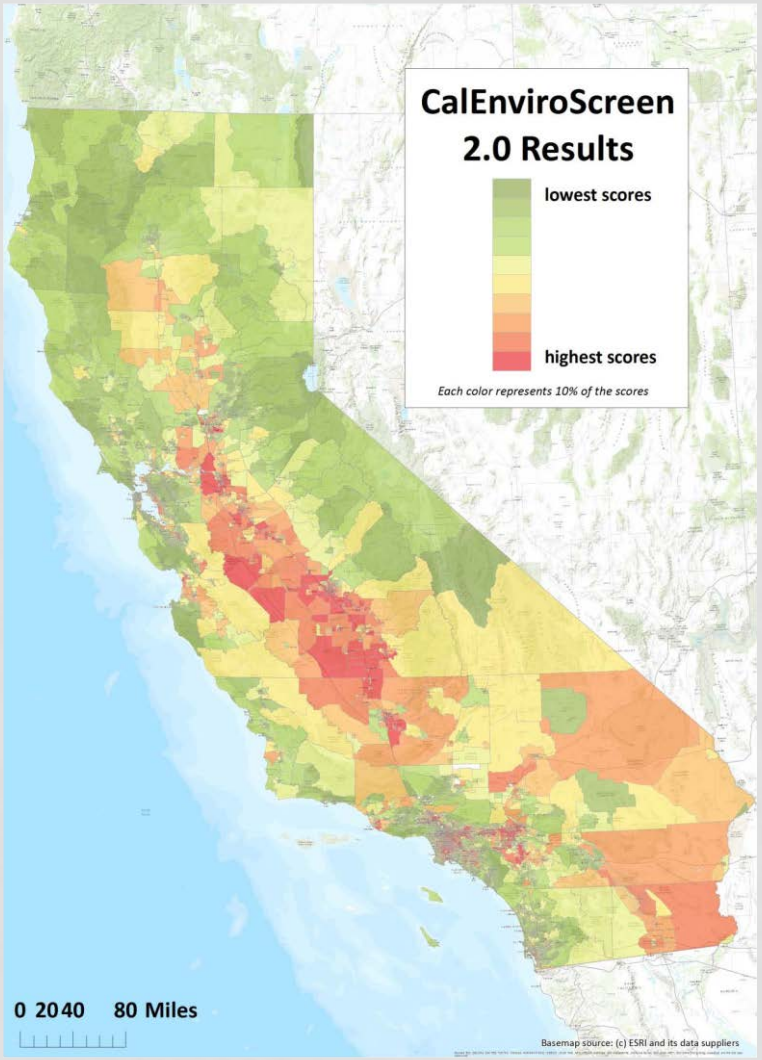
DEVELOPING CALIFORNIA EMISSION INVENTORIES:
INNOVATION AND CHALLENGES

2015 INTERNATIONAL EMISSIONS INVENTORY CONFERENCE: APRIL 14, 2015

PRESENTATION OVERVIEW

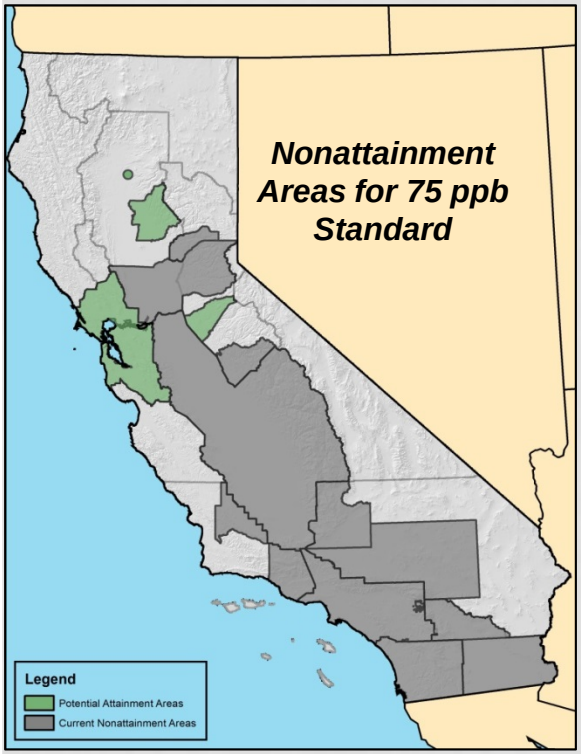
- Meeting California's air quality and climate goals – the role of emission inventories
  - Reducing near-source risk
  - Attaining federal air quality standards
  - Achieving greenhouse gas reduction goals
- Developing Innovative inventory approaches
- Addressing the inventory needs of the future

REDUCING NEAR-SOURCE RISK



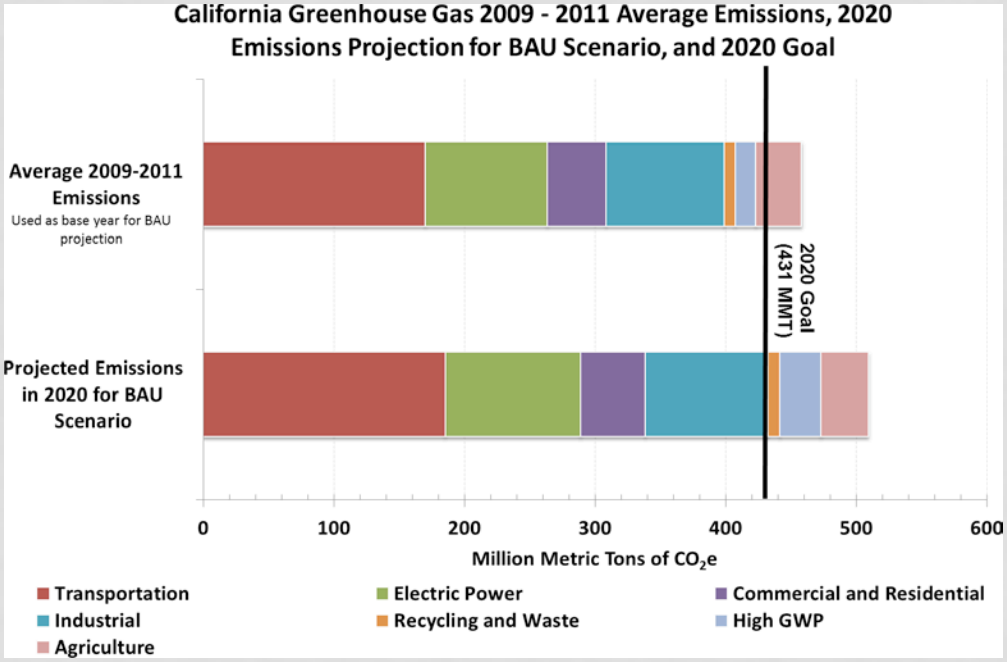
- CalEnviroScreen defines socioeconomically disadvantaged communities disproportionally impacted by pollution
- Key emissions inputs:
  - Diesel particulate matter emissions
  - Toxic releases from facilities
  - Pesticide use
- Tracking emissions provides method to demonstrate risk reduction

ATTAINING FEDERAL AIR QUALITY STANDARDS



- Emission inventories support many aspects of SIP planning:
  - Determining key source categories
  - Assessing role of precursors
  - Defining attainment targets
  - Specifying reasonable further progress
  - Foundation for development of regulations and incentive programs

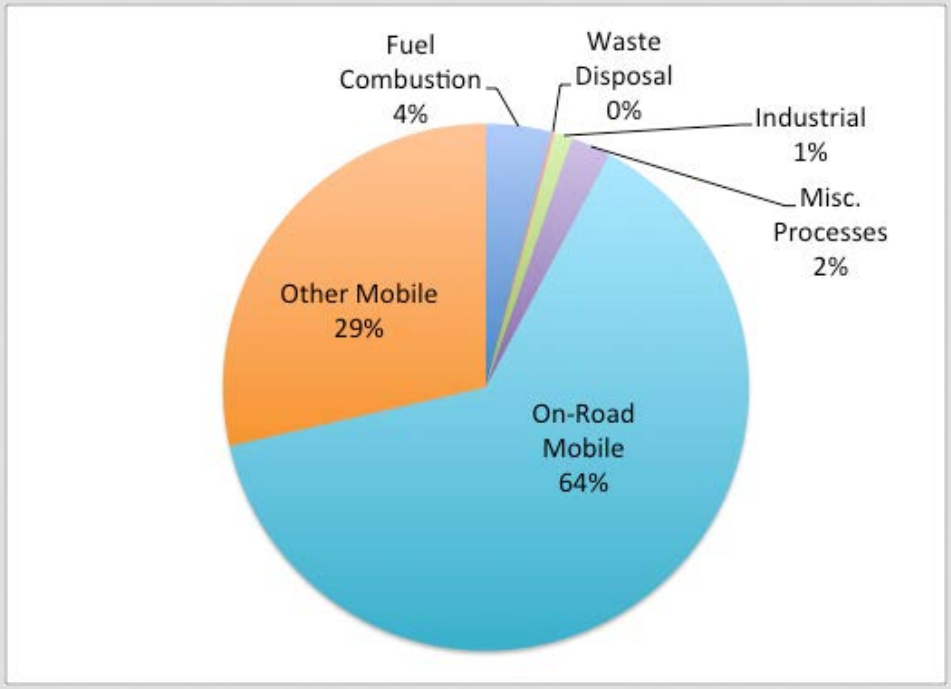
ACHIEVING GREENHOUSE GAS REDUCTION GOALS



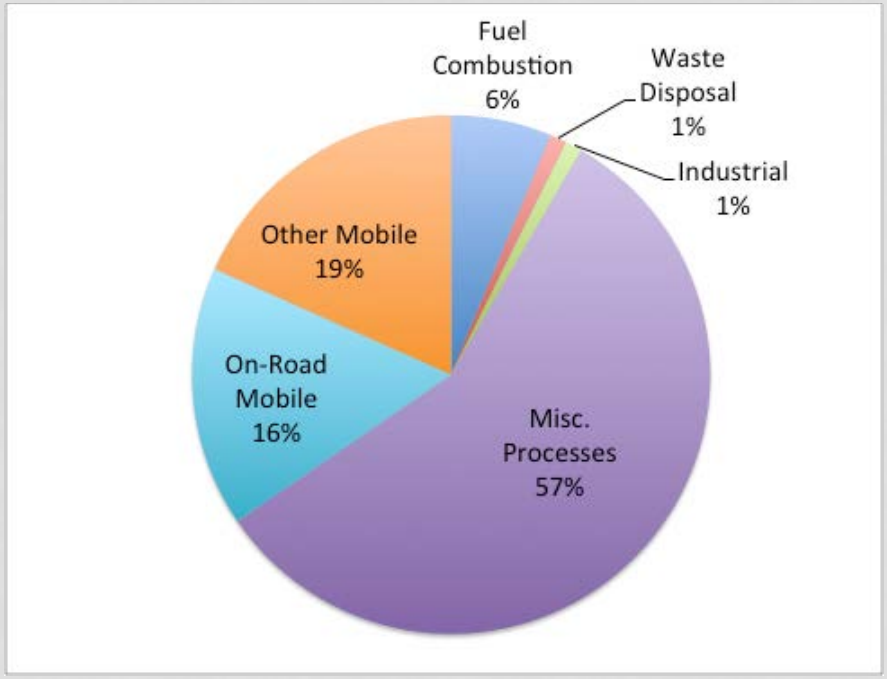
- AB 32 – Reduce GHG emissions to 1990 levels by 2020
- Governor's Executive Order – Reduce GHG emissions 80% by 2050
- New plan for reducing short-lived climate pollutants under development
- Emissions inventory is metric for tracking progress towards these goals

CALIFORNIA EMISSIONS
CRITERIA POLLUTANTS

San Diego County 2012 NOx Emissions



San Diego County 2012 PM2.5 Emissions



CALIFORNIA'S MOBILE SOURCE EMISSIONS MODEL

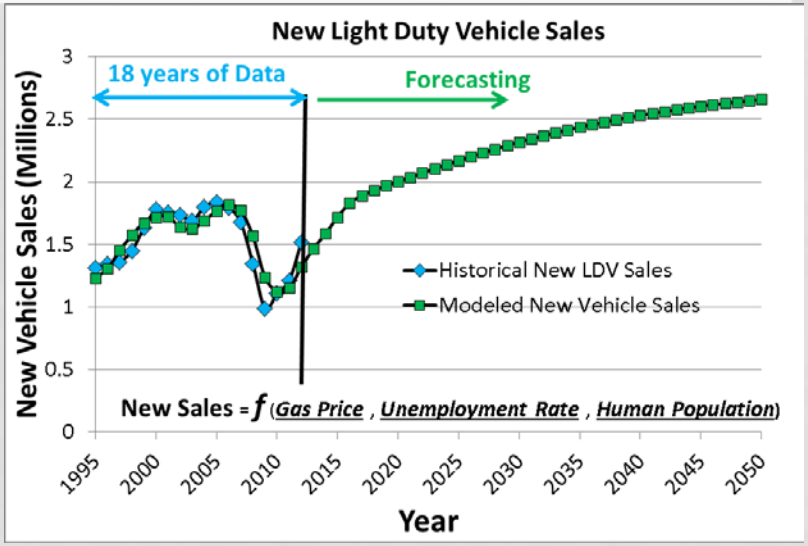
- EMFAC2014 is California's on-road mobile source emissions model
- Includes both criteria pollutant and GHG emissions estimates through 2050
- Updated to include latest emission factors and EPA/ARB regulations and standards:
  - Advanced Clean Cars program
  - In-Use Heavy Duty Diesel Regulation
  - Tractor-Trailer Regulation
  - Phase 1 GHG Regulation
- Includes new forecasting methods reflecting modeling of new vehicle sales and VMT growth

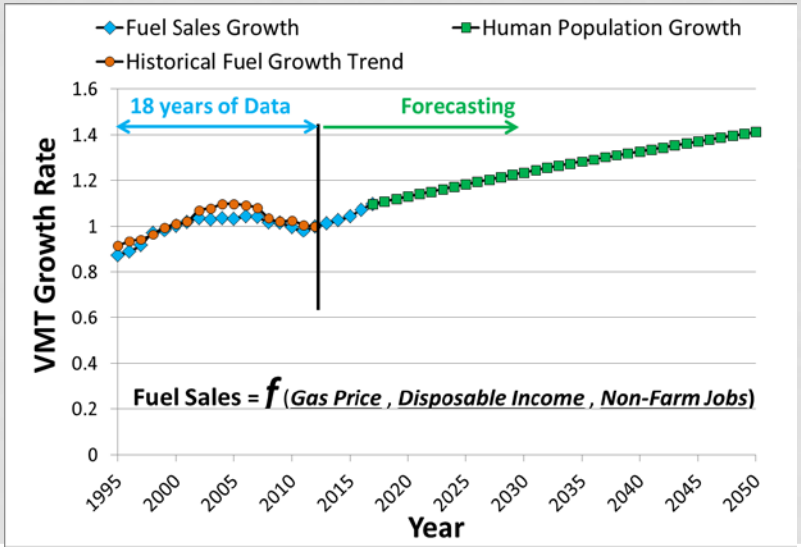
ON-BOARD EMISSION MEASUREMENTS

- Portable Measurement Systems
  - **PEMS**: **P**ortable **E**mission **M**easurement **S**ystem
  - **PAMS**: **P**ortable **A**ctivity **M**easurement **S**ystem
- Measuring emissions and/or activity under actual in-use operating conditions
- An alternative to engine and vehicle dynamometer laboratory testing
  - Lower cost
  - Greater number of vehicles tested within a relatively short timeframe
  - Significant benefits for emission modeling

EMFAC2014: ACTIVITY FORECASTING

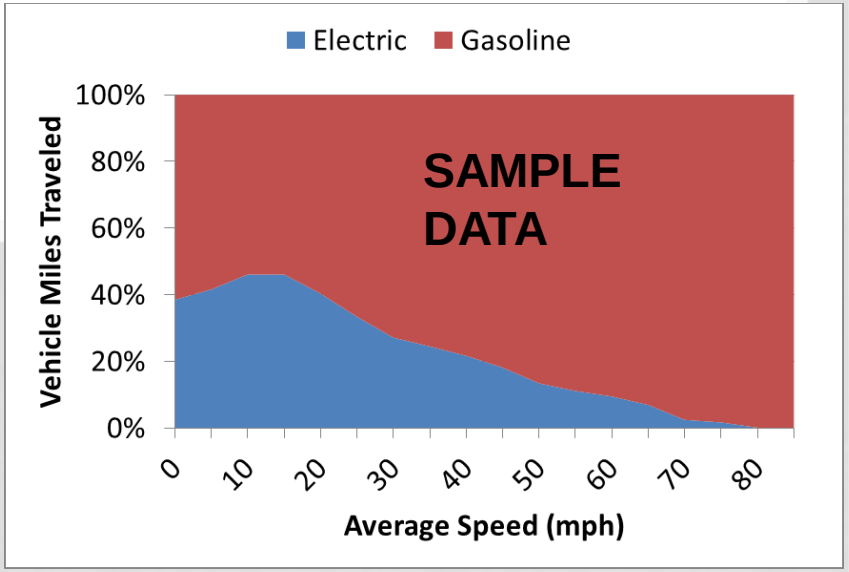
- New vehicle sales and VMT growth are based on socio-economic indicators:
  - Gas Price
  - Unemployment Rate
  - Disposable Income
  - Non-Farm Jobs
- Statewide VMT growth is matched to:
  - Forecasted fuel growth for 2013-2017
  - Human-population growth for 2018-2050

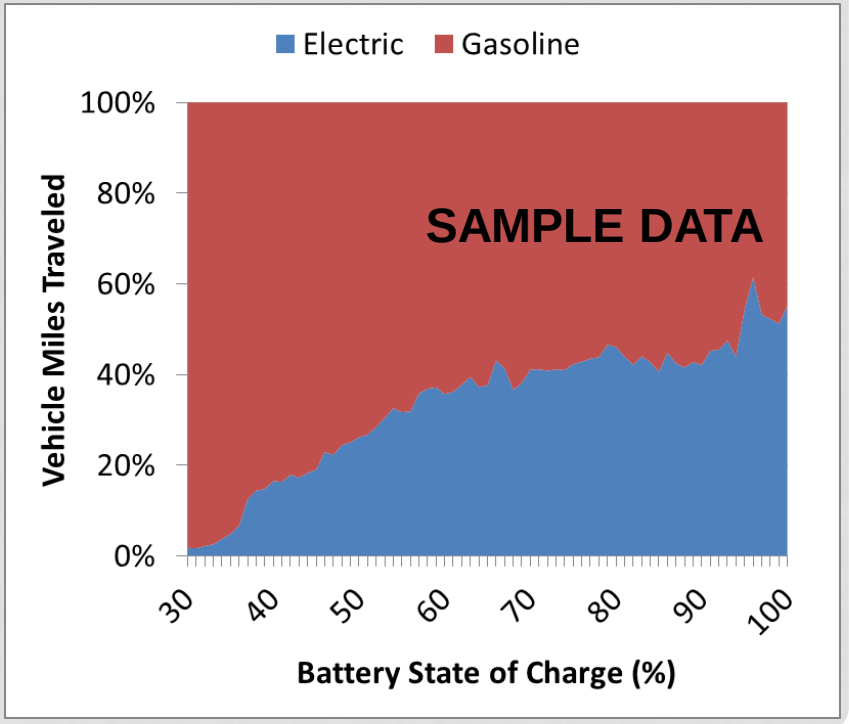




PLUG-IN ELECTRIC VEHICLES (PEVS)

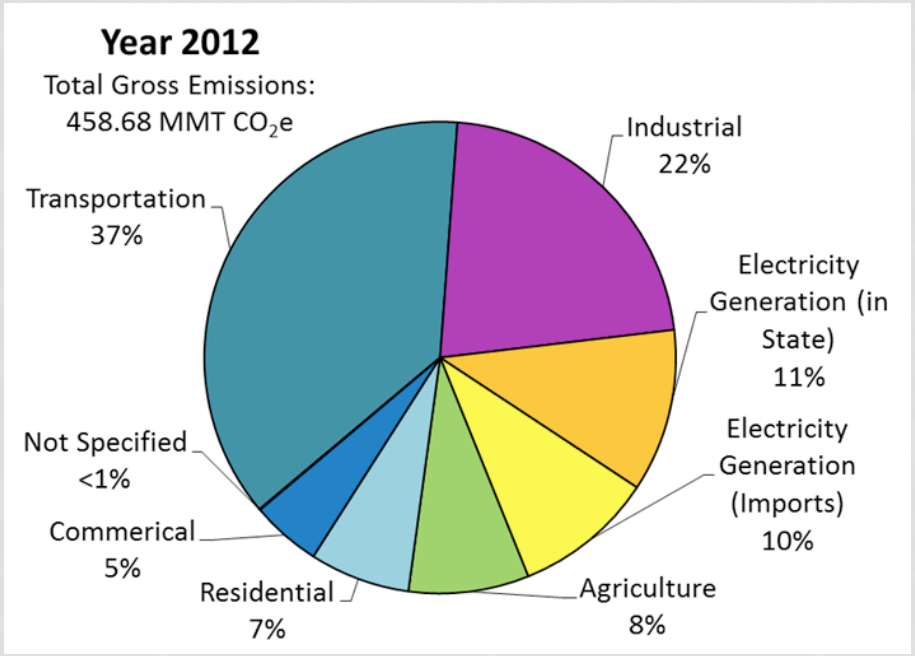
- Characterize PEV travel:
  - PEV vehicle activities vs. typical vehicle
  - Battery state of charge effects
  - Total VMT vs. electric VMT (eVMT)
- Characterize differences by secondary owner vs. 1st owner
- Improve estimates of emission benefits and forecasts of emissions from the light-duty fleet



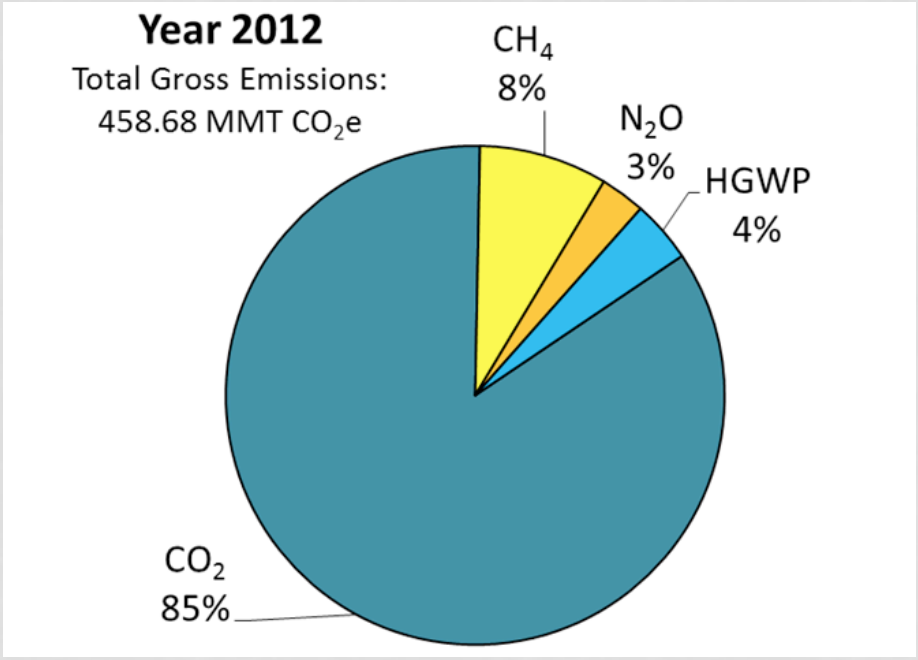


CALIFORNIA EMISSIONS
CLIMATE POLLUTANTS

2012 Emissions by Sector

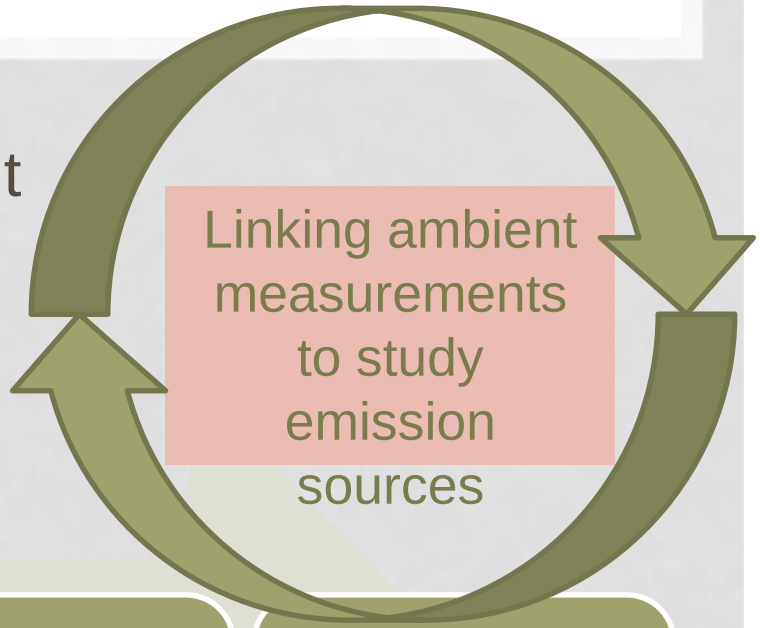


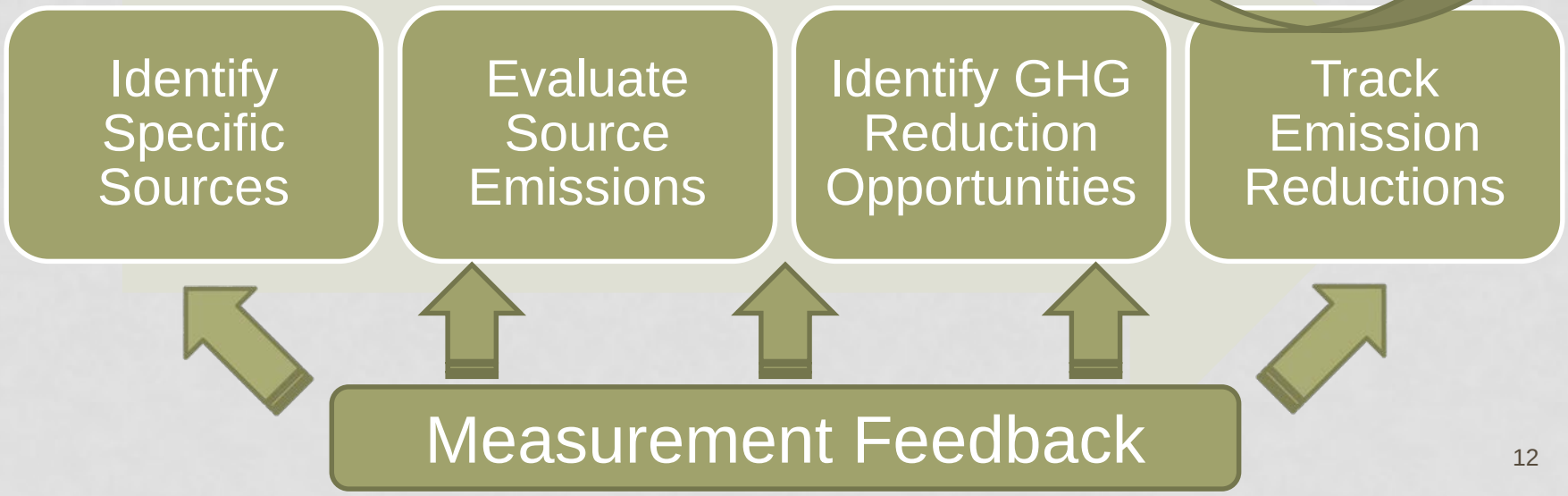
2012 Emissions by GHG



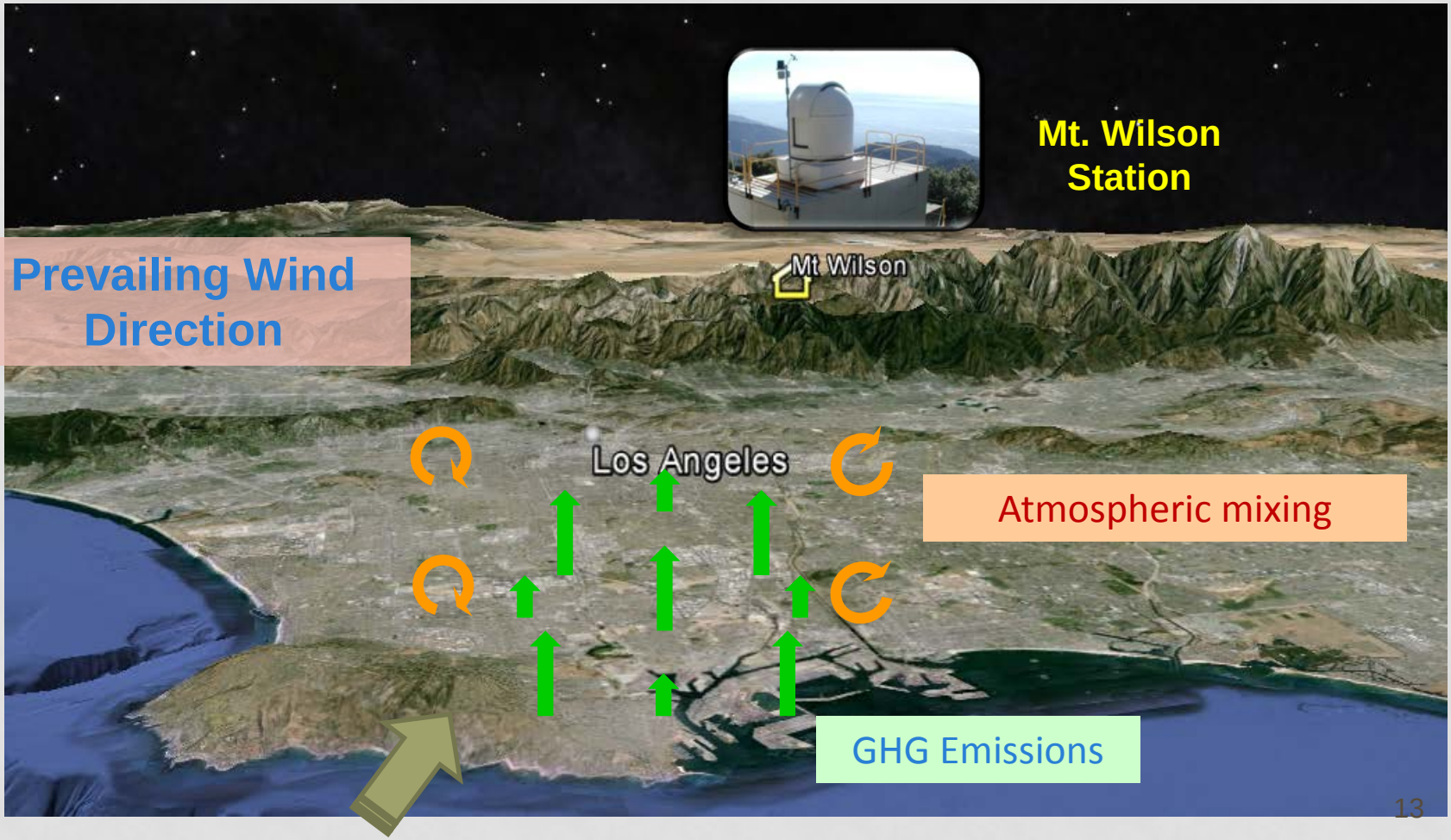
GHG MEASUREMENT PROGRAM

ARB's greenhouse gas measurement program is designed to support California's GHG reduction efforts



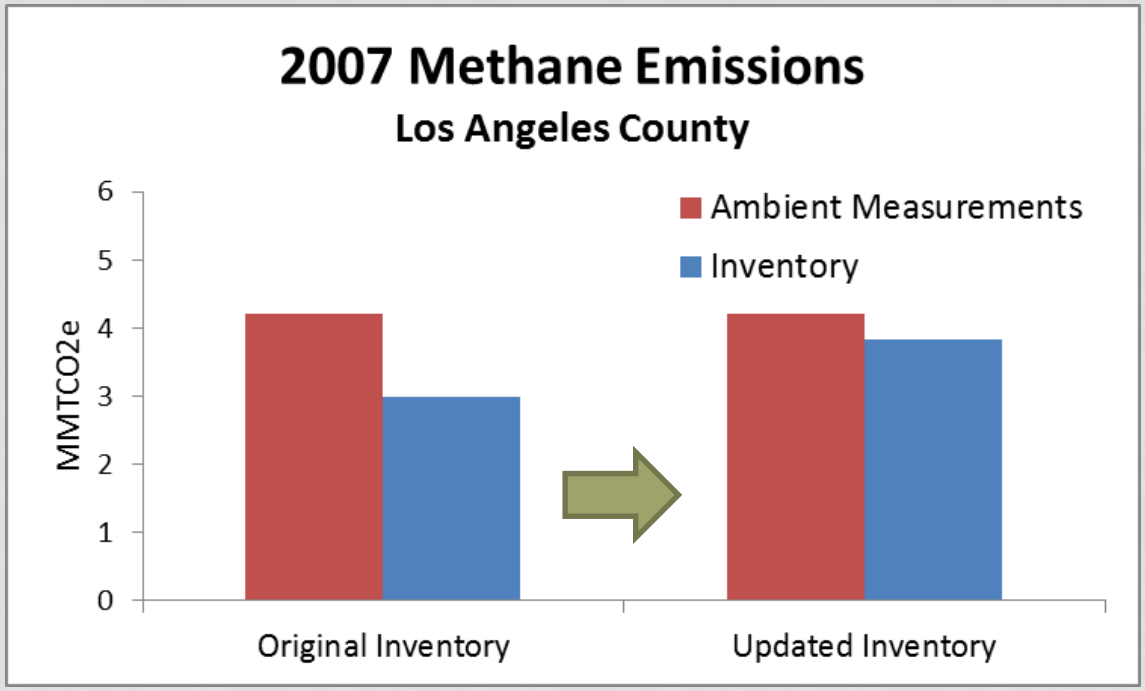


MT. WILSON OBSERVATORY STATION
LOS ANGELES COUNTY



METHANE FINDINGS
LOS ANGELES COUNTY

- 2007 Mt. Wilson study suggested methane emissions were underestimated
- ARB updated methods to develop regional methane inventory, as well as improved estimates for several sources
- 2014 methane emissions inventory and ambient measurements now well correlated

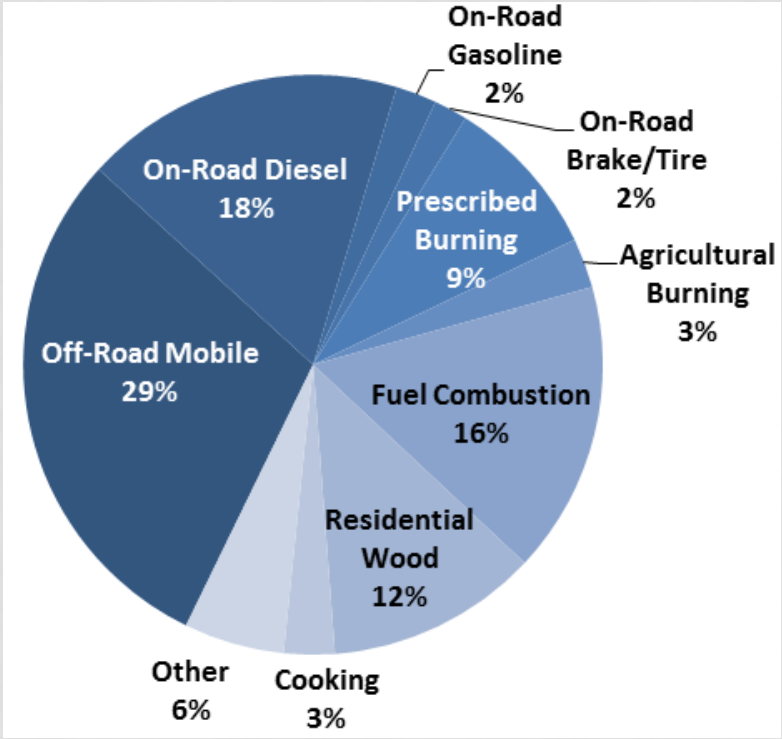


Reference: Hsu, et al. (2010) *Atmospheric Environment,* pp. 1–7

CALIFORNIA'S BLACK CARBON EMISSION INVENTORY

- Black carbon (BC) is a potent climate forcing pollutant
- ARB has developed a statewide BC inventory for the short-lived climate pollutant plan
- Wildfires account for significant BC emissions but emission estimate has large year to year variability

2012 Black Carbon Emissions
Excluding Wildfire



BLACK CARBON INVENTORY DEVELOPMENT

- Inventory uses elemental carbon (EC) speciation factors as a proxy for BC
- Starting point was preliminary California-specific speciation factors developed as part of ARB air quality modeling efforts
- Speciation factors were verified using current literature and U.S. EPA recommendations
- Speciation factors were applied to existing $PM_{2.5}$ inventory to create BC inventory

NEW CHALLENGES
INVENTORY NEEDS OF THE FUTURE

- New mobile source technologies and fleet mixes
  - Plug-in electric vehicles
  - Hybrid cars and trucks
  - Zero-emission vehicles
- New energy sources and production
  - Biodiesel
  - Hydrogen for fuel cells
- Sustainable communities
  - Changing land use patterns
  - Increased use of transit options
- Climate change
  - Drought impacts
  - Wildfires