



# CARB Light-Duty OBD Regulation Update

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# Discussion Points

Background

Regulatory Changes

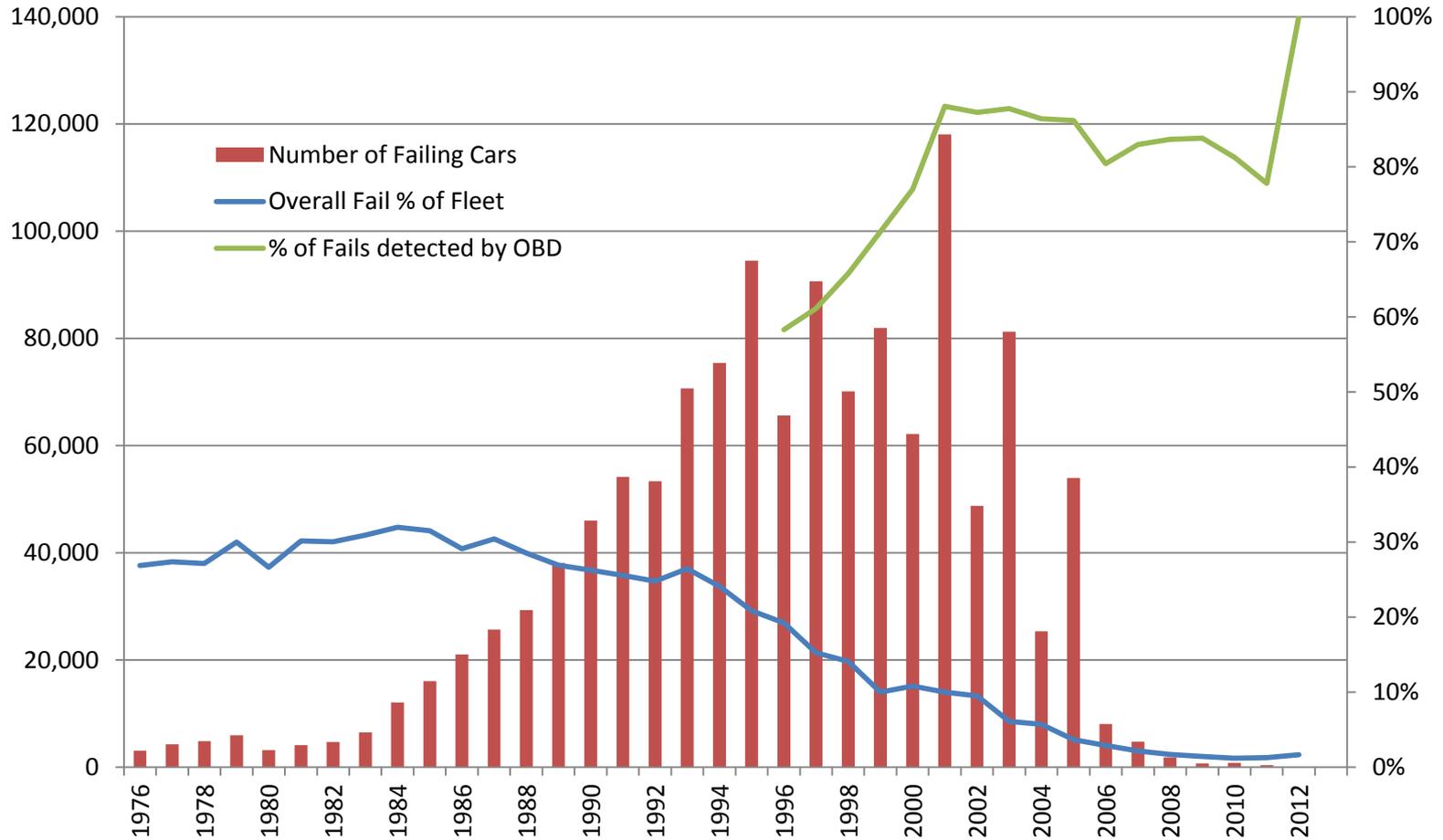
Other Changes

Recent In-Use Issues

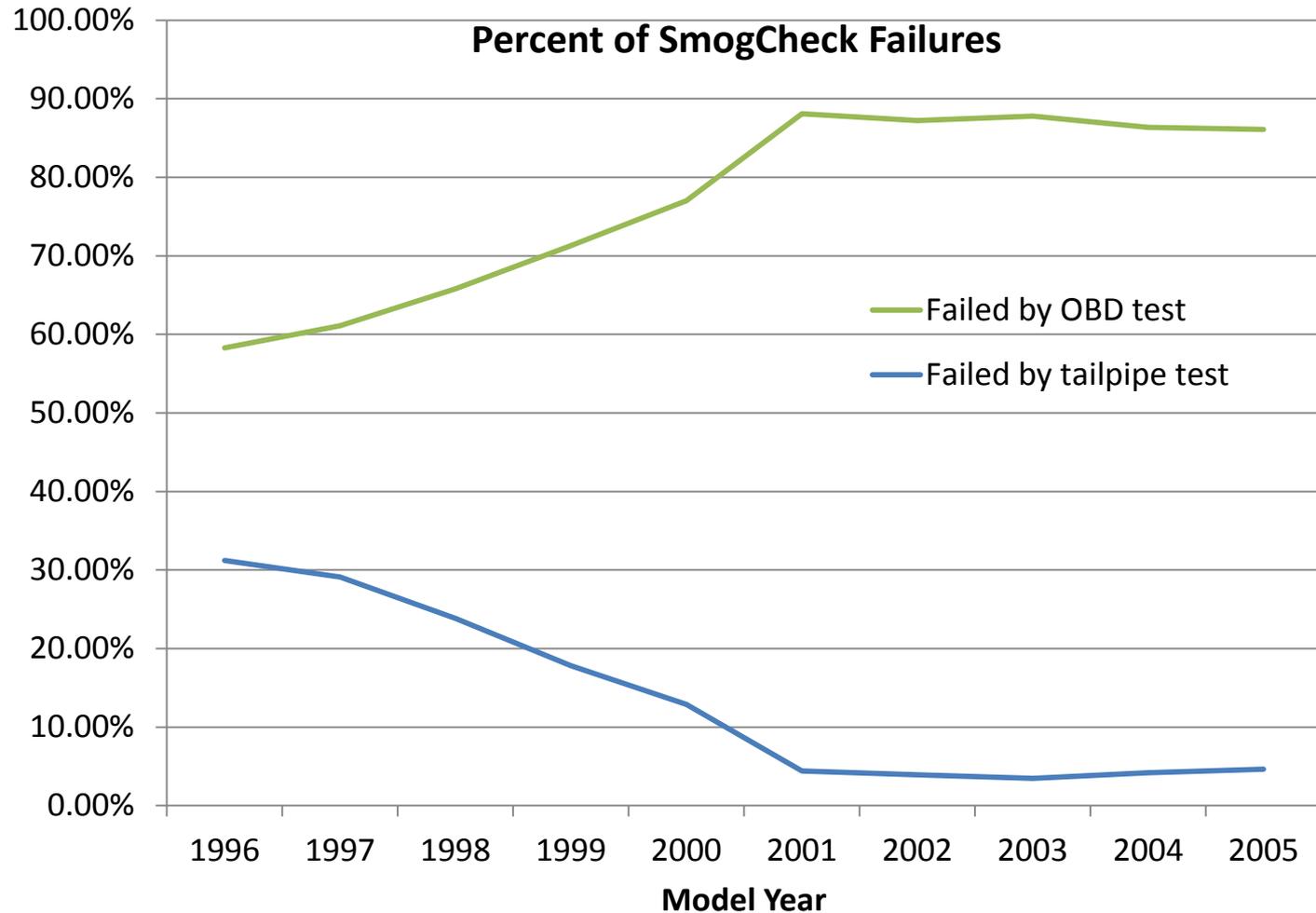
# Background

- Over 17 years since first systems introduced
- Dominant technology used by IM programs
  - Identify vehicles in need of repair
  - Facilitate quick and accurate inspection
- Only CA standard that directly addresses emissions beyond useful life

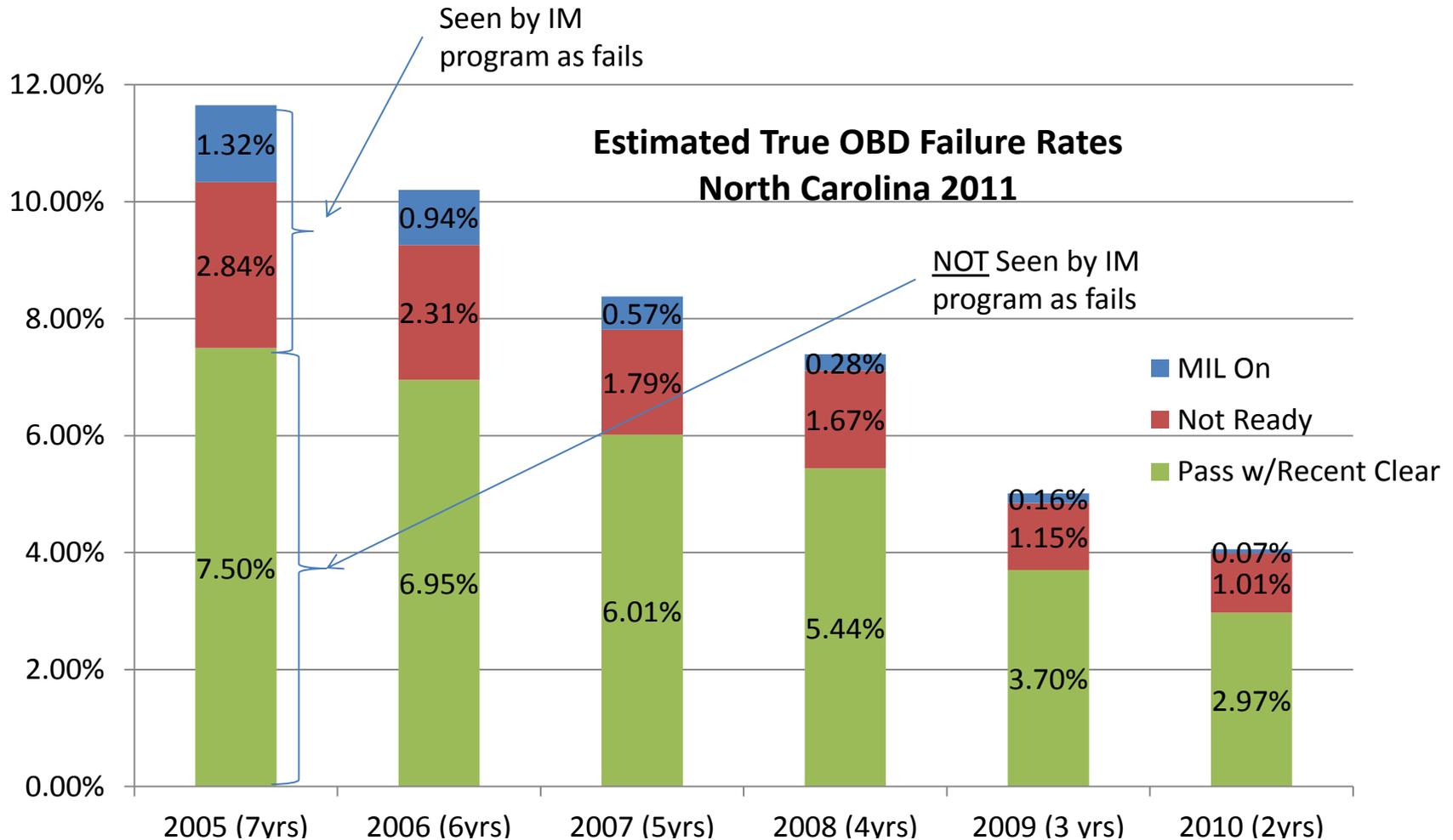
# 2011 Calif IM Data



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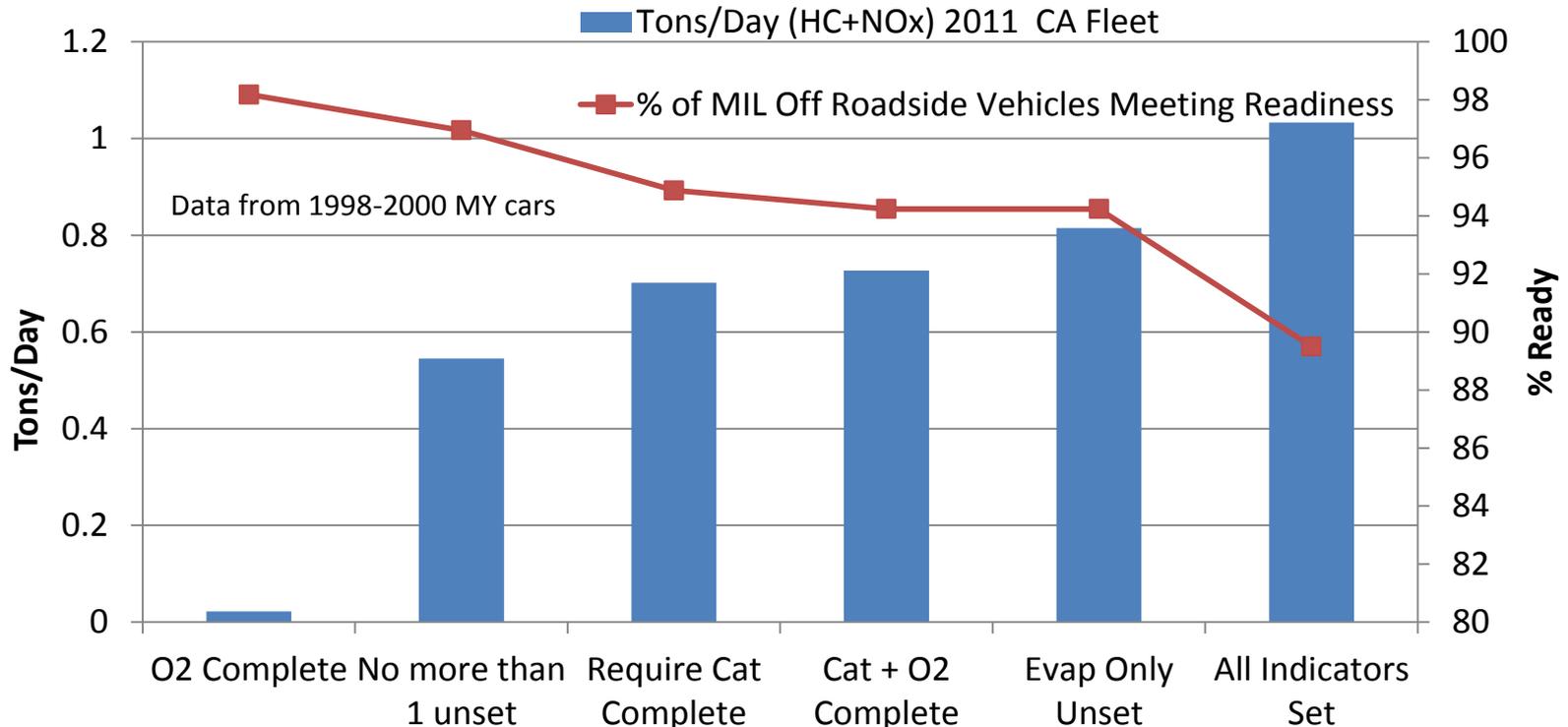


# Only a Fraction of the Benefit is Seen in I/M Data



# Nationwide IM update

- 30+ states doing OBD inspections
- Recent EPA guidance suggests States look at tightening readiness
  - Current Policy: allow any 2/any 1 not ready for '96-'00/'01+ model year
  - Calif actively looking at tighter criteria for older and newer cars including use of permanent DTCs



# Nationwide IM update

- Light-/Medium-duty diesel
  - Workgroup convened by EPA to develop diesel-specific guidance
  - Several states already inspecting diesels and more interested
  - Recommendation near completion
    - To reduce reliance on stringent readiness criteria, includes use of:
      - Permanent DTCs,
      - Distance since code clear, and
      - Number of warm-ups since code clear

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# Regulatory Revisions

- Regulatory revisions conducted periodically
  - Five revisions in last 15 years
  - Update for new technology, problems found, etc.
- Time-critical revisions were recently made
  - Part of the LEV III rulemaking in January

# Light-duty Diesel Revisions

- Monitoring delayed until 2015 for:
  - Catalyst proper feedgas generation (e.g., NO/NO<sub>2</sub>)
  - Catalyzed DPF proper NMHC catalyst performance
  - Tolerance compensation features (e.g., coded fuel injectors)
- PM Filter monitoring (1.75x std in 2013MY)
  - Allow 4<sup>th</sup> year of deficiency in 2013 MY only
  - Extend provision to exempt some failure modes (e.g., partial melt/partially crack) to 2013 MY only
  - Free deficiencies for PM sensor-based monitors in 2014-2015

# Plug-in Hybrid Revisions

- In-use Monitoring Performance Ratio Changes
  - General denominator criteria uses 'propulsion system active' instead of engine runtime
  - Major monitor denominator adds 10 secs engine runtime
    - Rest of criteria based on vehicle operation (regardless of IC operation)
  - Evap denominator changed
    - 'Engine off time > 6 hours' replaces ECT vs ambient cold start criteria
  - Two ignition cycle counters
    - Track all vehicle trips
    - Track only trips with an engine start
  - Lower (0.100) minimum ratio for early years
- Warm-up cycle definition
  - Used to erase DTCs from Mode \$03 after MIL is off
  - Change to general denominator trip instead of ECT warm-up based trip

# Additional Changes

- Recent HD OBD rulemaking
  - Changes also affect medium-duty diesel
- Future rulemaking schedule
  - Resource permitting, late 2013 calendar year rulemaking
  - Major items:
    - Typical clean-up
      - Which monitors need test results
      - Which monitors tied to each readiness bit, etc.
    - LEV III updates
      - Threshold for HC+NOx std and new categories
      - DOR threshold
    - Hybrid updates
      - Misfire detection interval for plug-ins
      - Other issues
    - GHG involvement
      - In or out of OBD
      - Threshold vs functional vs any measurable increase
      - Constrained to 'powertrain ' somehow

# LEVIII Gasoline Thresholds

Emission Std	Emission Std				OBD Thresholds							Catalyst Threshold					
	HC+NOx	HC	NOx	CO	HC+NOx Multiplier	HC+NOx THD	HC Multiplier	HC THD	NOx Multiplier	NOx THD	Compared HC+NOx THD	Multiplier	HC+NOx	HC Multiplier	HC	NOx Multiplier	NOx
LEV 160 (LEVII)	0.160	(0.090)	(0.070)	4.2	1.5	0.240	-	-	-	-	0.240	1.75	0.280	-	-	-	-
ULEV 125 (ULEVII)	0.125	(0.055)	(0.070)	2.1		0.188	-	-	-	-	0.188		0.219	-	-	-	-
Bin 4	-	0.070	0.040	2.1	-	-	1.5	0.105	2.5	0.100	0.205	-	-	1.75	0.123	2.5	0.100
Bin 3	-	0.055	0.030	2.1		-		0.083		0.075	0.158		-		0.096		0.075
ULEV 70	0.070	-	-	1.7	2.0	0.140	-	-	-	-	0.140	2.0	0.140	-	-	-	-
ULEV 50	0.050	-	-	1.7		0.100	-	-	-	-	0.100		0.100	-	-	-	-
SULEV30 (SULEVII)	0.030	(0.010)	(0.020)	1.0	2.5	0.075	-	-	-	-	0.075	2.5	0.075	-	-	-	-

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# Other Changes

- Document Management System
  - Have been working on migrating to DMS for OBD
    - Essentially, electronic submission of application
  - ~50% of manufacturers submitting applications via DMS
  - 2013MY Goals:
    - Every LD manufacturer with at least one application uploaded (even if is post-cert)
  - 2014MY Goals:
    - Every LD application submitted via DMS prior to cert
    - Very early 2014 MY can be uploaded after cert

# Other Changes (cont)

- Mail-outs/Guidances
  - Used to clarify existing requirements, provide examples, etc. *typically in between rulemakings*
  - Drafts near completion on:
    - Alternate fuel conversions
    - Driver selectable switches
    - EWMA implementation
  - Future topics include:
    - Readiness/Test result mapping
    - Dual-path purge lines on turbo engines
    - LEV III thresholds (if needed before scheduled rulemaking)
    - Exclusion of safety critical system default actions

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# Dual-path Purge

- More commonly seeing boosted engines with two purge paths
  - ‘normal’ path for non-boost operation
  - Separate path for boost operation
  - Increasing importance on downsized turbocharged that spend more time in boost and need to purge
- Verification of flow to engine required on both paths
  - Have had to remind manufacturers about this
  - Guidance planned to further help

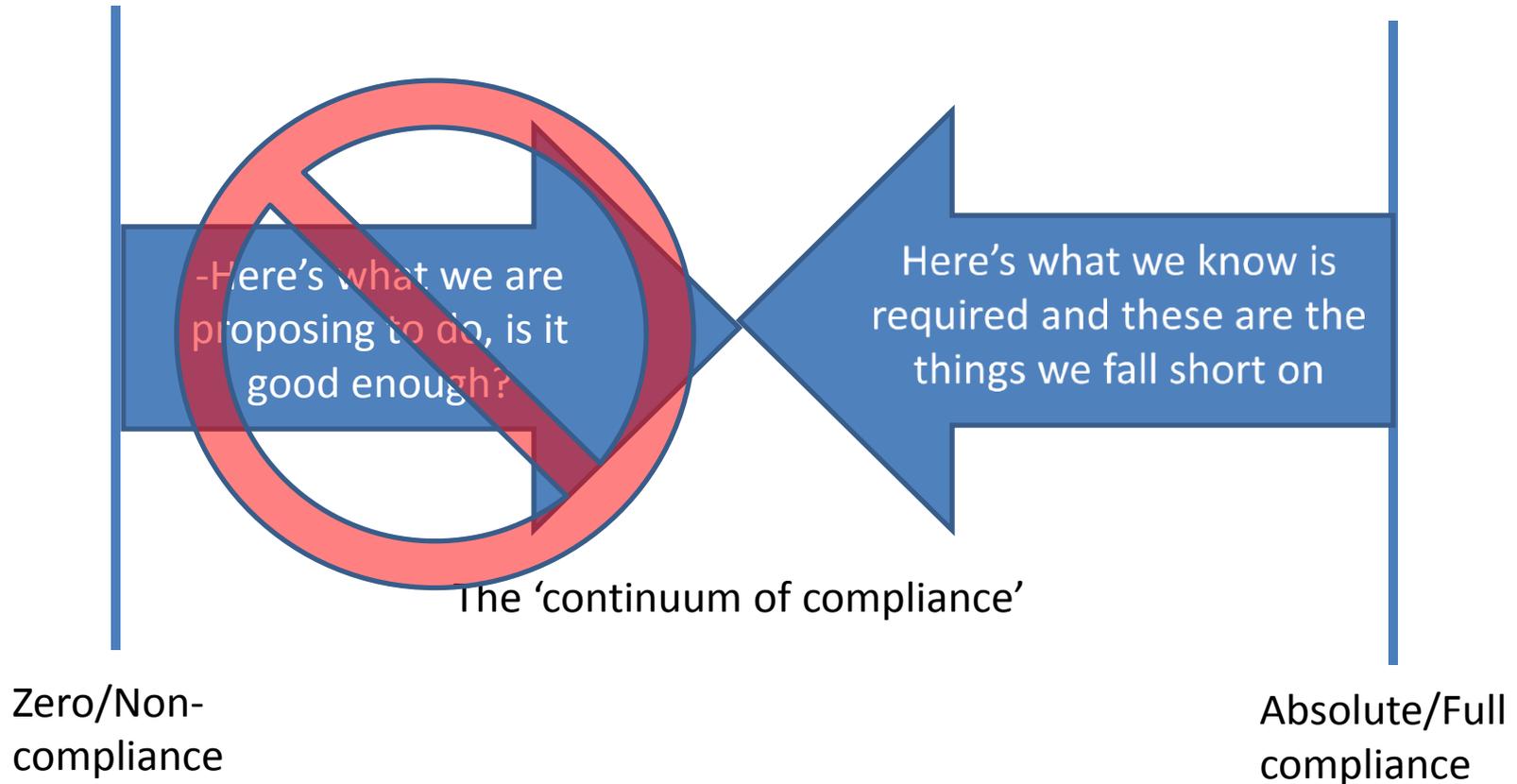


# Rate based data template

- Zooming in:
  - Denominators not matching up raised questions

Gen Den	Ign Cycle	B1SO2Num	B1SO2Den	B2SO2Num	B2SO2Den
388	1127	130	334	130	334
367	1213	180	310	180	310
220	795	85	215	85	215
189	860	69	182	69	182
202	671	40	197	40	197
227	773	121	213	121	213
194	584	91	184	91	184
218	713	100	199	100	199
168	739	82	158	82	158
337	1268	163	299	163	299
204	747	38	202	38	202
338	1532	112	336	112	336
227	820	65	187	65	187
359	1303	140	322	140	332
377	1482	74	360	74	360

# Varied Approach to Compliance





$L = L-R$   $T = 2x/L$   $\Delta V = VR\Delta T$   
**CONFIRMED**  
 $\Delta V = \int \frac{dQ}{T}$

**BUSTED**

$L = L-R$   $T = 2x/L$   $\Delta V = VR\Delta T$   
**PLAUSIBLE**  
 $\Delta V = \int \frac{dQ}{T}$

# Myth#1: Definition of 'diagnostic-critical control units'

- Recent misinterpretations:
  - ABS controllers are identified as exempt in definition thus: OBD comprehensive component monitoring requirements also do not apply:
    - ABS inputs/outputs can be used to enable/disable other OBD monitors; and
    - You are exempt from any and all monitoring of these components
  - Controllers with OBD inputs/outputs and OBD diagnostics but not required to support CAL ID and CVN are:
    - Not required to illuminate the MIL for those OBD diagnostics
    - Not covered under emission warranty
- Reality: Definition in OBD regulation
  - Solely determines whether control unit needs to report CAL ID and CVN
  - All other OBD (and emission warranty) rules still apply

# Myth #2: No-start = No OBD required

- Misinterpretation: If you detect a fault and take default action to shut the engine down and/or prevent re-starting, you are exempt from OBD requirements and emission warranty coverage
  - Variation #1: If a failure causes a no-start, you are exempt from monitoring/detecting that fault.
  - Rationale is that subsequent to the fault being detected, there is no further emission increase
- Reality:
  - If a failure causes a no-start and it is not technically feasible to detect the fault because of the no-start condition, ARB will approve the system being unable to detect the fault. However, emission warranty coverage still required for that component.
    - Example: Crankshaft position sensor no signal fault causes engine to be unable to start.
  - Faults that cause a no-start but are able to be detected must be detected
    - Example: Insufficient fuel pressure to begin injection.
  - Faults that are detected and then default action invoked to prevent re-starts are not exempt from OBD monitoring or warranty coverage
    - Not an option to detect a catalyst fault and then default to no-start to avoid MIL illumination and warranty coverage
    - And, while default action will prevent a further emission increase, emissions have typically already increased prior to fault detection so that component still does affect emissions.

# Air Quality in Los Angeles



# Regulation Has Been Effective: Less Summertime Smog

## # of Smoggy Days<sup>1</sup>

1990	2011	Change
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Greater Los Angeles	181	106	41%
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Pop. ↑21%

VMT ↑25%

<sup>1</sup> Pollution exceeds national 8 hour ozone standard

# Objectives

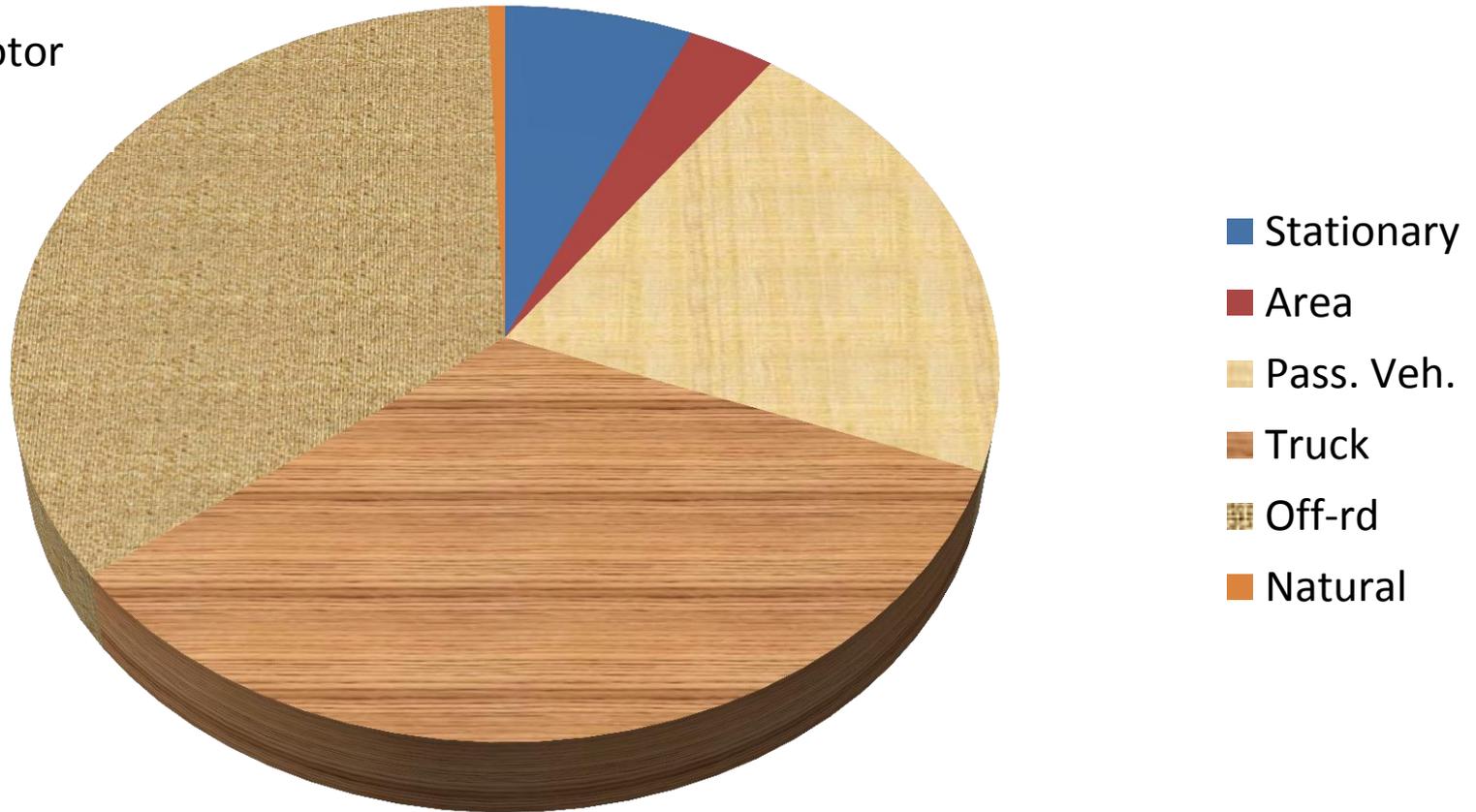
- Meet 2023 and 2032 federal Ozone standards
  - Los Angeles and San Joaquin Valley
  - NOx reduction primary need

	8 hour Ozone, ppm	
2011 Highest Pollution	0.107	
Federal Standard	0.075	0.070 <sup>1</sup>
Attainment Date	2023	2032

- Meet GHG target
  - 80% reduction in 2050 from 1990 emissions

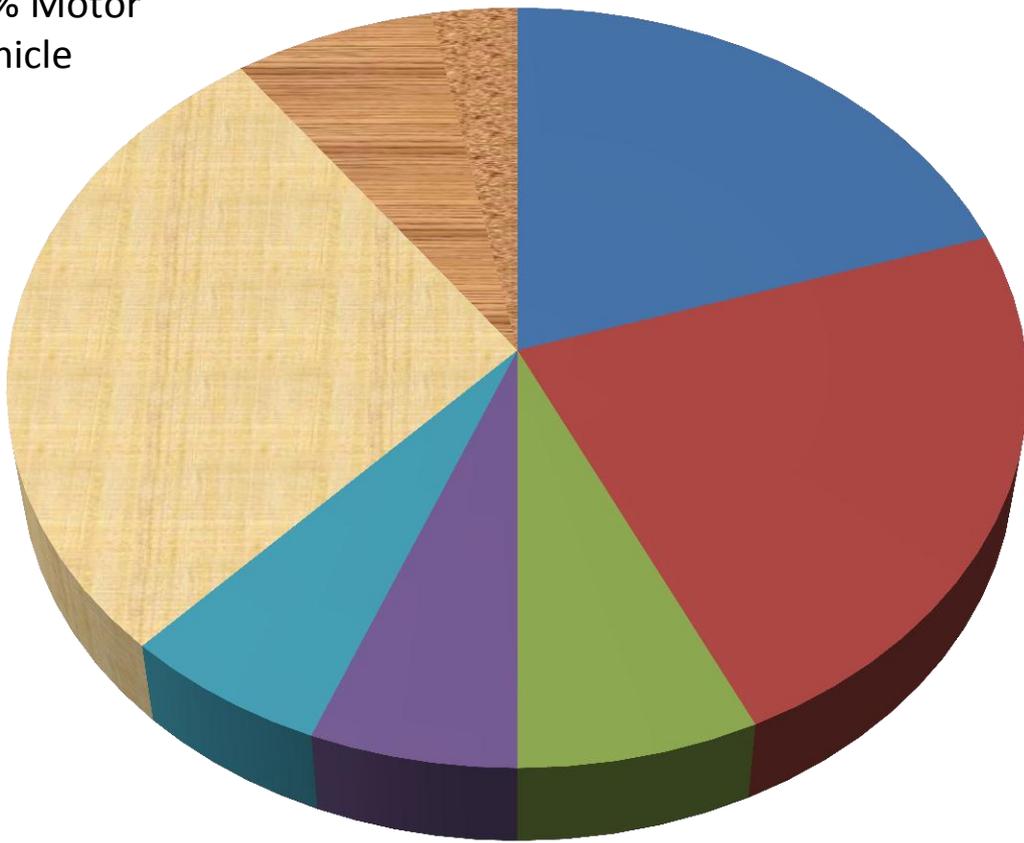
# Sources of Emissions Today – NO<sub>x</sub>\*

89% Motor  
Vehicle



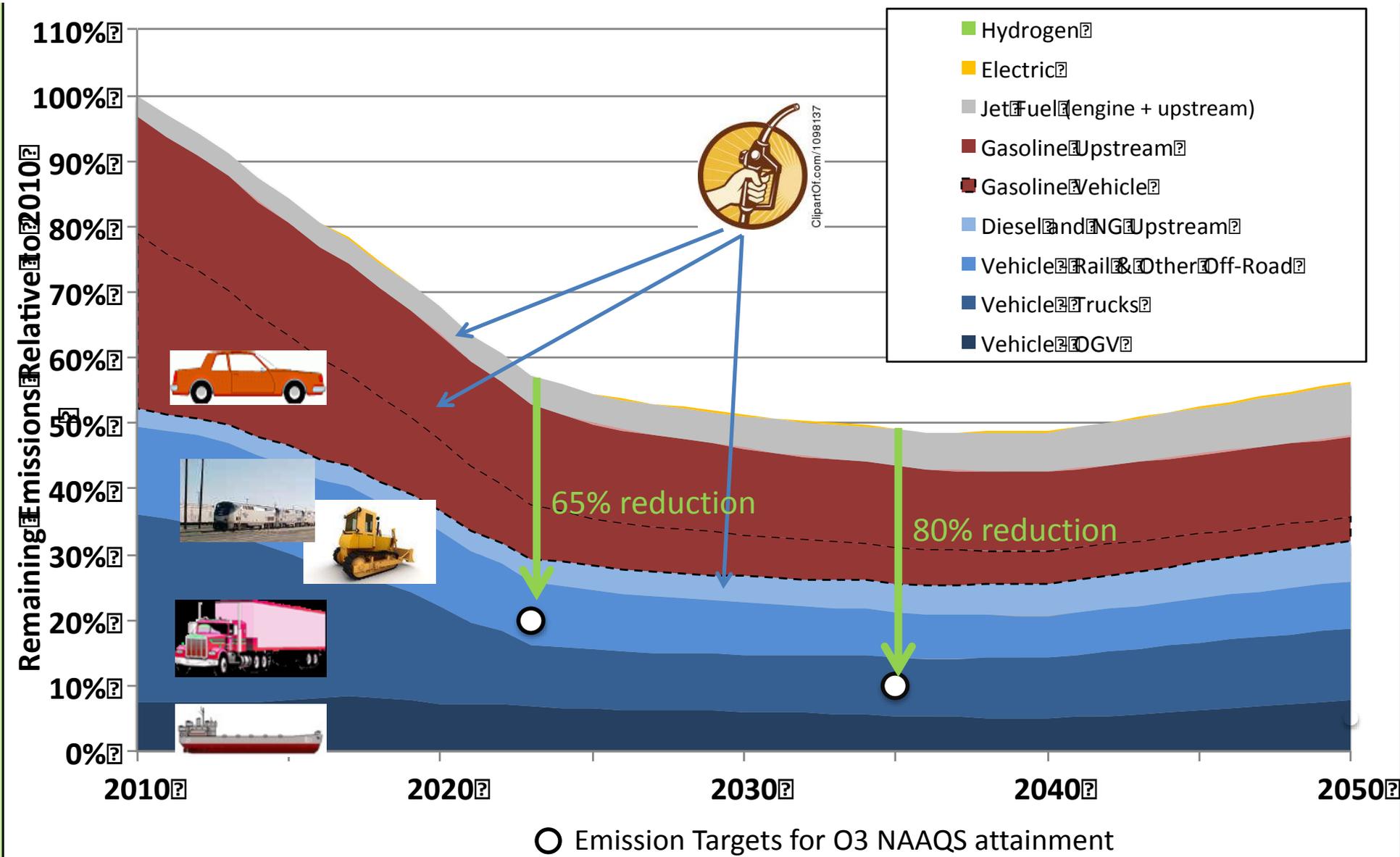
# Sources of Emissions Today - GHG

38% Motor Vehicle

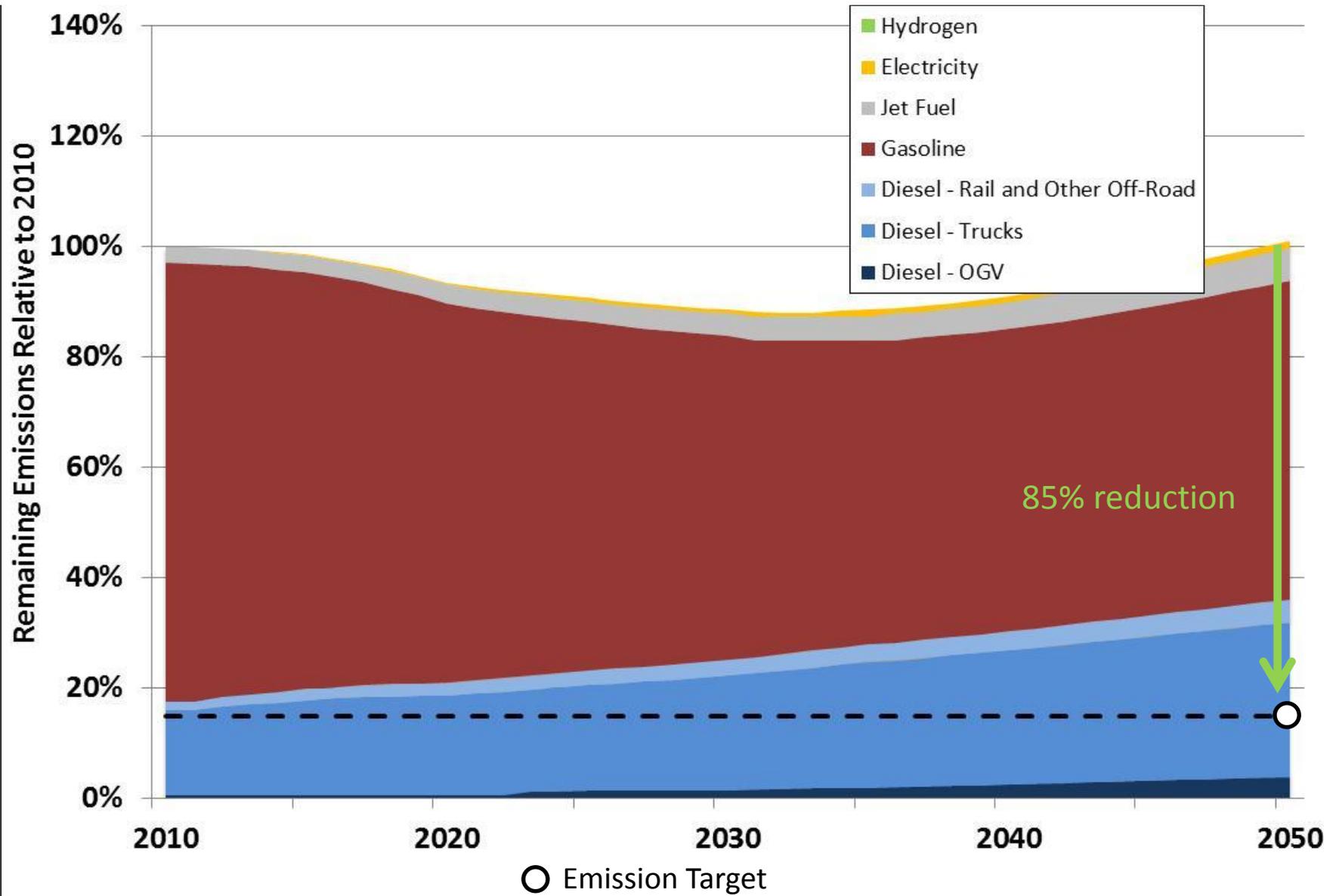


- Industrial
- Electricity
- Agric.
- Residential
- Other
- Pass. veh.
- Truck
- Off-rd

# BAU: NOx Mobile Source Emissions (South Coast)



# BAU: GHG Mobile Source Emissions (statewide)



# What is the Solution?

- Cars and light trucks
  - Nearly complete conversion to electric drive by 2050
    - Mostly battery and fuel cell vehicles
  - Further reduction in electricity and hydrogen production GHG emissions (60-70% lower carbon intensity)
  - Modernization of legacy vehicles through incentives and scrap, to reduce NOx
  - Reduction in VMT (~13-22%) by 2035

Official CARB documents available from

▮ [www.arb.ca.gov](http://www.arb.ca.gov)

Direct link to OBD page:

▮ <http://www.arb.ca.gov/msprog/obdprog/obdprog.htm>

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