AGENDA: 16

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

Urban Heat Island (UHI) Impacts on Energy Use, Climate, Air Pollution, Greenhouse Gases, and Health

2015 Efforts of Advisory Council

Prepared for the
Board of Directors
November 18, 2015

Advisory Council
2015 Activities

- Objectives
  - Study UHI impacts on energy use, climate, air pollution, greenhouse gas emissions, and health
  - Identify recommendations to mitigate its effects in the Bay Area
- 5 regular meetings (over 5 months)
- 4 expert speakers
  - Air District, University, National Laboratory, CalFire
- 1 summary report

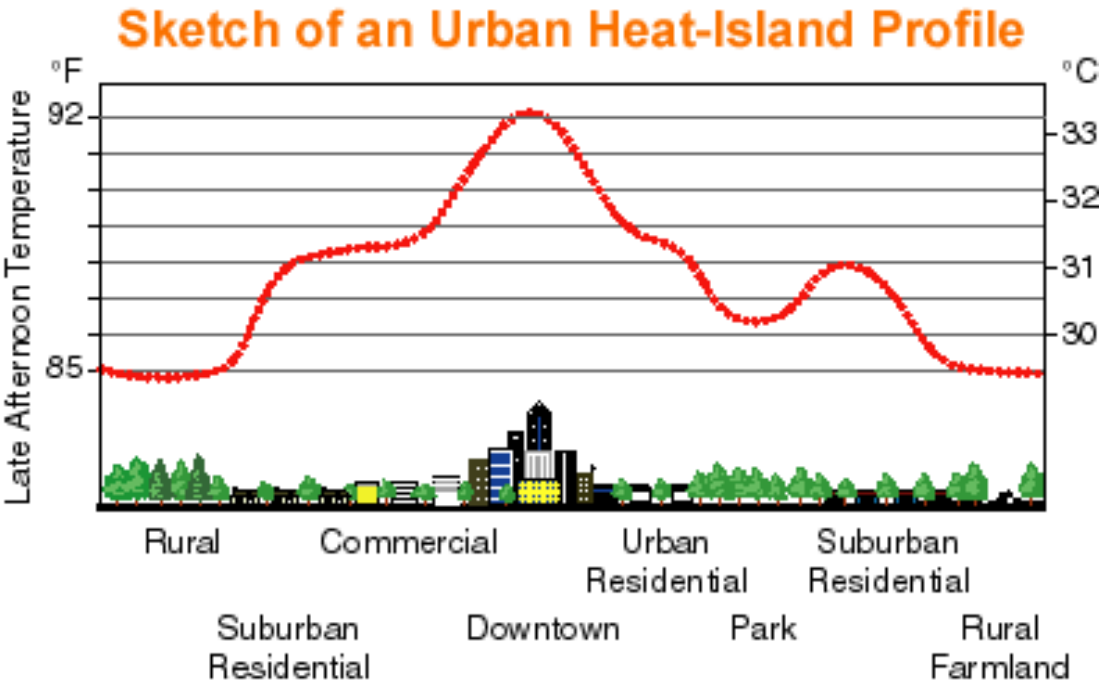
Advisory Council:
Topics and Speakers

UHI Impacts and Mitigation Strategies

- **Saffet Tankrikulu, PhD,** BAAQMD (overview)
- **Bob Bornstein, PhD**, San Jose State University, on behalf of **Jorge E. Gonzalez, PhD**, City College of New York (UHI science)
- **Ronnen Levinson, PhD**, LBNL (cool roofs)
- **John Melvin**, CalFire (urban forestry)

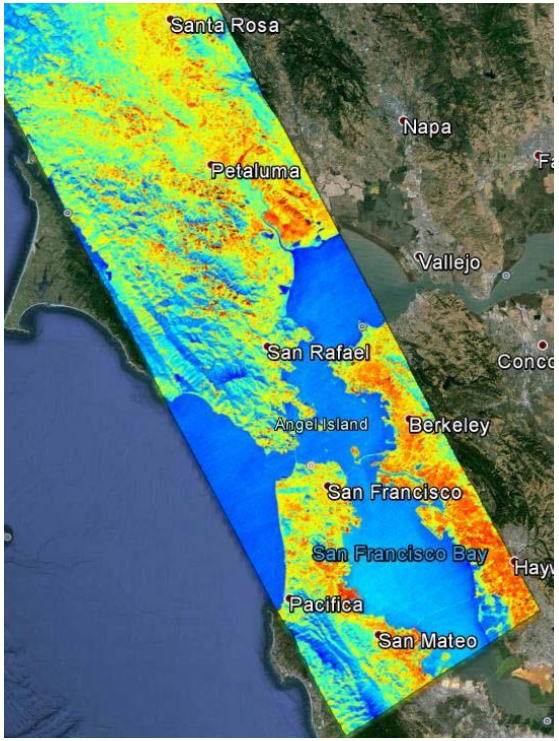
What is an UHI?

An UHI is a relative term comparing the temperature of an urban area to its surrounding area

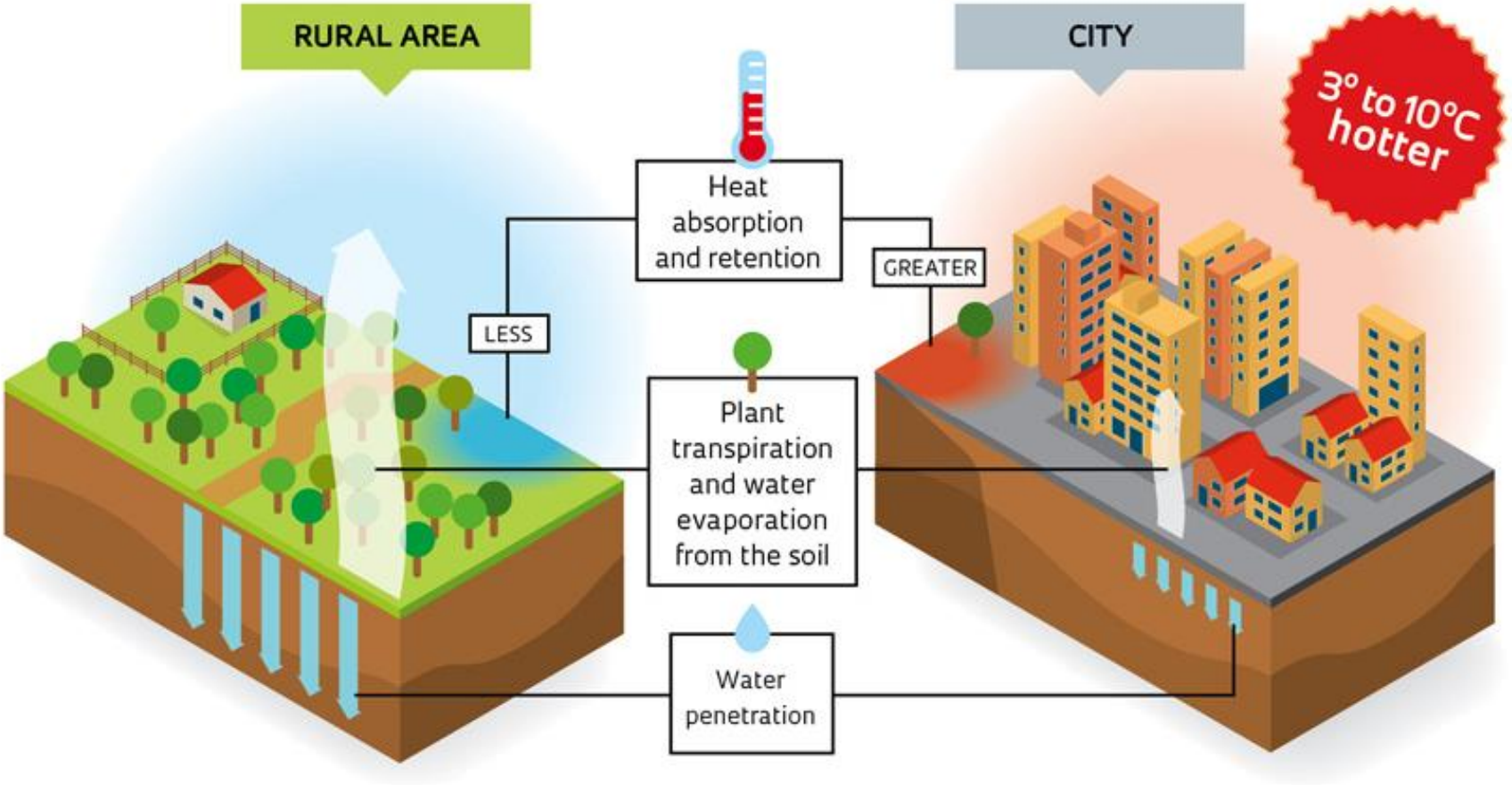


Courtesy of LBNL

Aerial Temperature Image Taken From Aircraft



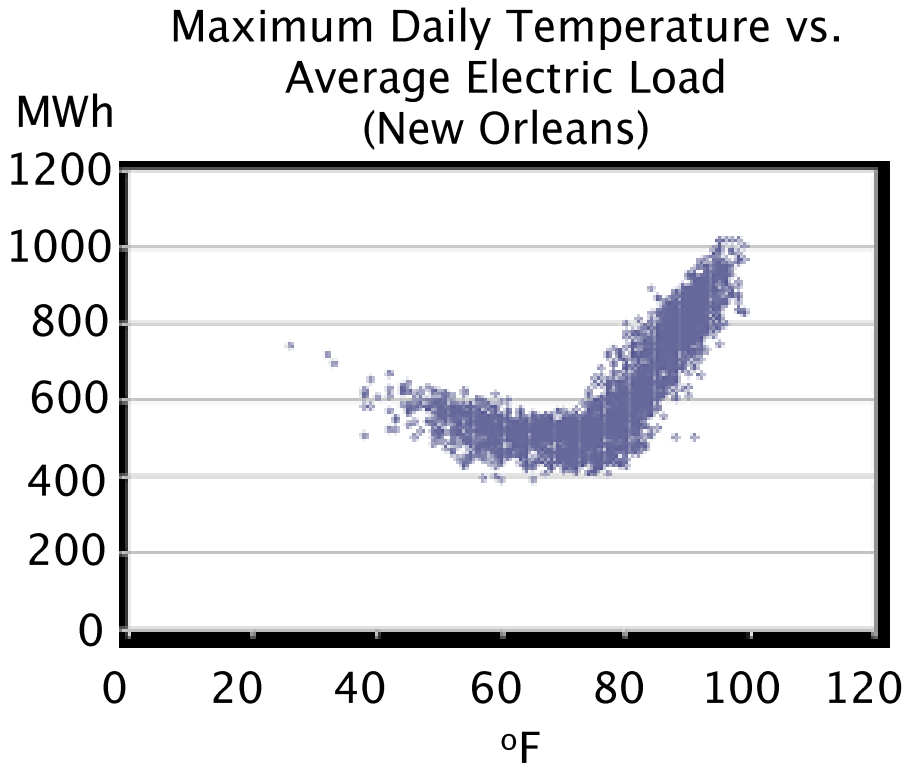
Causes of UHIs



Courtesy Alexandre Affonso

Impacts of High Urban Temperatures

1. Increased ozone due to accelerated photochemical reactions
2. Increased heat-related illness
3. Increased building cooling loads, driving increased electricity generation, driving increased pollution
4. Contribution to global warming

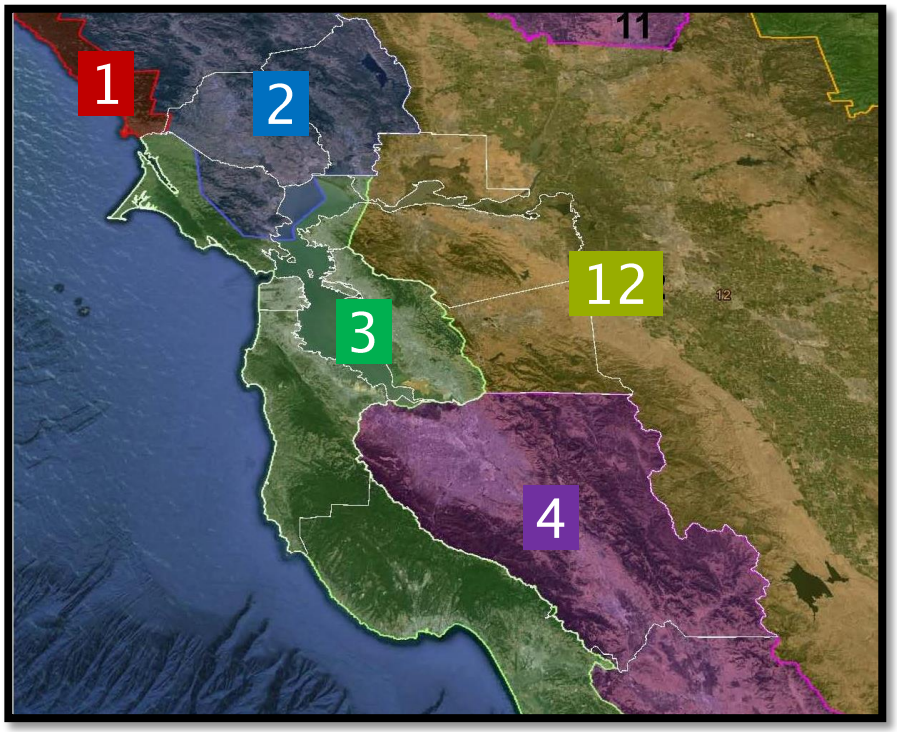


Courtesy US EPA

Bay Area Geography and UHI Variation

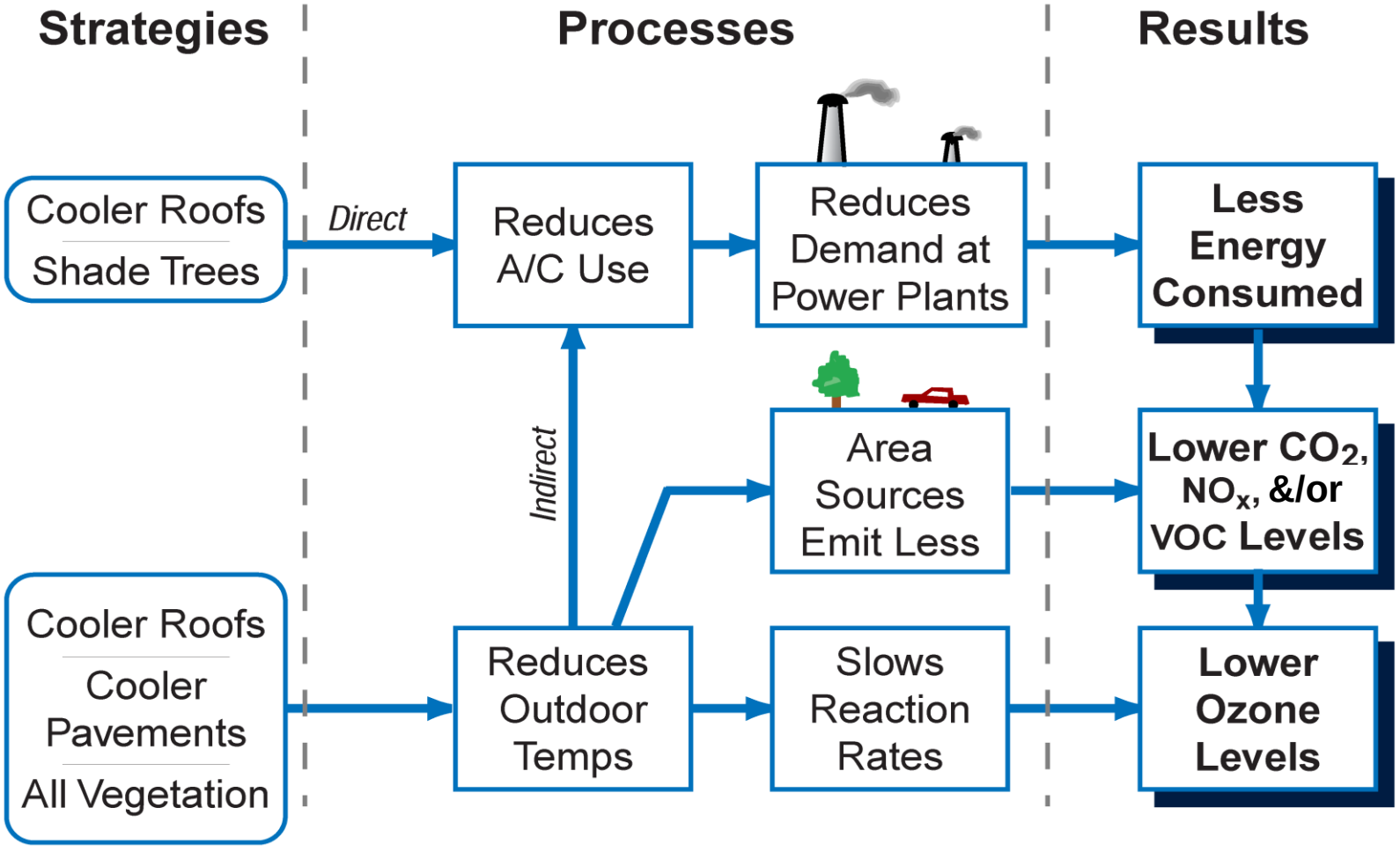
- UHIs are a concern in areas with:
  - hot summers (zones 2, 4, & 12)
  - elevated emissions and air pollution levels
- Heat wave vulnerability is elevated in zone 3

California Climate Zones



Courtesy CEC

Mitigation Strategies



Courtesy Ronnen Levinson, LBNL

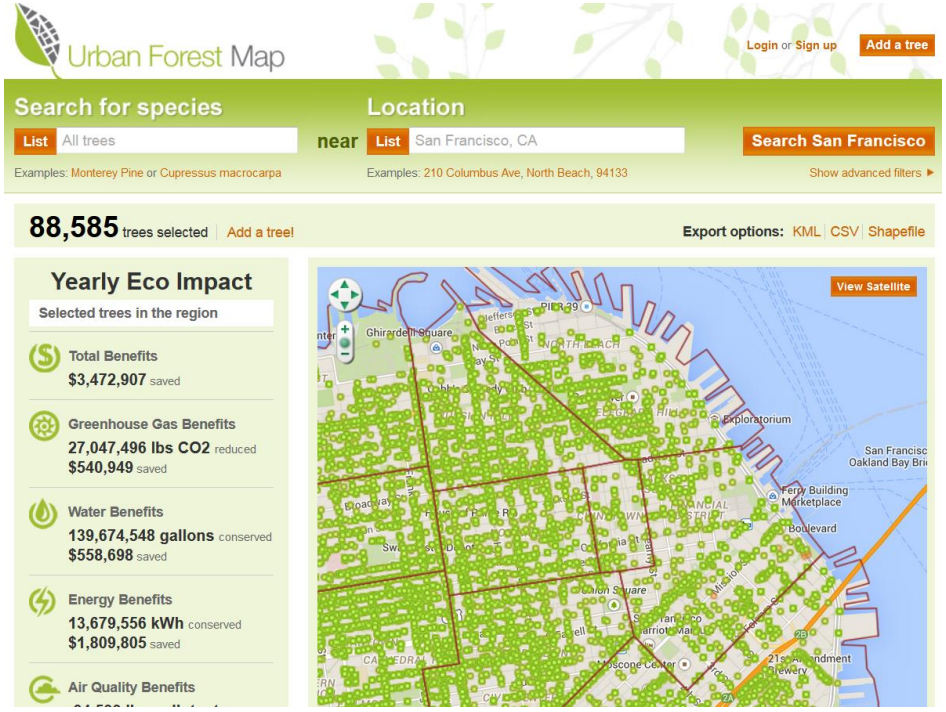
Trees as an Urban Cooling Strategy

- Urban cooling benefits:
  - Evapotranspiration decreases air temperature
  - Canopy provides shade to decrease surface temperature
  - Vegetation reduces period of high daytime temperatures

Courtesy John Melvin, CalFire

Trees Offer Important Co-benefits

- Carbon sequestration
- PM capture
- Storm-water capture
- Water quality improvement
- Increased property values
- Reduced energy use
- **Annual regional benefits ≈ $5.1B**
- **A one-time 3% increase in regional urban tree canopy ≈ $475M/yr**



Courtesy urbanforestmap.org

Cool Roofs

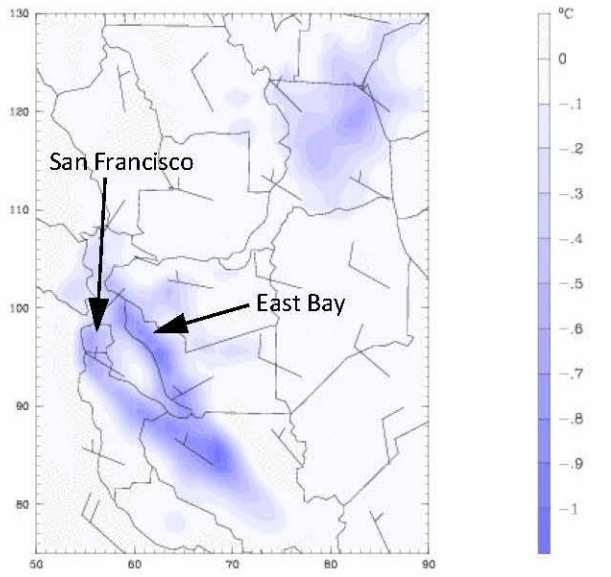
A cool tile roof in Fresno, CA saved 25% of annual cooling energy costs in a single-family home

Courtesy Ronnen Levinson, LBNL

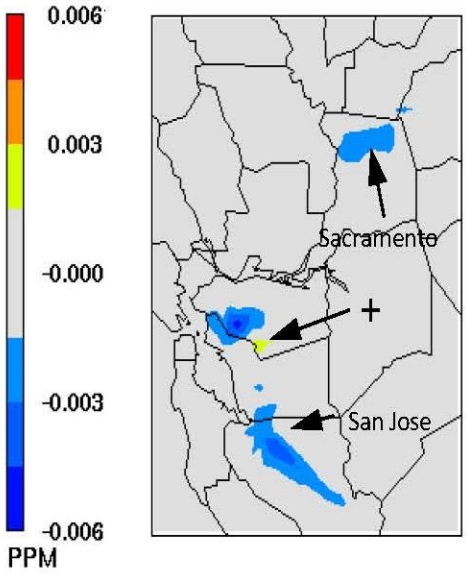
Cool Roof Impacts on Ozone Formation

A regional climate model simulation predicts that increasing roof and pavement albedos can reduce temperatures up to 1°C and lower ozone by 2–6 ppb.

Change in air temperature at 2 m AGL at 11:00 PDT on 27 July 2000



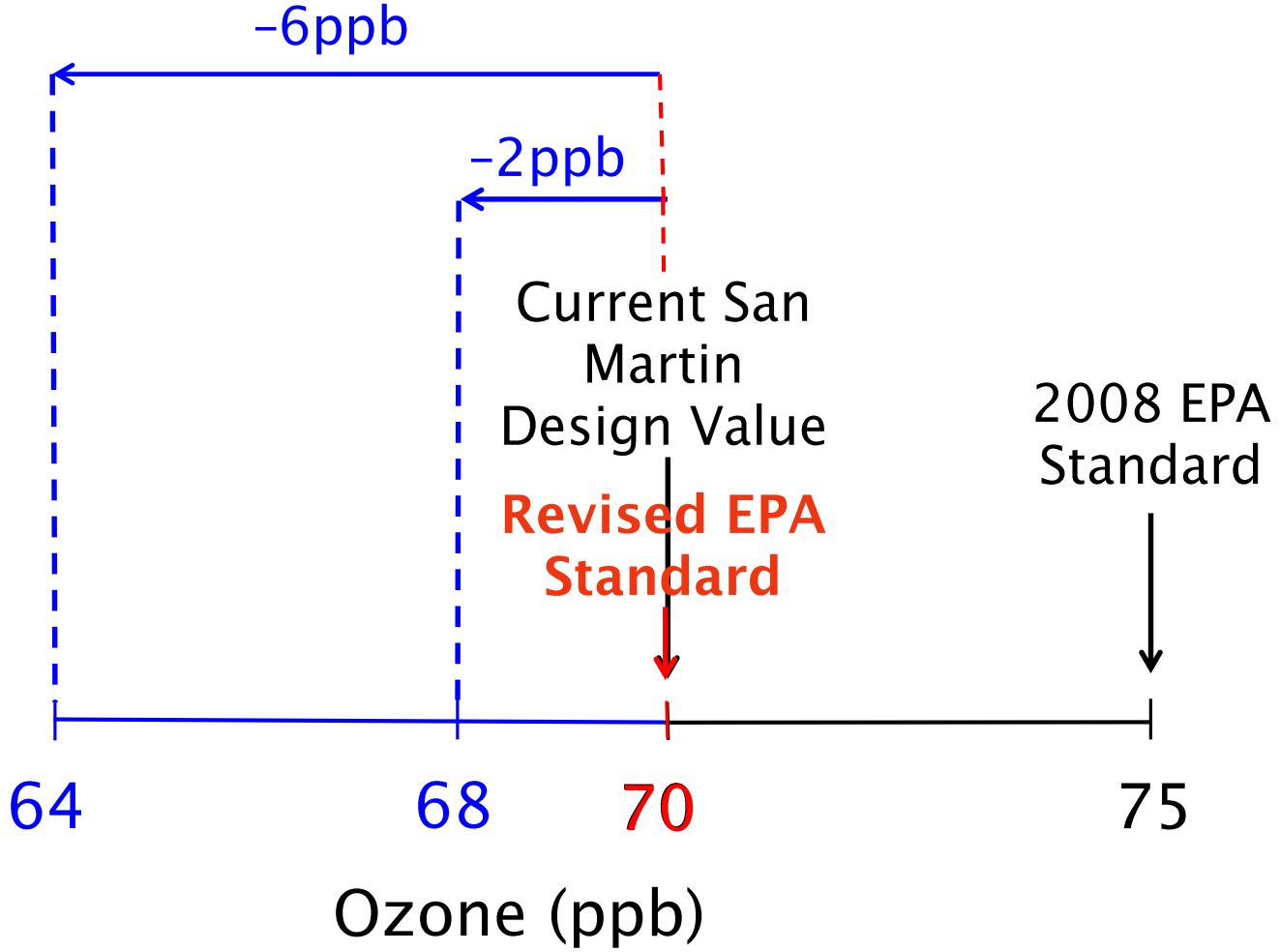
Corresponding change in ozone with year-2000 emissions



Study increased
roof albedo by 0.25 – 0.55
pavement albedo by 0.22 – 0.27

Results courtesy of Haider Taha, Altostratus Inc., http://altostratus.com .

Significance of Reducing Ozone by 2-6 ppb: San Martin as an Example



Recommendation: Study UHI Impacts

- Perform a cost-benefit analysis of urban cooling strategies versus alternative methods of improving air quality
- Prioritize Bay Area communities that would benefit from more aggressive adoption of targeted measures
- Explore options for promoting more aggressive adoption of urban cooling measures in identified high priority communities

Recommendation: Local Government Engagement

- Provide technical support to local governments on:
  - Incorporating air quality criteria in their street-tree selection processes
  - Incorporating cool roof requirements into local building codes in areas with warmer climates
  - The temperature and air quality benefits of additional urban cooling strategies (e.g., covered parking lots, white roofs on city fleets)

Recommendation: Public Outreach

- Communicate the benefits of urban cooling measures as part of geographically-targeted public awareness campaigns

airing ideas

PUBLIC PARTICIPATION PLAN

Recommendation: State Standards

- Support adoption of more rigorous energy standards for cool roofs by helping CEC to incorporate quantified air quality benefits in cost-benefit analyses

Thank You!

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

AGENDA: 17

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

Advisory Council: A Summary of Past Activities

Prepared for the
Board of Directors 2015

November 18, 2015

Advisory Council Overview 2009-2015

- Annually: 20 members of varied backgrounds
  - Over 40 have served
  - Many long serving members (>12 years)
  - Wonderful staff liaisons
- World-class, state-of-the-art speakers
  - University researchers, LNBL, LLNL
  - ARB, EPA, CEC, BAAQMD, SCAQMD, BAR, SFDPH, MTC, etc.
- 19 technical reports
- Focus on emerging, rather than current, issues
- Holistic perspective: integration of air quality, health, energy and climate; co-benefits; and potential unintended consequences

Advisory Council Topics: 2009-2015

- 2009: Air Quality and Public Health
- 2009-2010: AB32 GHG Reduction Goal
- 2011-2012: Ultrafine Particulate Matter
- 2013: Black Carbon – Health Effects and Climate Forcing Potential
- 2014: Bay Area Energy Future (2050) vis-à-vis Regional Climate Protection Strategy
- 2015: Urban Heat Island Effect

Significant Past Advisory Council Recommendations

- 2003: SMOG Check II changes to reduce gross polluters on road
- 2008: Integrate climate change into air quality management planning process and establish a Climate Protection Officer
- 2009: Integrate PM into CARE program methodology
- 2009: Develop strong community outreach program
- 2009: Implement integrated multi-pollutant planning strategies for criteria pollutants, air toxics, and GHGs

Significant Past Advisory Council Recommendations

- 2009 (and 2011): Create Health Effects Officer Position
- 2011 and 2012: UFP – develop monitoring strategy; develop emissions inventory; perform modeling; and contribute to research to quantify health metrics
- 2013: Develop climate protection strategies and evaluate their potential for health co-benefits and unintended consequences
- 2014: Work to reduce GHG emissions from small stationary sources i.e., backup generators, furnaces, boilers, and water heaters

Questions?

Thank you for the opportunity to serve.

Summary of Ozone Seasons

Year	National 8-Hour	State 1-Hour	State 8-Hour
2012	4	3	8
2013	3	3	3
2014	5	3	10
2015	5	4	11

Spare the Air Alerts: 7/28, 7/29, 8/16, 8/17, 9/8, 9/9, 9/10, 9/20, 9/21

Days > 0.075 ppm 8-hour NAAQS: 8/16, 8/17, 9/9, 9/19, 9/20