Cleaning Up Non-Road Diesel Vehicles: A Public Health Imperative

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Cleaning up Non-Road Diesel Engines

- Public health threats
  - Over 8,500 lives saved per year if nonroad standards harmonized with highway
- Over 5.5 million non-road engines, many 10 to 20 years old
  - 10% in CA
- High emissions of NOx and PM
  - 20% of NOx from mobile sources
  - 1/3rd of PM from mobile sources

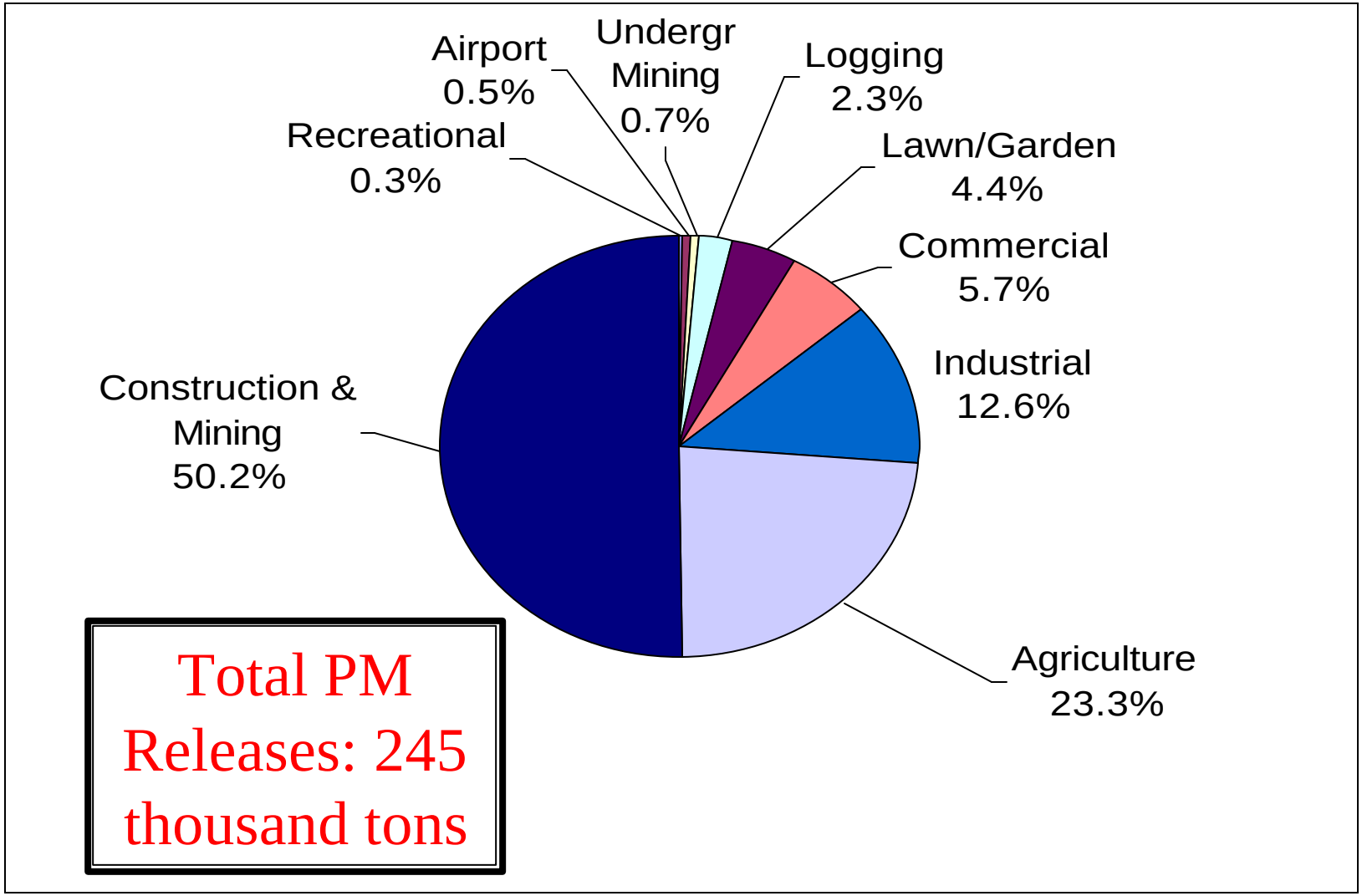
STAPPA/ALAPCO Study:
Benefits of Regulating Non-Road Diesel

- Premature mortality: 8,522
- Chronic bronchitis: 5,467
- Hospital admissions: 4,928
- Asthma attacks: 180,598
- Work loss, days: 1,580,512
- Respiratory symptoms, children: 396,618
- Monetary: $67.5 billion

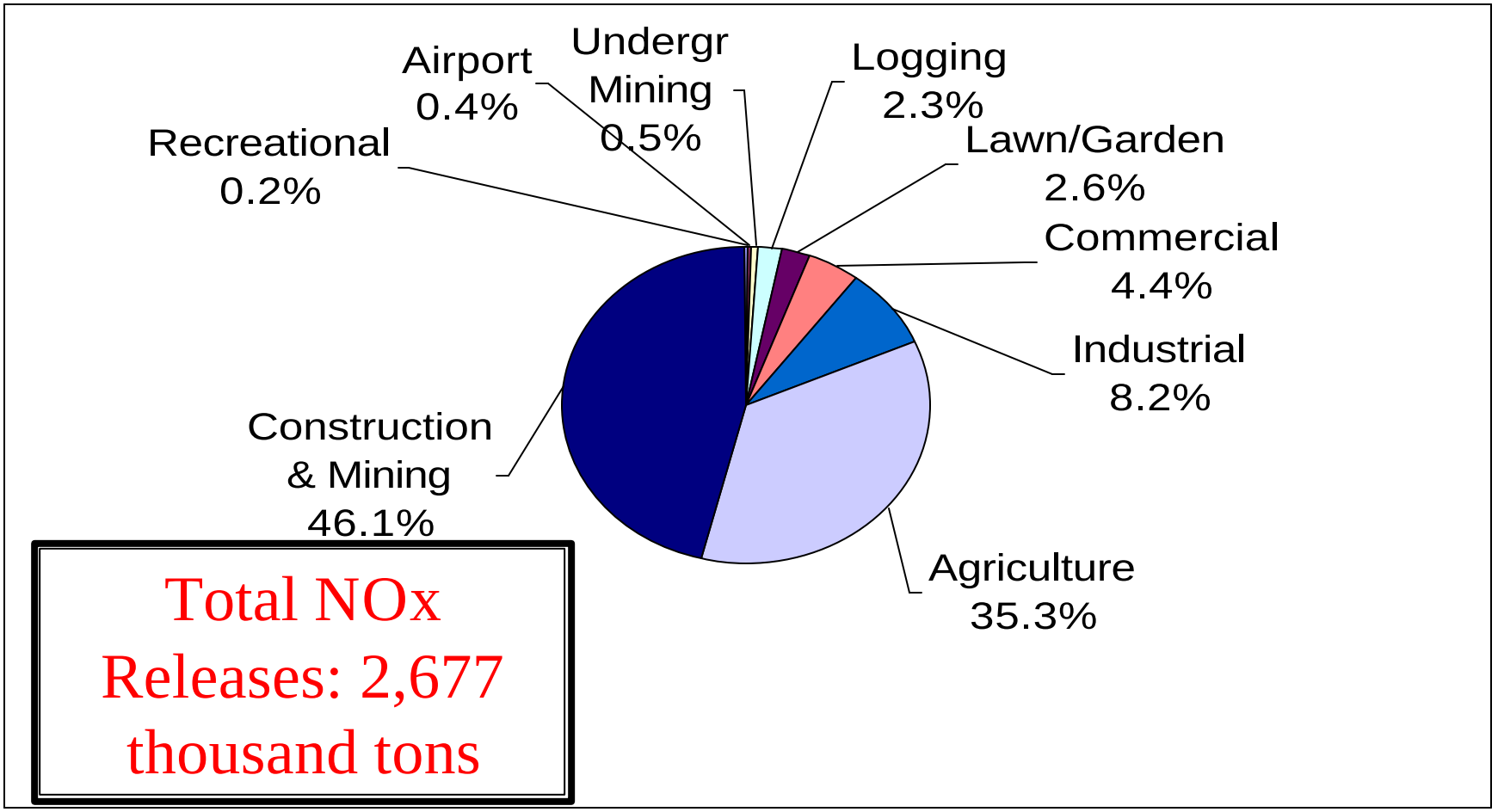
Non-Road Diesel Population U.S. and California

Category	U.S. 2000	CA 2002	% in CA
Agricultural	1,946,374	197,908	10%
Airport Ground Support	13,209	2,074	16%
Commercial	903,334	55,092	6%
Construction	1,654,866	173,270	10%
Industrial	456,997	12,437	3%
Lawn & Garden	606,473	45,552	8%
Logging	20,888	2,785	13%
Grand Total	**5,602,141**	**534,826**	**10%**

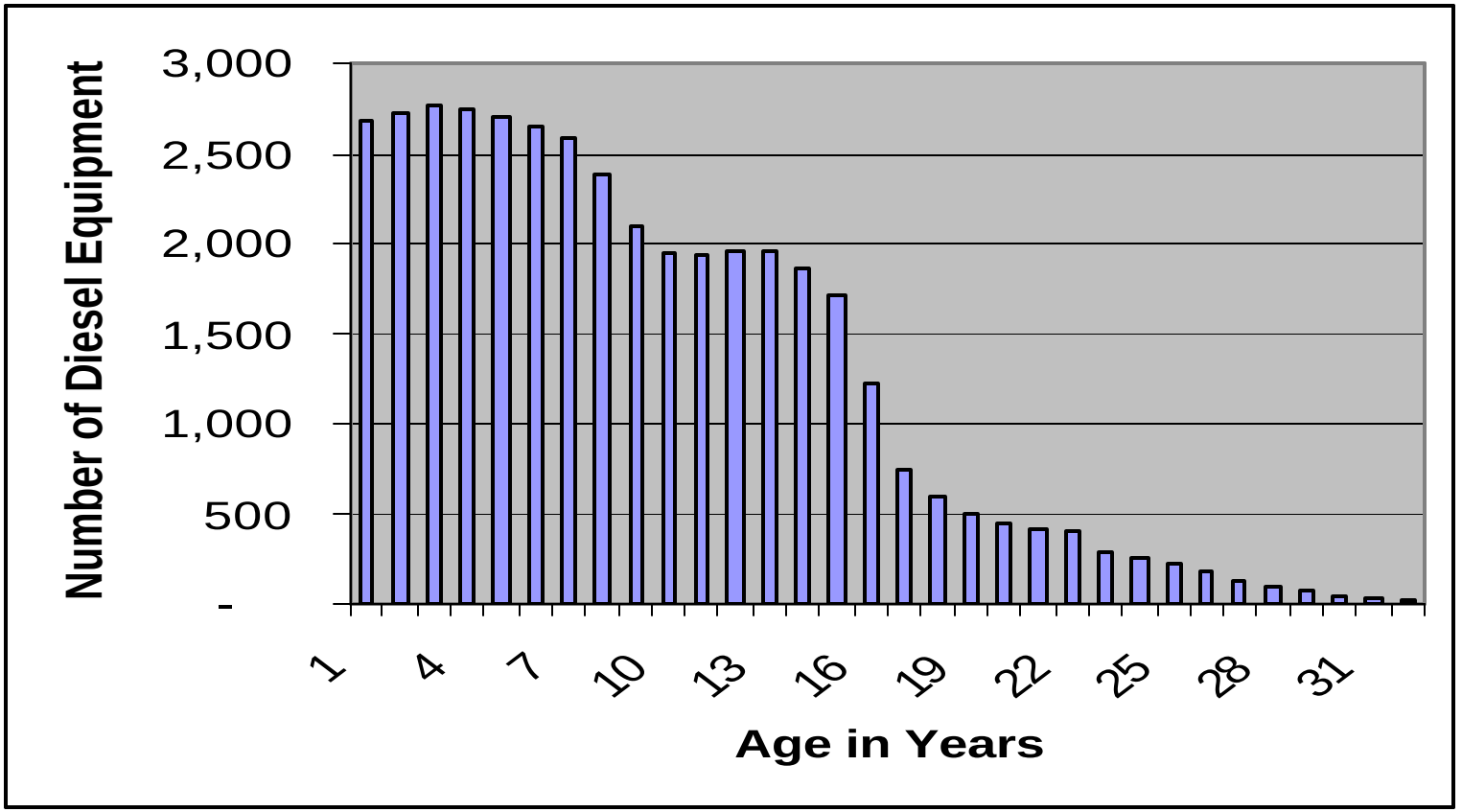
PM from Non-Road Diesel



NOx from Non-Road Diesel



Age Distribution of CA's Non-Road Equipment



Non-Road Challenges

- Large population of engines, many smaller hp
- Older engines
  - Retrofits critical
- Wide variety of engine types
  - eg, bulldozers, excavators, portable generators, tractors, combines, irrigation pumps, airport
- Variable cycles
- Variable environmental conditions

Conclusions

- Health impacts of non-road diesel emissions argue for harmonization of emissions standards w/highway
- ECT for nonroad face significant technical challenges
- Retrofitting of existing fleet w/ECT critical
- Non-road is the next hurdle facing ECT manufacturers, w/big public health payoff

Light Duty Diesel Vehicles:
Why the European Model Doesn't Work in the U.S.

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Light Duty Diesel Vehicles

- Fuel economy vs. health tradeoff
  - The European approach
  - Light duty diesel in the US
- Tailpipe standards
- Challenges facing ECT for LDD
  - Technical, economic, infrastructure, pollution
- Can LDD compete with advanced technology gasoline, like hybrid electrics?

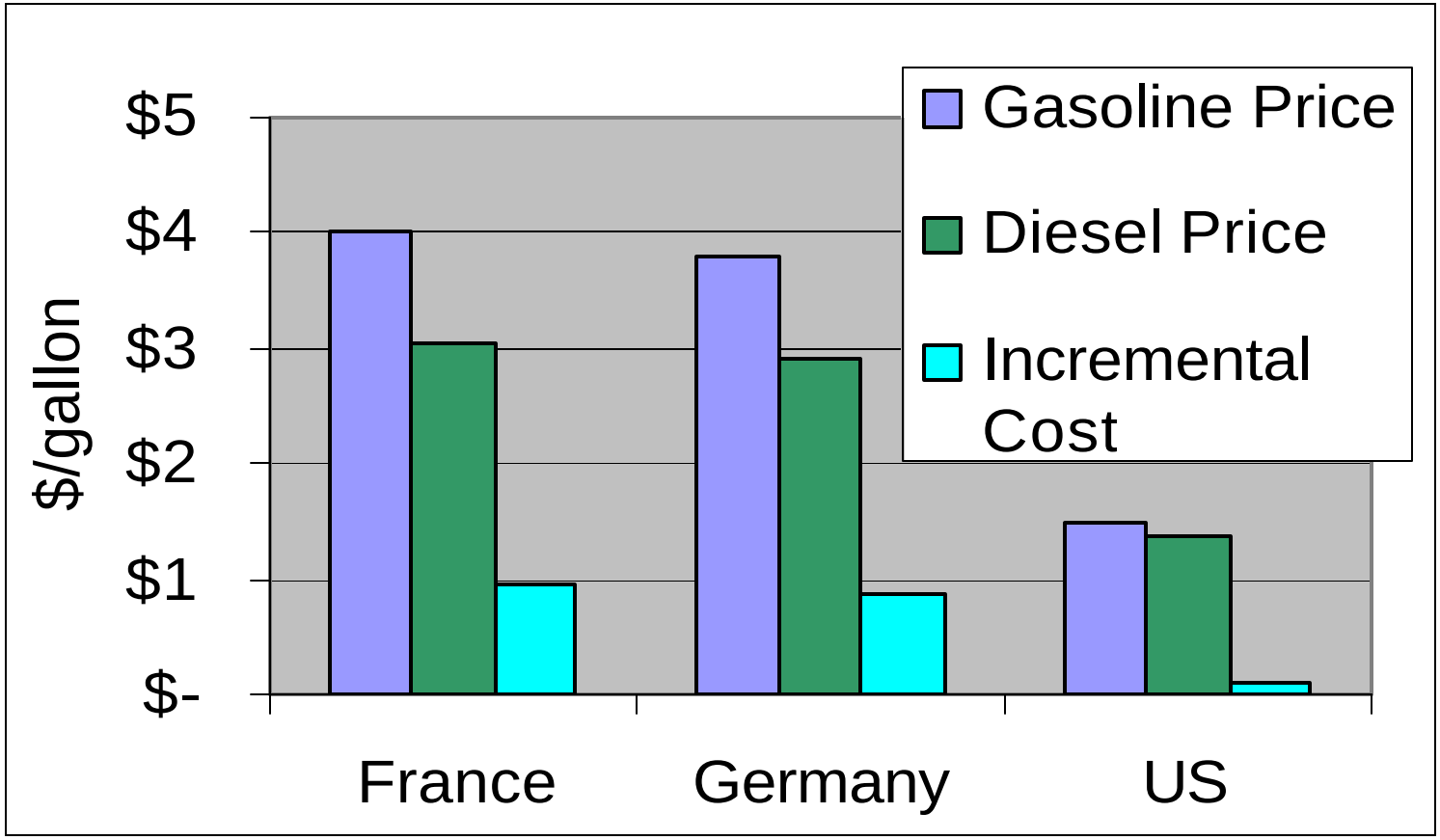
Comparing VW Diesel & Gasoline Cars

Maximum Emission Levels (grams per mile)		
	Gasoline	**Diesel**
Vehicle Emission Class	Ultra Low Emission Vehicle (ULEV)	Small Truck Diesel
NMOG	0.055	0.32
NOx	0.3	1.25
PM	0.04	0.1
CO2 Emissions (g/m)	440	327
MGP, gasoline gal equiv	23 city/29 hwy	31 city/40 hwy

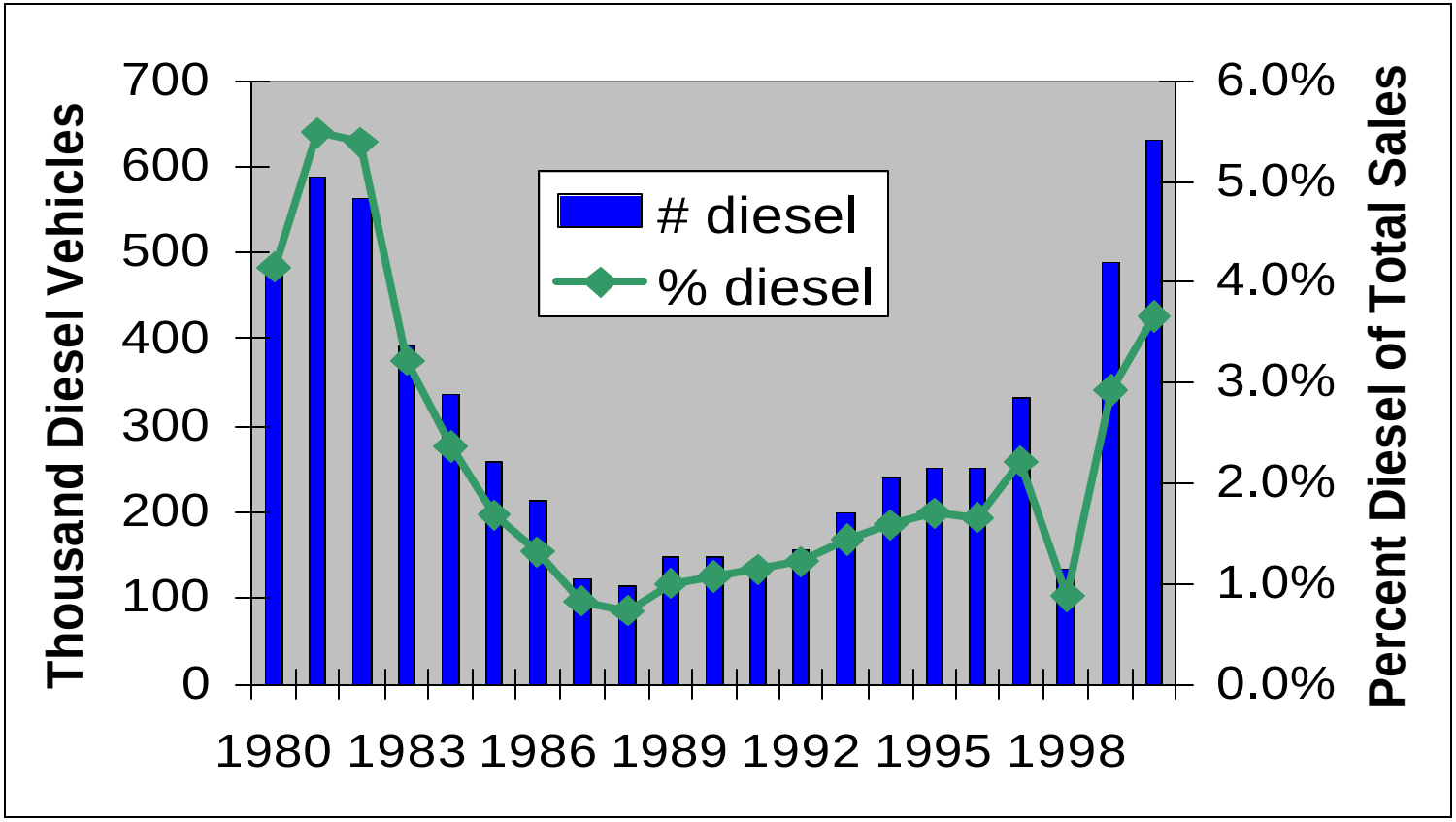
Comparing U.S. and Europe's Diesel Vehicles and Fuel

	U.S.	Europe
Light Vehicle Market Share	Less than 4%	33%
Cost of gasoline/gallon	$1.50	$3-$4
Cost of diesel/gallon	$1.45	$2-$3
Maximum Allowable NOx for Diesel Vehicles	0.97 to 1.53 g/m today 0.2 in 2009	0.8 to 1.04 g/m today 0.4 to 0.5 g/m in 2006
Maximum Allowable PM for Diesel Vehicles	0.1 g/m today .02 g/m in 2009	0.08 to 0.11 g/m today 0.04 to 0.06 g/m in 2006
Diesel sulfur content (parts per million)	500 today 15 in 2007	350 today 50 in 2005

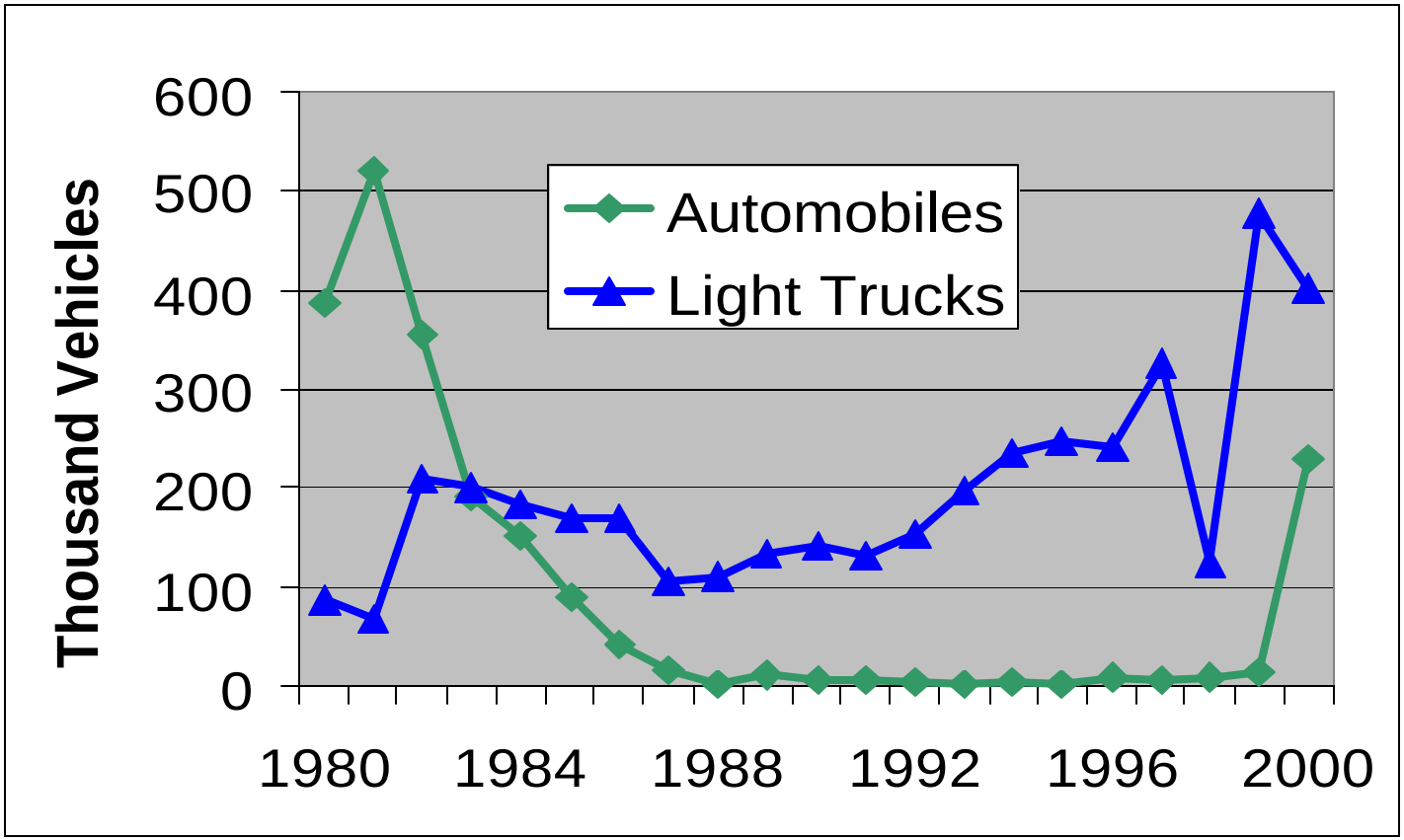
Comparing Gasoline and Diesel Prices in Selected Countries



Diesel Light Duty Vehicle Sales, 1980 - 2000



Diesel Automobile & Light Truck Sales, 1980 - 2000



Medium Duty Passenger Vehicles and Diesel

- 38% of MDPV pickups are diesel
- 11% of MDPV Vans/SUVs are diesel
- 33.1% of all MDPVs are diesel

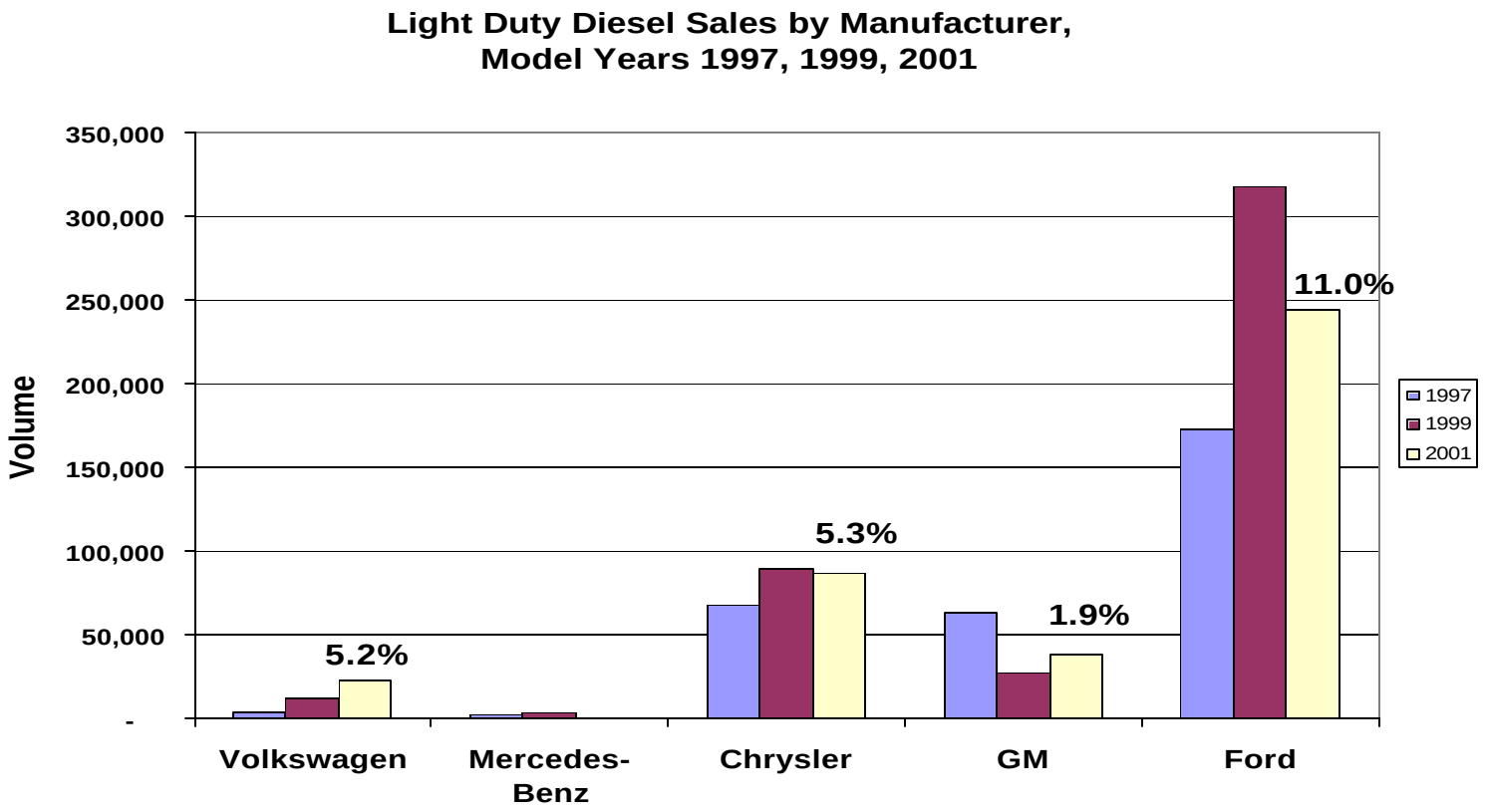
Source: J. Kliesch, American Council for an Energy Efficient Economy

Today's Domestic Diesel Passenger Vehicles

- Passenger Cars
  - VW Golf TDi
  - VW Jetta TDi
  - VW Jetta Wagon TDi
  - VW New Beetle TDi
- (Sort of) Light Trucks
  - Ford Excursion
  - Ford F-250/350 Super Duty
  - Chevrolet Silverado 2500/3500 Heavy Duty
  - GMC Sierra 2500/3500 Heavy Duty
  - Dodge Ram 2500/3500

Source: J. Kliesch, American Council for an Energy Efficient Economy

Diesel Sales by Manufacturer



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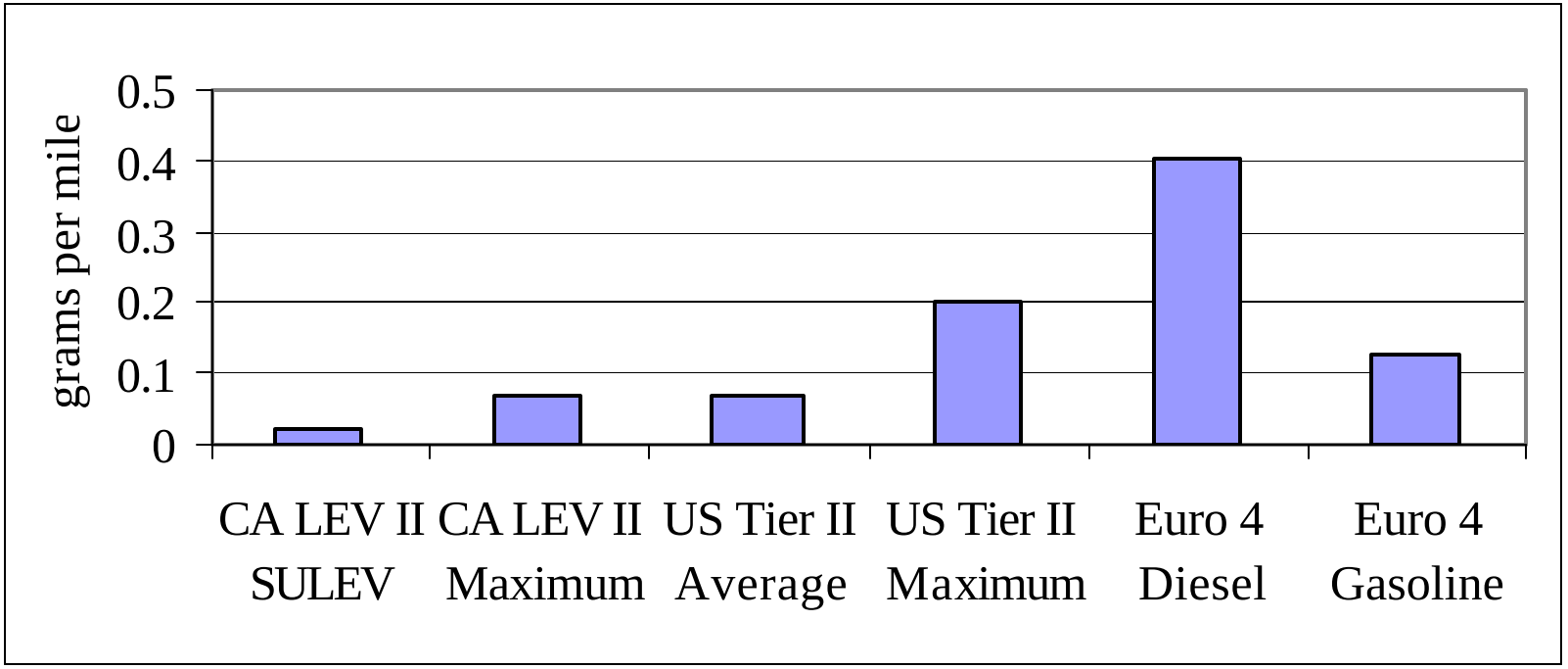
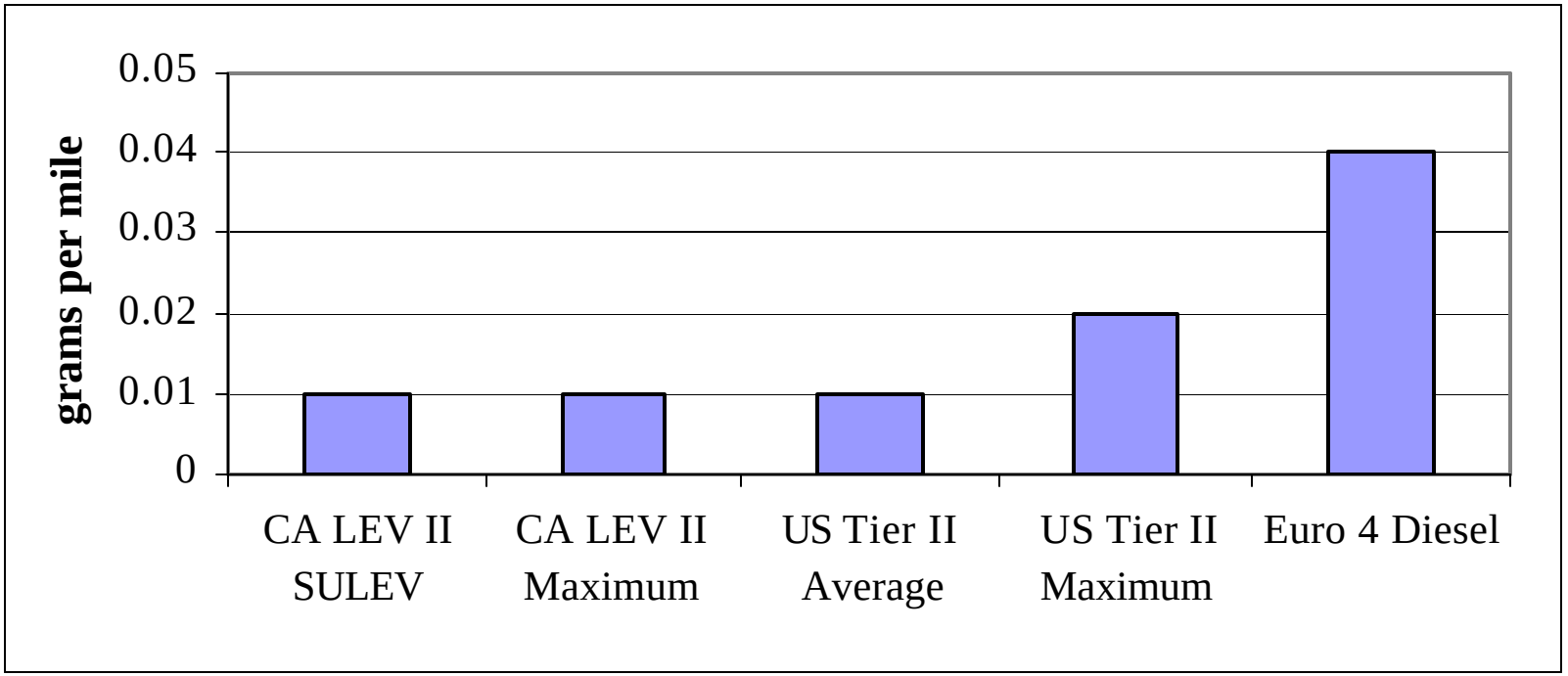
Europe vs. US Standards for Passenger Cars: NOx



Europe vs. US Standards for Passenger Cars: PM



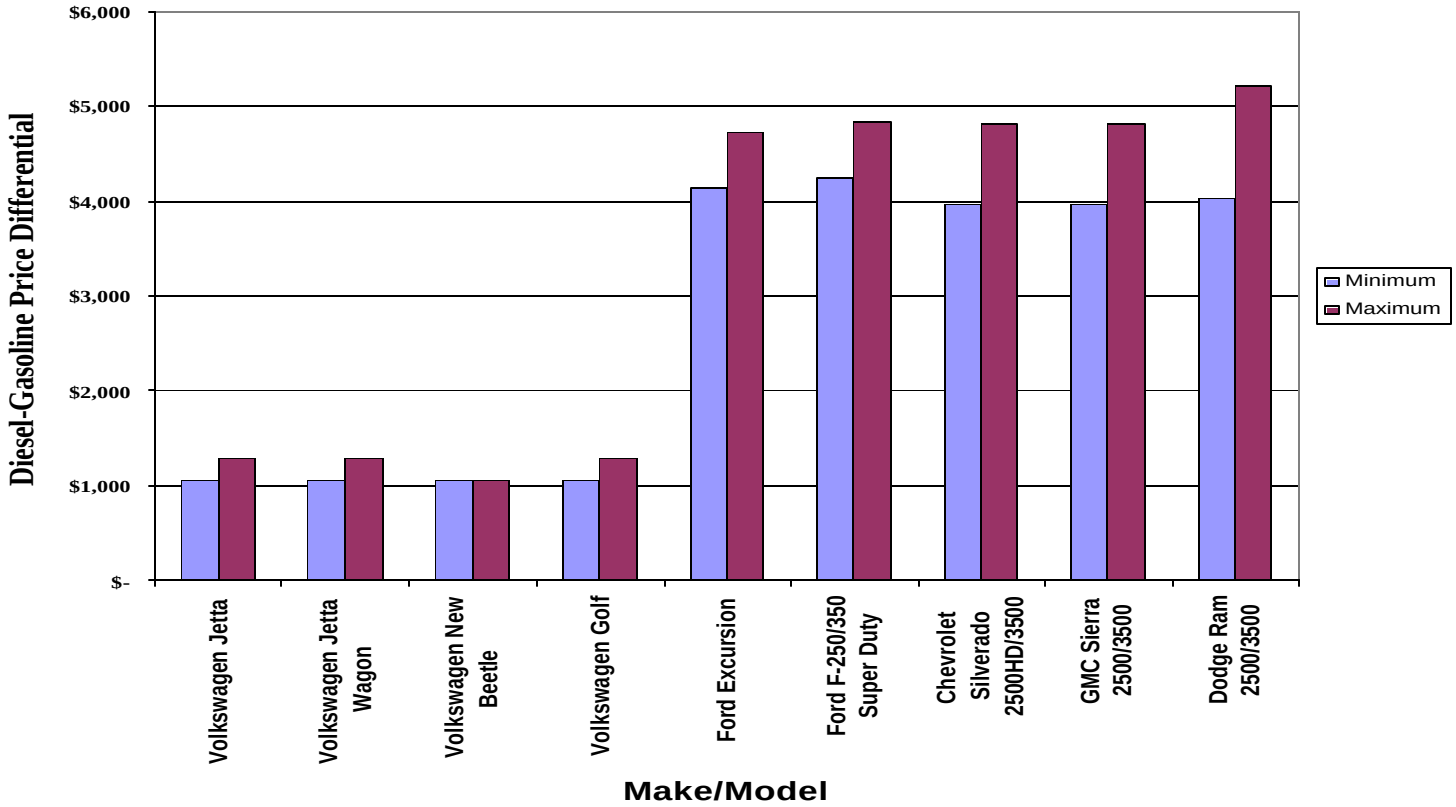
Maximum NOx Emissions Under Tier 1 & 2

Year Range	Federal Standard	Fuel	Passenger Cars and Truck-1	Truck-2	Truck-3	Truck-4	Medium-duty passenger vehicles
2002-03	Tier 1	diesel	1.25	0.97	0.98	1.53	?
		gasoline	0.6	0.97	0.98	1.53	?
2004-06	Tier 2	gas or dsl	0.6	0.6	0.6	0.6	0.9
2007	Tier 2	gas or dsl	0.2	0.2	0.6	0.6	0.9
2008	Tier 2	gas or dsl	0.2	0.2	0.6	0.6	0.9
2009+	Tier 2	gas or dsl	0.2	0.2	0.2	0.2	0.2

Maximum PM Emissions Under Tier 1 & 2

Year Range	Federal Standard	Fuel	Passenger Cars and Truck-1	Truck-2	Truck-3	Truck-4	Medium-duty passenger vehicles
2002-03	Tier 1	diesel	0.1	0.1	0.1	0.12	?
		gasoline	0.1	0.1	0.1	0.12	?
2004-06	Tier 2	gas or dsl	0.08	0.1	0.1	0.12	?
2007	Tier 2	gas or dsl	0.02	0.02	0.1	0.12	?
2008	Tier 2	gas or dsl	0.02	0.02	0.08	0.08	0.12
2009+	Tier 2	gas or dsl	0.02	0.02	0.02	0.02	0.02

Diesel Incremental Costs



Source: J. Kliesch, American Council for an Energy Efficient Economy

Diesel clean up technologies show promise, but doubts remain

- Technical challenges:
  - NOx reduction
  - PM traps: NO2 generation
- Cost of new technologies
  - Can diesel compete with hybrid-electric gasoline vehicles?
- Infrastructure requirements
- Pollution challenges

Current and New Health Concerns

- Near term (through 2008): Criteria pollutants (NOx, PM, SOx)
- Longer term: Nanoparticles from advanced technologies like EGR, high fuel injection pressure
- Longer term: NH3 slip from SCR
- Longer term: N2O from NOx slip cats at 250-300C

Diesel Engines and Global Warming

- Diesel releases about 25% less CO2 per mile traveled (based on VW Jetta)
- New studies (Jacobson) indicate carbon is a potent greenhouse gas
  - Estimates carbon responsible for 15 to 30% of global warming, second only to CO2
  - Concludes that diesel vehicles warm climate more than gasoline

Conclusions

- Future of domestic diesel far from certain
  - Technical, economic, infrastructure, and pollution challenges remain
- To assure diesel does not compromise public health, it is critical to:
  - Maintain Tier 2/LEV II standards
  - Reduce diesel sulfur content
  - Address emerging emissions concerns

Thank You

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