California Low Emission Truck Policies and Plans

STEPS Truck Choice Workshop
Davis, California
May 22, 2017

Tony Brasil, Chief
Transportation and Clean Technology Branch

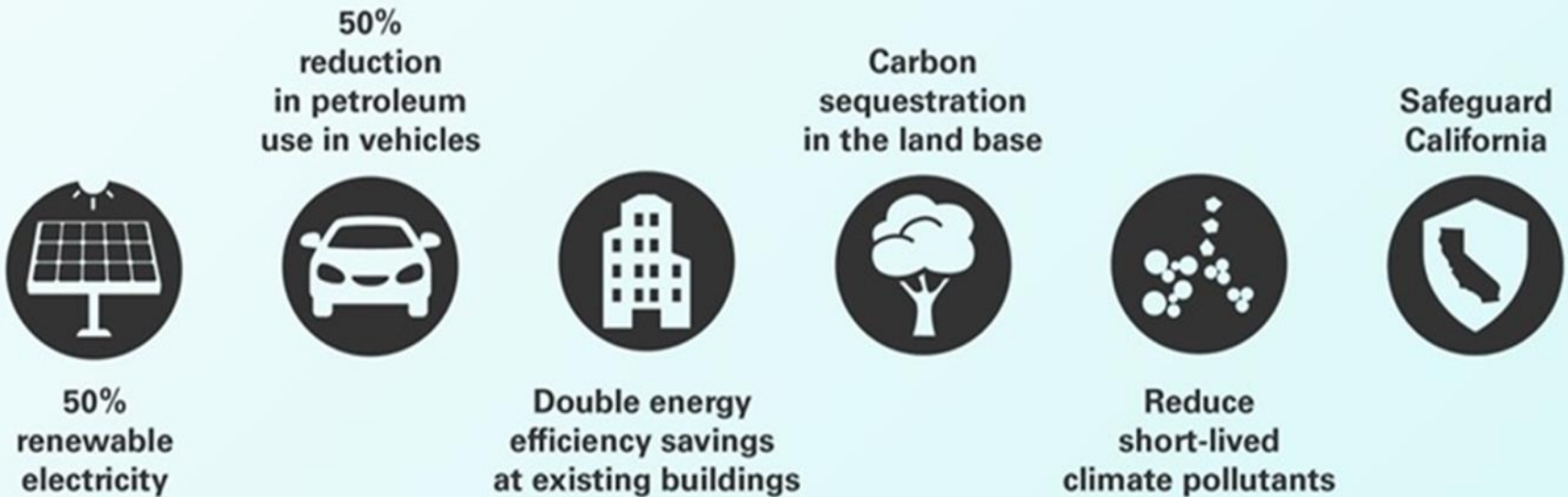
California Environmental Protection Agency
Air Resources Board

Outline

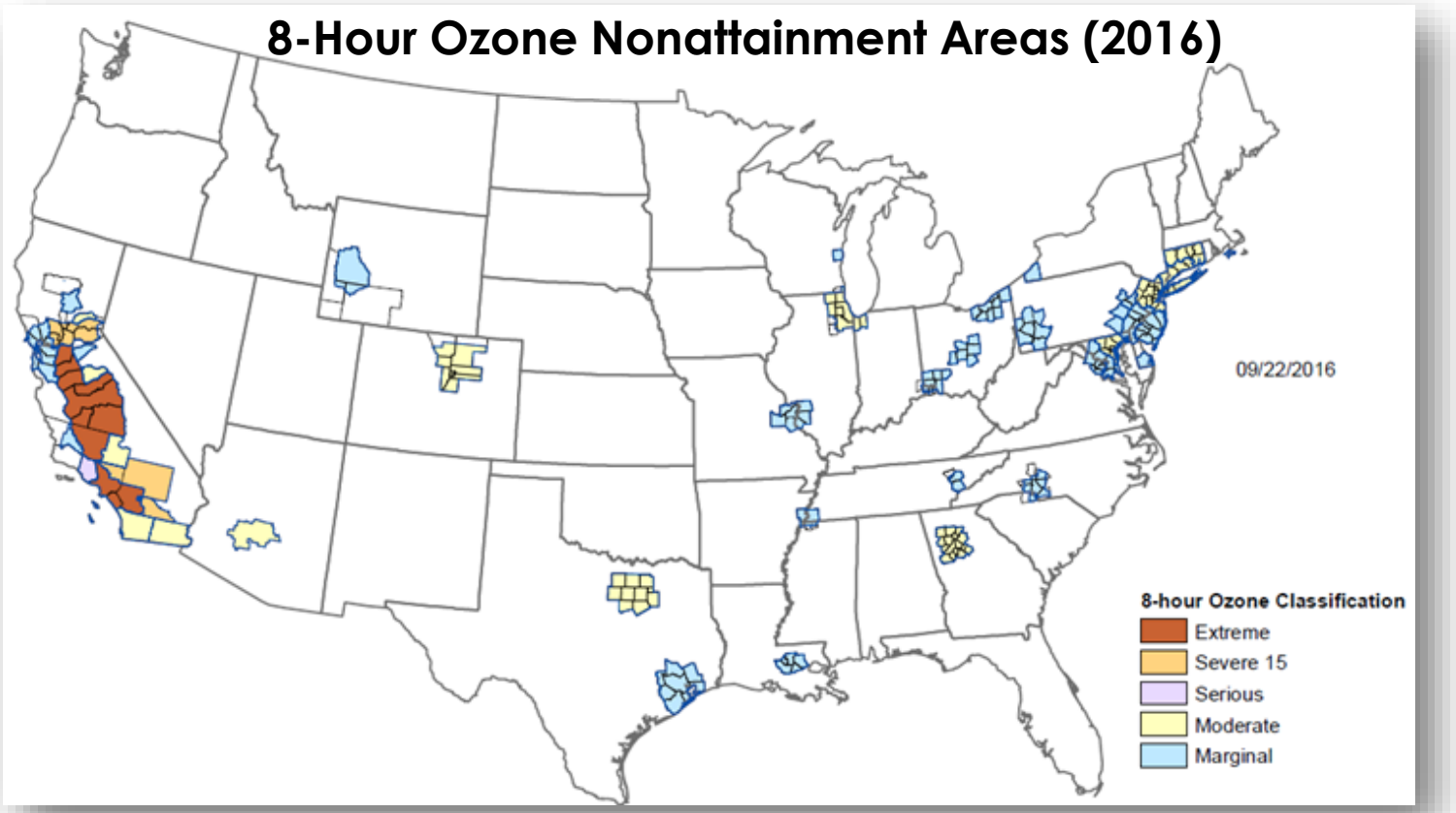
- California's major challenges and goals
- Strategic planning to address greenhouse gas (GHG) & NOx reduction
- Promoting near term emerging technologies
- Providing longer term certainty
  - CA Phase 2 HD GHG program
  - Low NOx program
  - Zero emissions where feasible, near-zero emissions with renewables everywhere else

Reduce GHG Emissions

- California goals
  - Reduce to 1990 levels by 2020
  - Reduce 40 percent below 1990 levels by 2030
  - Reduce transportation GHGs by 80 percent by 2050
- Supporting Governor's five pillars

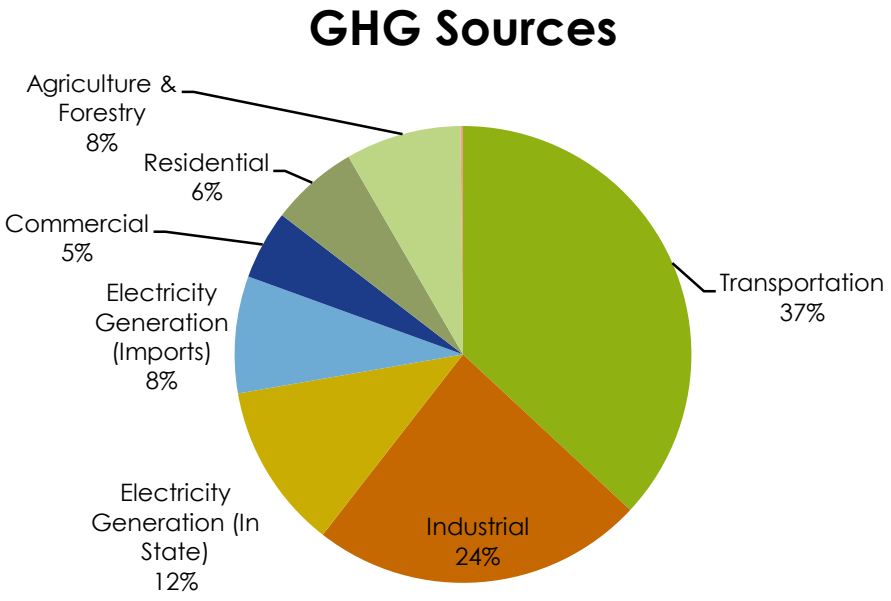


Meet Federal Ambient Ozone Standards

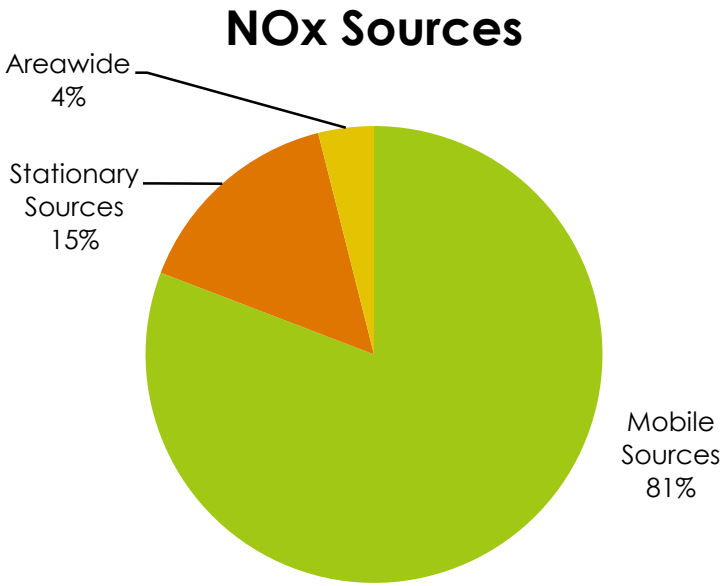


https://www3.epa.gov/airquality/greenbook/map8hr_2008.html

Transportation is Largest Emissions Source in California



Total 2014 GHG Emissions – 441.5 MMT CO_2

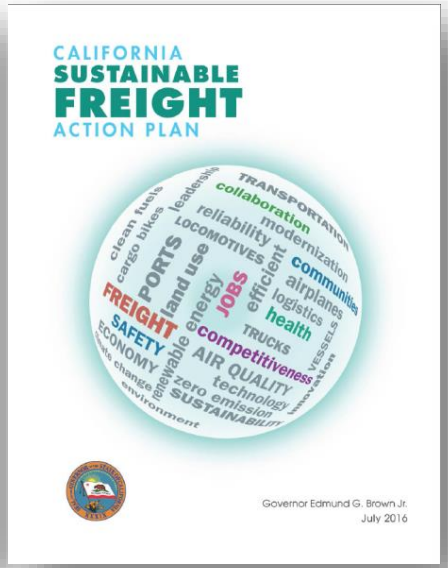


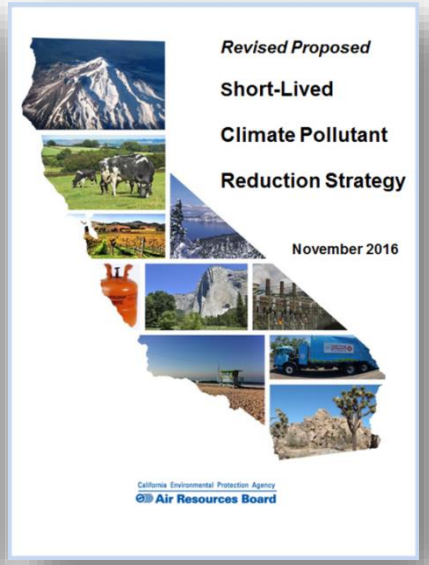
Total 2015 NOx Emissions – 1886 tpd NOx

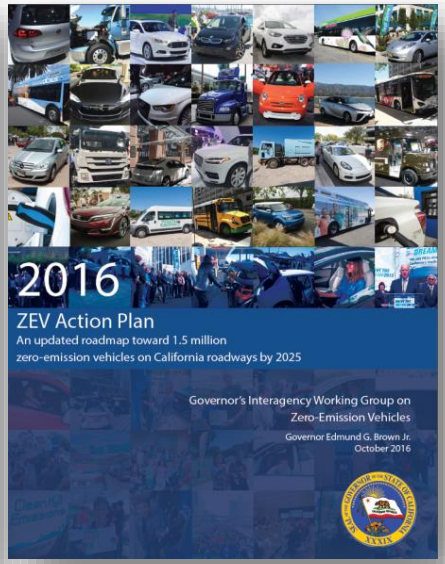
Source – California Air Resources Board Emissions Inventory

Clean Air Plans & Strategies

- Integrated approach
  - Multi-pollutant benefits
  - Identifies interactions between measures to guide policy
- Focus on cleaner technologies and fuels







California Sustainable Freight Action Plan

- Three primary goals:
  - Increase quantity of freight moved per ton CO2 by 25%
  - Deploy over 100,000 zero emission vehicles and equipment in freight sector by 2030
  - Increase economic growth and development in the freight sector
- "Transporting freight reliably and efficiently by zero emission equipment everywhere feasible, and near-zero emission equipment powered by clean, low-carbon renewable fuels everywhere else."

Source: https://www.arb.ca.gov/gmp/sfti/sfti.htm

Low NOx Engine Technology Evaluation

- CARB sponsored low NOx engine demonstration
  - At Southwest Research Institute with MECA
- Targeting 0.02 g/bhphr NOx
- Natural gas engine's 0.02g/bhphr NOx and low load NOx control capabilities independently confirmed on 12 liter engine
- Work ongoing for 13 liter diesel engine
  - 0.035 g/bhphr FTP NOx demonstrated at full useful life aging

Recent Pilot Projects and Demonstrations

- $130 million in grant funding
- Multisource projects
  - 36 battery electric trucks and off-road equipment (drayage trucks, yard trucks, forklifts, top picks)
  - Integrated solar and battery storage
- Truck and Bus Pilots
  - 25 fuel cell electric buses
  - 54 battery electric buses
  - 68 battery electric trucks
- Zero-Emission Drayage Truck Demonstration
  - 43 drayage trucks from 4 manufacturers
- Vehicle data collection planned for all projects

Commercial Deployment Incentives

- Voucher incentive programs
  - Heavy duty hybrids & ZEVs: $5M deep waiting list
  - Low NOx Engines: $3M paid, $11M still on hand
- Proposed budget to cover anticipated low NOx engine sales
  - Both 8.9 liter & 12 liter for FY 17/18
- Carl Moyer new guidelines and cost effectiveness
  - Low NOx engine deployment projects
  - Inclusion of infrastructure (charging, fueling, etc.)

Flexibilities for Market Entry

- Optional low-NOx engine regulation
  - Defined 50%, 75%, 90% NOx reduction
  - Codified certification and on board diagnostic flexibilities
  - Two CNG engines certified at 0.02g & 0.1g/bhphr levels
  - One propane engine certified at 0.1 g/bhphr
- Innovative technology regulation
  - Provides certification pathway for new and aftermarket heavy duty hybrids
  - Provides certification flexibilities for
    - High GHG efficiency engines
    - Certification of multiple low-NOx engine families

Heavy Duty GHG Phase 2

- EPA final rulemaking
  - Requires decrease GHG emissions and fuel usage 25% by 2027
  - Requires enhanced aerodynamics, engine stop/start, weight reductions, and other advanced technologies
  - Compliance dates (2018, 2021, 2024, and 2027)
- California program goals
  - To align with the agreed structure, timing and stringency
  - To seek additional GHG benefits while harmonizing with national vehicle & engine requirements
- Update other regulations to harmonize with Phase 2
- Proposal due to ARB board in late 2017

Innovative Clean Transit

- Partner with transit fleets to improve public transportation efficiency and opportunities for zero-emission modes
  - Low-NOx engines and renewable fuels
  - Zero-emission buses where suitable 2018-2040
  - Enhanced mobility and connectivity
- End goal of all zero emission passenger transportation

Zero Emission Buses Lead the Market

- More manufacturers produce zero emission buses than conventional buses
- Battery electric buses in all configurations
  - More than 300 miles on single charge
  - On-route charging
  - Total cost of ownership comparable to conventional
- Fuel cell electric buses
  - Fueling and range similar to conventional buses
- Success in zero emission bus deployment can be replicated in other heavy duty sectors

Zero Emission Bus Market Growing[1]

In Service	109
Pending Delivery	241
Total	350

[1] Buses in transit fleets and universities

Advanced Clean Local Trucks

- Long term plan to use performance based strategy to maximize GHG and NOx reductions
  - Wide range of advanced technologies for all truck types
- Evaluating near term strategy for manufacturer sales of trucks with zero-emission capability
  - Class 2B to Class 7 (optional credit for Class 8)
  - Fuel cell, plug-in electric/hybrids, range extenders, electric PTO

Zero Emission Truck Market Status

- Mitsubishi Fuso is first major manufacturer planning to bring a battery electric truck to market in 2017
- Workhorse Group announced plans for first range extended battery electric pickup truck
  - Has been producing range extended battery electric step vans
- Ford recently approve electric drivetrains in its qualified vehicle modifier program
- Several zero emission truck/equipment manufacturers

Low Carbon Fuel Standard

- Phase-in lower carbon intensity of transportation fuels to achieve 10% reduction by 2020
  - Increasing supply of renewable diesel, renewable natural gas, and other low carbon fuels
  - Credits offset higher costs of production. Reflected in pump price.
- Fleet owners can earn credits to sell on open market*
  - Electricity – About $0.06/kWh for use in trucks, $0.11/kWh for buses.
  - Dispense own CNG – About $0.12/DGE in 2017 and declines to $0.04/DGE in 2020
- 2018 updates – may increase credits for battery electric trucks and for fleet owner to claim credit for dispensing hydrogen
- Future carbon intensity reductions needed

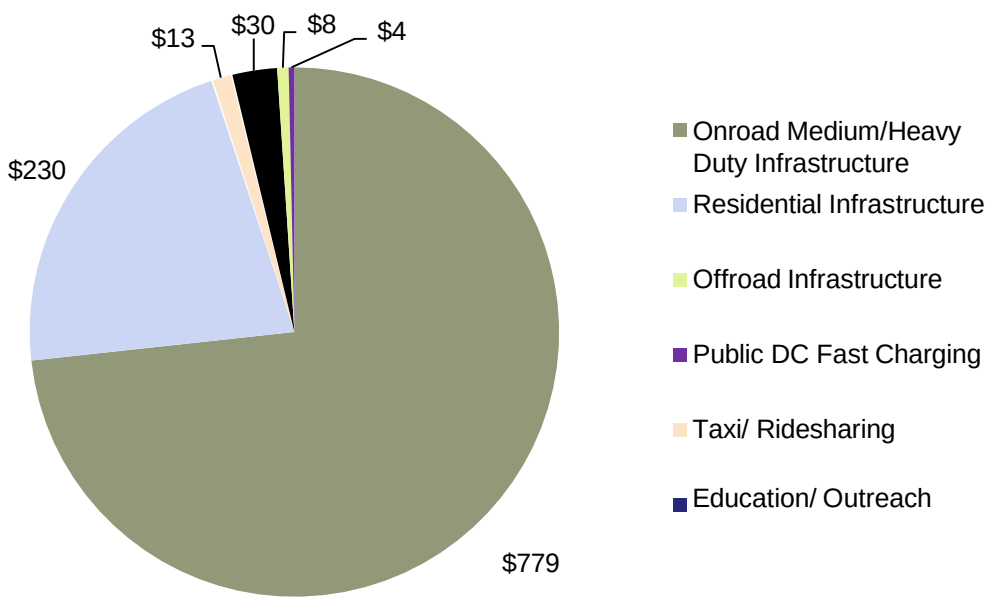
*Estimates based on credit value of $100 per credit
LCFS Program: https://www.arb.ca.gov/fuels/lcfs/lcfs.htm

Electricity and Transportation (SB 350)

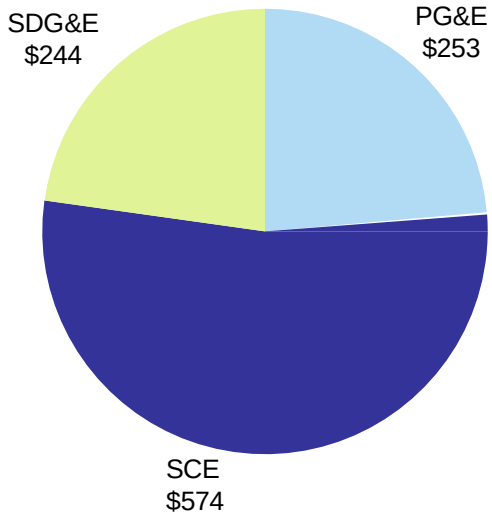
- Increase grid electricity to 50% renewable by 2030
- Utilities to remove barriers for transportation electrification
- Energy efficiency requirements
- Ensure benefits in disadvantage communities
- Others

Investor Owned Utility Applications
$1 billion Funding Requested

Funding by Project Type (millions)



Funding Requested (millions)



Potential to offset heavy duty infrastructure costs, establish new EV rates, on-site battery storage, and improve grid reliability

Conclusions

- California facing tough challenges in GHG & NOx
- Tools exist to address both GHG and NOx simultaneously
- Aggressive immediate deployment needed for zero emission vehicles, near-zero technology and low carbon fuels
- CARB committed to concerted action with technology providers, regulators, incentive funding and end users

Reference Materials

- Mobile Source Strategy
  https://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm
- Short-lived Climate Pollutant Reduction Strategy
  https://www.arb.ca.gov/cc/shortlived/shortlived.htm
- California Sustainable Freight Action Plan
  http://www.casustainablefreight.org/
- ZEV Action Plan
  https://www.gov.ca.gov/docs/2016_ZEV_Action_Plan.pdf
- Incentive Programs
  https://www.arb.ca.gov/ba/fininfo.htm
- Low NOx Technology Evaluation Activities
  https://www.arb.ca.gov/research/veh-emissions/low-nox/low-nox.htm
- CPUC Transportation Electrification Activities (SB 350)
  http://www.cpuc.ca.gov/sb350te/
- Advanced Clean Local Trucks
  www.arb.ca.gov/msprog/actruck/actruck/htm