AGENDA: 14

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

Transboundary (International) Ozone Transport

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Board of Directors
April 15, 2015

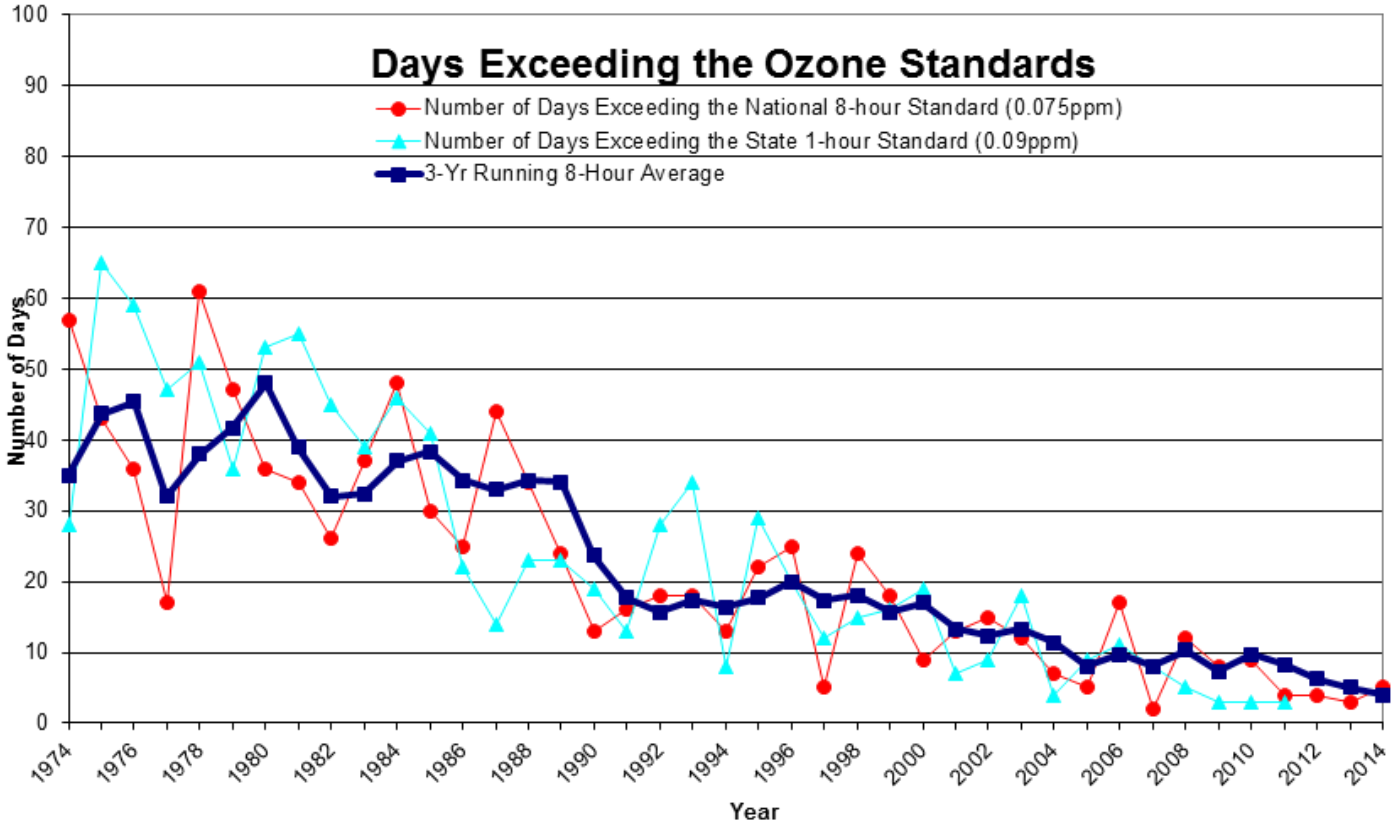
Presentation Overview

- Status of ozone in the Bay Area
- Pollution level in Asia, especially in China
- Federal effort to estimate international pollution transport
- Transport impacts in the western US
- Air District's effort to estimate local impacts
- Continuing collaboration among Federal, State and local agencies

Air District's Research and Modeling Program

- Study ozone, particulate matter (PM2.5), air toxics and ultrafine particulate matter (PM0.1)
- Chemically speciate emissions for modeling
- Study meteorological conditions impacting air quality
- Simulate pollutant and precursor concentrations
- Study pollutant response to changes in emissions; answer what-if questions
- Estimate exposure and health impacts of pollutants
- Provide technical support to Clean Air Plan updates
- Collaborate with EPA, NOAA, NASA, ARB, neighboring districts and research community

Ozone Trend in the Bay Area

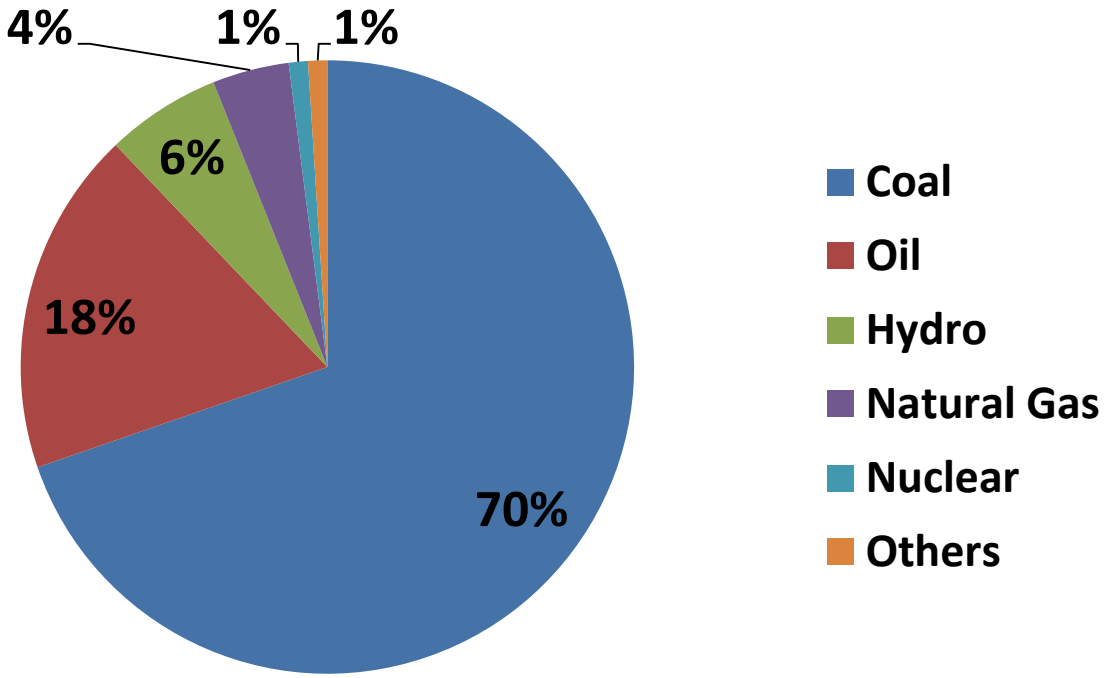


Status of Ozone in the Bay Area

Year	National 8-Hour	State 1-Hour	State 8-Hour
2011	4	5	10
2012	4	3	8
2013	3	3	3
2014	5	3	10

Days > 0.075 ppm 8-hour NAAQS: 4/30, 5/1, 5/14, 10/4, 10/5

Total Energy Consumption in China by Fuel Type, 2011



Energy consumption increased about 2.5 times from 1990 to 2010

Source: US Energy Information Administration

Asian Pollution

- Pollution in Asia has increased in recent years
- High pollution levels and long pollution seasons
  - Ozone – spring, summer and fall
  - PM2.5 – fall, winter and spring
  - Dust – winter and spring (yellow dust – Mongolia)

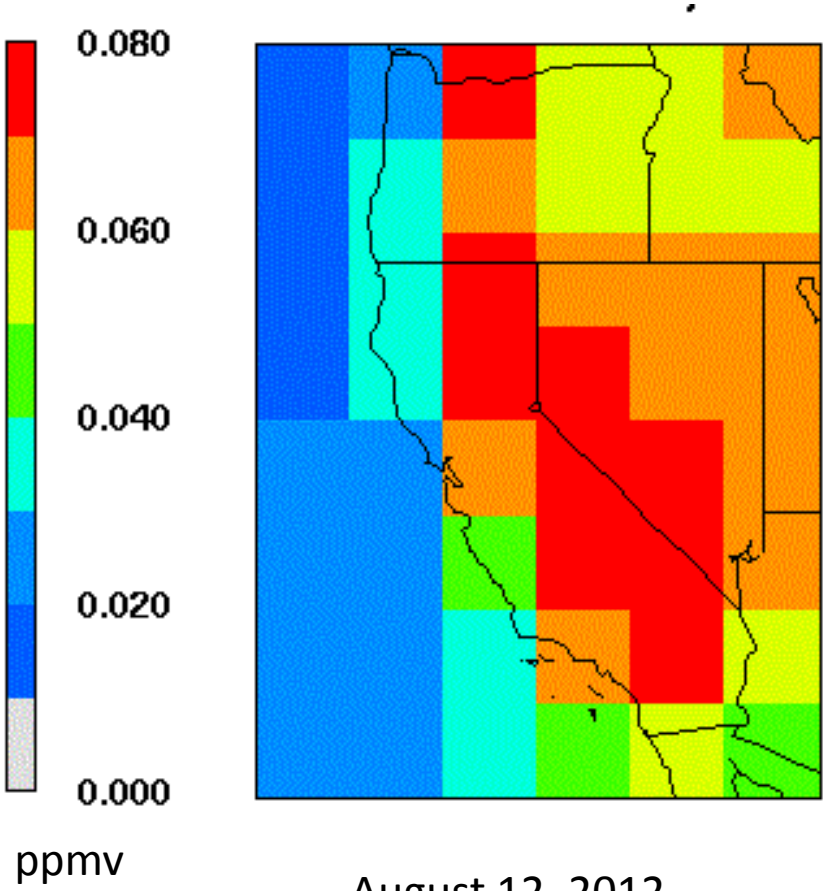
Beijing air on a day after rain and on a smoggy day, 2005

Federal Effort to Estimate Transport

- NOAA, NASA, EPA and others launched a field campaign during the summer of 2010
  - Aircraft-based ozone measurements
  - Ozonesonde measurements, including measurements at Point Reyes and Point Sur
  - Ground-level ozone monitoring in the western US
  - Monitoring pollution transport via satellites
  - Data analysis
  - Global modeling with and without inclusion of anthropogenic emissions in Asia

Global Model

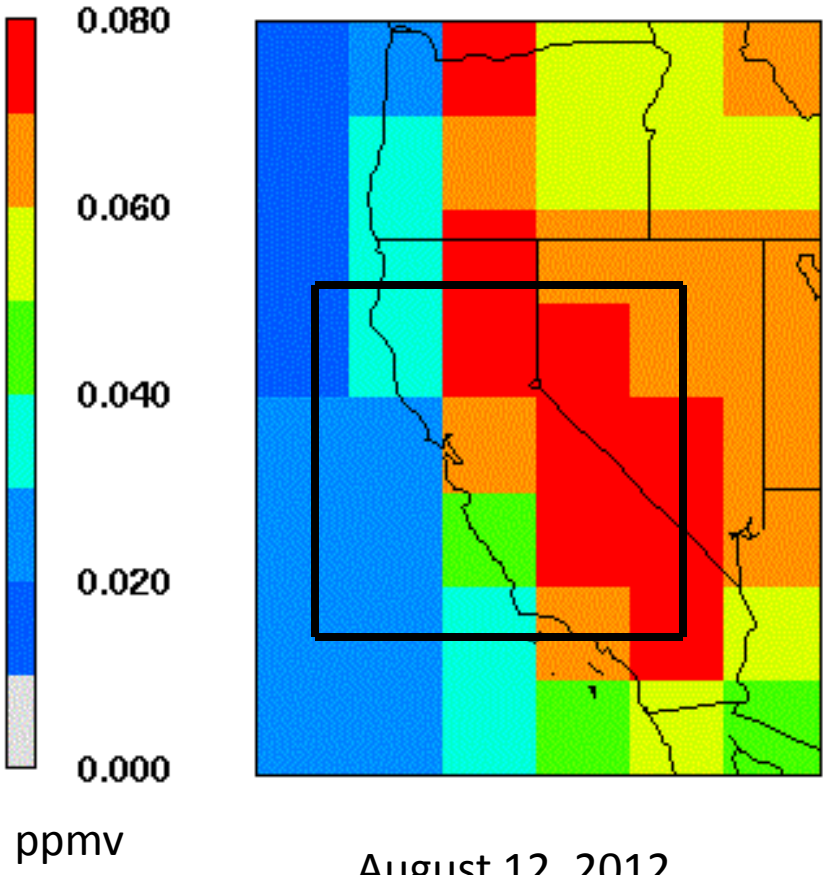
- Conducted by NCAR
- Ozone, PM2.5 and precursors
- 200 km horizontal resolution
- Available every six hours



August 12, 2012

Global Model

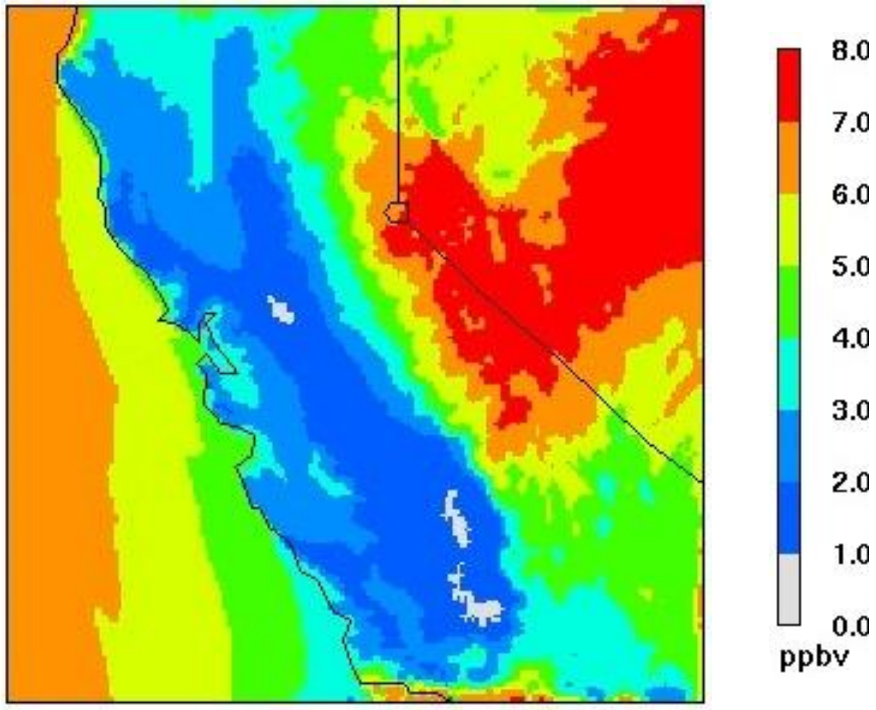
Provides incoming boundary pollution information to local models



August 12, 2012

Air District's Effort to Estimate Transport

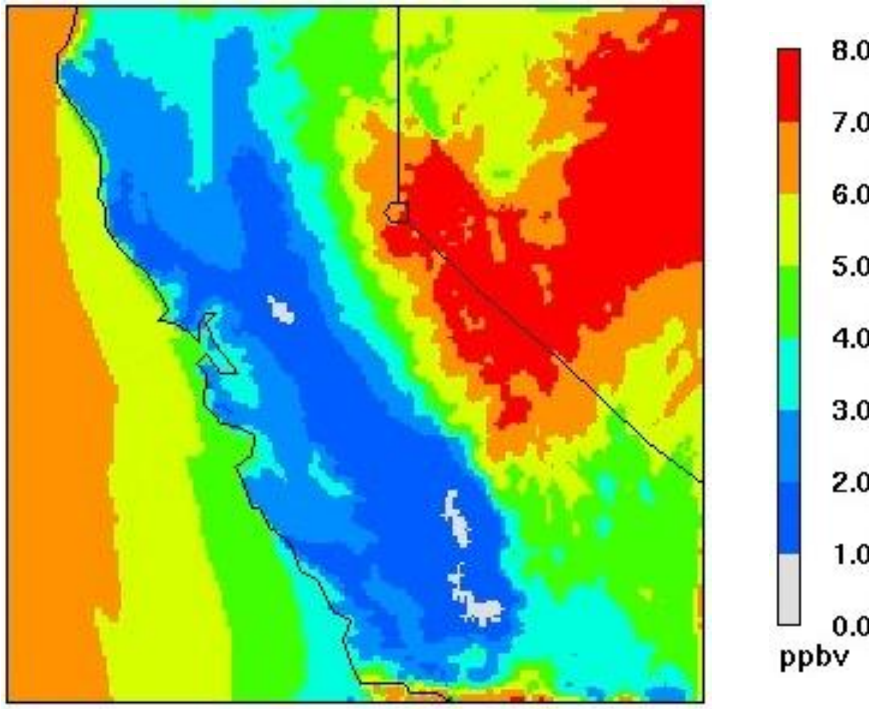
- Asian ozone transport was estimated for a 2-week period in August, 2012
- Ozone at the boundaries was obtained from NOAA's global simulations for two scenarios, with and without Asian anthropogenic emissions
- Two local simulations, using data from NOAA's scenarios, were conducted. The difference represents transported ozone



Example of ozone transport via the western boundary

Air District's Effort to Estimate Transport

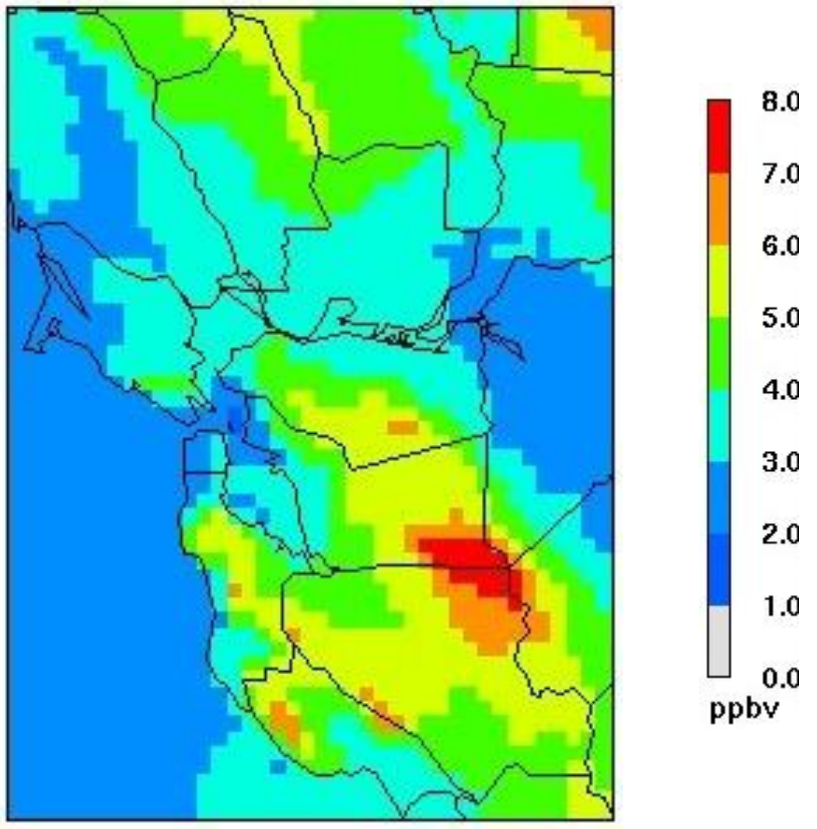
- International ozone transport takes place mostly in aloft layers of the atmosphere
- Transported ozone impacts higher elevations the most
- Cooler and cloudy air along the California coast brings ozone concentrations down at lower elevations



Example of ozone transport via the western boundary

Air District's Effort to Estimate Transport

- International ozone transport impacts the Bay Area
- Locations of air monitoring stations are also impacted

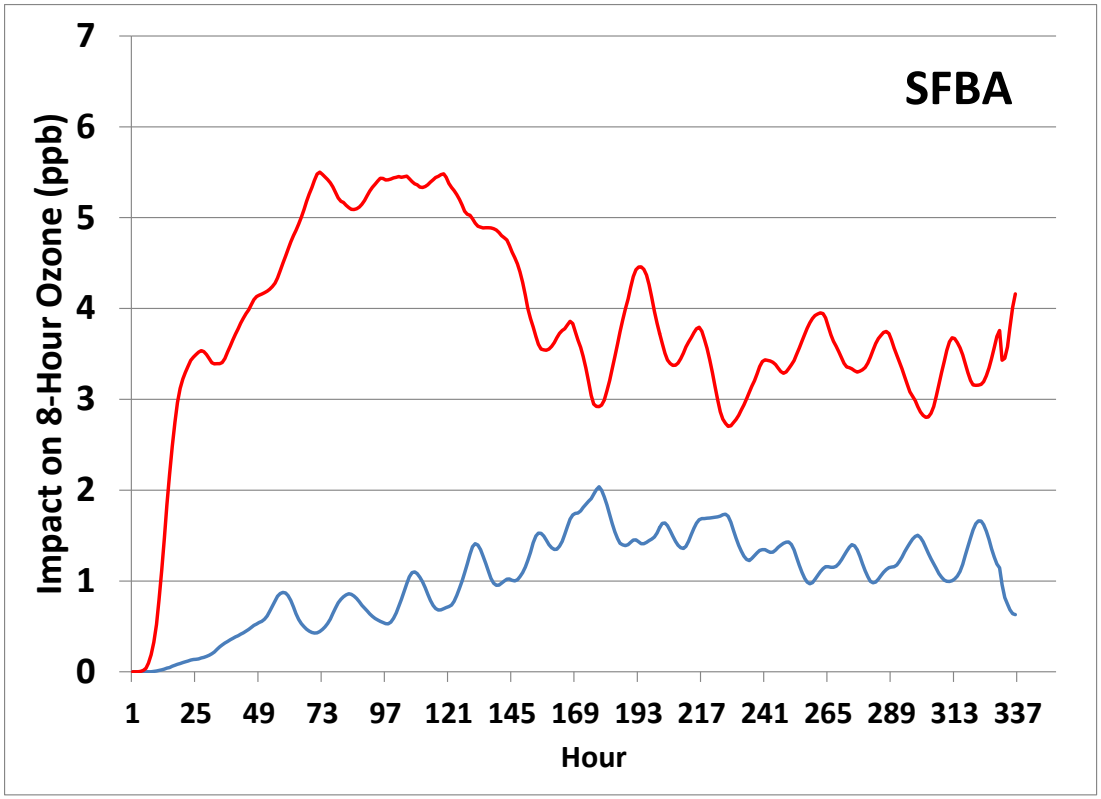


Example of ozone transport via the northern boundary; Bay Area close-up

Air District's Effort to Estimate Transport

Estimated upper and lower bounds of transported ozone averaged across Bay Area air monitoring stations for 2 weeks

- Four transport scenarios were simulated
- Upper bound is as much as 5.5 ppb
- This amount is significant for the Bay Area; it could impact our attainment status



Key Takeaway

- There is an ozone contribution from Asia
- It is relatively small, 2-5 ppb
- Spring season and higher elevations seem impacted the most
- We will continue with in-house research and collaborate with others

Continuing Collaboration Among Federal, State and Local Agencies

- NOAA plans to work with State and local agencies to accommodate their needs for estimating ozone transport
- NASA plans to launch a new satellite in 2018 that will collect pollution data every 1-3 hours
- NASA has been funding the Air Quality Applied Science Team to help interpret satellite-based data for air agencies
- ARB plans to launch daily ozonesodes at two coastal locations in northern and central California during the summer of 2015
- Districts and Western Regional Air Partnership plan to collaborate and further study continental ozone transport
    - PM2.5 and dust transport is of interest

AGENDA: 15

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

Exploring Bay Area Energy Future as Part of Climate Protection Strategy

2014 Efforts of Advisory Council

Prepared for the
Board of Directors
2015

Advisory Council 2014 Activities

- Objective
  - Explore Bay Area's energy future, investigating technical issues related to Air District's Climate Protection Program
  - #10 in 10-Point Climate Action Work Program
- 10 regular meetings
- 6 expert speakers
  - Universities, national laboratory, CA Energy Commission, EPRI
- 4 reports

Advisory Council: Topics and Speakers

Bay Area Energy Future

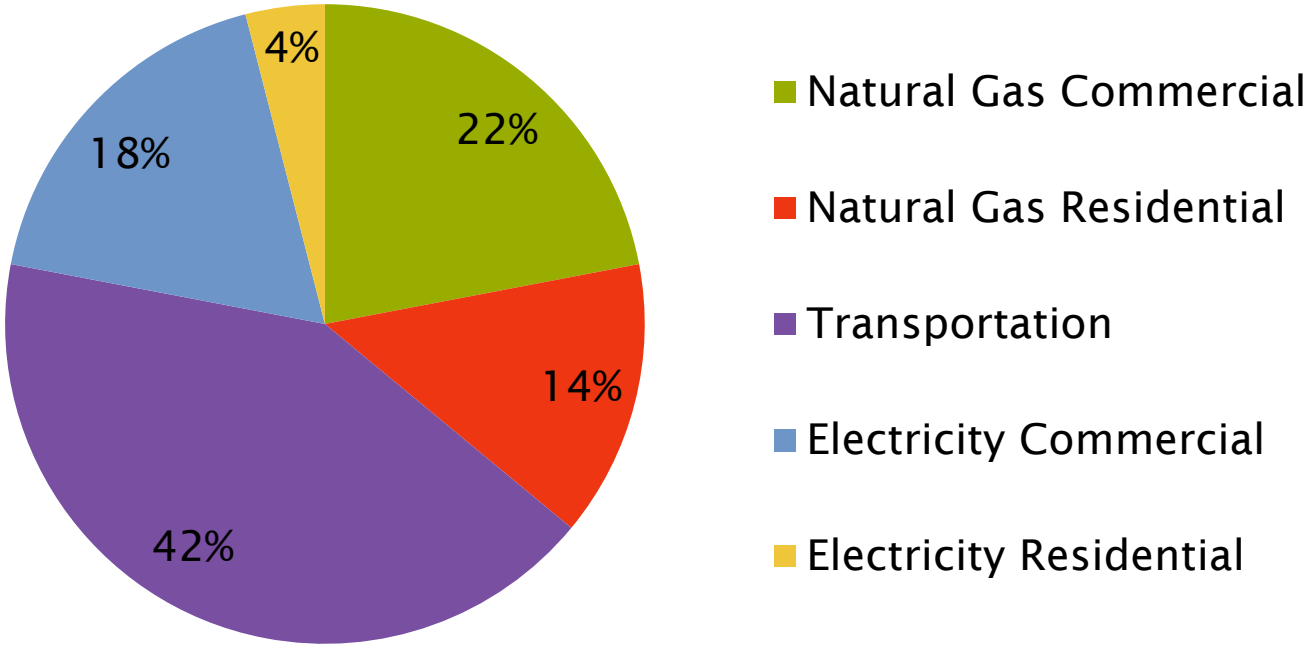
- **Mark Jacobson**, Professor, Stanford (100% wind, water, solar pathway)
- **Jim Williams**, PhD, E3 (all available measures pathway)
- **Jane C.S. Long**, PhD, LLNL/EDF (action plan, feasibility, all available measures pathway)
- **Emilio Camacho**, Esq., CA Energy Commission (innovation)
- **Daniel Kammen**, Professor, UC Berkeley (Bay Area energy and climate opportunities)
- **Haresh Kamath**, EPRI (energy storage and integrated smart grid)

Energy Future:
Big Picture

- Efficiency
  - Especially uses that cannot be easily electrified
- Electrification
  - All feasible fossil-fuel combustion uses
- Decarbonization
  - Electricity supply (e.g., renewables) and fossil fuels

Energy Future:
Where We Are – Bay Area

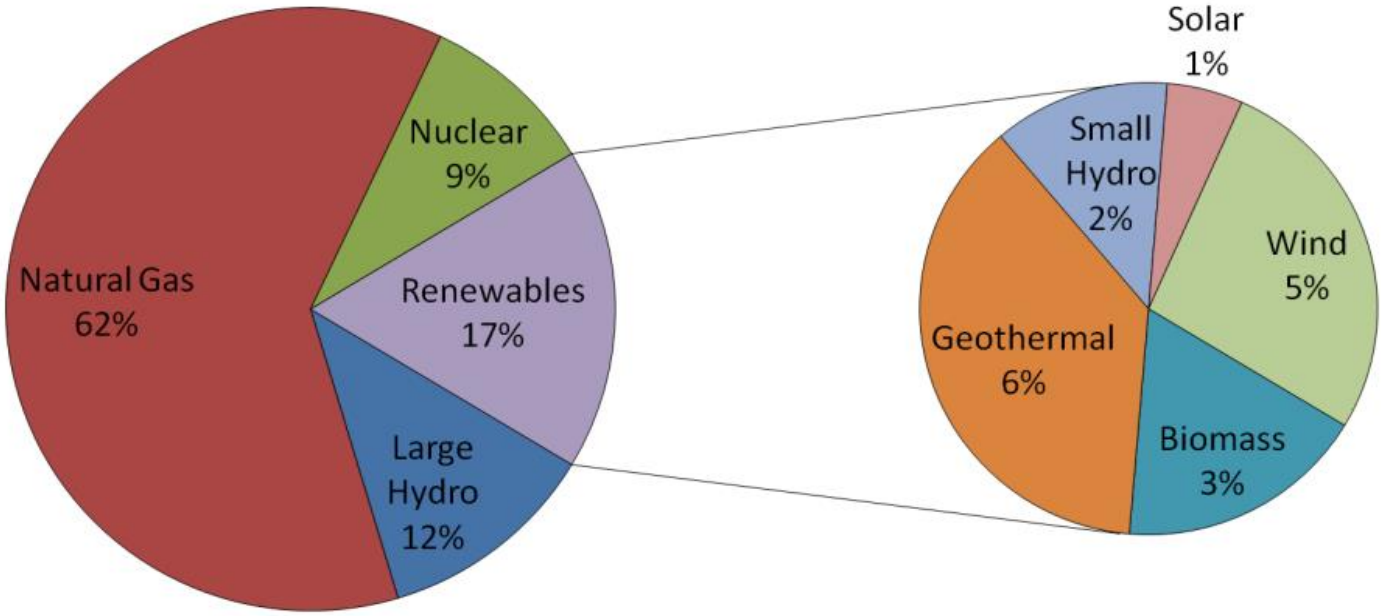
Bay Area Energy Consumption (percent) in 2012



Source: California Energy Commission and Air Resources Board

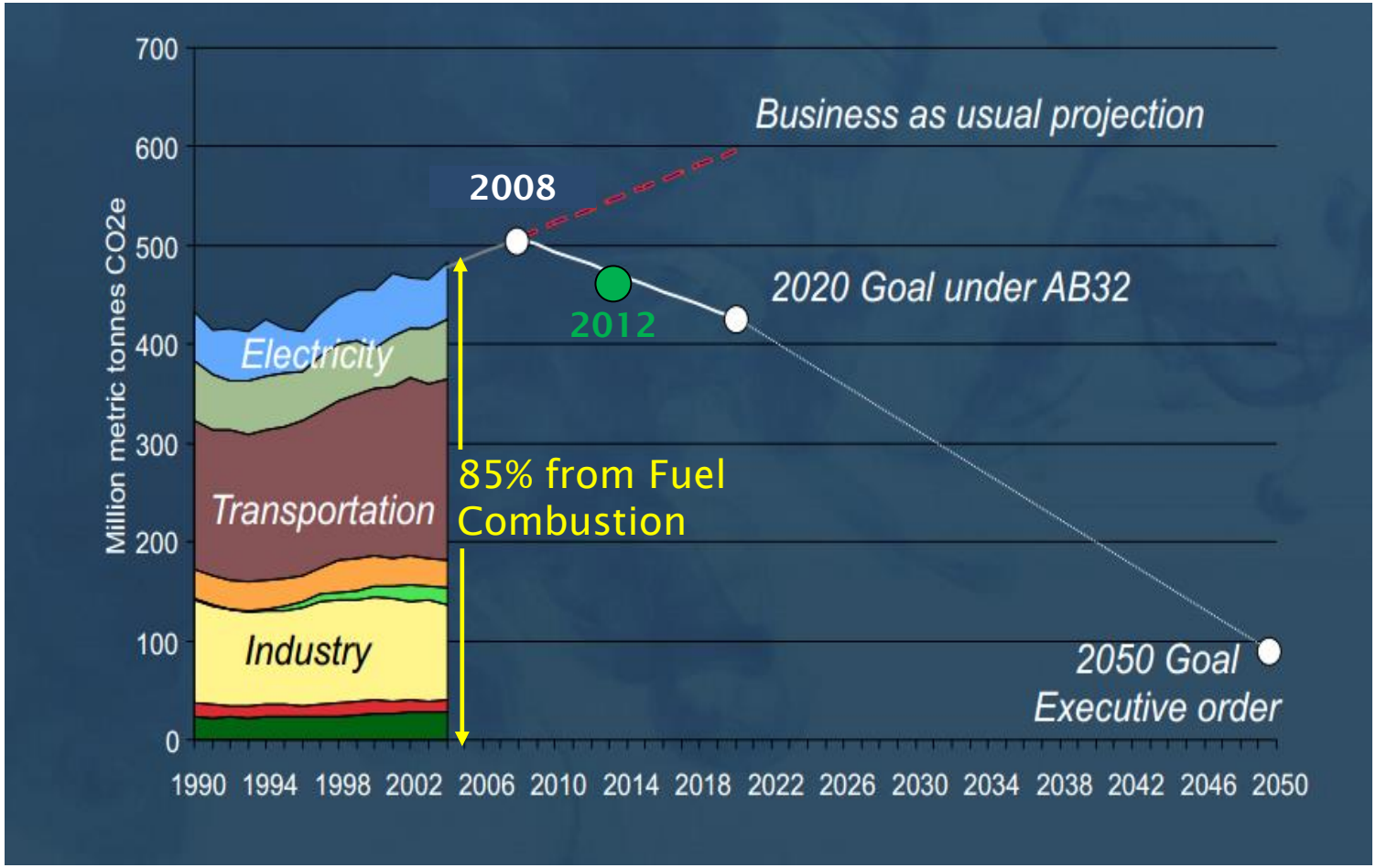
Energy Future:
Where We Are - State

CA In-State Electricity Generation in 2012



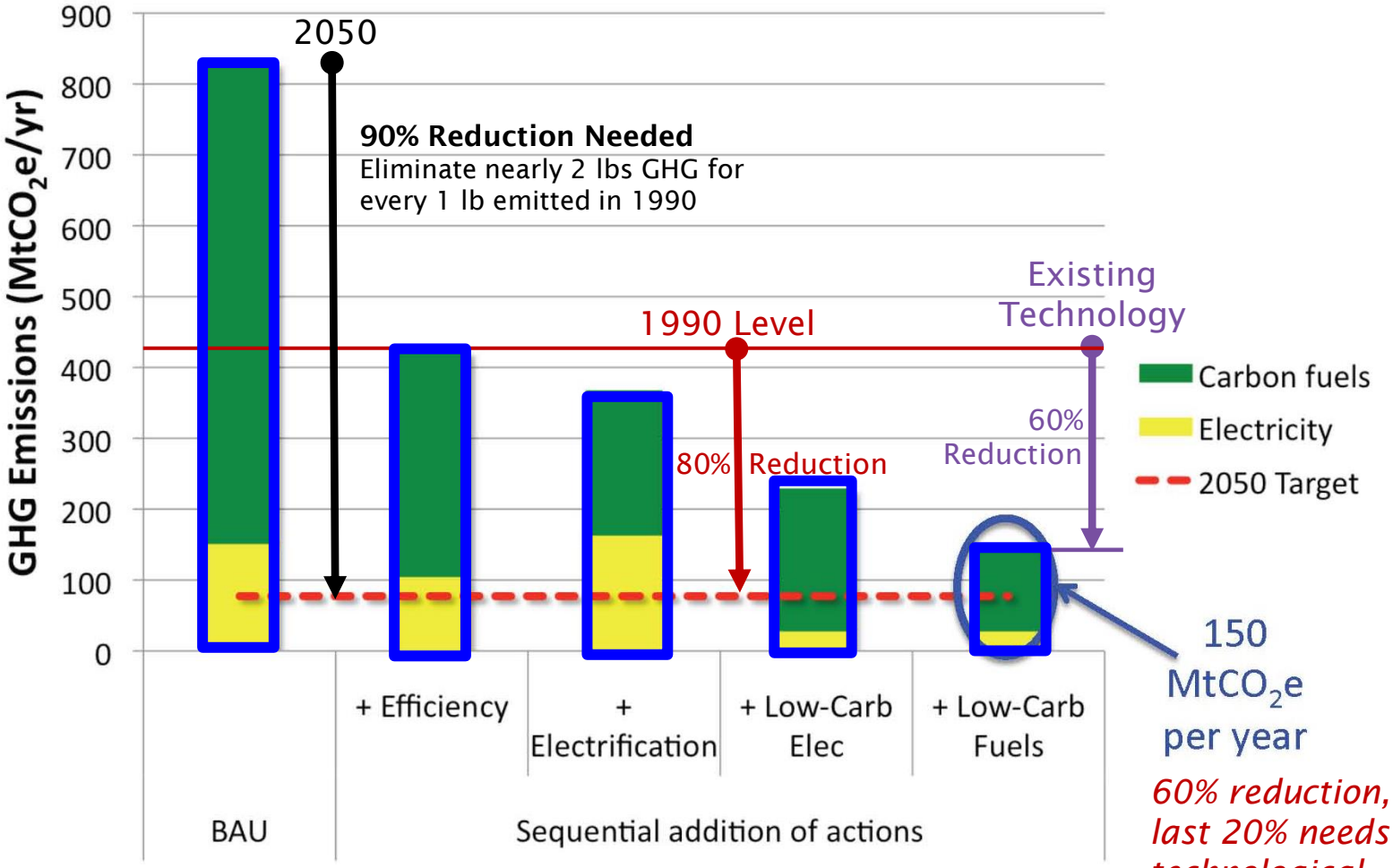
Sources: California Energy Commission, QFER and SB 1305 Reporting Requirements. In-state generation is reported generation from units 1 MW and larger.

Energy Future:
Where We Are Going



Source: Dr. Jim Williams, Energy and Environmental Economics, Feb. 2014

Energy Future:
How We Can Get There



60% reduction, last 20% needs technological breakthrough

Source: Dr. Jane Long, California's Energy Future - the view to 2050, July 2011

Energy Future:
Two Points on Spectrum

1. 100% Wind, Water, and Solar
   - All renewables including energy conservation and efficiency gains
   - Maximizes air quality and climate benefits with no air emissions

   Issues: Technical challenges, large number, permitting, variability, grid reliability

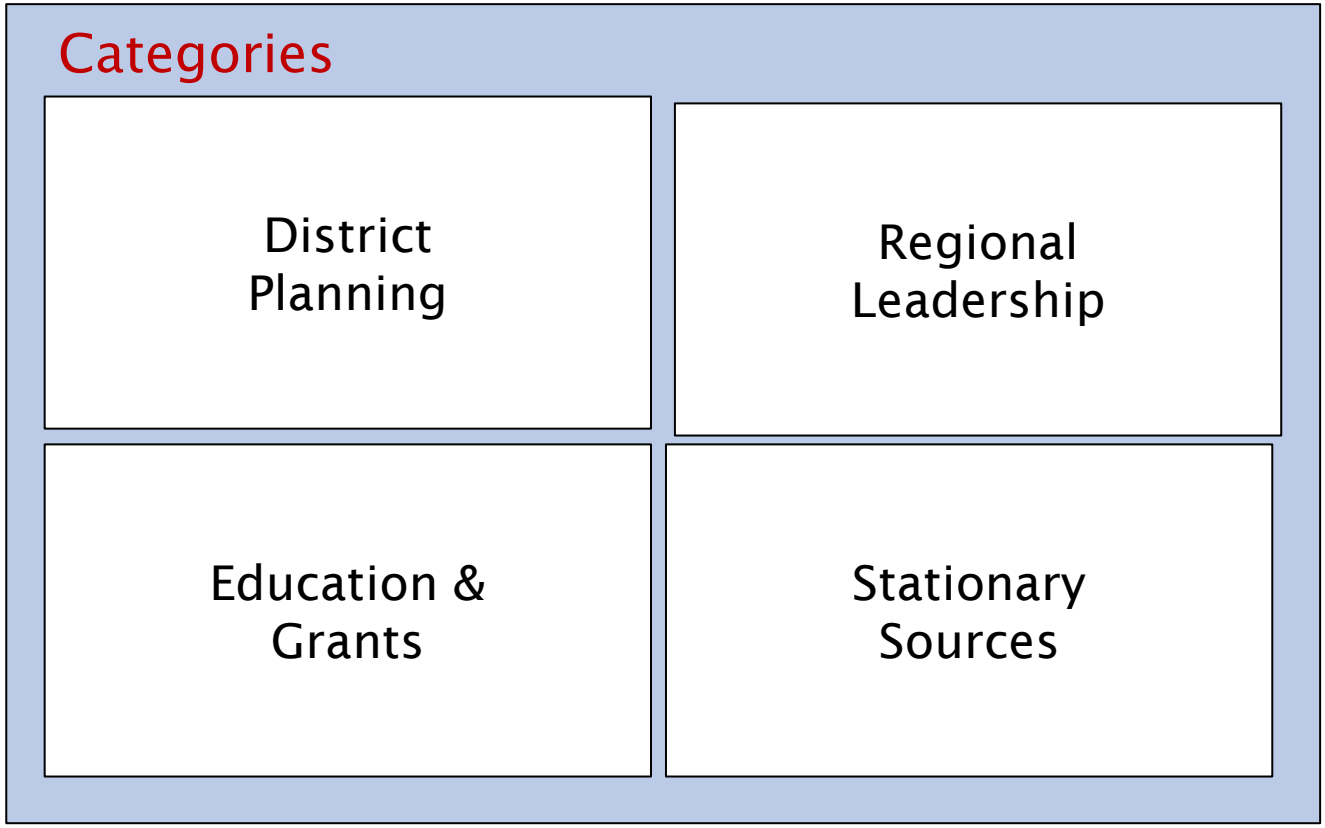
2. All Available Measures
   - All possibilities, including wind, water, solar plus biofuels, carbon capture, energy storage, and nuclear
   - 60% reduction in carbon doable with known technologies; remaining 20% reduction challenging

   Issues: Technical challenges, negative side effects, use of fossil fuels for back up power with associated emissions, public acceptance

Energy Future: Major Challenges

- Energy storage
  - Critical to renewables success, pumped storage most readily available now, batteries, hydrogen, and compressed air not ready yet
- Grid reliability & load balancing
  - Integrated “smart” grid, demand management
- Carbon pricing
  - Needed for market-based solutions
- Environmental & social equity
  - Energy costs and availability, land use
- Political leadership
  - Many difficult decisions, cost, reliability, public acceptance

Recommendations



Recommendations: District Planning

Continue multi-pollutant approach to reduce GHG emissions, limit unintended consequences, negative effects from other airborne pollutants

- Identify Air District's most appropriate role vis-à-vis Bay Area energy future
- Conduct study to project how Bay Area future energy trends may impact or complement Air District's clean air plans
- Integrate implications of future energy trends into Air District's clean air and climate plans, modifying plans if necessary

Chevron oil refinery, Richmond, CA (www.wtsp.com)

Recommendations: Regional Leadership

Collaborate with state, regional, and local agencies to incorporate energy considerations into Air District's Regional Climate Action Strategy

- Consult and coordinate with relevant agencies and stakeholders in energy-related planning
  - State and federal agencies
    - ARB, CEC, CPUC, EPA, DOE, ISO
  - Regional and local agencies:
    - MTC, ABAG, Publicly Owned Utilities
  - Private sector
    - EPRI, PG&E, refineries, other

Recommendations: Education

- Integrate latest information on energy behavior-oriented recommendations into Air District's public education and outreach efforts
- Concepts could include:
  - Greater efficiency for appliances, cost savings
  - Energy audits/upgrades to residences, offices
  - Electric vehicles
  - Public transit

Recommendations: Grants

- Integrate future energy-related criteria into grant proposal evaluation and selection
- Expand incentives to encourage/support more desirable energy sources and behavior

Recommendations: Stationary Sources

- Integrate GHG emission reductions into new and existing Air District's permitting rules
- Explore ways to reduce GHG emissions from large numbers of small stationary sources of CO_2 (furnaces, boilers, water heaters)
- Evaluate proliferation and potential use of backup generators (understand significant growth in number and look for opportunities to use energy storage devices instead)

Thank You!

- We appreciate your time and interest
- Questions or comments?