

California Emission Control Case Study

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Air Resources Board

www.arb.ca.gov



Main Points

- California has realized significant non-CO₂ GHG reductions
- California has reduced the growth of CO₂ emissions
- These reductions were realized for reasons other than climate change
- Further reductions will focus on diesel and other PM sources



**California has realized significant
non-CO₂ GHG reductions ...**



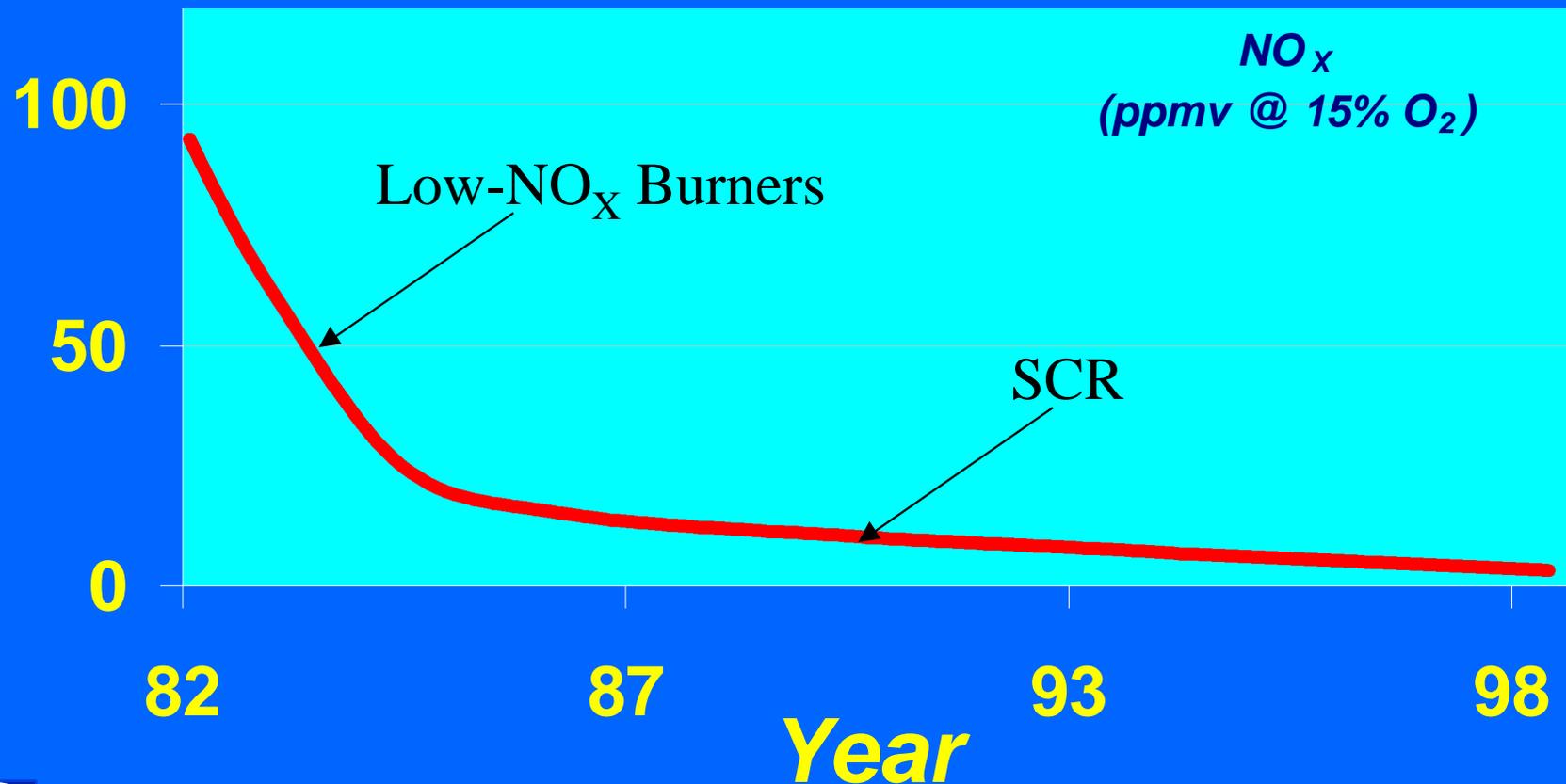
Stationary Source Controls

- Low-NO_x Burners
- Selective Catalytic Reduction
- Cleaner Fuels (i.e., compressed natural gas)
- Vapor Recovery
- Low-NMVOC Coatings and Solvents



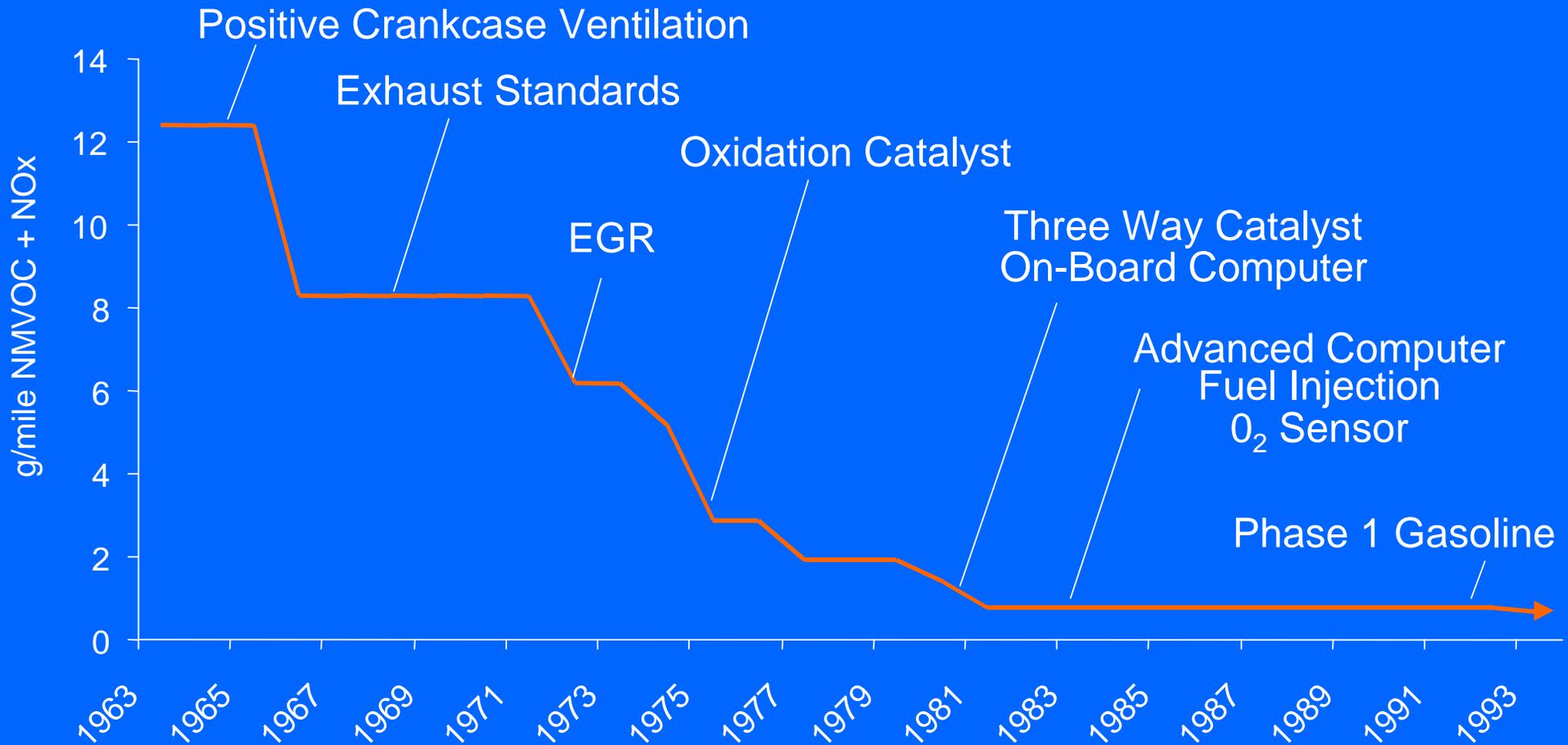
Evolution of NO_x Controls from Power Plants in California

(Combined-Cycle/Cogeneration Configurations)



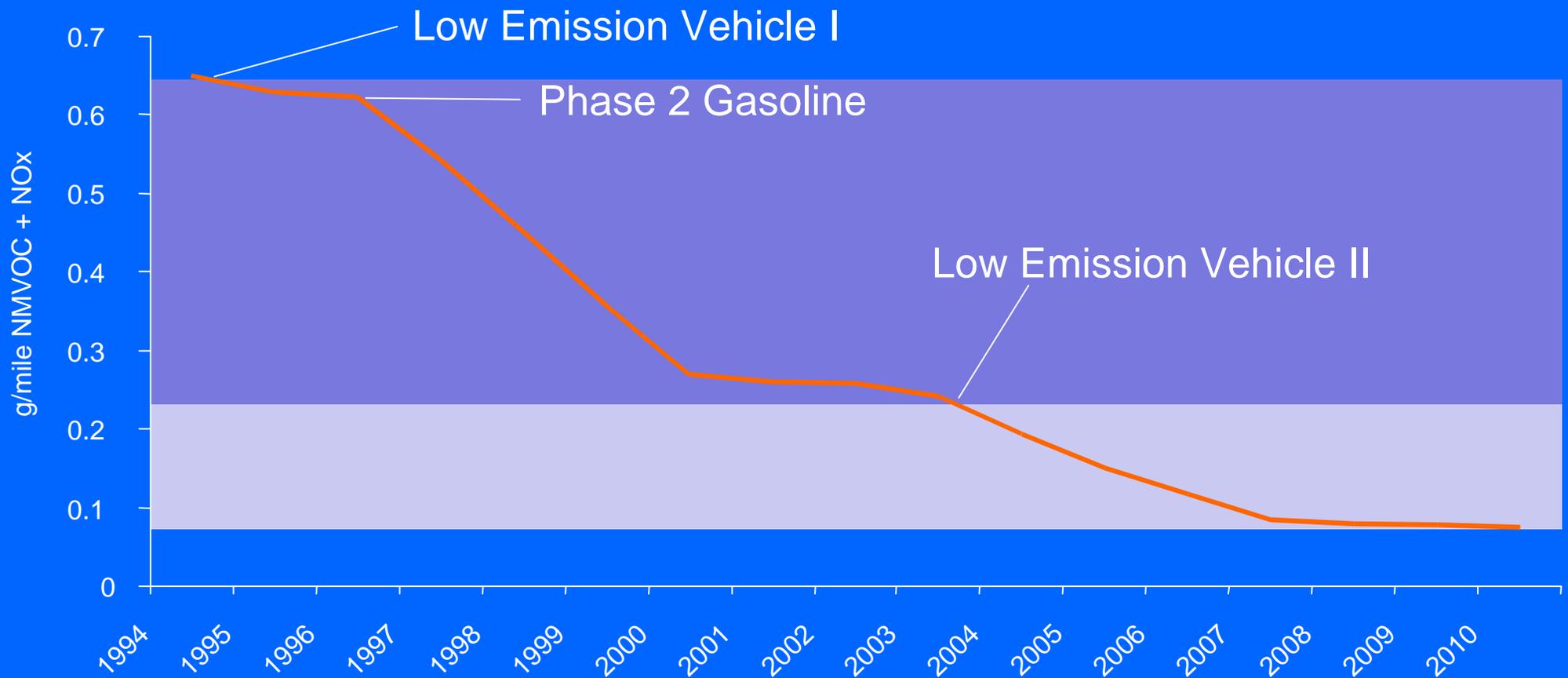
Evolution of California Auto Controls

Implementation: 1963 - 1993

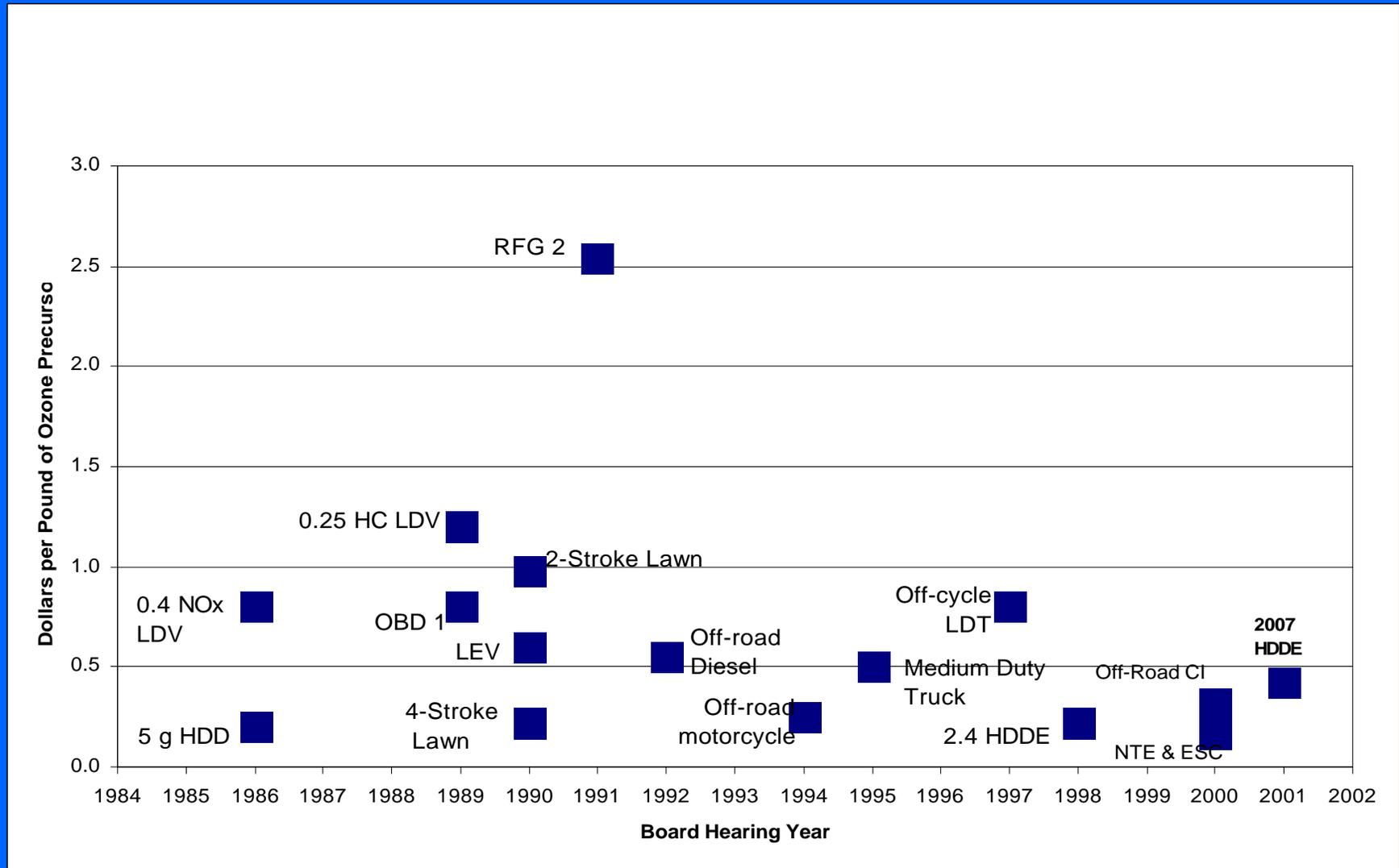


Evolution of California Auto Controls

Implementation: 1994 - 2010



Cost-effectiveness Values for Various Mobile Source and Fuel Regulations



California Emission Reductions (Tg/yr)

	<u>1980</u>	<u>2000</u>
▶ Stationary (NMVOC+NO _x)	0.93	0.40
– Electricity Prod. (NO _x)	0.11	0.02
▶ Autos (NMVOC+NO _x)	1.8	0.8
▶ Autos (CO)	10.3	4.0
▶ Trucks (PM ≅ BC)	0.013	0.007

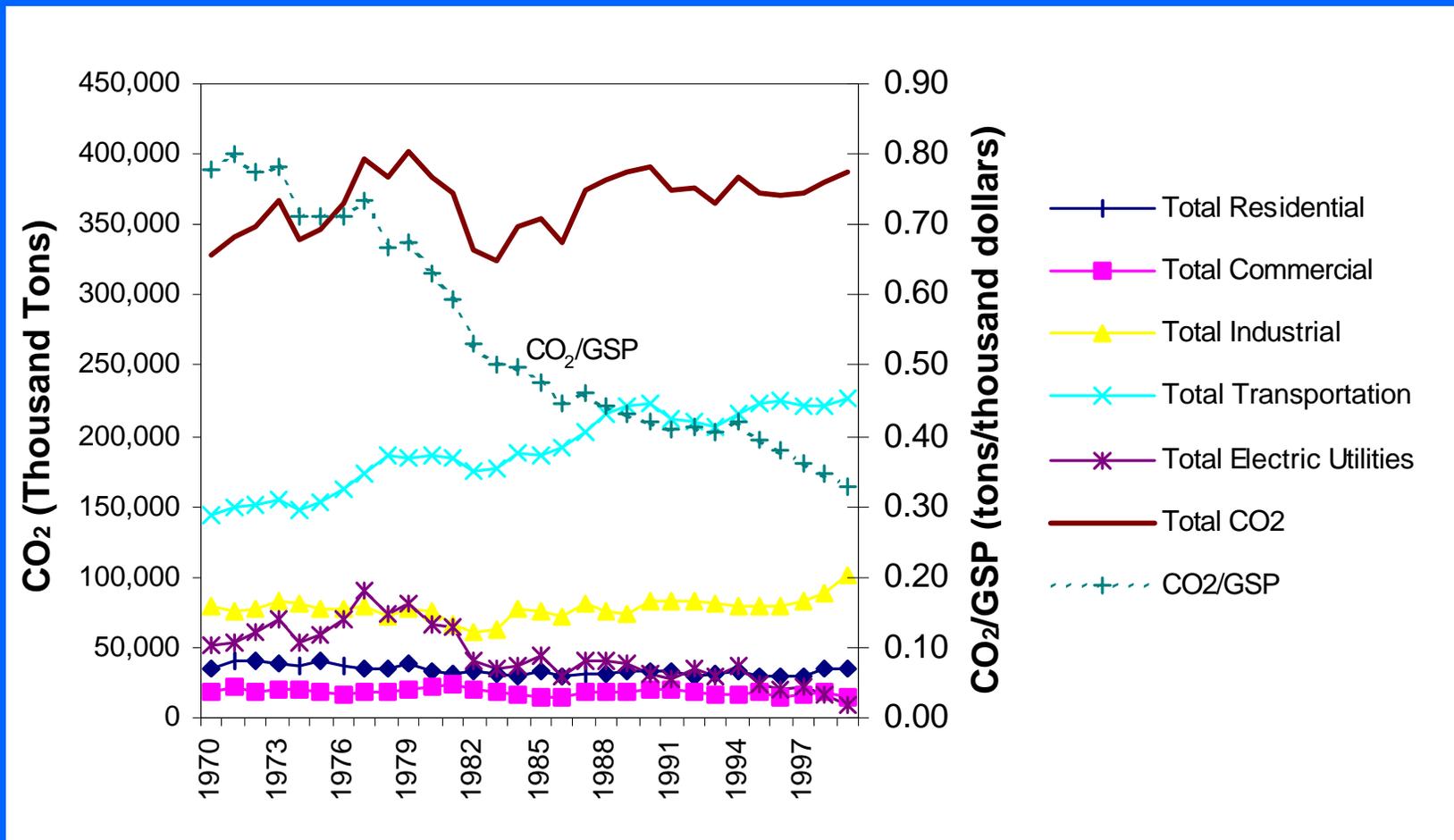


**California has reduced the growth
of CO₂ emissions ...**

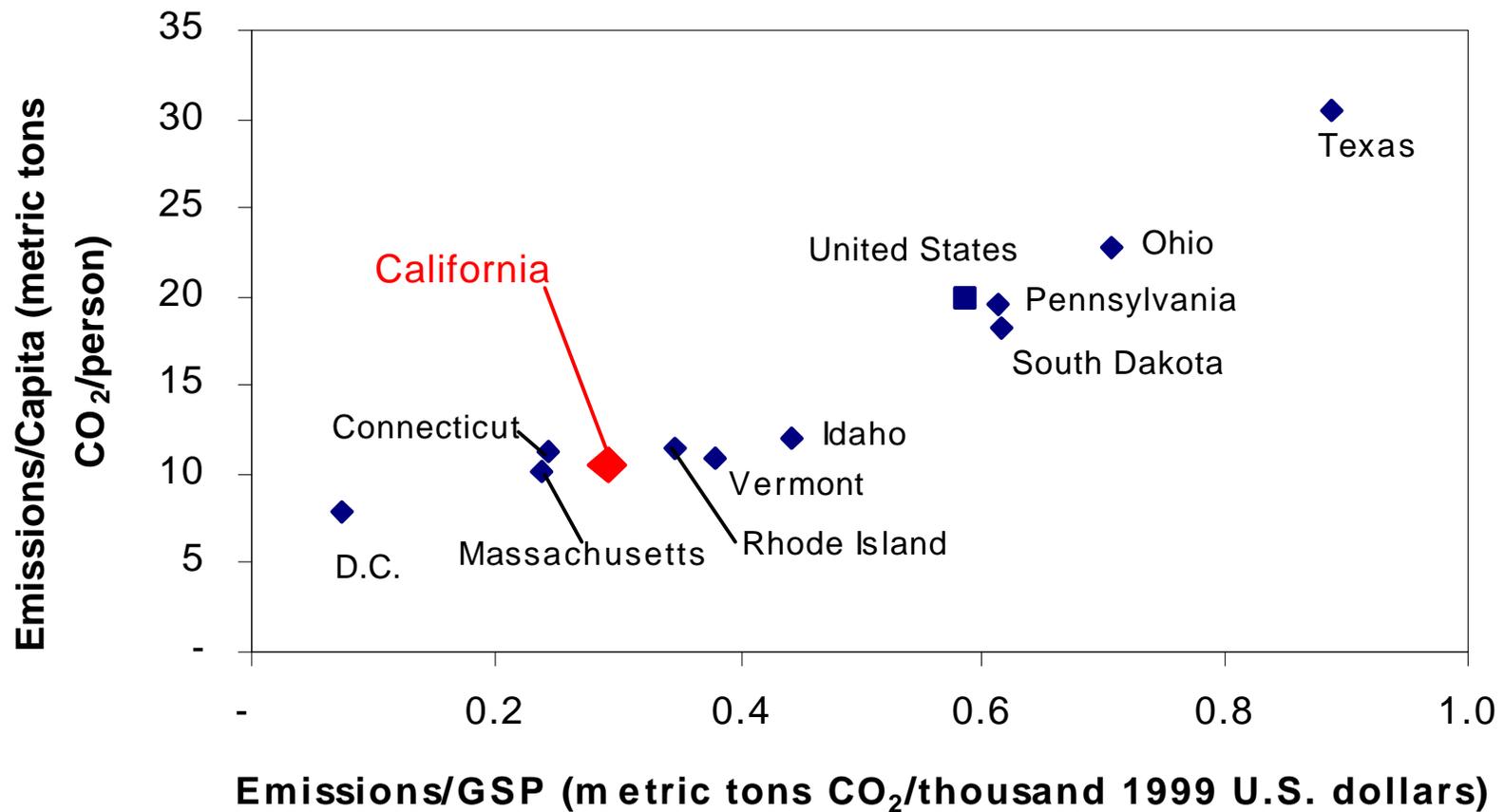


California GHG Emission Trend

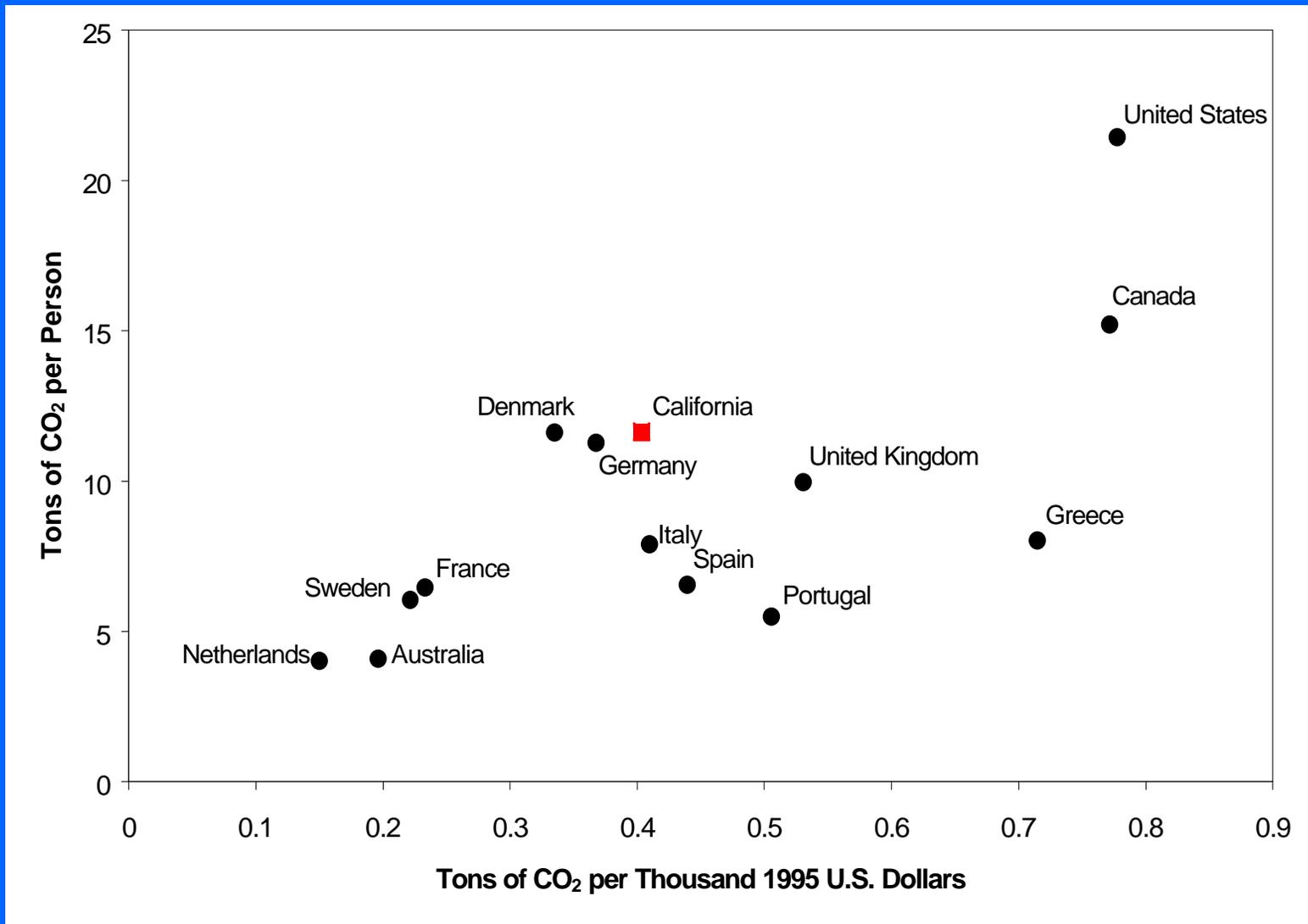
(CO₂ equivalents for Kyoto Protocol Gases)



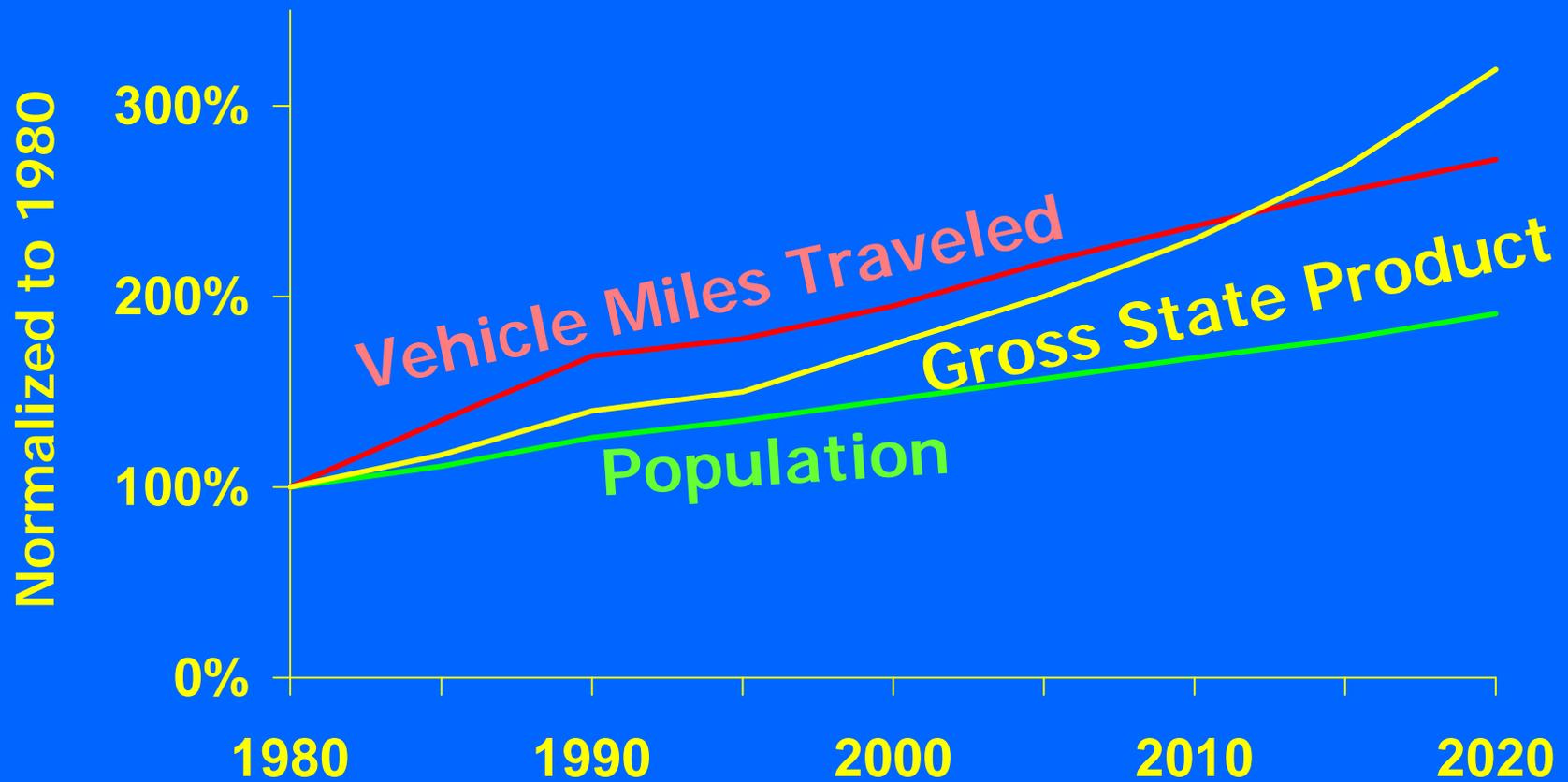
Carbon Intensities for California and Selected States - 1995



Carbon Intensities for California and Selected Countries - 1995



Growth Trends



Changes Since 1990

	<u>Total</u>	<u>Per Capita</u>
▶ NO _x	-29%	-37%
▶ NMVOC	-32	-40
▶ CO	-39	-46
▶ SO _x	-44	-50
▶ Combustion PM (\cong BC)	-16	-25
▶ GHG (CO ₂ equivalent)	+8	-4
– CH ₄	-9	-19
– N ₂ O	-4	-15



Net Effect From 1990 to 2000

(Tg/yr CO₂ equivalent)

	<u>1990</u>	<u>2000</u>
Kyoto GHG	378	399
<u>Other GHGs and BC</u>	<u>16</u>	<u>10</u>
Total	394	409

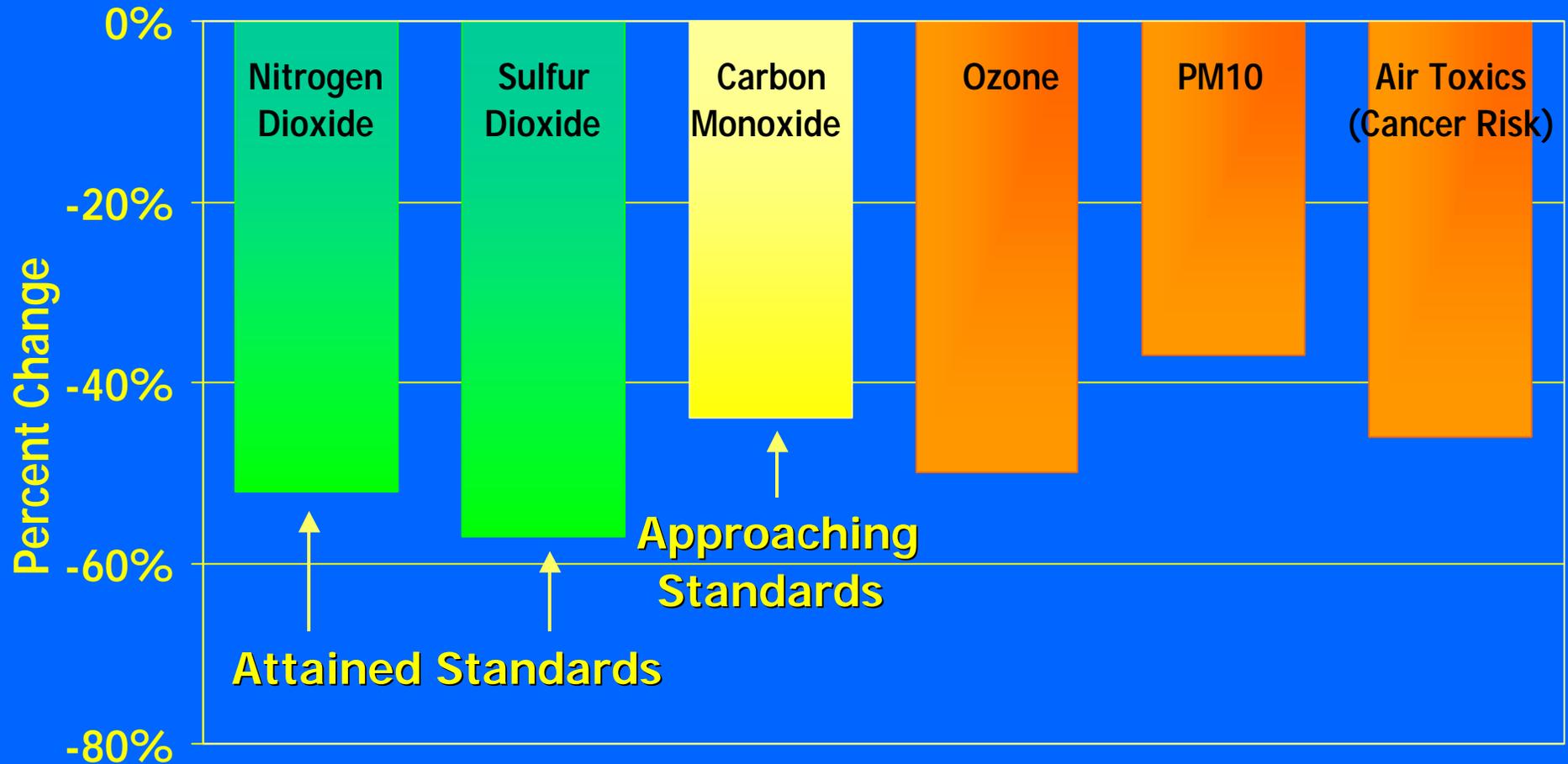
GWPs: CO₂=1, N₂O=296, CH₄=23, NO_x=0, NMVOC=2.8, CO=1.2, SO_x=0,
aerosols not considered



**These reductions were realized
for reasons other than global
climate change ...**



Improvement in Ambient Air Quality Over Past 20 Years



Air Pollution Health Effects

- **Currently, air pollution in California contributes annually to as many as:**
 - ▶ **17,000 premature deaths**
 - ▶ **55,000 hospital admissions**
 - ▶ **1,300,000 asthma attacks**
 - ▶ **3,300,000 lost work days**



Visibility Reduction



10-75% of light extinction in urban areas is from diesel black carbon



**Further reductions will focus on
diesel and other PM sources...**



Ozone and PM10 Exposure

1-Hour Ozone Exposure 1993-1995

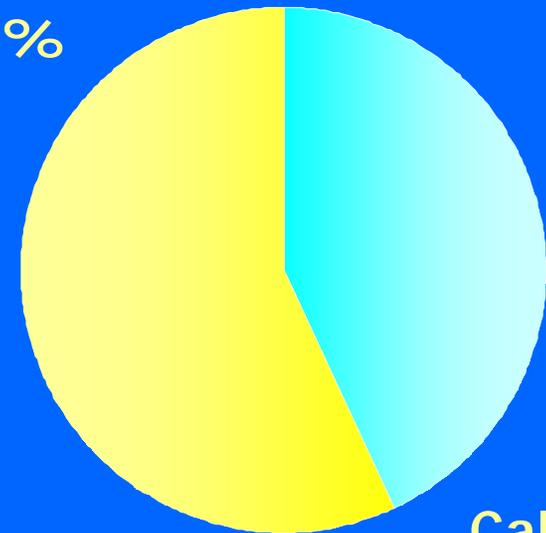
Rest of Nation
29%



California
71%

Annual Mean PM10 Exposure 1994-1996

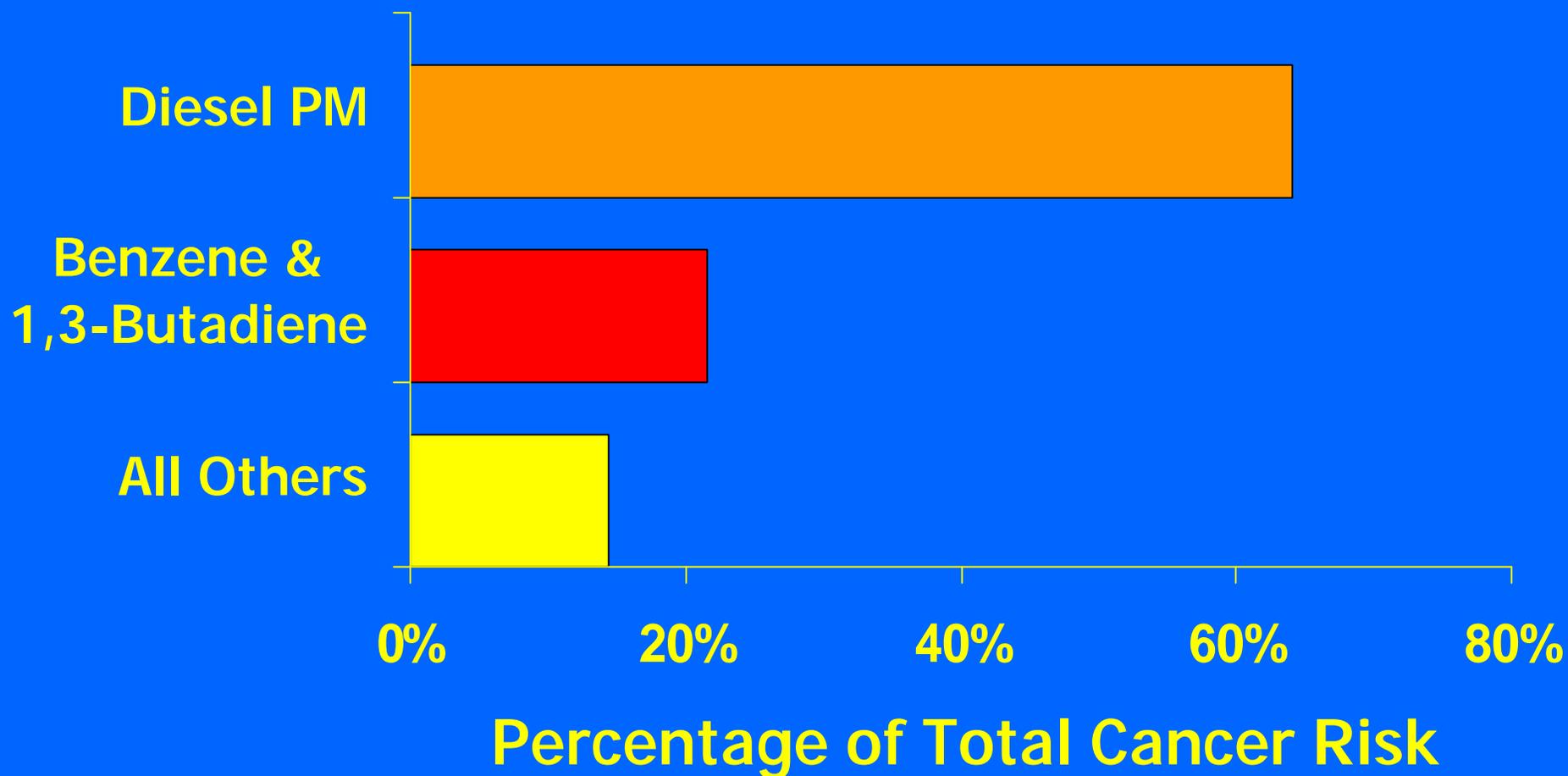
Rest of Nation
57%



California
43%



Toxic Air Contaminants



75% Reduction in Diesel PM by 2010

(On- and Off-road Vehicles, Stationary Engines)

- New vehicle and engine standards
- Retrofits where technically feasible and cost-effective
- International Advisory Committee
- Low-sulfur (15 ppmw) diesel fuel
- Enforcement programs



www.arb.ca.gov/diesel/dieselrrp.htm



California Climate Change Activities

- **Assembly Bill 1058**
 - ▶ Instructs CARB to adopt regulations that achieve the maximum feasible, cost-effective, and technologically achievable reductions of CO₂ emitted by passenger vehicles
 - ▶ Passed Senate, amended by Senate
- **Senate Bills 1771 and 527**
 - ▶ Created California GHG Registry



Summary

- **Technology exists for significant non-CO₂ GHG reductions**
- **Improvements in power generation have slowed the growth of CO₂ emissions**
- **Emission reductions to address health and welfare concerns have a co-benefit for climate change**
- **Further reductions will focus on diesel and other PM sources**

