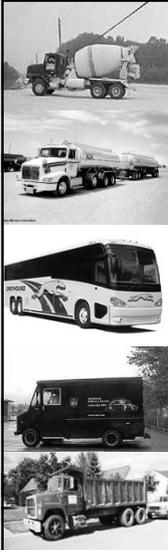


Costs Methodology for the Proposed Statewide Truck/Bus Regulation



Costs Methodology for the Proposed Statewide Truck and Bus Regulation

Workshop Series
Fresno – July 8
El Monte – July 11
Sacramento – July 14

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Overview

- ◆ Introduction
- ◆ Summary of proposed regulation
- ◆ Cost analysis method and inputs
- ◆ Results
- ◆ Next steps



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2

Introduction

- ◆ Purpose of meeting is to discuss cost methodology
 - ◆ Workshops to discuss proposed regulation are scheduled
- ◆ Regulation requires fleet modernization and PM exhaust retrofits
 - ◆ Three main compliance options
 - ◆ Number of special provisions
- ◆ Costs attributable to regulation are cost increases beyond normal vehicle replacements
- ◆ Affects companies differently depending on normal vehicle replacement practices

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3

Summary of Proposed Regulation

Overview of Proposed Regulation

- ◆ Install PM exhaust retrofit controls in 2010-2013
- ◆ Phase-in 2010 model year engine equivalent between 2012 and 2022
- ◆ Any of 3 compliance options for PM or NOx each year
- ◆ Special provisions
 - ◆ Lower usage, NOx exempt regions, specialty vehicle exemptions, etc.

Compliance Option 1: Best Available Control Technology (BACT) Schedule

- ◆ PM BACT
 - ◆ Highest level PM control technology
- ◆ NOx BACT
 - ◆ 2010 model year emissions or cleaner
 - ◆ 2004-2006 model year emissions with $\geq 85\%$ NOx reduction
 - ◆ 2007 model year emissions with $\geq 70\%$ NOx reduction
- ◆ No reporting required

Compliance by December 31:	Existing Engine Model Year	Requirements
2010	Pre-1994	PM BACT
2011	2003-2004	PM BACT
2012	2005-2006 1994-1999	PM BACT NOx and PM BACT
2013	2000-2002	NOx and PM BACT
2014	Pre-1994	NOx and PM BACT
2015	2003-2004	NOx and PM BACT
2016	2005-2006	NOx and PM BACT
2017	NA	NA
2018	NA	NA
2019	NA	NA
2020	2007	NOx and PM BACT
2021	2008	NOx and PM BACT
2022	2009	NOx and PM BACT

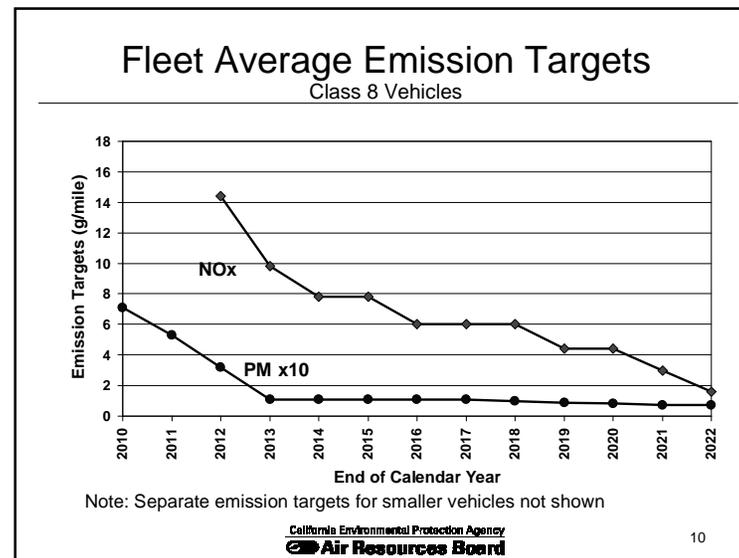
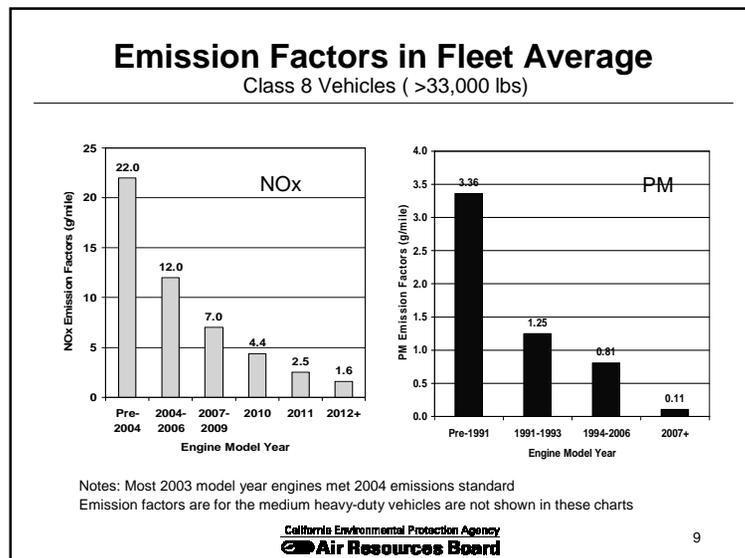
Compliance Option 2: BACT Limits

- ◆ PM BACT
 - ◆ Highest level PM control technology
- ◆ NOx BACT
 - ◆ 2010 model year emissions or cleaner
 - ◆ 2004-2006 model year emissions with $\geq 85\%$ NOx reduction
 - ◆ 2007 model year emissions with $\geq 70\%$ NOx reduction
- ◆ Requires reporting

Compliance by December 31:	PM BACT	NOx BACT
2010	25%	NA
2011	50%	NA
2012	75%	25%
2013	100%	50%
2014	"	60%
2015	"	70%
2016	"	80%
2017	"	80%
2018	"	80%
2019	"	90%
2020	"	90%
2021	"	90%
2022	"	100%

Compliance Option 3: Fleet Average

- ◆ Allows mix of cleaner and dirtier engines
- ◆ NOx and PM targets decline over time
 - ◆ PM begins in 2010
 - ◆ NOx begins in 2012
- ◆ Emissions factors depend on vehicle loaded weight and model year



- ### Summary of Special Provisions
- ◆ Exempt from all clean-up requirements
 - ◆ Backup vehicles used fewer than 1,000 miles and less than 100 hours per year
 - ◆ Delayed turnover requirements
 - ◆ Early PM controls (2013)
 - ◆ Low use over 1000 miles or over 100 hours (2017)
 - ◆ Vehicles outside non-attainment areas (2017)
 - ◆ Delayed PM requirements
 - ◆ Certain specialty farm vehicles (2017)
 - ◆ Small fleet provisions
 - ◆ Other provisions
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- 11

Cost Analysis Method and Inputs

Costs Methodology for the Proposed Statewide Truck/Bus Regulation

Cost Analysis Method Overview

- ◆ Compares increases in capital investments with regulation compared to normal capital expenditures
- ◆ Evaluates individual real fleets from survey
- ◆ Estimates costs each year from 2008-2030
- ◆ Evaluates any of 3 compliance options
 - ◆ BACT
 - ◆ BACT % limits
 - ◆ Fleet average
- ◆ Separate analysis for various compliance provisions
 - ◆ Full requirements
 - ◆ Low usage
 - ◆ Other special provisions
- ◆ Results scaled to reflect overall emissions inventory
- ◆ Add annual costs

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13

Capital Cost Model

- ◆ Access database program
- ◆ Evaluates one company fleet at a time
- ◆ Costs evaluated each year from 2009-2030
- ◆ Determines baseline costs
 - ◆ Estimates normal turnover rates and vehicle replacement age from fleet average age
- ◆ Determines costs with regulation
 - ◆ Uses same turnover rates and vehicle replacement age as in baseline
 - ◆ Accelerates replacement when required
 - ◆ Purchase newer than normal when required
 - ◆ PM retrofits after replacements completed
- ◆ Compare costs in \$2008 equivalent expenditures
 - ◆ Discount rate = 5%

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14

Capital Cost Model

Determining Annual Compliance

```

    graph TD
      A[Determine normal replacement*] -- No --> B[Is BACT met]
      B -- No --> C[Is NOx target met]
      C -- No --> D[Is 2010 MY limit met]
      D -- No --> E[Replace another vehicle]
      E --> C
      C --> F[Is PM target met]
      F -- No --> G[Is PM limit met]
      G -- No --> H[Install PM retrofit]
      H --> C
      F --> I[Move to next year]
      G --> I
      H --> I
      
```

* Select newer purchase if applicable

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15

Capital Cost Model

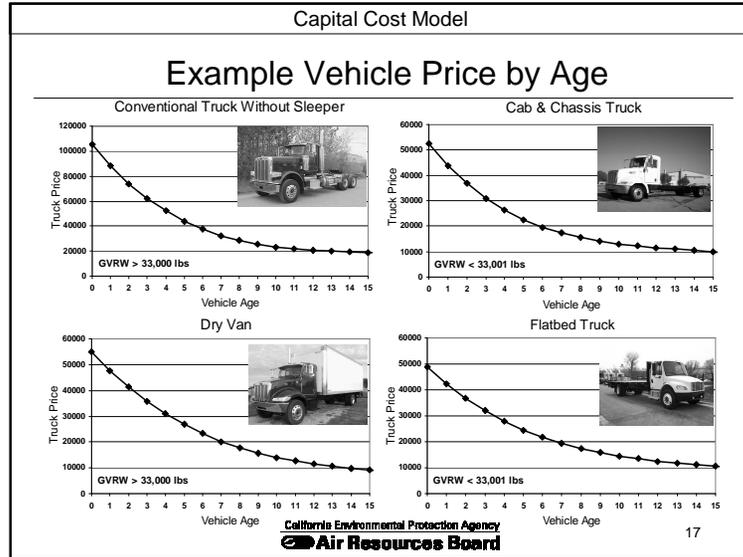
Vehicle Prices

- ◆ Price curves used to determine replacement vehicle price and salvage value
 - ◆ Multiple categories
 - ◆ Axle configuration
- ◆ Data from for-sale prices
 - ◆ Truckpaper.com
 - ◆ Tractorhouse.com
 - ◆ Other sources
- ◆ Compares well with NADA prices for tractors
- ◆ Body transfer to cab and chassis used for certain vehicles
- ◆ Loss in salvage value estimate
 - ◆ \$5,000 for in-state single unit HHD
 - ◆ \$2,000 for in-state MHD
 - ◆ \$1,000 for in-state tractors
 - ◆ \$0 for out of state tractors

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16

Costs Methodology for the Proposed Statewide Truck/Bus Regulation



Capital Cost Model

Other Capital Costs

- ◆ 2010 and newer price premium with SCR
- ◆ 12% Federal excise tax on new vehicles
- ◆ 8% sales tax on purchases

PM Retrofits	Installed Cost
1994 and newer	\$10,000
Pre-1994	\$20,000

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18

Capital Cost Model

Average Replacement Vehicle Ages

- ◆ Computed from survey data collected
- ◆ Scaled to match emissions inventory categories
- ◆ Used in determining cost in baseline and with regulation

Fleet Average Age	Replacement Vehicle Age
0 to 3	0
>3 to 6	0
>7 to 10	1
>11 to 13	2
>14 to 16	5
>17 to 20	8
>20	10

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19

Capital Cost Model

Vehicle Replacement Sequence

- ◆ Certain vehicles more likely to be replaced than others
- ◆ Data from emissions inventory determines half-life by vehicle category
 - ◆ CA-IRP, Instate HHD, Instate MHD, neighboring states...
- ◆ Relative Age = Age of vehicle / (2*Half-Life)
- ◆ Vehicle with highest relative age replaced first

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20

Individual Company Fleets Analyzed

Individual Company Fleets Analyzed

- ◆ Over 688 individual company fleets
- ◆ Over 6,700 vehicle records
- ◆ Survey data as reported by individual companies
 - ◆ Type of Vehicle
 - ◆ Engine and/or Vehicle Model Year (MY)
 - ◆ Gross vehicle weight ratings
 - ◆ Number of axles
 - ◆ Annual mileage (total & CA miles)

Summary of Fleets Analyzed Model

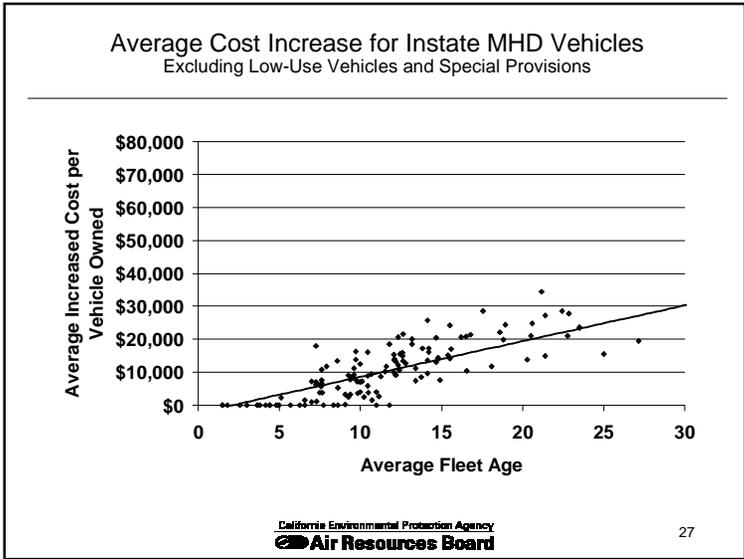
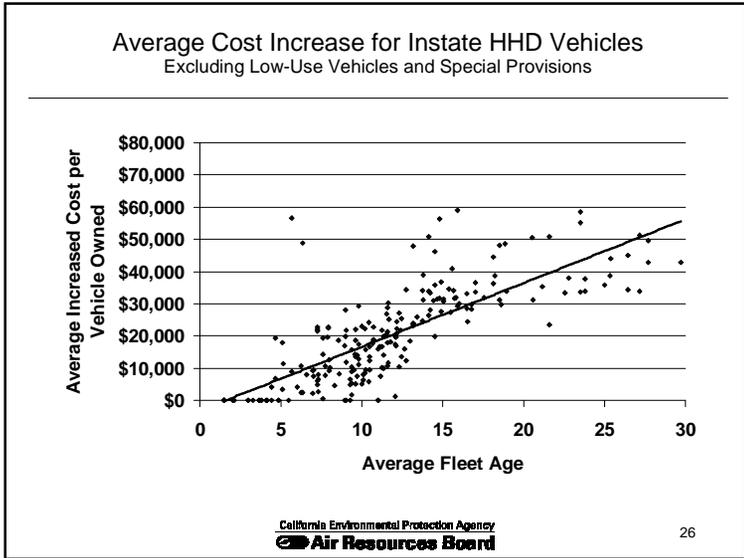
Fleet Age Group	Fleet Size (# of Vehicles)		
	1to3Vehicles	>3 Vehicles	Total
<=3	50	110	160
>3 & <=6	103	1,315	1,418
>6 & <=10	72	2,601	2,673
>10 & <=13	81	918	999
>13 & <=16	190	687	877
>16 & <=20	64	200	264
>20	115	200	315
Totals	675	6,031	6,706

Capital Cost Model

Summary of Body Types Used in Model

BodyType	# Vehicles
Tractor: Conventional HHDDT tandem	2549
Cab & Chassis MHDDT	579
Cab & Chassis HHDDT tandem	502
Other	336
Tractor: Sleeper HHDDT	289
Tractor: Conventional MHDDT	282
Flatbed MHDDT	274
Dump HHDDT	247
Bus - Coach HHDDT	171
Tractor: Cab-Over HHDDT tandem	122
Other	1355
TOTAL	6706

Capital Cost Analysis Results



Scaling to Statewide Costs

Number of Vehicles by Fleet Average Age

Fleet Age	Percent of Vehicles by Fleet Average Age			
	Instate* HHD	CA-IRP* HHD	Instate* MHD	Far States** HHD
0 to 3 Years	8.9%	16.8%	19.9%	81.8%
>3 to 6 Years	13.5%	35.2%	20.1%	7.9%
>6 to 10 Years	27.7%	36.4%	27.4%	9.7%
>10 to 13 Years	19.6%	7.6%	12.4%	0.5%
>13 to 16 Years	13.1%	1.7%	9.1%	0.1%
>16 to 20 Years	9.8%	1.2%	6.5%	0.0%
>20 Years	7.4%	1.0%	4.6%	0.0%

Sources: *DMV 2006
**IRP 2006

Example of Scaling Costs

Instate Heavy Heavy-Duty Vehicles (Excluding vehicles qualifying for special provisions)				
Fleet Average Age	% of Vehicles by Fleet Age	# Vehicles	\$/Vehicle (Per Model Output)	Total Costs \$2008
<=3	12.3%	7,038	\$ 1,395	\$ 9,820,793
>3 & <=6	17.0%	9,673	\$ 7,688	\$ 74,368,382
>6 & <=10	29.0%	16,544	\$ 13,981	\$ 231,302,715
>10 & <=13	18.8%	10,688	\$ 20,274	\$ 216,685,634
>13 & <=16	13.1%	7,470	\$ 25,668	\$ 191,734,179
>16 & <=20	6.4%	3,661	\$ 31,961	\$ 117,024,855
>20	2.9%	1,673	\$ 53,537	\$ 89,545,011
Unknown	0.4%	254	\$ 16,324	\$ 4,151,247
	100.0%	57,000		\$ 934,632,817

Total Capital Costs by Category

Fleet/Population Type	Total \$	# Vehicles
Instate MHD Fleets - Small	\$ 574,189,000	80,404
Instate MHD Fleets - >3 Vehicles	\$ 586,011,000	91,865
Instate MHD - Low Mileage	\$ 206,449,000	35,019
Instate HHD Fleets - Small	\$ 729,550,000	35,920
Instate HHD Fleets - >3 Vehicles	\$ 901,211,000	56,943
HHD - Low Mileage*	\$ 350,530,000	30,356
HHD Buses	\$ 283,379,000	8,183
MHD Buses	\$ 29,844,000	3,135
CA-IRP - Small	\$ 280,728,000	24,834
CA-IRP - >3 Vehicles	\$ 309,411,000	32,509
Neighboring States - Small	\$ 117,896,000	10,429
Neighboring States - >3 Vehicles	\$ 314,425,000	29,233
Non-Neighboring	\$ 469,772,000	224,760
Non-Neighboring - <1000 Miles	\$ -	224,760
Port Trucks (2017-2023)	\$ 59,588,000	21,650
School Buses (excluding Prop. 1B)	\$ 200,000,000	18,000
Two Engine Cranes	To be determined	
Utility Fleets (2017-2023)	To be determined	4,150
Proposition 1B Funds Savings	\$ (300,000,000)	
Grand Total	\$ 5,112,983,000	932,149

*Includes CA-IRP, Neighboring States, Instate HHD

School Buses

- ◆ Significant portion of fleet in compliance
- ◆ Majority of school buses can be retrofit
 - ◆ Active and passive DPFs are prevalent in fleet
- ◆ Replacement of some buses will be required
 - ◆ Pre-1987 model year school buses
 - ◆ Model year 1987 to 1993 two-strokes
- ◆ School bus population collected from several sources
 - ◆ 2005 CHP database
 - ◆ EMFAC 2007
 - ◆ ARB data
- ◆ Cost savings from proposition 1B

Additional Capital Cost Analyses to be Performed

- ◆ Cost savings from proposition 1B
 - ◆ Vehicle replacements
 - ◆ PM retrofits
- ◆ Utility fleets
- ◆ Two engine cranes
 - ◆ Off-road capital costs model

Annual Costs

Summary of Annual Costs to be Included

- ◆ Aftermarket PM retrofits
 - ◆ Fuel economy loss (2%)
 - ◆ Annual cleanings (\$250)
- ◆ 2007 model year and newer PM exhaust controls
 - ◆ Annual cleanings (\$250)
- ◆ Fuel economy changes from newer vehicles
- ◆ Urea costs with selective catalytic reduction
- ◆ Reporting costs

Total Statewide Costs

- ◆ Current cost estimate up to \$5.4 billion (\$2008)
 - ◆ Capital costs range to \$4.2 to \$5.1 billion
 - ◆ Sum of annual costs about \$300 million
- ◆ Fleets likely to use strategies to lower compliance costs
 - ◆ Use credit for early action
 - ◆ Optimize vehicle replacement strategies
 - ◆ Route cleaner vehicles to California
 - ◆ Locate cleaner local use vehicles in California

Cost Estimates not Optimized to be Lower

- ◆ Did not assume the use of the cleanest 2010 model year engine in fleet average
- ◆ Did not model that fleets would replace low cost vehicles first
- ◆ Did not model that fleets would purchase older than normal vehicles
 - ◆ Fleets that would normally purchase new vehicles would not begin buying older replacement vehicles
- ◆ No cost savings estimated for lower repair costs and improved reliability with newer vehicles

Cumulative Costs with Other Regulations

- ◆ Examine the cumulative impact of the truck & bus regulation in conjunction with other ARB regulations
 - ◆ In-use off-road vehicles
 - ◆ Transportation refrigeration units (TRU)
 - ◆ Portable diesel-fueled engines
 - ◆ Greenhouse gas emissions
 - ◆ Public & utility fleets
- ◆ Evaluated handful of fleets
- ◆ Waiting to analyze data from industry groups

Next Steps

- ◆ Additional workshop on proposed regulation in July/August 2008
- ◆ Additional meetings with stakeholders
- ◆ Board consideration October 2008



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Verified Devices - www.arb.ca.gov/diesel/verdev/verdev.htm