity Demand Projection and Sources





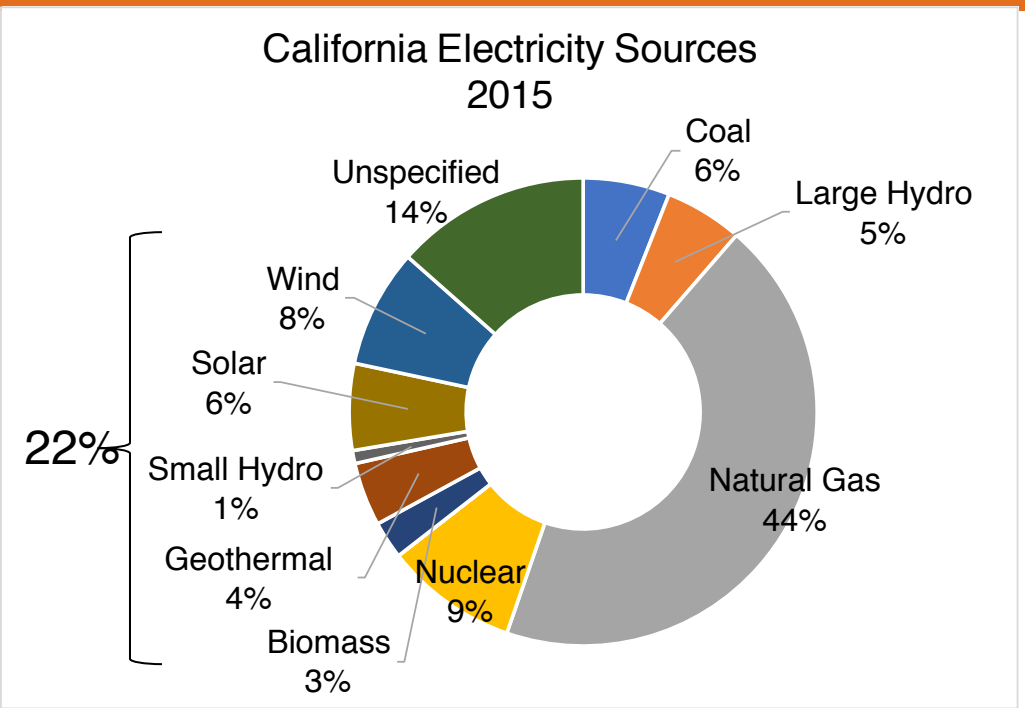
California 2017
Electricity Projection and Sources

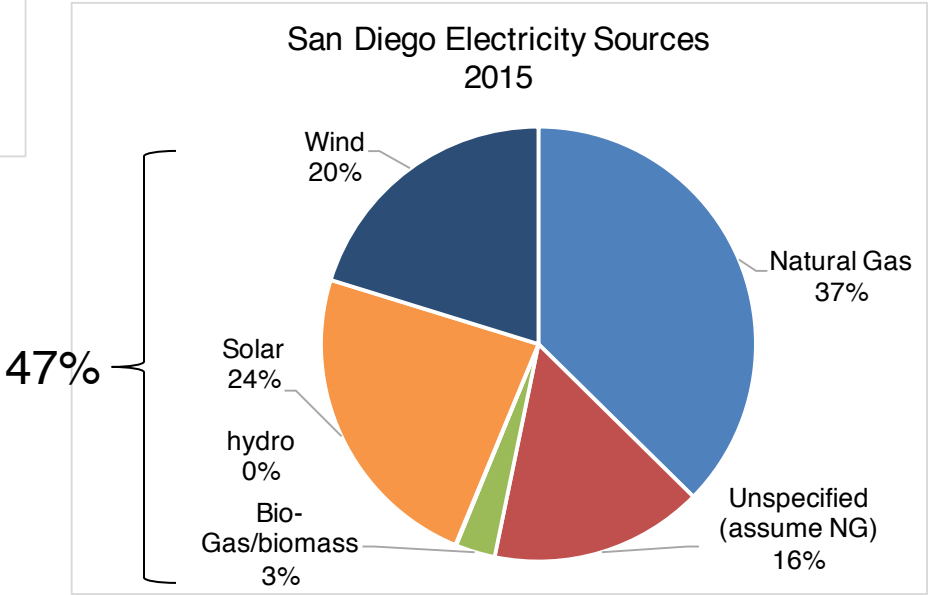
Figure ES-4: Statewide Baseline Retail Electricity Sales



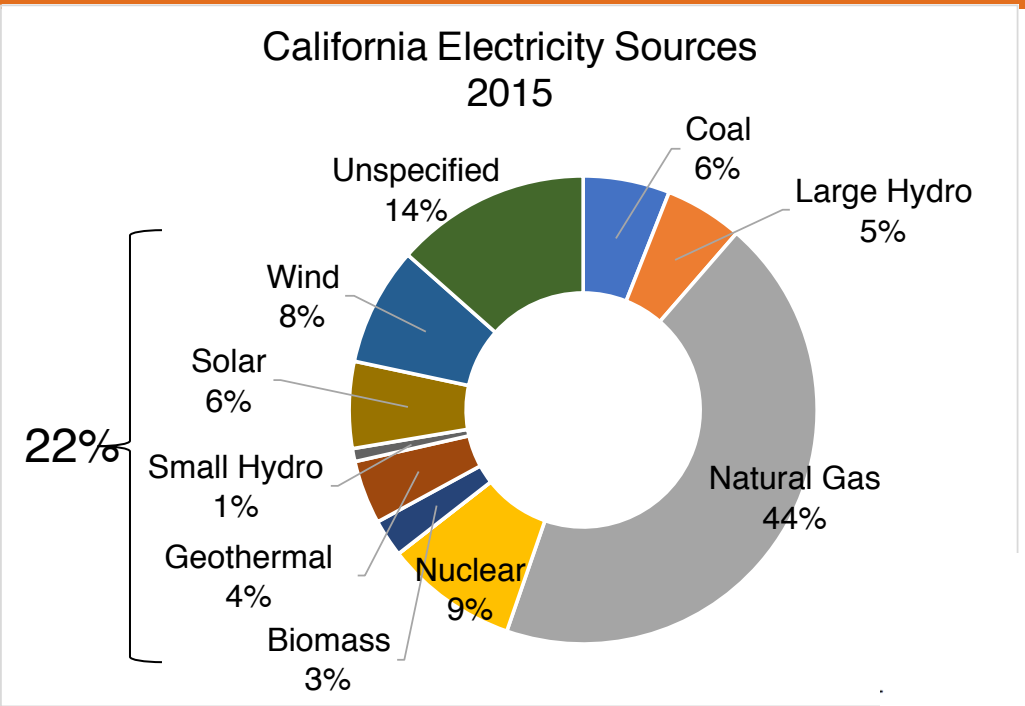
Source: California Energy Commission, Demand Analysis Office, 2015.

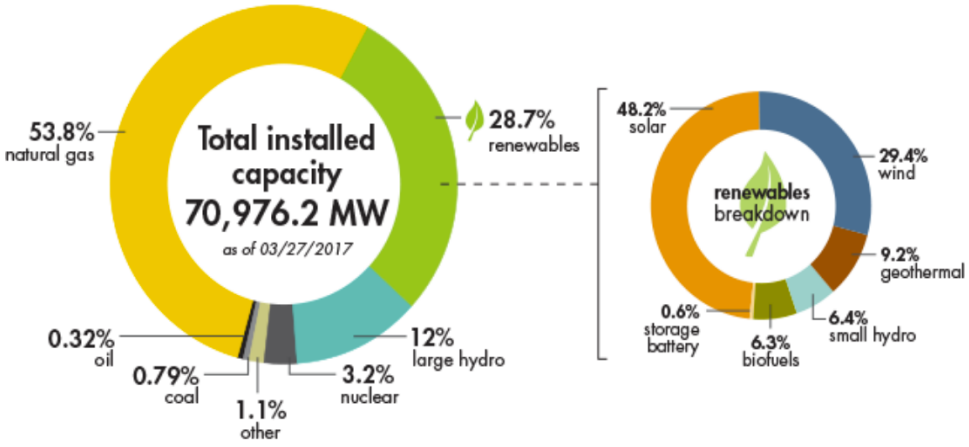
Electricity Generation Sources 2015



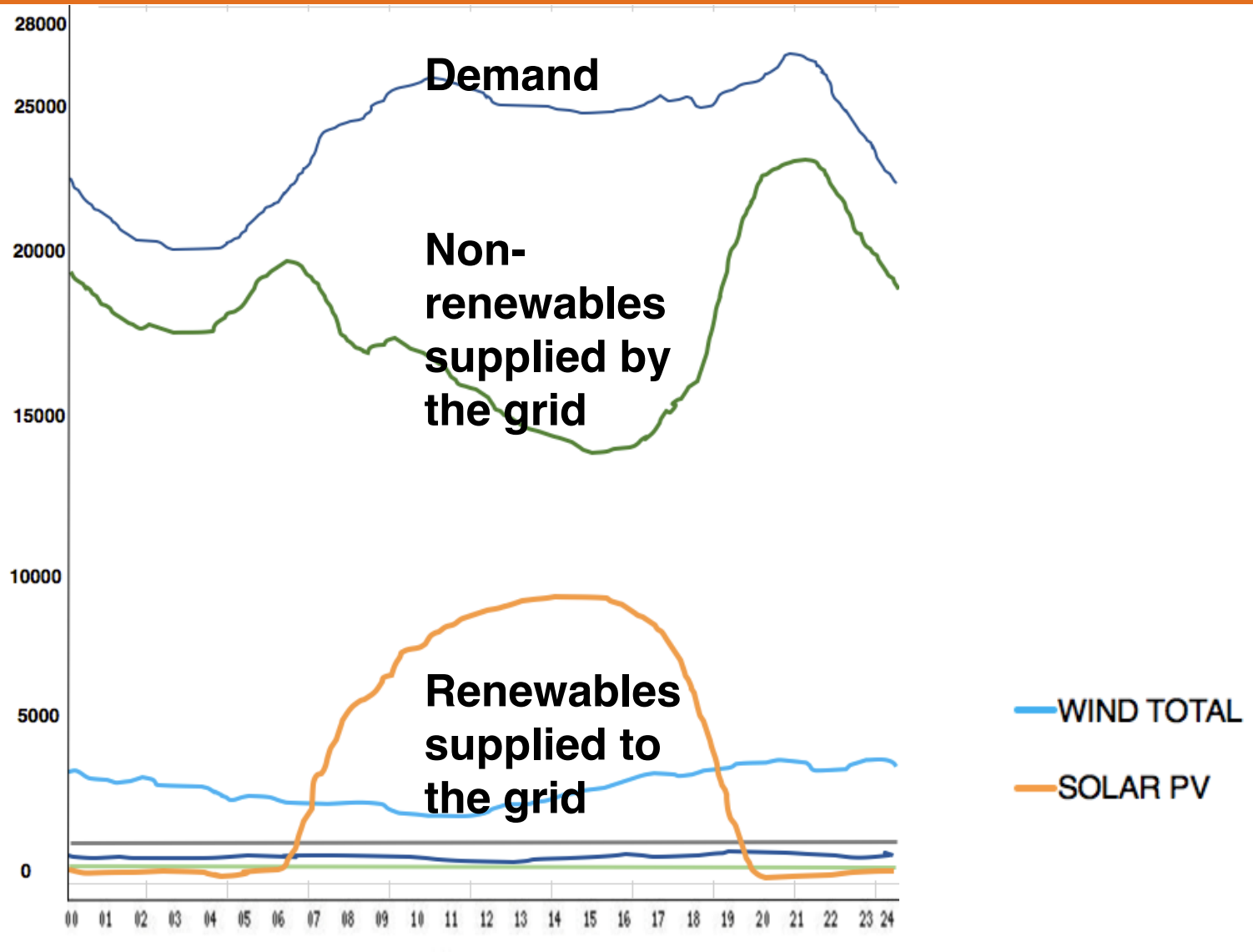


Electricity Generation Sources 2015





May 26 2017 California
Demand and Supply



Policies
Role of Electricity Restructuring and Deregulation? Environmental and Climate Concerns?

- 1998 – Electricity industry deregulation attempts
  - Creation of independent system operator (non-discriminatory transmission access)
  - Independent power producers (generation competition)
    - 1.6% by IPP in 1997, large generation reserve margins
    - 25% in 2012
  - Retail pricing reforms
    - More nimble technologically advanced system, depends on customer interaction/demand response, potentially good for intermittent renewables
- 2000's - Disruption from renewable energy mandates and environmental/climate concerns
  - Program started 1997
  - Renewable portfolio standards (20%, 33%, 50%, 100%), storage mandates, EVs for storage? Etc

Result of Policies

Grid Emission Factor

California 2015

290 g CO2e/KWh (630 lbs/MWh)

San Diego Gas and Electric 2015

270 g CO2e/KWh (600 lbs/MWh)

Result of Policies

Grid Emission Factor

California 2015

290 g CO2e/KWh (630 lbs/MWh)

San Diego Gas and Electric 2015

270 g CO2e/KWh (600 lbs/MWh)

Shanghai

900 g CO2/KWh

Manila ?

Policies

Vehicle Standards

Vehicle fuel efficiency standards (state and federal)

2012-2016 new vehicles

2017-2025 new vehicles

California Zero Emission Vehicle Program

California Goal for EVS

1.5 million EVs by 2025

Result of Policies

Vehicle fuel efficiency standards (state and federal)

2012-2016 new vehicles : 250 grams CO2e/mile

2017-2025 new vehicles : 163 grams CO2e/mile

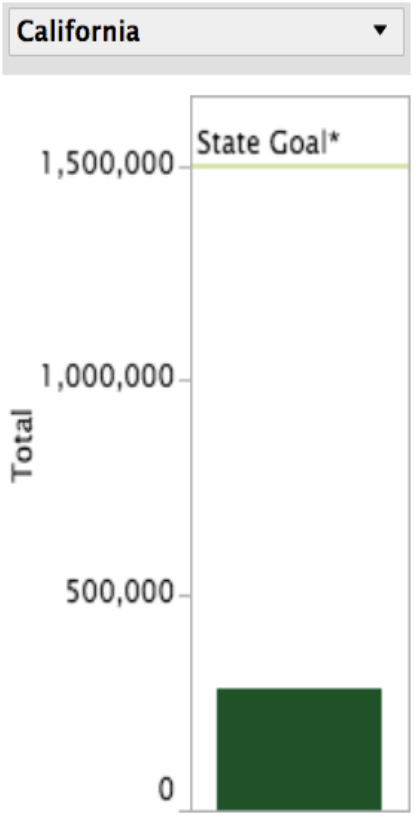
California Zero Emission Vehicle Program : 125 grams CO2e/mile 2025-2030
<100 grams CO2e/miles post 2035

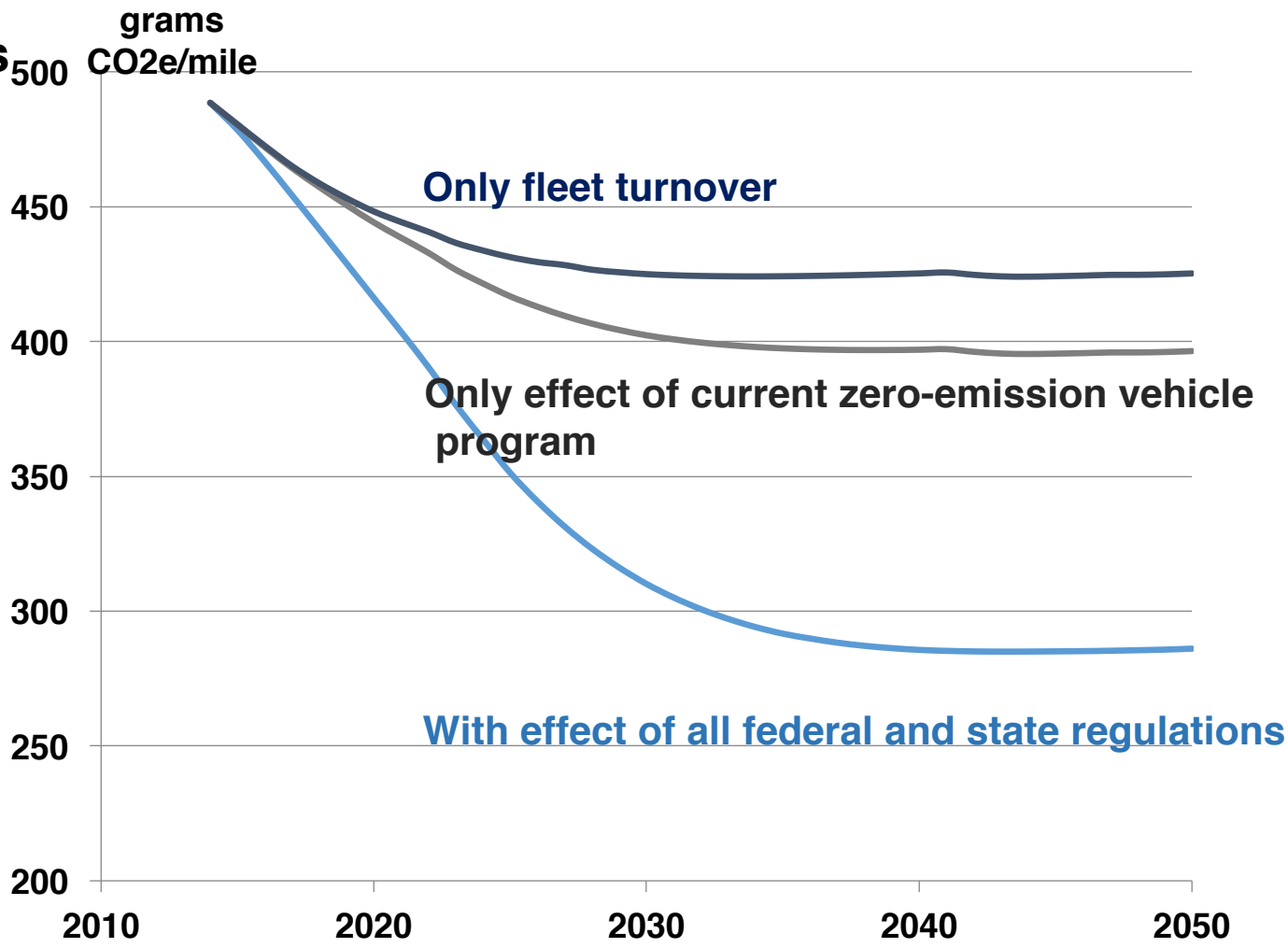
California Goal for EVS

1.5 million EVs by 2025

Tailpipe Emissions

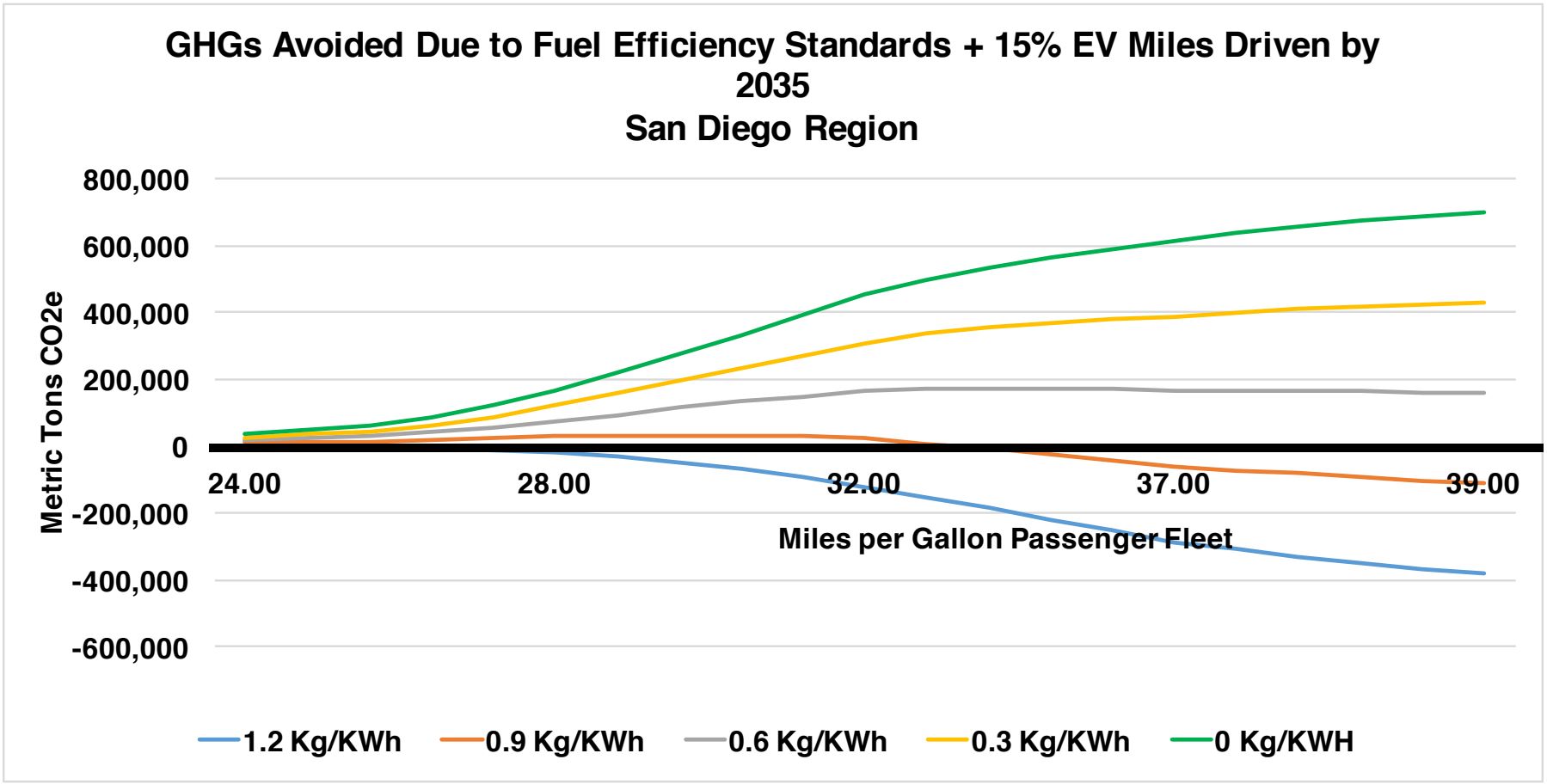
Goal: 1.5 million EVs by 2025





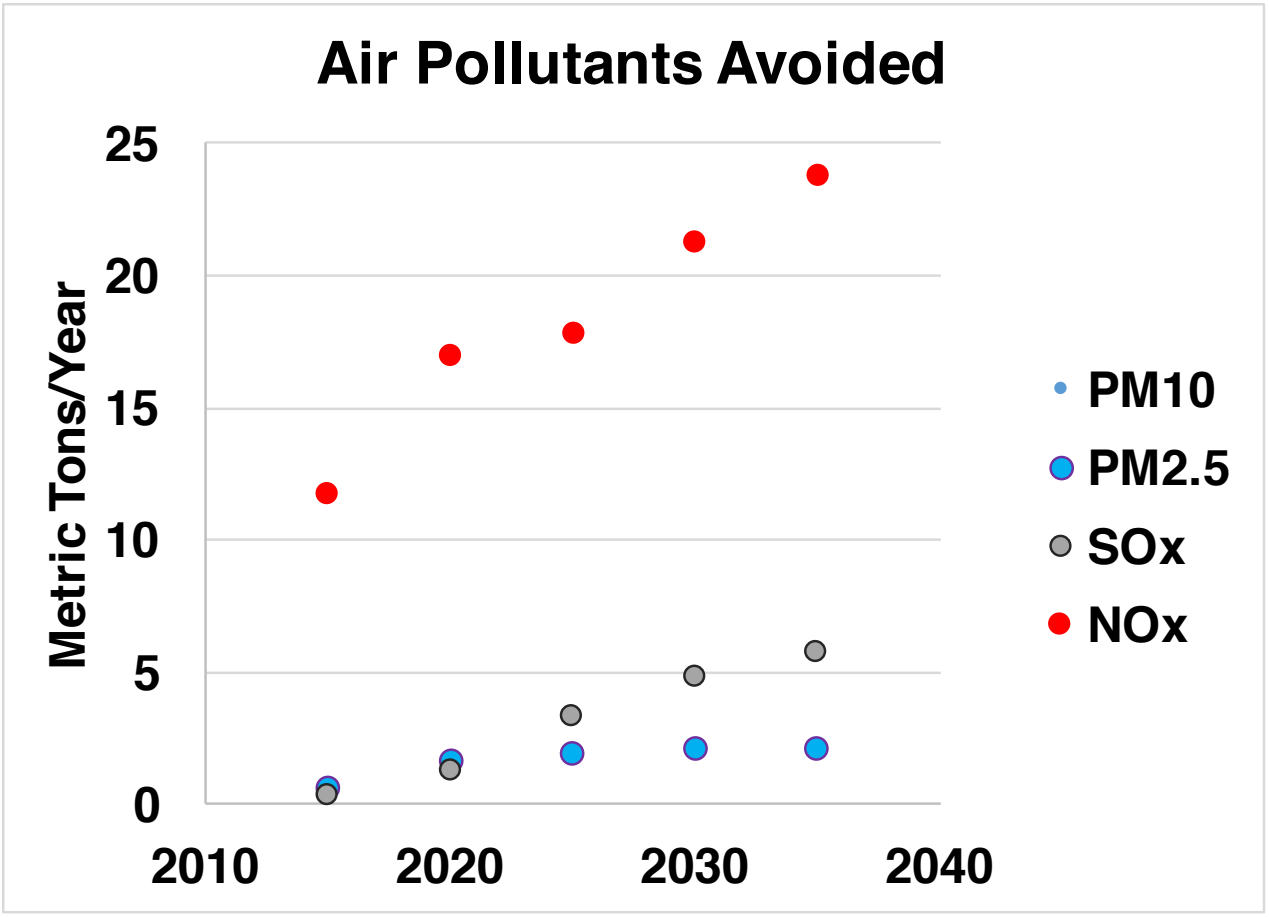
Source: ARB EMFAC2014, EPIC estimate 2017 *for San Diego region only, baseline year 2014

Tailpipe GHG Emissions Avoided with Cleaner Grid ….



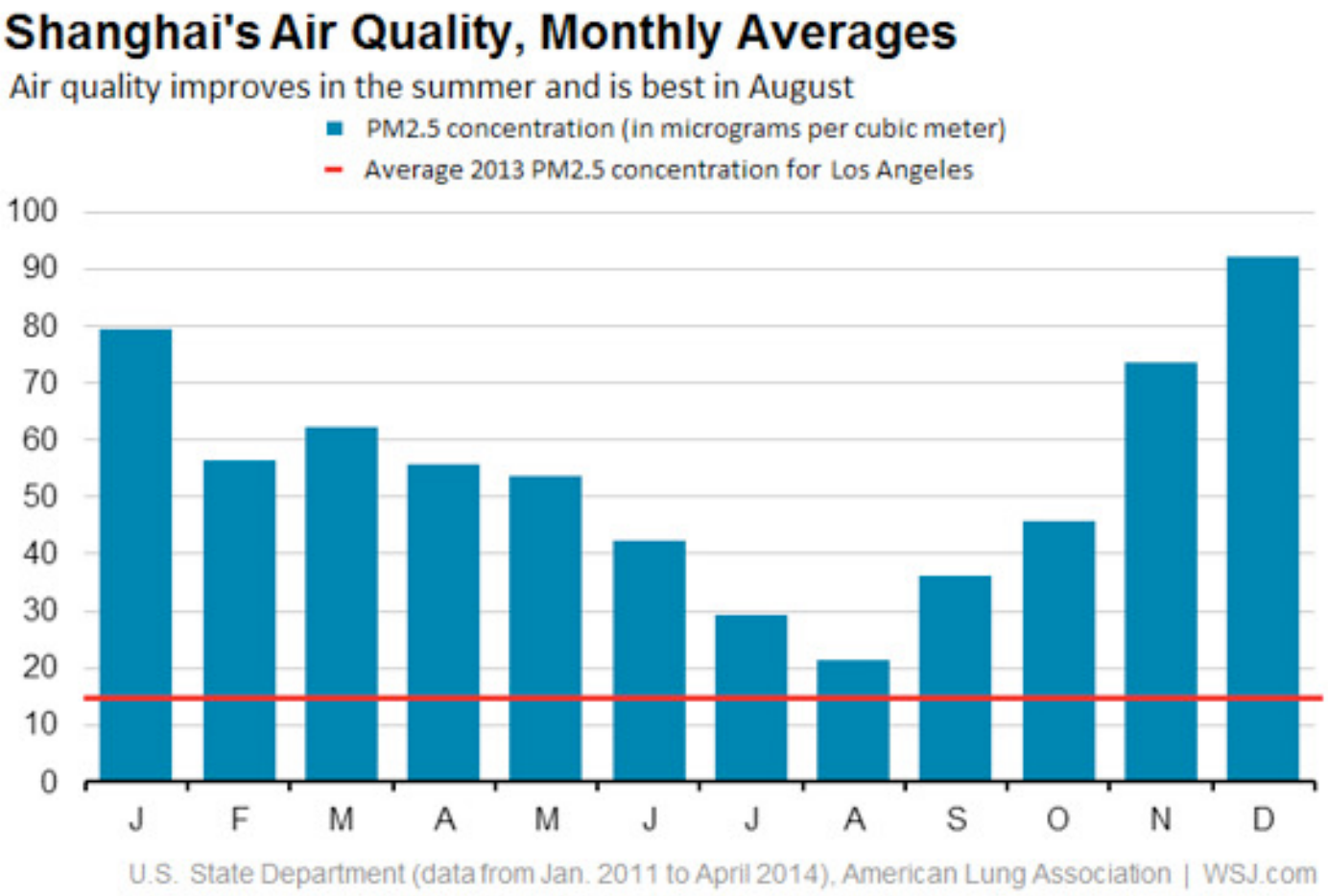
Co-benefits of a fleet with 15% EVs

SD region: only 1% diesel cars, 270 grams/KWh grid



Health benefits!

Air Quality


Shanghai's Air Quality, Monthly Averages
Air quality improves in the summer and is best in August
PM2.5 concentration (in micrograms per cubic meter)
Average 2013 PM2.5 concentration for Los Angeles
100
90
80
70
60
50
40
30
20
10
0
J
F
M
A
M
J
J
A
S
O
N
D
U.S. State Department (data from Jan. 2011 to April 2014), American Lung Association | WSJ.com

Conclusions

- **Must decarbonize the grid before or while promoting EVs**
- **Vast benefits in terms of air pollution reduction, noise**
  - Health benefits
  - Health cost reductions
- **Will not reduce congestion**

THANK YOU

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