



Evaluation of Environmental and Economic Impacts



Environmental Impacts

- Baseline emissions inventory
- Emissions reductions
- Cost effectiveness
- Other environmental impacts



Inventory Development

- Carbon dioxide and methane
 - Used EMFAC2002 mobile source emissions model (version 2.2, April 2003)
 - Emission rates in EMFAC derived from extensive in-use vehicle testing
 - Vehicle activity
 - Population from DMV registration
 - Miles traveled from local Transportation Planning Agencies



Inventory Development

- Nitrous oxide (N_2O)
 - Collected N_2O and NO_x emissions data for ~ 120 vehicles
 - Developed correlation between NO_x and N_2O emission rates
 - Used correlation equations to derive N_2O emission factors from NO_x rates in EMFAC



Inventory Development

- HFC-134a
 - Emissions by mass balance
 - Lifetime emissions = initial charge + recharges
 - amount recovered at end
 - Number of recharges: 12,000 vehicles in 9 fleets; surveys of 966 vehicle owners
 - End-of-life recovery: survey of dismantlers, discussions with USEPA & California reclaimers



Inventory Development

- HFC-134a
 - Over 16 year lifetime, average HFC-134a vehicle emits ~80 grams per year
 - Includes leakage, accidental and end-of life releases, and servicing fugitives
 - Does not include emissions from:
 - “do-it-yourself” repairs
 - topping Freon systems with HFC-134a



Climate Change Inventory

CO₂ equivalent baseline inventory
without impact of regulation

Calendar Year 2010 CO ₂ Equivalent Emissions in Tons per Day				
	CH ₄	CO ₂	N ₂ O	HFCs
PC and LDT1	594	296,320	3,625	4,824
LDT2	254	120,760	2,283	1,511
Total Light Duty	848	417,080	5,908	6,335



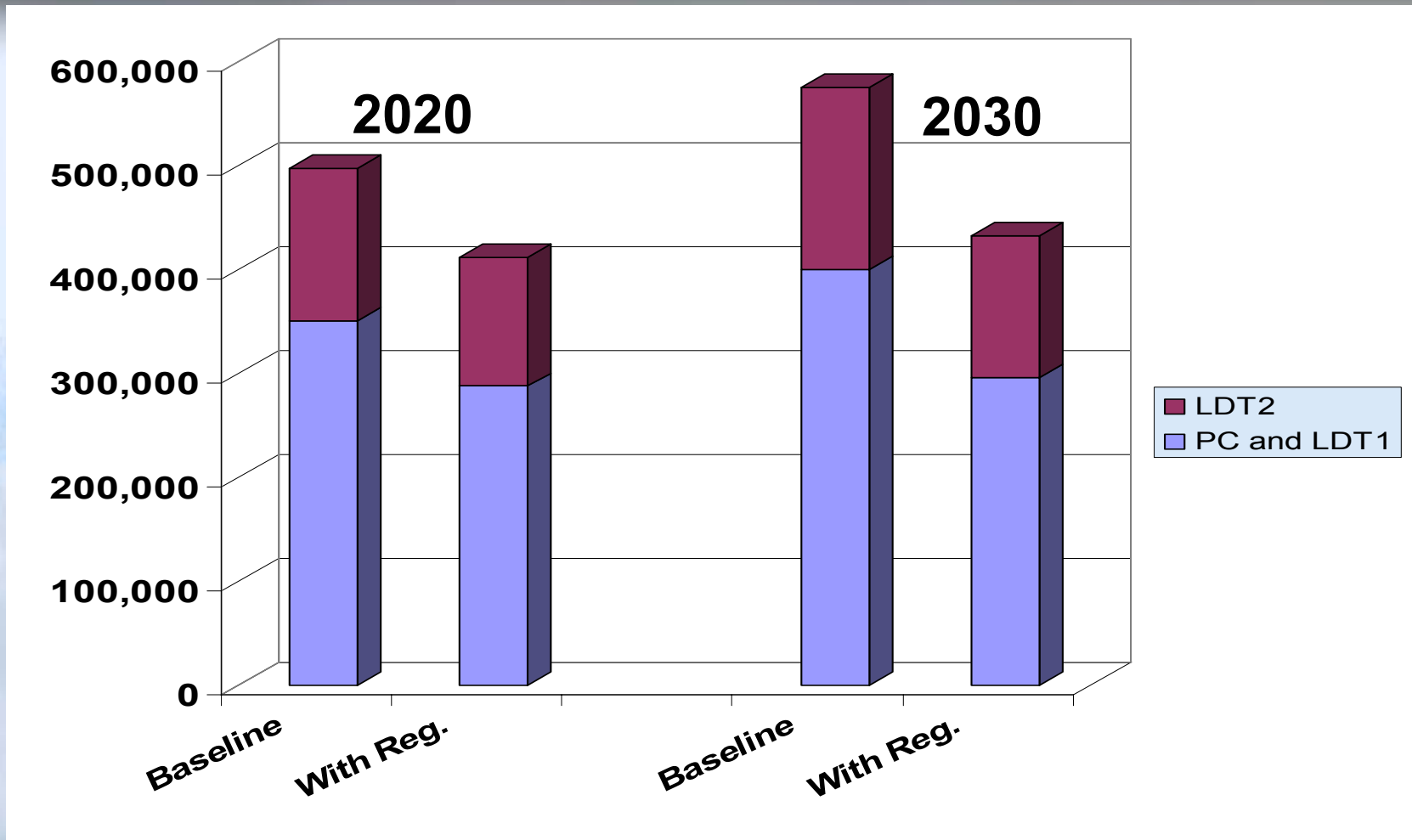
Climate Change Inventory

CO₂ equivalent inventory
without impact of regulation

	2010 (tons per day)	2020 (tons per day)	2030 (tons per day)
PC and LDT1	305,400	350,500	400,000
LDT2	124,800	146,900	175,500
Total Light Duty	430,200	497,400	575,500

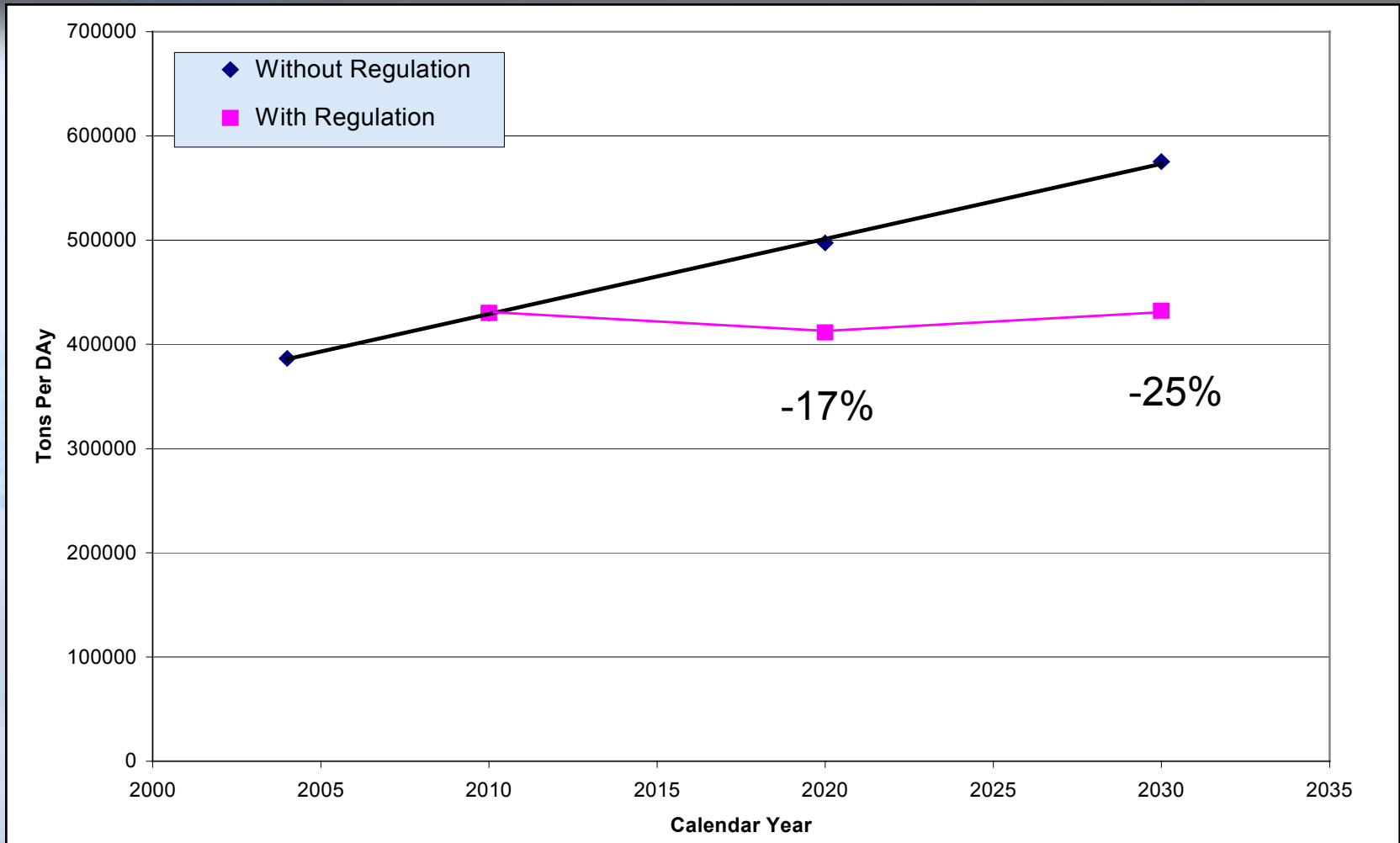


Impact on CO₂ Equivalent Emissions (tons per day)





Impact on Emissions Trends





Cost Effectiveness

- Technology improvements reduce operating costs more than they increase vehicle costs
- Annualized costs based on NESCAFF and other sources; assumes average vehicle life of 16 years



Cost Effectiveness

	2020	2030
Increased Vehicle Costs	\$837 million	\$1,692 million
Reduced Operating Costs (Savings)	(\$5,324 million)	(\$8,785 million)
Net Annualized Costs (Savings)	(\$4,487 million)	(\$7,092 million)
Emissions Reduction (tons/year)	31.3 million	52.3 million
Cost Effectiveness (\$/ton)	-143	-136

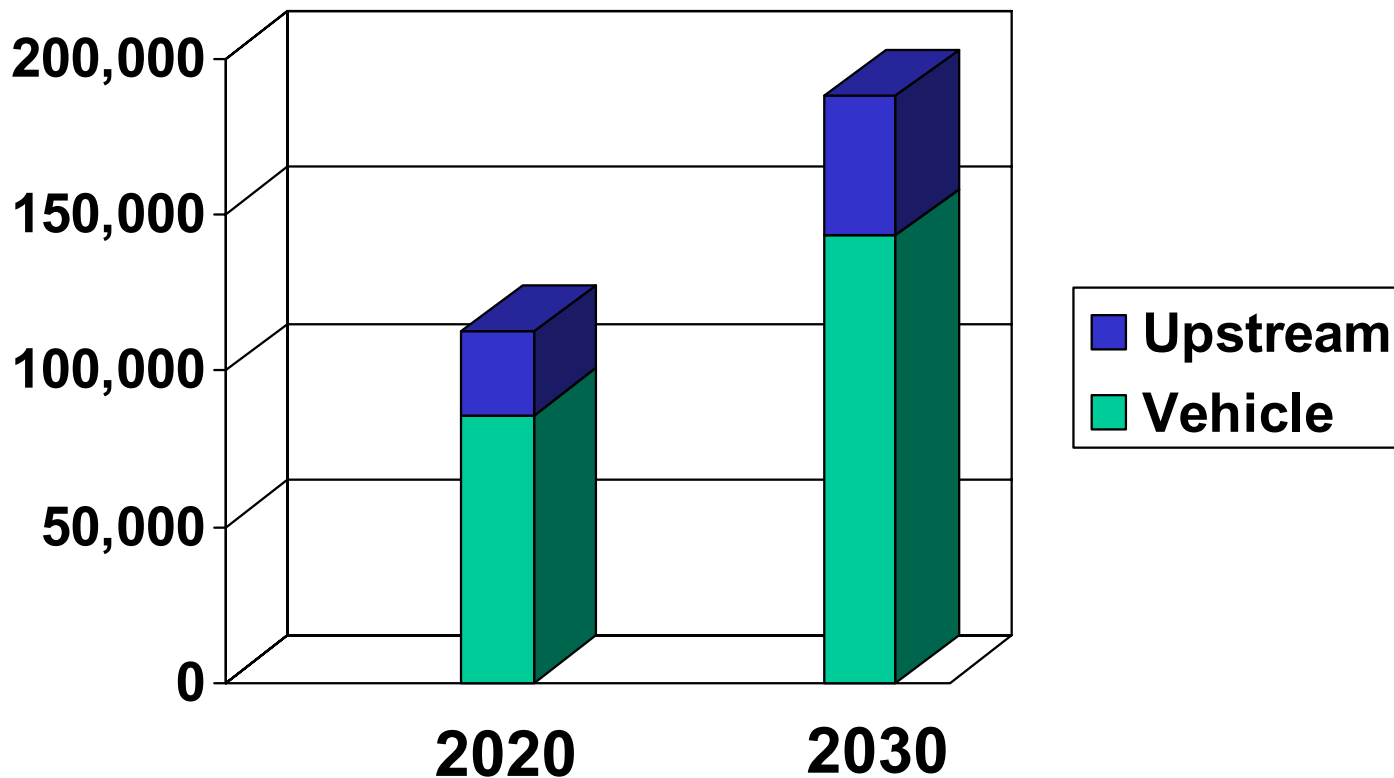


Other Environmental Impacts

- Positive impacts on:
 - fuel cycle emissions
 - energy cost and demand
 - other environmental media
- Other considerations
 - effect on consumer behavior including vehicle use and purchase



Fuel Cycle CO₂ Equivalent Emission Reductions (tons per day)





Economic Impacts



Analysis of Potential Economic Impacts

- Statewide Impacts
- Community Impacts
- Consumer Response



Statewide Impacts



Scope of Analysis

- Potential Impacts on:
 - Business Expansion or Elimination
 - Employment
 - Total Output
 - Personal Income
- E-DRAM Model of California Economy



Impacts on California Economy

- Annualized Costs
- Annual Operating Cost Savings



Economic Impacts on California

Year	Impact on	Baseline	With Reg.	Change*	Percent
2020	Output (billions in \$2003)	\$3,078	\$3,075	(\$2.6)	(0.08)
	Income (billions in \$2003)	\$2009	\$2,015	\$5.4	0.30
	Jobs (1000s)	18,661	18,718	57	0.30
2030	Output (billions in \$2003)	\$4,242	\$4,237	(\$4.7)	(0.10)
	Income (billions in \$2003))	\$2,781	2,789	\$7.7	0.30
	Jobs (1000s)	21,763	21,839	76	0.4

* - Change in output/income presented to the nearest \$100 million



State and Local Governments

- 420,000 Government Vehicles
- Average 12,500 Miles/Year
- Costs and Savings Similar to Consumers
- Net Positive Impacts



Summary of Potential Impacts

- Net Positive Impacts on:
 - Costs and Savings
 - Employment
 - Personal Income
 - Business Expansion
 - State and Local Governments



Community Impacts



Community Impacts

- Low-income communities and communities of color may be particularly vulnerable to climate change
- Working with outside sources to study the impacts of climate change on these communities



Community Input

- ARB has been working with stakeholders to get input from communities throughout the process
- Input at the community level is essential to a successful partnership and regulation



Community Outreach

Date	Organization/Meeting	Location
February 27, 2003	CLCV Education Fund Environmental Justice Forum	Los Angeles
July 22, 2003	Environmental Justice Coalition Meeting	Oakland
October 30, 2003	CLCV Education Fund Environmental Justice Forum	Los Angeles
February 18, 2004	ARB's EJ Focused Public Workshop	Los Angeles
May 13, 2004	Partnership for the Public Health, Environmental Justice Sub-Committee Meeting	North Richmond
May 20, 2004	Bluewater Network Environmental Justice Forum	San Francisco
June 10, 2004	3 rd Street Celebration	North Richmond
June 17, 2004	Community Health Roundtable	Fresno
July 6, 2004	ARB's EJ Focused Public Workshop	Oakland
July 8, 2004	ARB's EJ Focused Public Workshop	Fresno
July 13, 2004	ARB's EJ Focused Public Workshop	Pacoima



Low-Income Impact

- Annualized costs are from \$13 to \$33
- Annual reduction in operating costs are from ~\$100-150



Impacts on Affiliated Businesses

- Used San Diego as example
- Net increase in jobs and businesses
 - Reduction in future growth of gasoline station jobs and businesses
 - More than offset by increased growth of jobs and businesses in other sectors



Consumer Response



CARBITS Model

- Consumer Choice Model
- Developed By UC Davis
- Household Vehicle Purchase
- 14 Vehicle Classes
- Inputs of Vehicle Attributes
- Outputs of Sales and Fleet Size
- Regulation Compared to Baseline



Baseline Scenario

- Vehicle Prices Increase Slightly
- Operating Costs Decline Slightly
- Fuel Price - \$1.74/gallon
- Acceleration Increases Slightly
- All Other Attributes Remain the Same

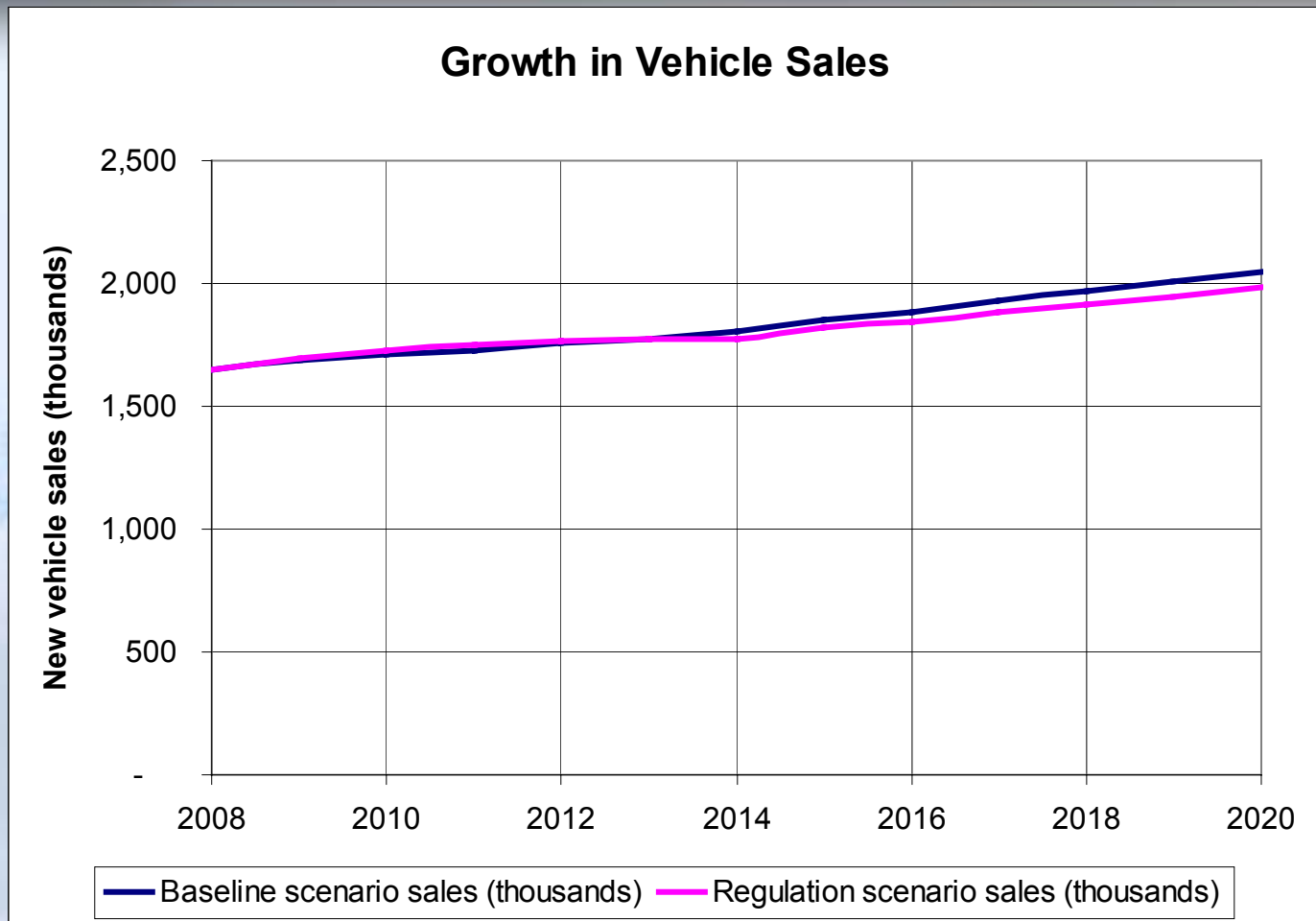


Regulatory Scenario

- Vehicle Prices Increase by Vehicle Class/Model Year
- Operating Costs Decline by Vehicle Class/Model Year
- All Other Attributes Remain the Same

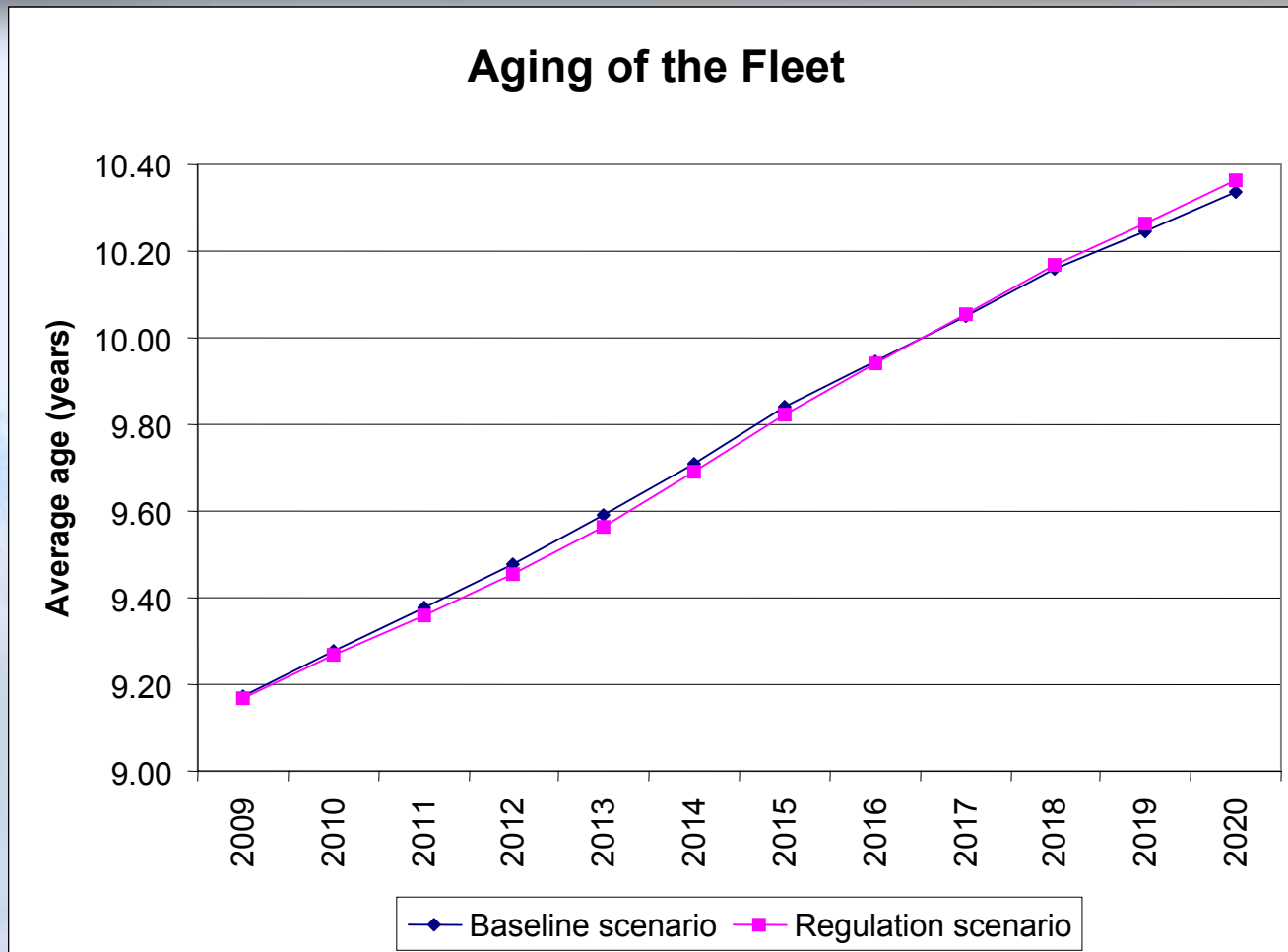


Consumer Response Results





Consumer Response Results





Consumer Response

Fleet Turnover Effect

- Based on CARBITS Results
- Pollutants Considered
 - ROG
 - NO_x
 - PM10
- Emission Impacts < 0.1% in 2020



Consumer Response

Vehicle Miles Traveled Impact

- Rebound Effect Definition
- UC Irvine Study
- California-Specific Estimates
- Rebound number for 2020
- Similar Results with Travel Demand Models



Consumer Response

Vehicle Miles Traveled Impact

- Rebound Effect of 1.27%
- Pollutants Considered
 - ROG
 - NO_x
 - PM10
 - CO
- Emission Impacts < 0.3% in 2020



Summary of Economic Analysis

- Net Positive Statewide Impacts
- Net Positive Community Impacts
- Consumer Response Produces Consistent Results