

# Zero Emission Vehicles and the California Hydrogen Highway Network

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# Overview

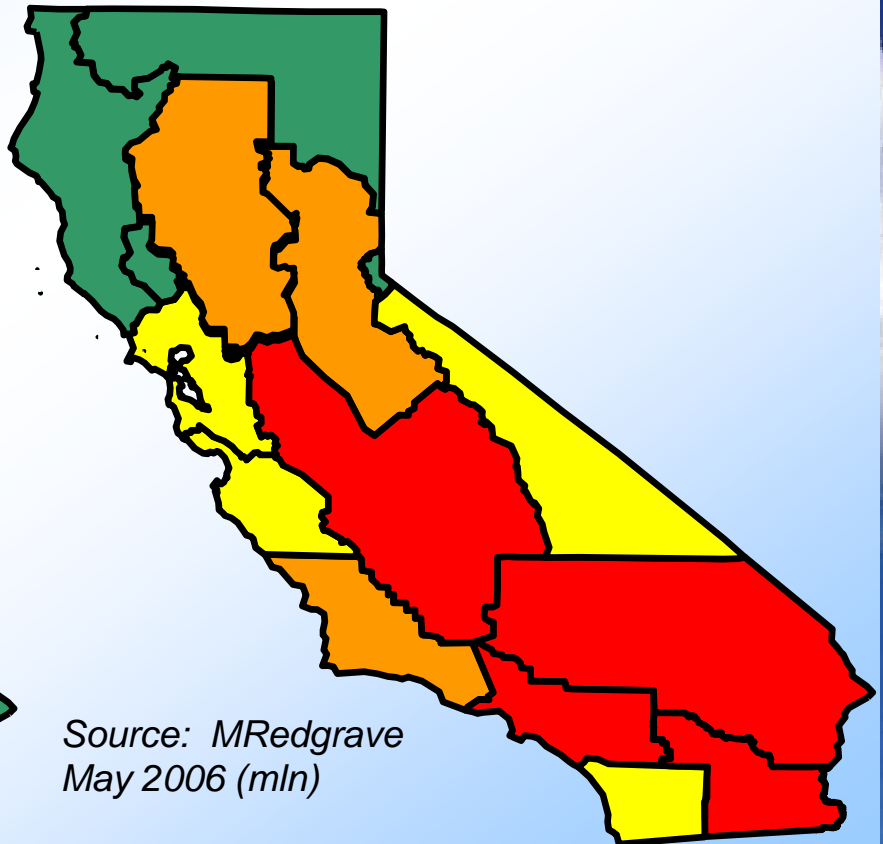
- Environmental Drivers
- Getting from Here to There
- Regulatory Vehicles
  - The Zero Emission Vehicle Regulation
  - The Zero Emission Bus Regulation
- Non-Regulatory Vehicles
  - California Hydrogen Highway Network
  - Legislation and Policies



# Over 90% of Californians Breathe Unhealthy Air at Times

*Days Over State 24-Hour  
PM10 Standard*

*Days Over State 8-Hour  
Ozone Standard*



Source: ADAM  
September 2006 (tfn)

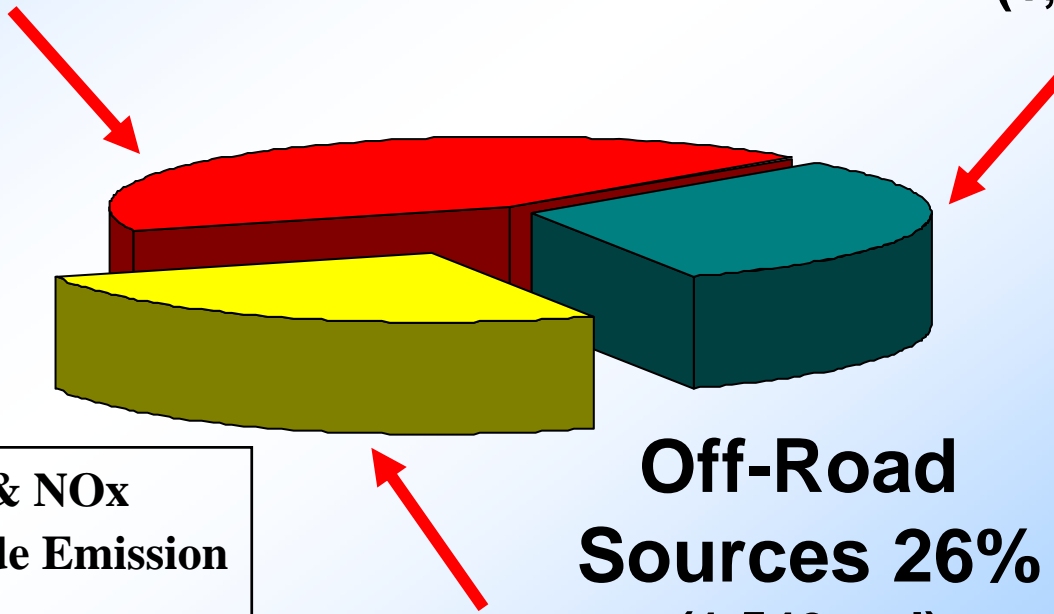
Source: MRedgrave  
May 2006 (mln)



# Sources of Smog-Forming Emissions\*

**On-Road Motor Vehicles 43%**  
(2,554 tpd)

**Stationary Sources 31%**  
(1,824 tpd)



**Off-Road Sources 26%**  
(1,540 tpd)

\* ROG & NO<sub>x</sub>  
2003 Statewide Emission  
Inventory

# Climate Impacts

## Projected California Impacts

75% loss in snow pack

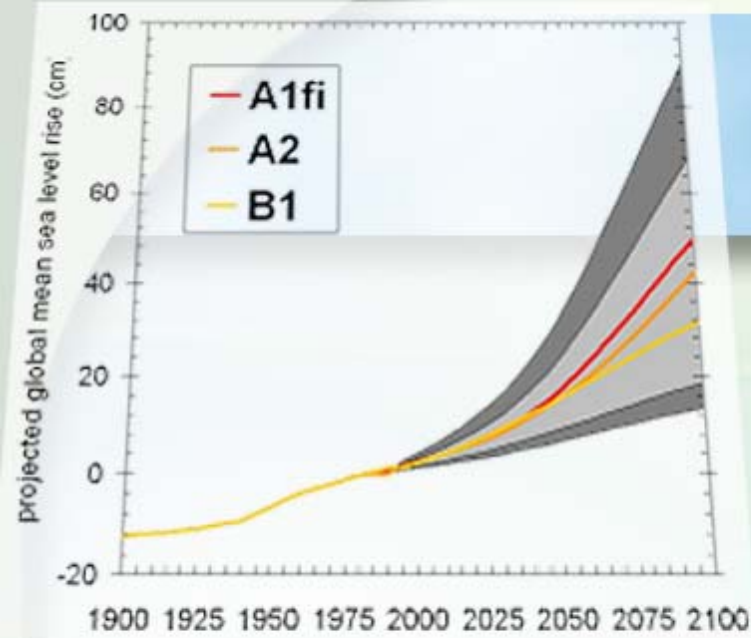
1-2 foot sea level rise

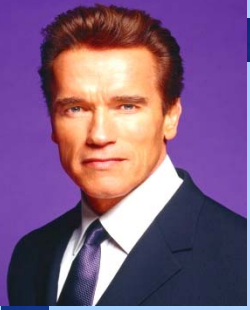
70 more extreme heat days/year

80% more 'likely ozone' days

55% more large forest fires

Twice the drought years

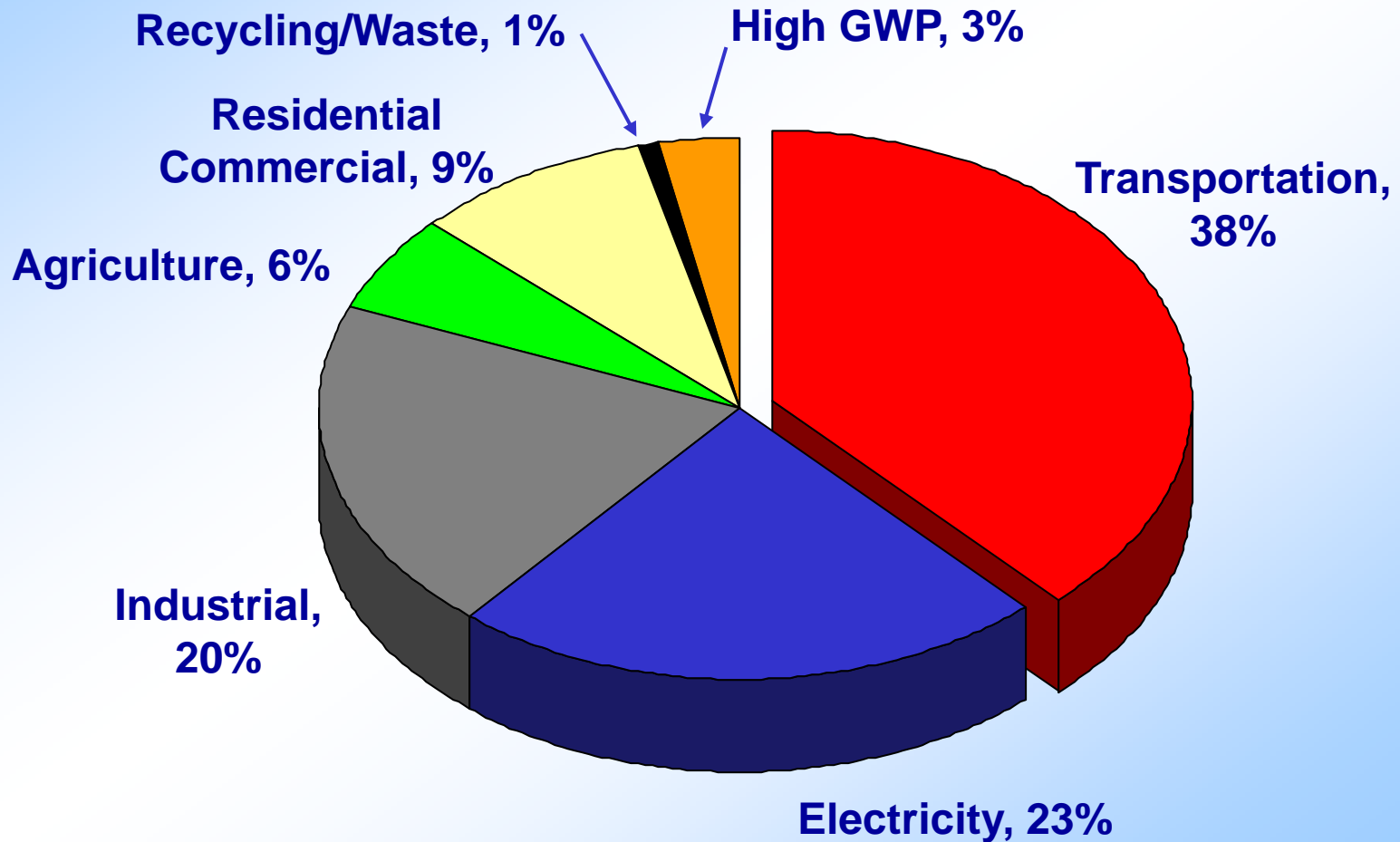




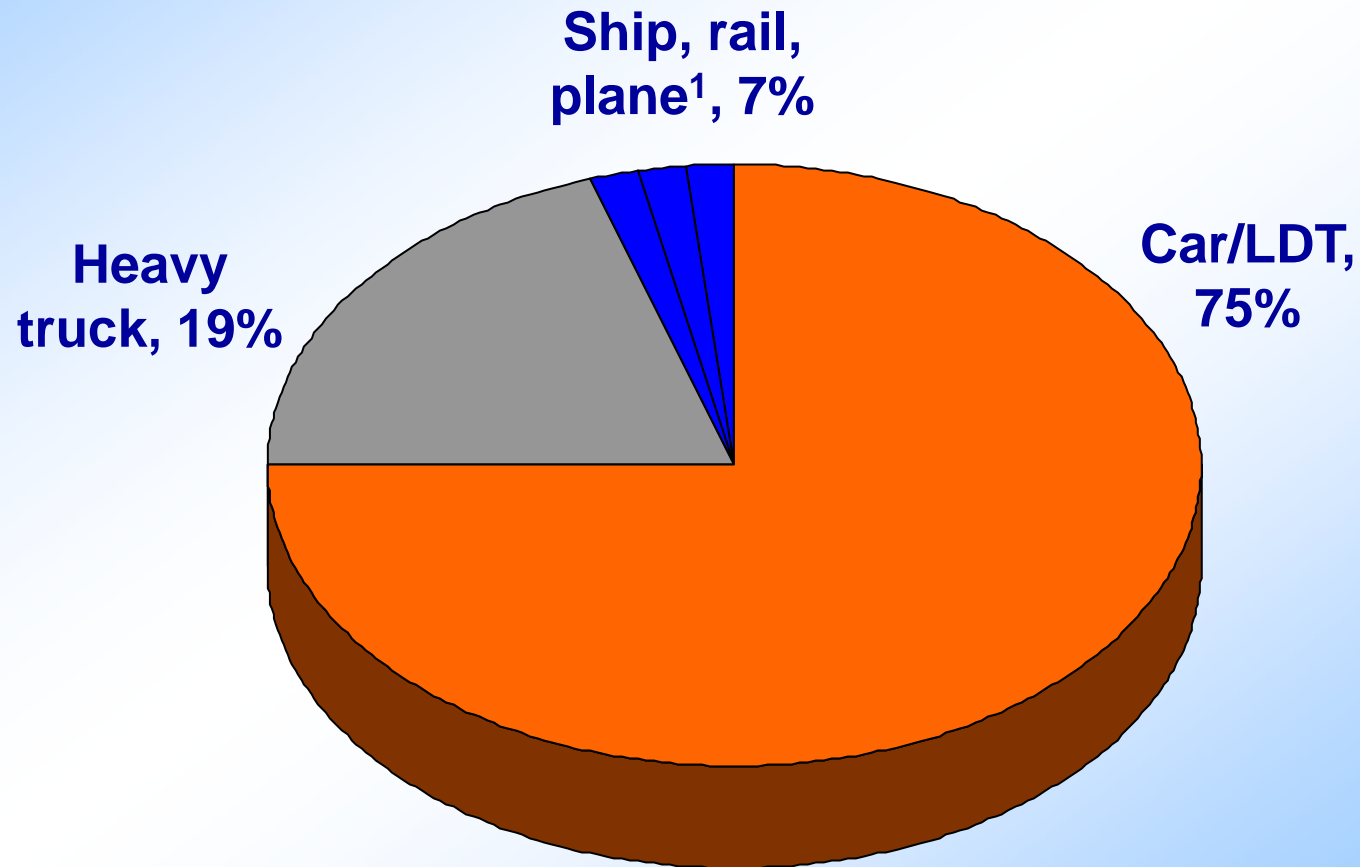
# CA's Climate Change Program The Basic Pieces

- **Two GHG reduction goals**
  - Return to 1990 GHG levels by 2020 (28% ↓)
  - 80% below 1990 by 2050
- **Global Warming Solutions Act 2006**
  - Comprehensive plan to meet 2020 target
    - Mandatory reductions
    - Market-based measures (e.g. cap and trade)
  - Path to 2050 goal

# Sources of GHG Emissions 2002-04



# Transportation GHG Emissions 2002-04



<sup>1</sup> Within CA



# Getting from Here to There



# Transportation Vision: 2050

## One Scenario

### GHG 2050

BAU	182 MMT
Vision	23 MMT
% Red.	87%

### Conventional



% veh.	10%
mpg	40 mpg
% fuel	30%

### Biofuel/HEV



% veh.	18%
mpg	60 mpg
% fuel	30%

### Electric/H2



% veh.	72%
mpg	80+ mpg
% fuel	40%

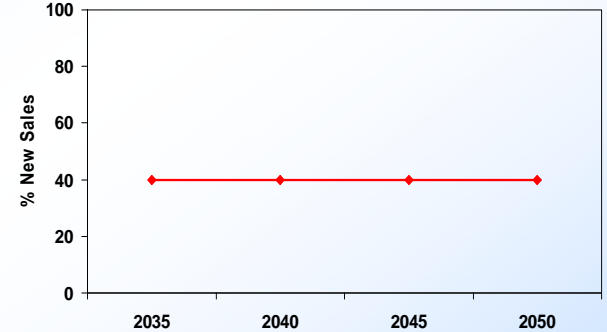
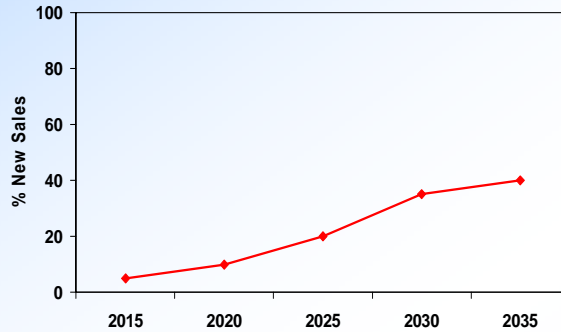
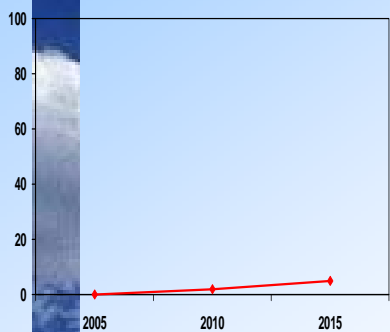
# vehicles  
up 54%



Population  
Up 50%



# Time To Start Is Now - Working Backwards From 2050



**Early  
Commercial  
-ization**

**Market Acceptance  
(Ramp Up of New Technology)**

**Fleet Turnover**

2010

2020

2030

2040

2050

2015



# Regulatory Vehicles

# ZEV Program

Current ZEV Program

**“10%” Mandate  
42% by volume**

**~1%**

**30 %**

**PZEV**



**11%**

**AT PZEV**



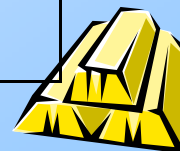
**ZEV**



# Zero Emission Vehicle Regulation (March 27, 2008)

- Requires market share of ZEV totals:
- 2500 fuel cell vehicles in 2009 to 2011

ZEV Vehicle Types	Vehicles Required 2012-2014
> 300 miles-fast refuel (Type V)	5,357
> 200 miles-fast refuel (Type IV)	7,500
Shorter-range FCV-fast refuel or >200 mile BEV (Type III)	9,375
> 100 mile BEV (Type II)	12,500



# “ZEV 2.0”

- Return to Board with a “Clean Sheet of Paper” approach
- Move PZEVs to LEV program to maximize smog benefits
- Move AT PZEVs to Motor Vehicle GHG (Pavely) program to maximize GHG benefits
- Re-vamp ZEV to concentrate on accelerating introduction of pre-commercial ZEV and ZEV enabling technologies

# Zero Emission Bus Regulation

- Part of Fleet Rule for Transit Agencies
- Transit Agencies > 200 urban buses
- Demonstration and purchase requirements
  - Diesel Path Transit Agencies
  - 12 Bus demonstration starting in 2009
- Purchase Requirement starts in 2011





# Non-Regulatory Vehicles

# California Hydrogen Highway Blueprint Plan Recommendations

- Phased approach to implementation
- Clear environmental goals GHG & Air quality benefits
- State to provide incentive funding
- Shared risk – Public/Private partnership



# CaH2 Net Hydrogen Vehicle Placements

- Help Ensure Adequate Station Utilization
  - 4-Quantum Hydrogen ICE Prius
    - UCLA, CSU Humboldt, Caltrans
  - 2-Ford HICE Shuttle Buses
    - East Palo Alto, San Diego
  - 1-GM Fuel Cell Equinox
    - University of California Irvine
- State fleet operations
  - Vehicles in State fleets



# Recent Funding

## Hydrogen FC Transit Buses

- Sunline's American Fuel Cell Bus Project
  - ARB contributing \$800,000 towards the \$5.4 million project
- Sunline's Thor Fuel Cell Bus Project
  - ARB contributing \$640,000 towards the \$1.275 million project
- Burbank's Fuel Cell Bus Project
  - ARB contributing \$1.37 Million toward the \$2 Million project
- The Zero Emission Bay Area Project
  - ARB contributing \$4.165 Million towards the \$39 Million Project





# 2008 CARB \$7.7 Million Station Funding RFP

- Cal State University Los Angeles
  - \$2.2M CARB (total \$4.1M), 33.3% renewable electrolysis
- Alameda-Contra Costa County  
Transportation District - Emeryville, CA
  - \$2.7M CARB (total \$5.56M), 100% renewable electrolysis, Co-located at HDD diesel and FC station
- Air Products and Chemicals Inc. -  
Fountain Valley CA
  - \$2.7M CARB (total \$10.4M) Partners: Orange County Sanitation District, U.S. DOE, SCAQMD, 100% renewable from waste water off-gassing, Co-located w public CNG station

# Initiatives that impact/interact with the CaH2Net

- **AB 1007 (2005)** – Plan to Reduce California's dependence on petroleum – renewable H<sub>2</sub>
- **AB 118 (2007)** – Alternative & Renewable Fuel and Technology Incentive Program
- **EO S-01-07 (2007)** – Low Carbon Fuels Standard
- **SB1505 (2006)** – Environmental Requirements for Hydrogen Production



# Summary

- Dramatic transformation of California's vehicle fleet is needed
- ZEV regulation revision will need to link us to the 2050 vision
- More than regulation is needed to get us there