Tier 3 Vehicle Emission and Fuel Standards

Presentation to the
Wasatch Front Regional Council Air Quality Committee
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DAQ Mobile Source and Transportation Section

Brief SIP Update

- UAQB approved the $PM_{2.5}$ SIP in December 2013-January 2014
- EPA threw us a curve ball:
  - Have to submit the SIP again by the end of 2014 (due to the UAQB in September) for all three non-attainment areas
    - "Moderate" under sub-part 4
    - Modeling year 2015
    - Essentially a "tune-up" of the SIP we submitted in January
    - Unlikely to include new controls
    - Unlikely to demonstrate attainment
    - EPA will then designate us as "serious"
  - Will then complete yet another SIP in 2017 with an attainment year of 2019
    - Would then potentially have an additional five year compliance window out to 2024

Tier 3 Vehicle Emission and Fuel Standards

- Tier 3 includes vehicle and fuel standards as an integrated system
  - 80% reduction in combined VOC and NO_x emissions on a fleet average basis
  - 70% reduction in direct particulate emissions on a per vehicle basis
  - Low-sulfur gasoline required to enable advanced emission reduction technologies in Tier 3 vehicles
    - 10 ppm nationwide average
    - 80 ppm refinery gate cap (proposed 50-80)
    - 95 ppm downstream per gallon cap (proposed 65-95)
  - Additional and immediate benefit from using low-sulfur fuel in existing (pre-Tier 3) vehicles
- Begins in 2017 and phased in through 2025
  - Benefits extend beyond 2025 as Tier 3 vehicles continue to replace older vehicles in the fleet

Tier 3 Vehicle Emission and Fuel Standards (continued)

- Improved emissions for medium- and some heavy-duty vehicles as well
- Improved evaporative emissions
- Useful life of the vehicle extended from 120,000 miles to 150,000 miles
  - Improved durability of vehicle emissions controls
- Includes measures to mitigate the economic impacts of the low-sulfur gasoline component of Tier 3 on refiners
  - Averaging, banking, and trading (ABT) program
  - Hardship provisions
  - Flexibility for small volume (i.e., 75,000 barrels/day or less) refiners such as those that operate in Utah.

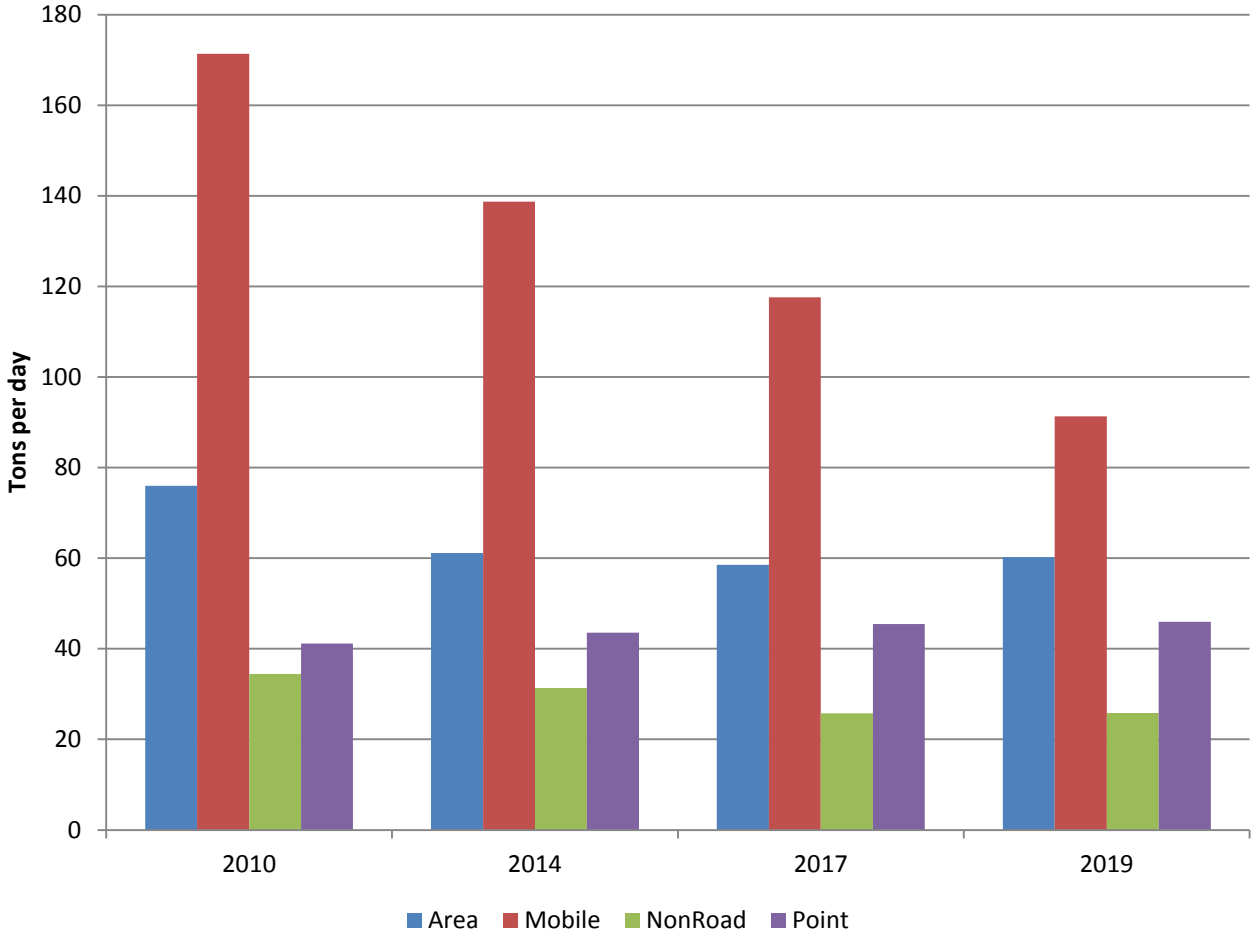
Vehicle Emissions Standards

- Tier 1
  - Adopted June 5, 1991
  - Phased-in from 1994-1997
- Tier 2
  - Adopted December 21, 1999
  - Phased-in from 2004-2009
- Tier 3
  - Proposed March 29, 2013
  - Comment period closed July 1, 2013
  - Final rule announced March 3, 2014
  - Phased-in from 2017-2025

2010 vs. 2019 Mobile Source Emissions (pre-Tier 3)

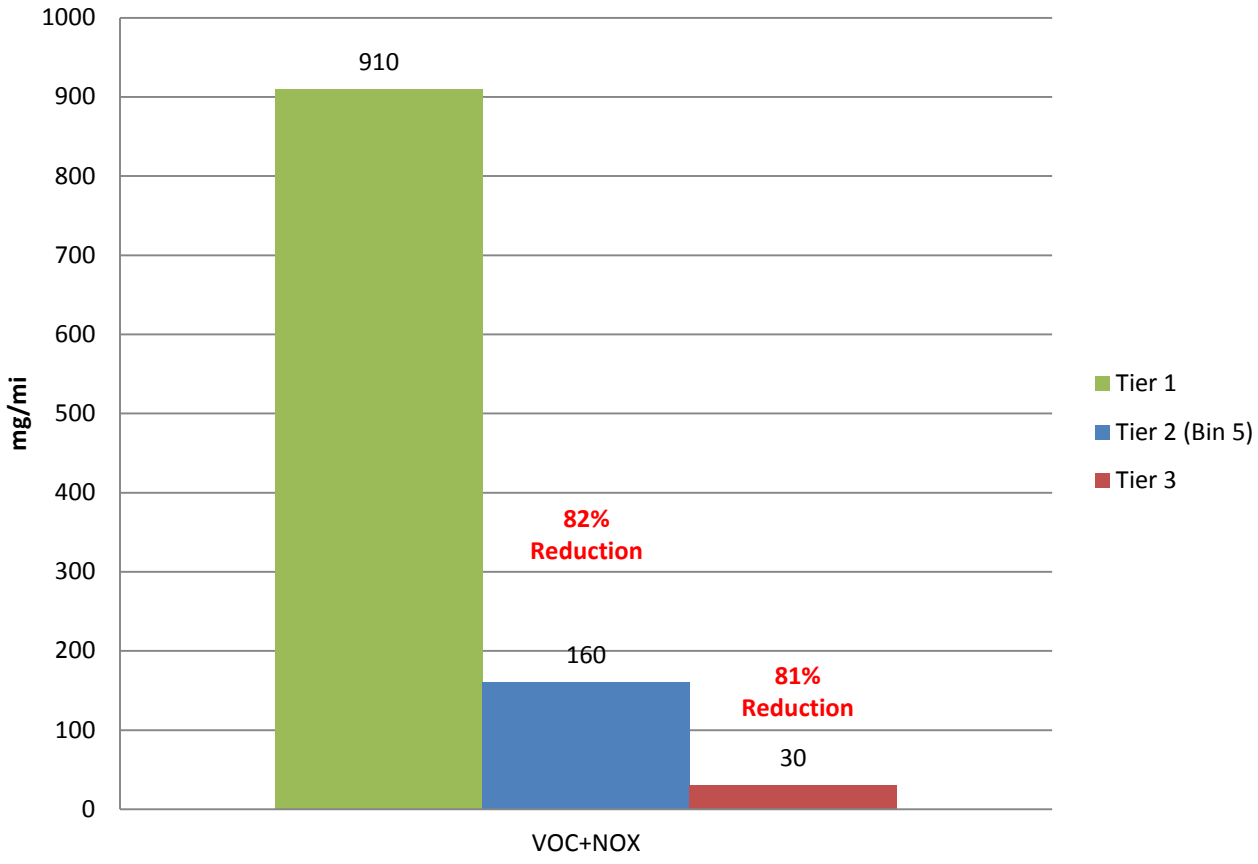
Salt Lake Non-attainment Area Data

2008-2019 Emissions by Source (pre-Tier 3)



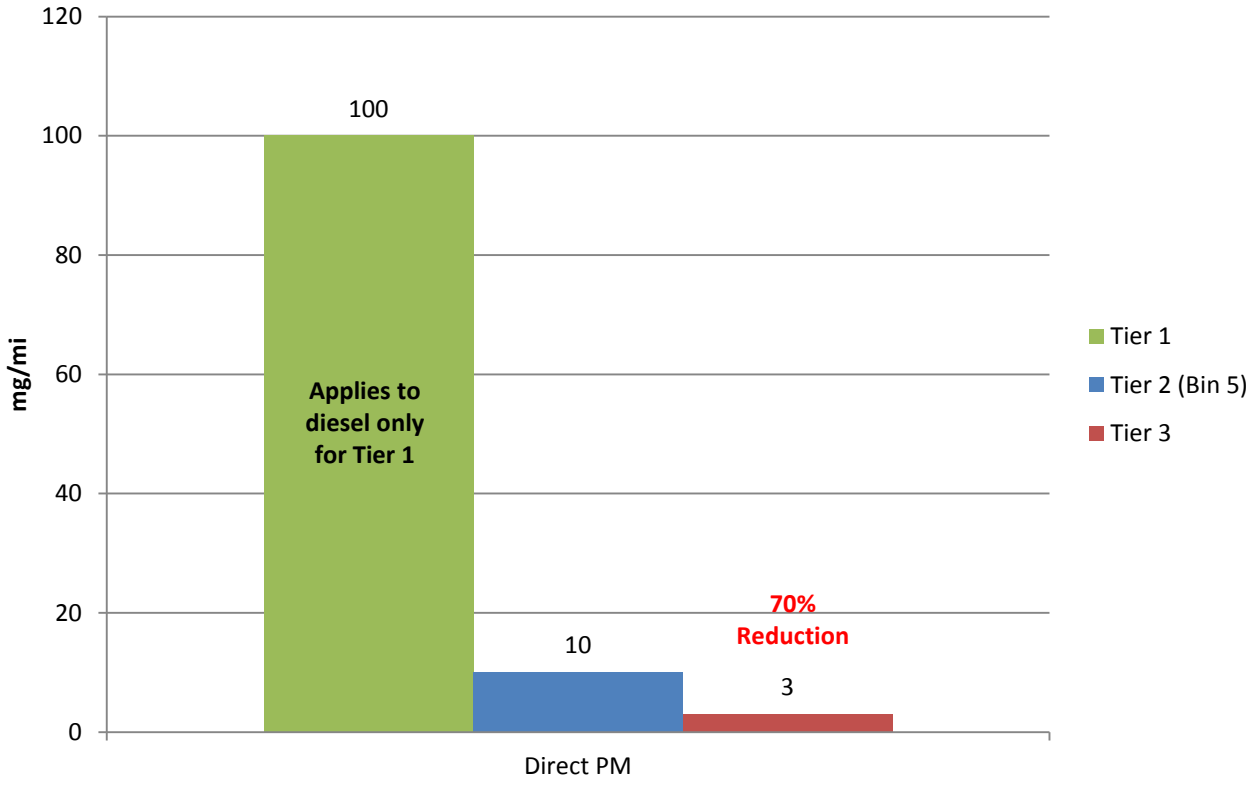
Salt Lake Non-attainment Area Data

Tier 1, Tier 2, and Tier 3*



*30 mg/mi is equivalent to Tier 2 Bin 2 (or approximately the same as a CNG Honda Civic)

Tier 1, Tier 2, and Tier 3



Current $PM_{2.5}$ SIP

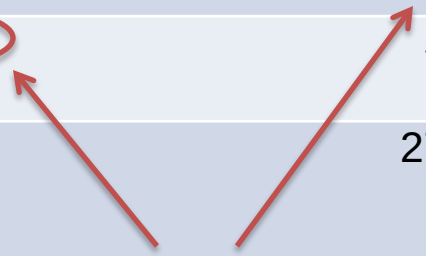
- 2019 is the last year in the compliance window for the recent $PM_{2.5}$ SIP
- SIP was completed before Tier 3 was finalized so Tier 3 reductions were not included
- Projected 2018 Tier 3 emissions reductions (assumes 10 ppm fuel sulfur standard is met):
  - 9.6% reduction in NO_x
  - 2.8% reduction in VOCs

Pre-Tier 3 vs. Tier 3 Emissions Reductions (Final Rule)

	2018	2030
NO_x Reductions	9.6%	24.7%
Reduction from pre-Tier 3 fleet due to sulfur standard	91.7%	17.1%
Reduction from Tier 3 fleet due to vehicle and sulfur standards	8.3%	82.9%
VOC Reductions	2.8%	15.5%
Reduction from pre-Tier 3 fleet due to sulfur standard	81.6%	6.7%
Reduction from Tier 3 fleet due to vehicle and sulfur standards	18.4%	93.3%

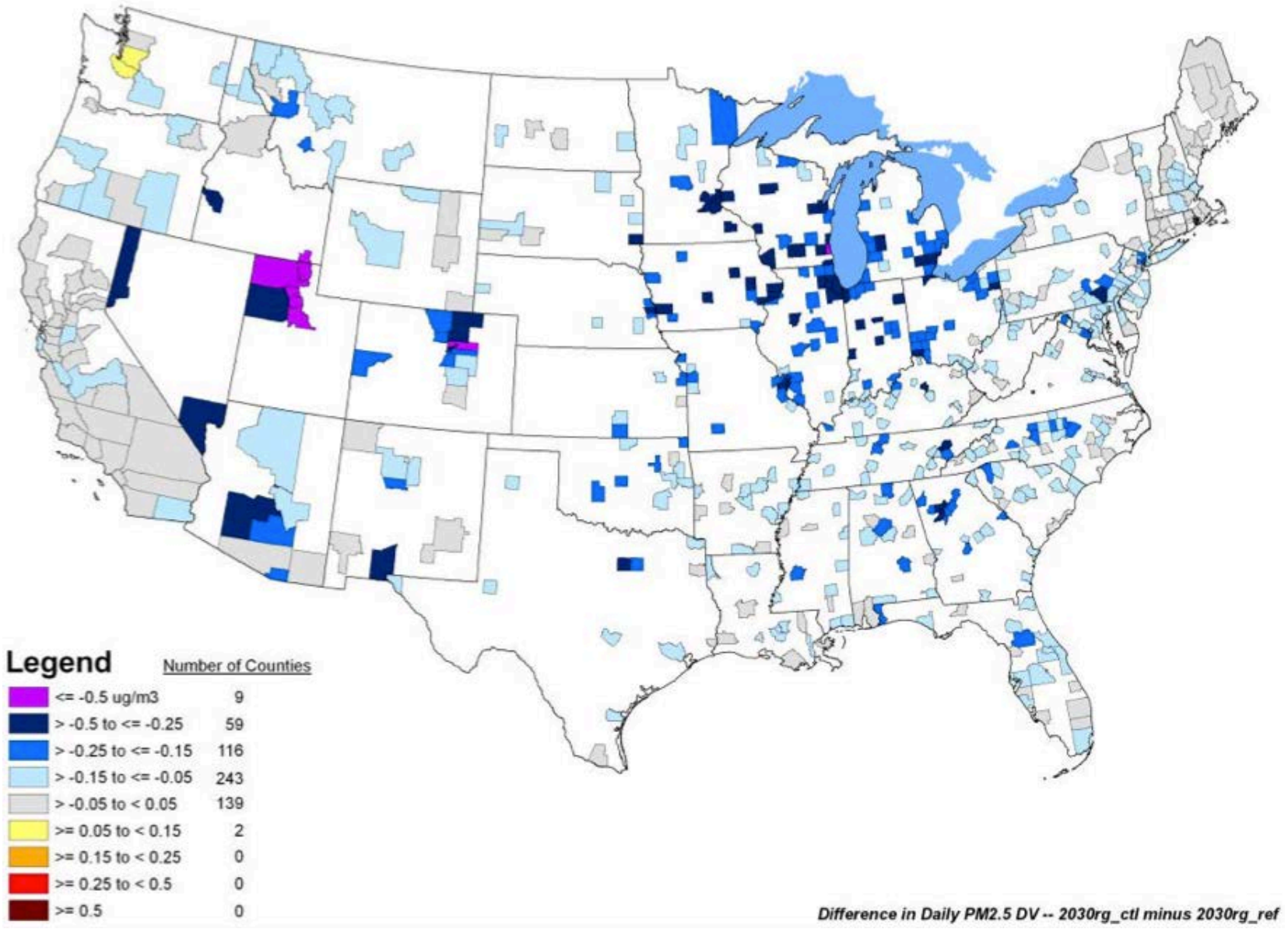
Pre-Tier 3 vs. Tier 3 Emissions Reductions (Final Rule)

	2018 (annual tons)	2030 (annual tons)
Total NOX reduction	264,369	328,509
Reduction from pre-Tier 3 fleet due to sulfur standard	242,434	56,324
Reduction from Tier 3 fleet due to vehicle and sulfur standards	21,934	272,185



2018 emissions reduction from using Tier 3 fuel in pre-Tier 3 fleet is 73.8% as large as the total projected reduction in 2030

Projected Change in 2030 24-hour



Tier 3: Costs

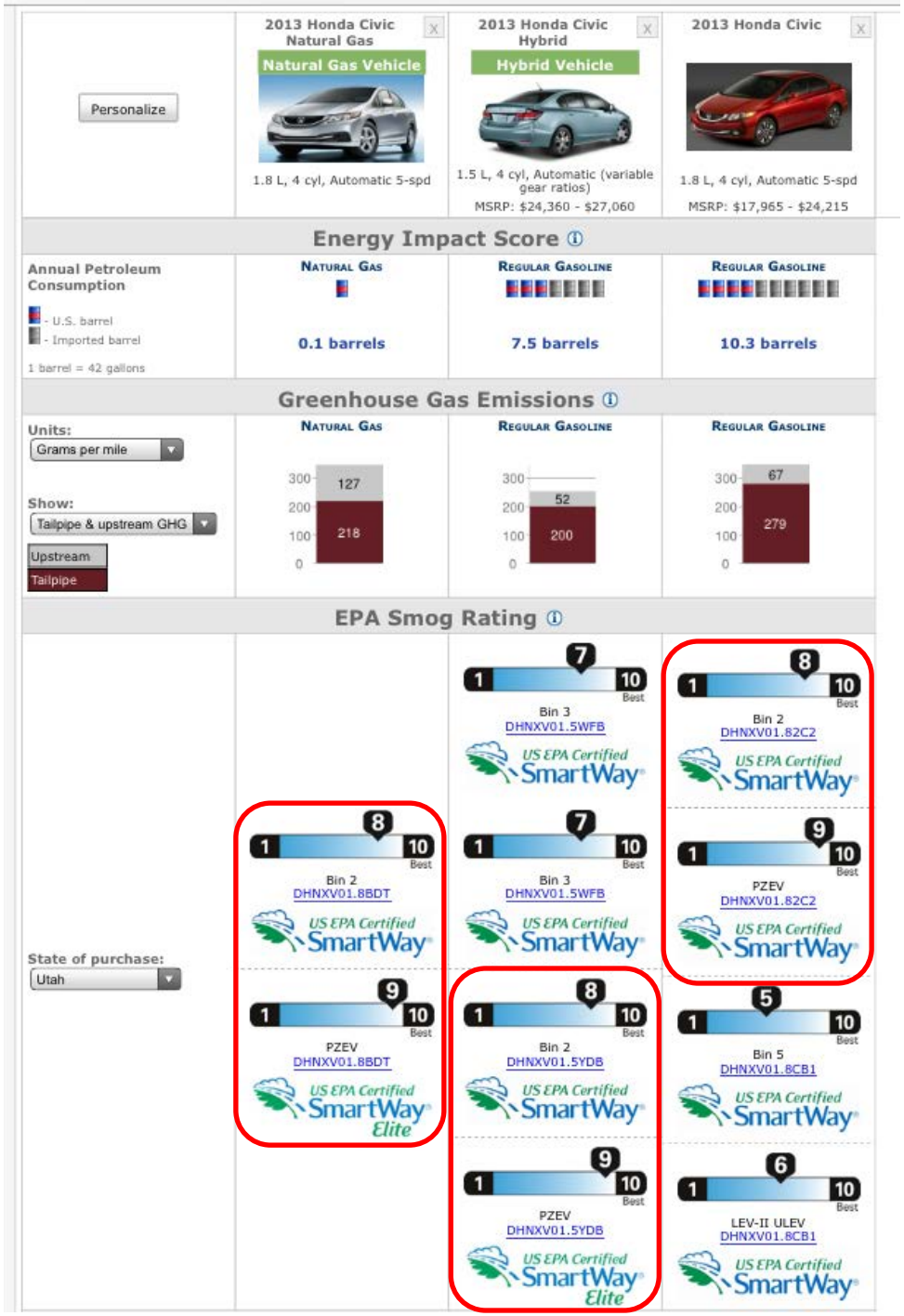
- Vehicles: Average cost of $72 per new car
- Fuel: Average cost of 0.65 cents per gallon

Can we accelerate Tier 3 adoption in Utah?

- Options:
  - Adopt the California Air Resource Board Low Emission Vehicle (LEV) III Standard
    - Already adopted by CARB and begins in 2015
    - Utah adoption would require advance notice of two years under the Clean Air Act
      - Would only advance implementation by a maximum of one year (i.e., we are currently in the 2014 model year)
  - Encourage automobile dealerships to provide cleanest currently-available cars
  - Encourage consumers to purchase cleanest currently-available cars

How do we identify cleaner cars?

- EPA and CARB vehicle emissions standards involve complicated sets of bin levels (e.g., Tier 2 Bin 5, Tier 2 Bin 1, LEV II, SULEV II, PZEV, etc.)
  - Very confusing for consumers
- EPA recognized a need for a simpler means of comparison:
  - EPA Green Vehicle Guide >> now www.fueleconomy.gov
  - New vehicle window stickers

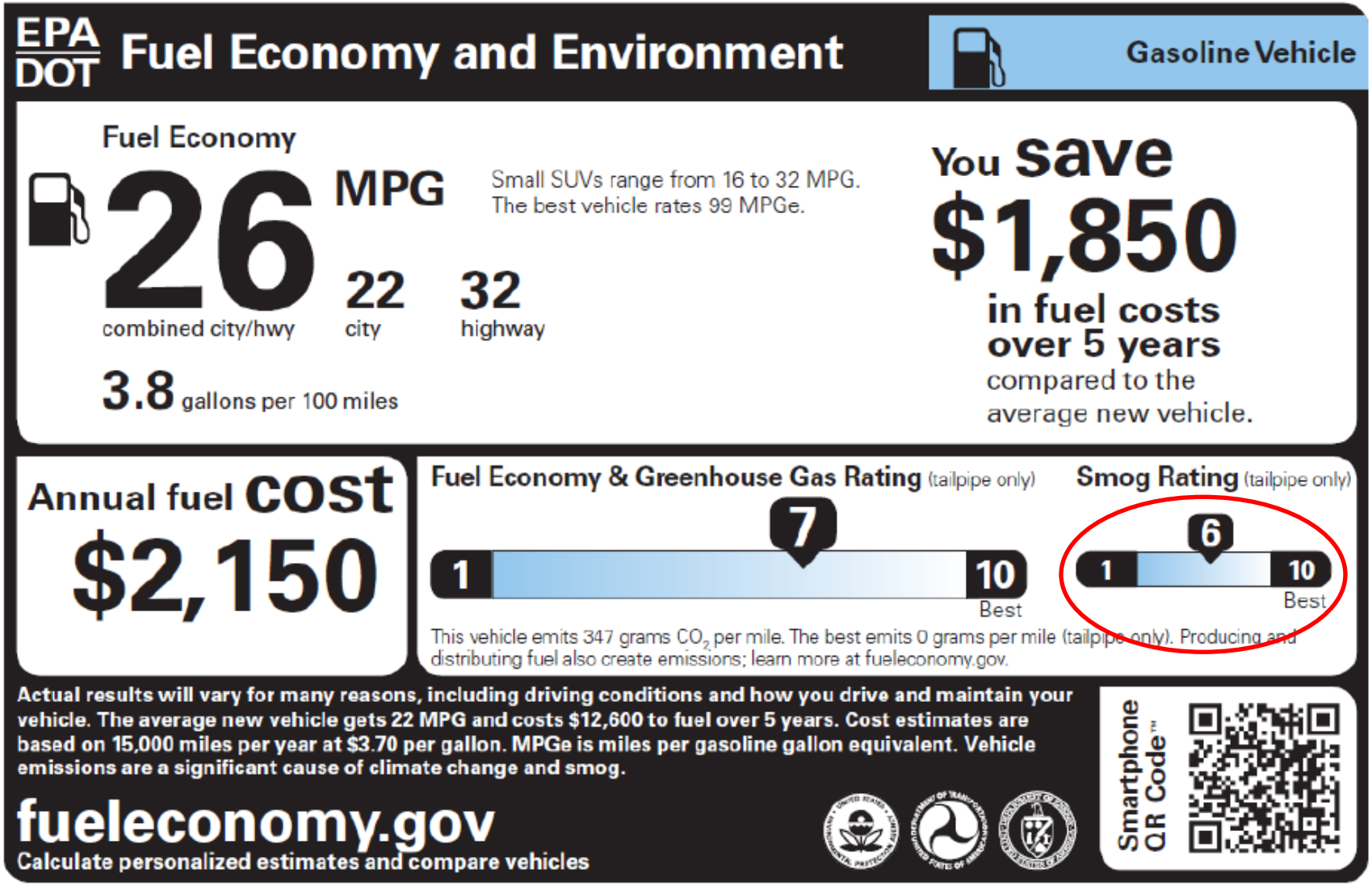


Source: www.fueleconomy.gov

Personalize	2013 Subaru Outback AWD	2013 Ford F150 Pickup 4WD
		© Ford Motor Company 
	2.5 L, 4 cyl, Automatic (variable gear ratios)	3.5 L, 6 cyl, Automatic (S6), Turbo
	MSRP: $23,495 - $32,095	MSRP: $28,710 - $53,300
Energy Impact Score		
Annual Petroleum Consumption - U.S. barrel - Imported barrel 1 barrel = 42 gallons	REGULAR GASOLINE **12.7 barrels**	REGULAR GASOLINE **19.4 barrels**
Greenhouse Gas Emissions		
Units: Grams per mile **Show:** Tailpipe CO2	REGULAR GASOLINE 339 grams per mile 7 (1–10, Best)	REGULAR GASOLINE 520 grams per mile 4 (1–10, Best)
EPA Smog Rating		
State of purchase: Utah	5 (1–10, Best) Bin 5 DFJXJ02.5MLP	
	5 (1–10, Best) LEV-II LEV DFJXJ02.5MLP	5 (1–10, Best) Bin 5 DFMXT03.54DX
	6 (1–10, Best) Bin 4 DFJXJ02.5NKR US EPA Certified SmartWay	5 (1–10, Best) LEV-II LEV DFMXT03.54DX
	9 (1–10, Best) PZEV DFJXJ02.5NKR US EPA Certified SmartWay	

Source: www.fueleconomy.gov

EPA/DOT Fuel Economy Label

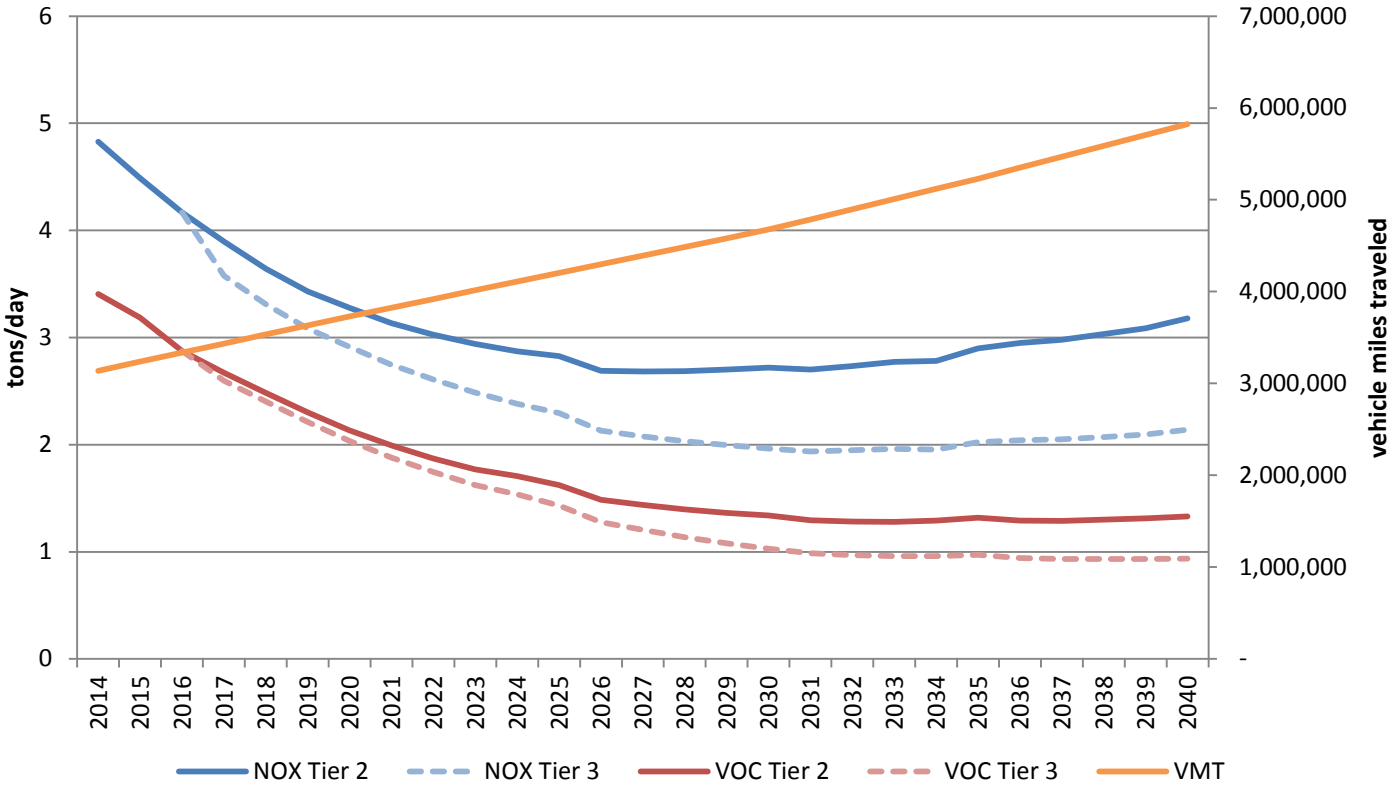


2013 Models With Air Pollution Score of 8 or Better

CODA Coda Electric	FORD Fusion PHEV 2 4 CVT	MERCEDES-BENZ E350 4Matic (coupe) 3.5 6 Auto-7	VOLKSWAGEN Jetta 2 4 AMS-6
FIAT 500e Electric	GMC Terrain 2.4 4 Auto-6	MERCEDES-BENZ E400 Hybrid 3.5 6 Auto-7	VOLKSWAGEN Jetta 2 4 Man-6
FORD Focus BEV Electric	HONDA Accord 2.4 4 CVT	MERCEDES-BENZ GLK350 3.5 6 Auto-7	VOLKSWAGEN Jetta 2.5 5 Man-5
HONDA Fit Electric	HONDA Accord 2.4 4 SCV-7	MERCEDES-BENZ GLK350 4Matic 3.5 6 Auto-7	VOLKSWAGEN Jetta 2.5 5 SemiAuto-6
MITSUBISHI i-MiEV Electric	HONDA Accord 3.5 6 Auto-6	MERCEDES-BENZ S400 Hybrid 3.5 6 Auto-7	VOLKSWAGEN Jetta Hybrid 1.4 4 AMS-7
NISSAN Leaf Electric	HONDA Accord 3.5 6 SemiAuto-6	NISSAN Altima 2.5 4 SCV-6	VOLKSWAGEN Jetta SportWagen 2.5 5 Man-5
SCION iQ EV Electric	HONDA CR-Z 1.5 4 Man-6	NISSAN Sentra 1.8 4 CVT	VOLKSWAGEN Jetta SportWagen 2.5 5 SemiAuto-6
SMART ForTwo Cabriolet Electric	HONDA CR-Z 1.5 4 SCV-7	SUBARU Forester 2.5 4 Man-5	VOLKSWAGEN Passat 2.5 5 Man-5
SMART ForTwo Coupe Electric	HONDA Civic 1.8 4 Auto-5	SUBARU Forester 2.5 4 SemiAuto-4	VOLKSWAGEN Passat 2.5 5 SemiAuto-6
TESLA Model S Electric	HONDA Civic HF 1.8 4 Auto-5	SUBARU Impreza 2 4 CVT	VOLVO S80 3.2 6 SemiAuto-6
TOYOTA RAV4 EV Electric	HONDA Civic Hybrid 1.5 4 CVT	SUBARU Impreza 2 4 Man-5	VOLVO XC 60 3.2 6 SemiAuto-6
ACURA ILX 1.5 4 SCV-7	HONDA Insight 1.3 4 CVT	SUBARU Impreza Wagon 2 4 CVT	VOLVO XC 70 3.2 6 SemiAuto-6
AUDI A3 2 4 AMS-6	HONDA Insight 1.3 4 SCV-7	SUBARU Impreza Wagon 2 4 Man-5	BMW 128Ci Convertible 3 6 Man-6
AUDI A3 2 4 Man-6	HYUNDAI Elantra 1.8 4 Auto-6	SUBARU Legacy 2.5 4 CVT	BMW 128Ci Convertible 3 6 SemiAuto-6
BUICK Lacrosse 3.6 6 SemiAuto-6	HYUNDAI Elantra Blue 1.8 4 Auto-6	SUBARU Outback AWD 2.5 4 CVT	BMW 128i 3 6 Man-6
CADILLAC ATS 2.5 4 SemiAuto-6	HYUNDAI Elantra Coupe 1.8 4 Auto-6	SUBARU Outback AWD 2.5 4 Man-6	BMW 128i 3 6 SemiAuto-6
CADILLAC ATS 3.6 6 SemiAuto-6	HYUNDAI Elantra GT 1.8 4 Auto-6	SUBARU XV Crosstrek 2 4 CVT	BMW 328i 3 6 Man-6
CHEVROLET Cruze 1.8 4 Man-6	HYUNDAI Sonata 2.4 4 Auto-6	SUBARU XV Crosstrek 2 4 Man-5	BMW 328i 3 6 SemiAuto-6
CHEVROLET Cruze 1.8 4 SemiAuto-6	HYUNDAI Sonata Hybrid 2.4 4 AutoMan-6	TOYOTA Camry 2.5 4 SemiAuto-6	BMW 328i Convertible 3 6 Man-6
CHEVROLET Equinox 2.4 4 Auto-6	HYUNDAI Sonata Hybrid Limited 2.4 4 AutoMan-6	TOYOTA Camry Hybrid LE 2.5 4 CVT	BMW 328i Convertible 3 6 SemiAuto-6
CHEVROLET Impala 3.6 6 Auto-6	HYUNDAI Tucson 2.4 4 Auto-6	TOYOTA Camry Hybrid XLE 2.5 4 CVT	LEXUS CT 200h 1.8 4 CVT
CHEVROLET Malibu 2.5 4 SemiAuto-6	KIA Forte 2 4 Auto-6	TOYOTA Prius 1.8 4 CVT	LEXUS ES 300h 2.5 4 SCV-6
CHEVROLET Sonic 1.8 4 Man-5	KIA Forte 2.4 4 Auto-6	TOYOTA Prius Plug-in Hybrid 1.8 4 CVT	LEXUS GS 450h 3.5 6 SCV-6
CHEVROLET Sonic 1.8 4 SemiAuto-6	KIA Forte Eco 2 4 Auto-6	VOLKSWAGEN Beetle 2 4 AMS-6	LEXUS LS 600h L 5 8 SCV-8
CHEVROLET Sonic 5 1.8 4 Man-5	KIA Forte Koup 2 4 Auto-6	VOLKSWAGEN Beetle 2 4 Man-6	LEXUS RX 450h 3.5 6 SCV-6
CHEVROLET Sonic 5 1.8 4 SemiAuto-6	KIA Forte Koup 2.4 4 Auto-6	VOLKSWAGEN Beetle 2.5 5 Man-5	NISSAN Cube 1.8 4 CVT
CHEVROLET Volt 1.4 4 CVT	KIA Optima 2.4 4 Auto-6	VOLKSWAGEN Beetle 2.5 5 SemiAuto-6	NISSAN Cube 1.8 4 Man-6
CHRYSLER 200 2.4 4 Auto-4	KIA Optima Hybrid 2.4 4 AutoMan-6	VOLKSWAGEN Beetle Convertible 2 4 AMS-6	TOYOTA Avalon Hybrid 2.5 4 SCV-6
CHRYSLER 200 2.4 4 Auto-6	KIA Optima Hybrid EX 2.4 4 AutoMan-6	VOLKSWAGEN Beetle Convertible 2 4 Man-6	TOYOTA Highlander Hybrid 3.5 6 CVT
DODGE Avenger 2.4 4 Auto-4	KIA Sportage 2.4 4 Auto-6	VOLKSWAGEN Beetle Convertible 2.5 5 SemiAuto-6	TOYOTA Prius c 1.5 4 CVT
DODGE Avenger 2.4 4 Auto-6	MAZDA 3 2 4 Man-6	VOLKSWAGEN CC 2 4 AMS-6	TOYOTA Prius v 1.8 4 CVT
FORD C-MAX PHEV 2 4 CVT	MAZDA 3 2 4 SemiAuto-6	VOLKSWAGEN CC 2 4 Man-6	VEHICLE PRODUCTION GROUP MV-1 4.6 8 Auto-4
FORD Focus 2 4 AutoMan-6	MERCEDES-BENZ C300 4Matic 3.5 6 Auto-7	VOLKSWAGEN GTI 2 4 AMS-6	VOLKSWAGEN Eos 2 4 AMS-6
FORD Focus 2 4 Man-5	MERCEDES-BENZ C350 3.5 6 Auto-7	VOLKSWAGEN GTI 2 4 Man-6	
FORD Focus 2 4 SemiAuto-6	MERCEDES-BENZ E350 3.5 6 Auto-7	VOLKSWAGEN Golf 2.5 5 Man-5	
FORD Fusion 1.6 4 SemiAuto-6	MERCEDES-BENZ E350 4Matic 3.5 6 Auto-7	VOLKSWAGEN Golf 2.5 5 SemiAuto-6	

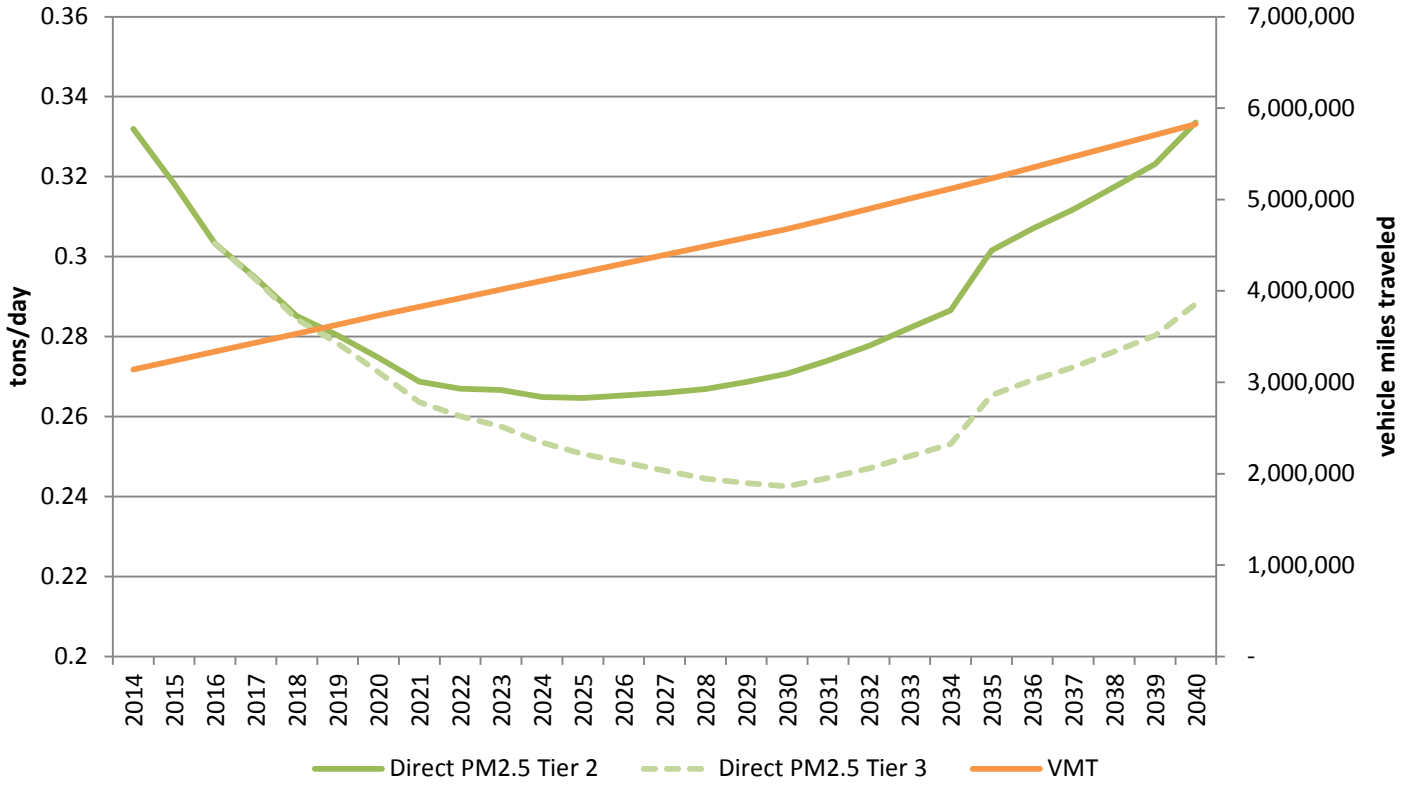
Questions?

Tier 2 vs. Tier 3: NO_x and VOC



Cache County Data

Tier 2 vs. Tier 3: Direct $PM_{2.5}$



Cache County Data

Table 2
Tier 2 Emission Standards, FTP 75, g/mi

Bin#	Intermediate life (5 years / 50,000 mi)					Full useful life				
	NMOG*	CO	NOx	PM	HCHO	NMOG*	CO	NOx†	PM	HCHO
Temporary Bins										
11 MDPV[c]						0.280	7.3	0.9	0.12	0.032
10[a,b,d,f]	0.125 (0.160)	3.4 (4.4)	0.4	–	0.015 (0.018)	0.156 (0.230)	4.2 (6.4)	0.6	0.08	0.018 (0.027)
9[a,b,e,f]	0.075 (0.140)	3.4	0.2	–	0.015	0.090 (0.180)	4.2	0.3	0.06	0.018
Permanent Bins										
8[b]	0.100 (0.125)	3.4	0.14	–	0.015	0.125 (0.156)	4.2	0.20	0.02	0.018
7	0.075	3.4	0.11	–	0.015	0.090	4.2	0.15	0.02	0.018
6	0.075	3.4	0.08	–	0.015	0.090	4.2	0.10	0.01	0.018
5	0.075	3.4	0.05	–	0.015	0.090	4.2	0.07	0.01	0.018
4	–	–	–	–	–	0.070	2.1	0.04	0.01	0.011
3	–	–	–	–	–	0.055	2.1	0.03	0.01	0.011
2	–	–	–	–	–	0.010	2.1	0.02	0.01	0.004
1	–	–	–	–	–	0.000	0.0	0.00	0.00	0.000

* for diesel fueled vehicle, NMOG (non-methane organic gases) means NMHC (non-methane hydrocarbons)
† average manufacturer fleet NOx standard is 0.07 g/mi for Tier 2 vehicles

a – Bin deleted at end of 2006 model year (2008 for HLDTs)
b – The higher temporary NMOG, CO and HCHO values apply only to HLDTs and MDPVs and expire after 2008
c – An additional temporary bin restricted to MDPVs, expires after model year 2008
d – Optional temporary NMOG standard of 0.195 g/mi (50,000) and 0.280 g/mi (full useful life) applies for qualifying LDT4s and MDPVs only
e – Optional temporary NMOG standard of 0.100 g/mi (50,000) and 0.130 g/mi (full useful life) applies for qualifying LDT2s only
f – 50,000 mile standard optional for diesels certified to bins 9 or 10

It may be noted that bin 5 has a NO_x limit of 0.07 g/mi, which is equal to the fleet average NO_x standard. Therefore, NOx emissions from vehicles certified to bins higher than bin 5 must be offset by selling a sufficient number of vehicles certified to bins lower than bin 5.

The EPA bins cover California LEV II emission categories, to make certification to the federal and California standards easier for vehicle manufacturers.

Table 1
Proposed Tier 3 Certification Bin Standards (FTP; 150,000 miles)

Bin	NMOG+NOx	PM	CO	HCHO
	mg/mi			
Bin 160	160	3	4200	4
Bin 125	125	3	2100	4
Bin 70	70	3	1700	4
Bin 50	50	3	1700	4
Bin 30	30	3	1000	4
Bin 20	20	3	1000	4
Bin 0	0	0	0	0

Bin 160 NMOG+NOx limit is equivalent to the sum of NMOG and NOx limits in the Tier 2 Bin 5. Bin 30 emissions are equivalent to Tier 2 Bin 2.

Emissions must be met over full useful live of 150,000. Manufacturers have an option to certify certain vehicles to a 120,000 miles useful life, provided they meet a more stringent fleet average NMOG+NOx standard.

The EPA bins and the California LEV III emission categories have the same emission limits, to harmonize the federal certification testing with California requirements.