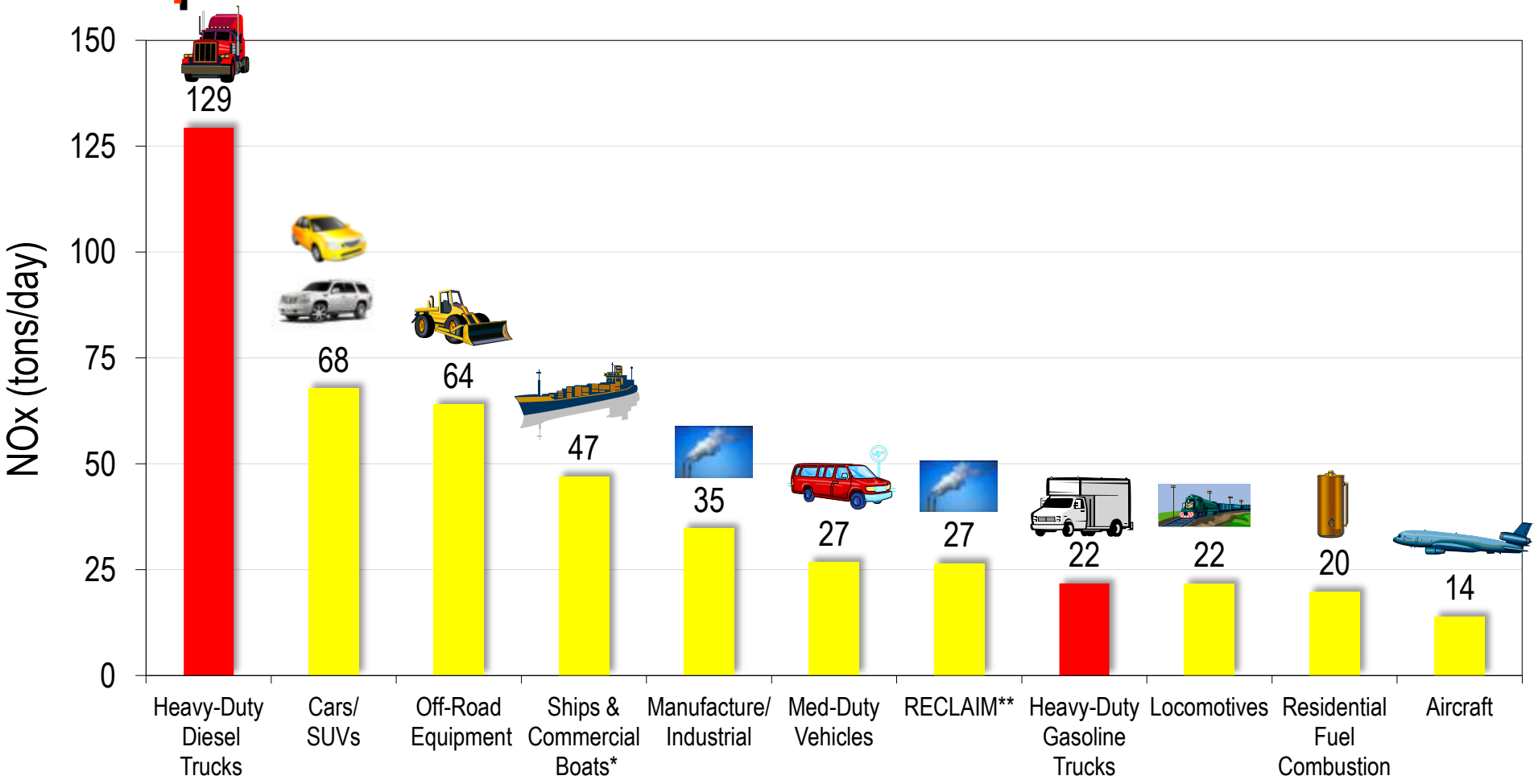
On-Road Heavy-Duty Vehicles

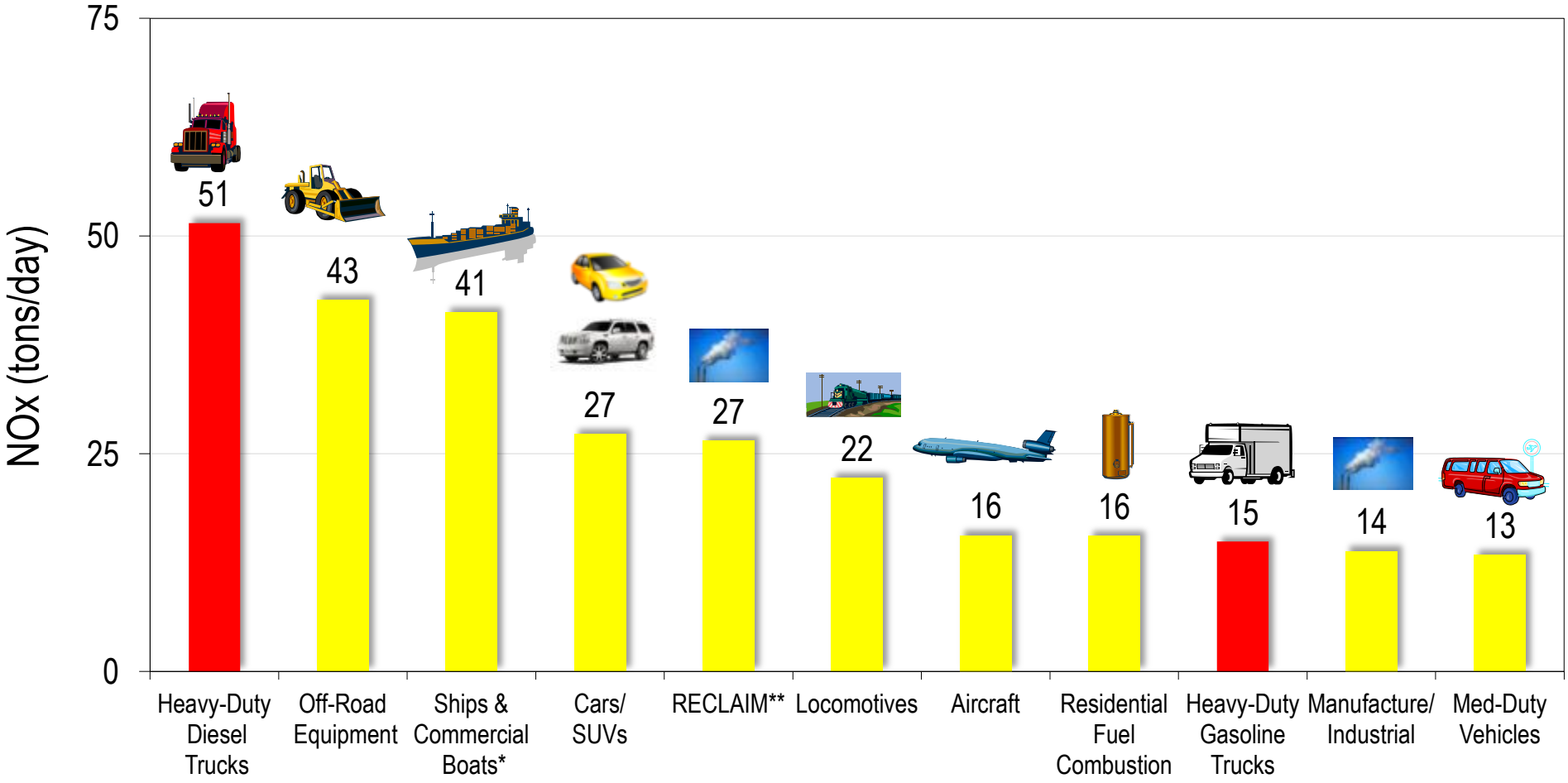
Top NOx Emissions Sources in 2014



* Ocean-going vessels = 35 tons/day

**RECLAIM: 320 largest stationary sources, including all refineries and power plants

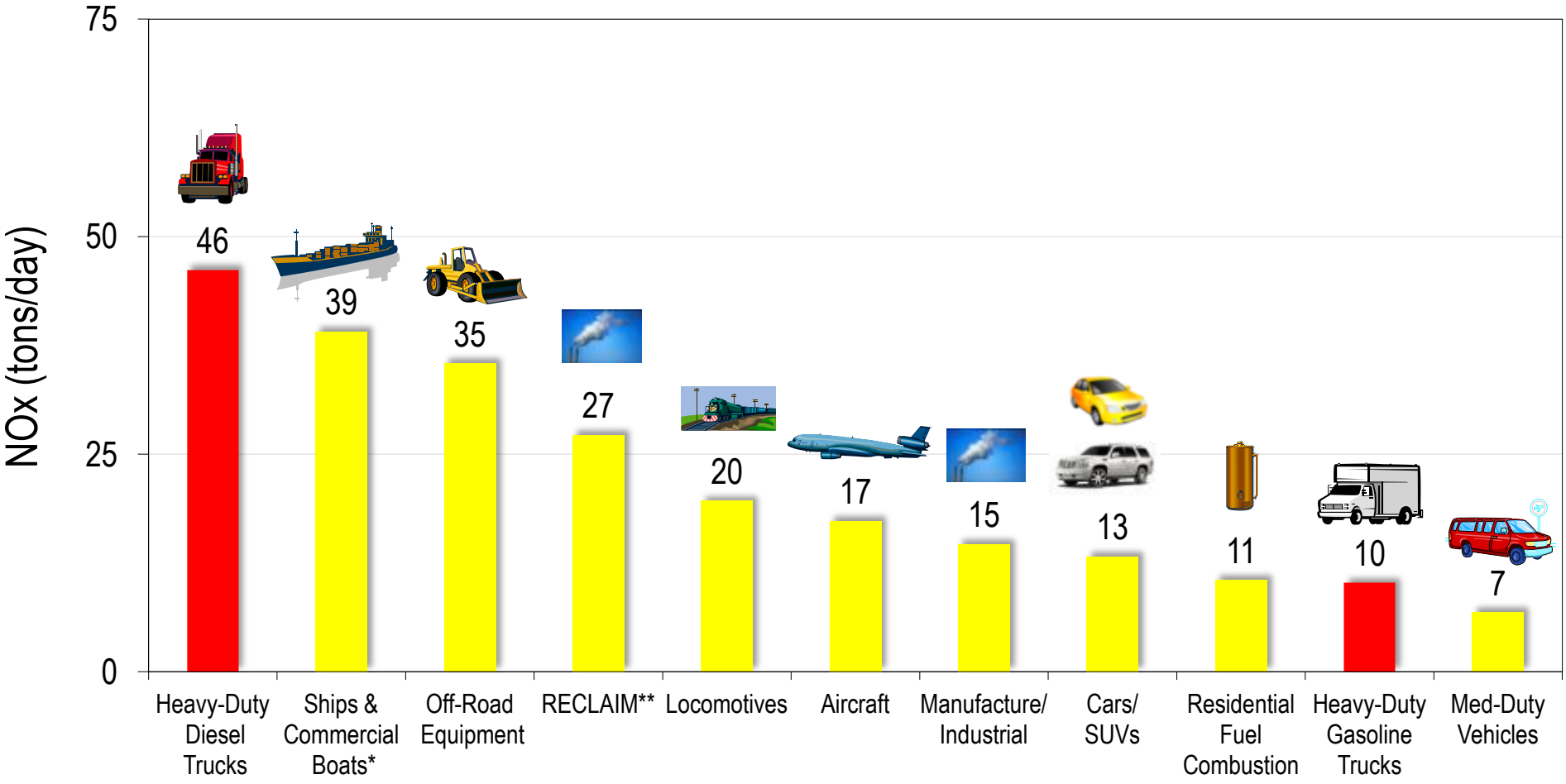
Top NOx Emissions Sources in 2023



* Ocean-going vessels = 32 tons/day

**RECLAIM: 320 largest stationary sources, including all refineries and power plants

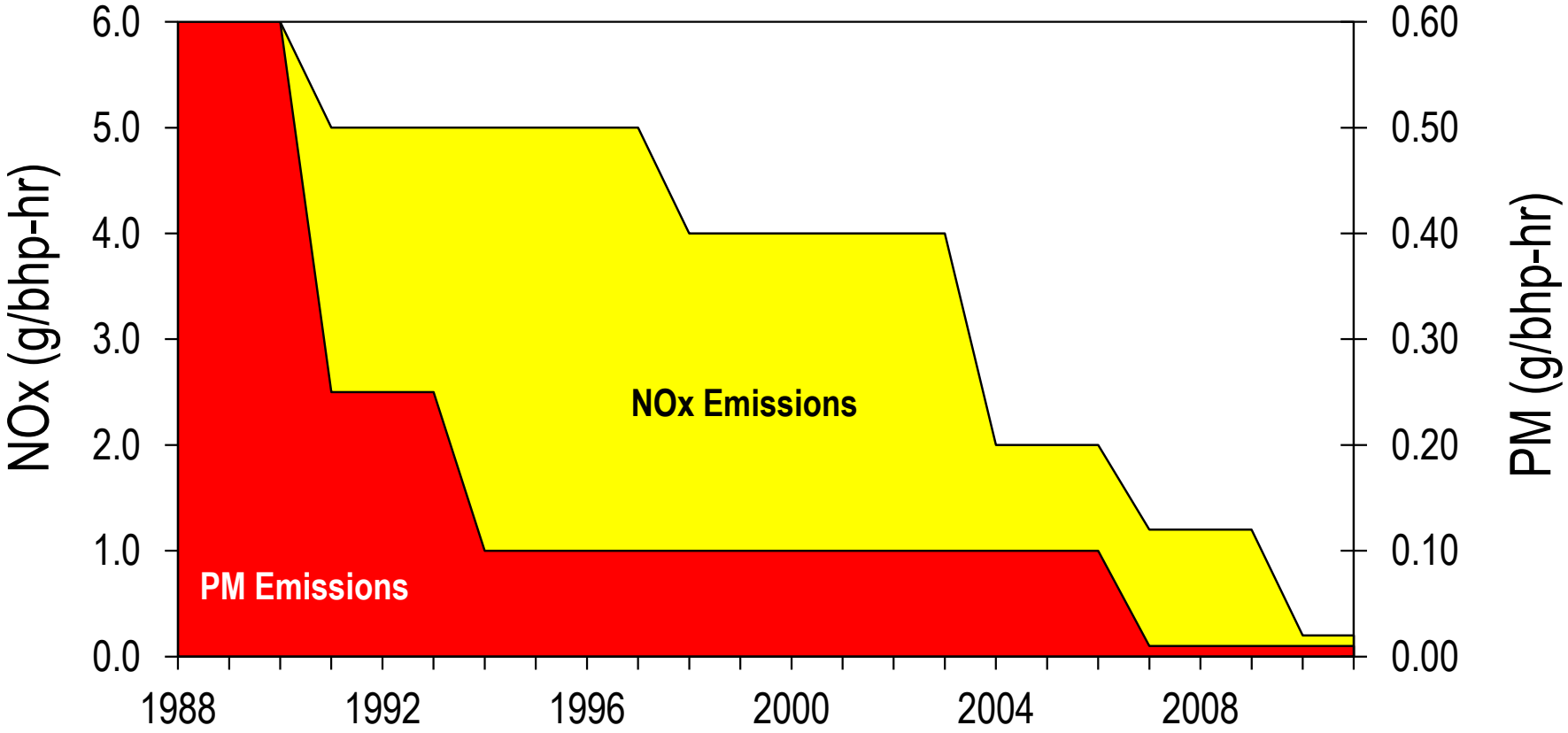
Top NOx Emissions Sources in 2032



* Ocean-going vessels = 29 tons/day

**RECLAIM: 320 largest stationary sources, including all refineries and power plants

On-Road Heavy-Duty Engine Exhaust Emissions Standards



Key Challenges Moving Forward

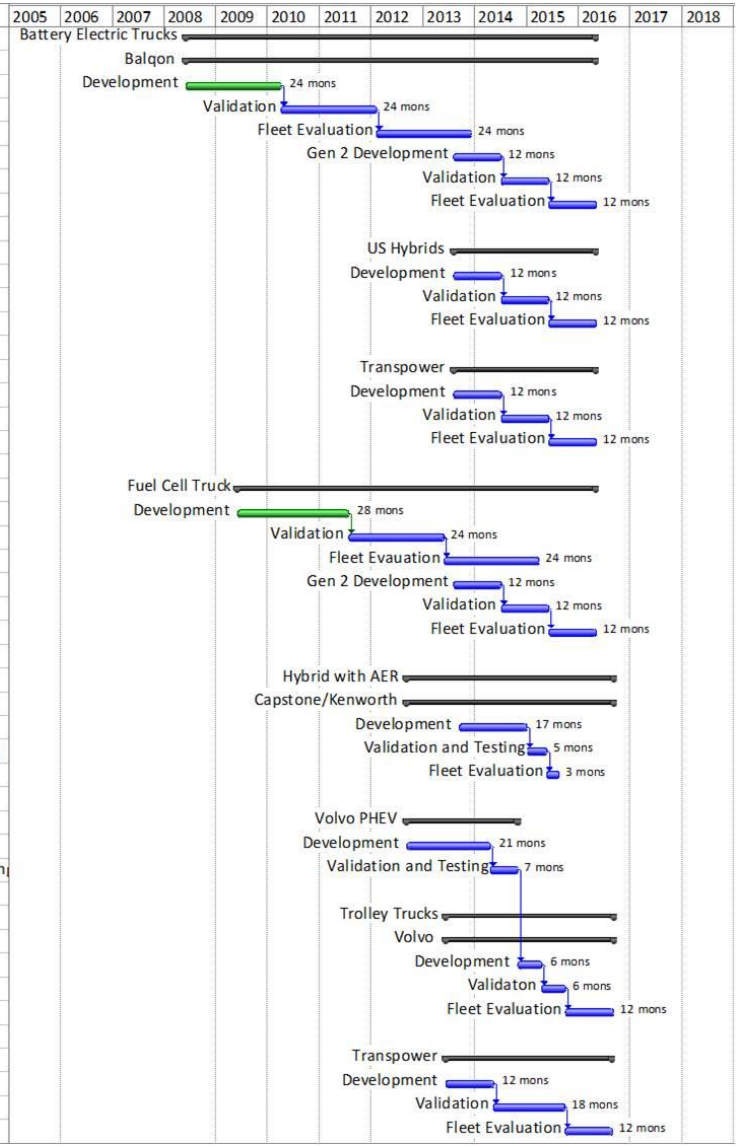
- Largest NOx Emissions Source Category
- Zero- and Near-Zero Emission Technologies Under Development
  - 0.02 g/bhp-hr Engine Development
  - Complete Demonstrations Class 8 Trucks as Early as Possible
- Develop mechanisms for Deployment of Zero- and Near-Zero Emission Trucks
- Economic Concerns with Replacement Value of Recently Acquired Trucks
- Incentive to Purchase Zero-Emission Technology

Going Beyond Current Technologies

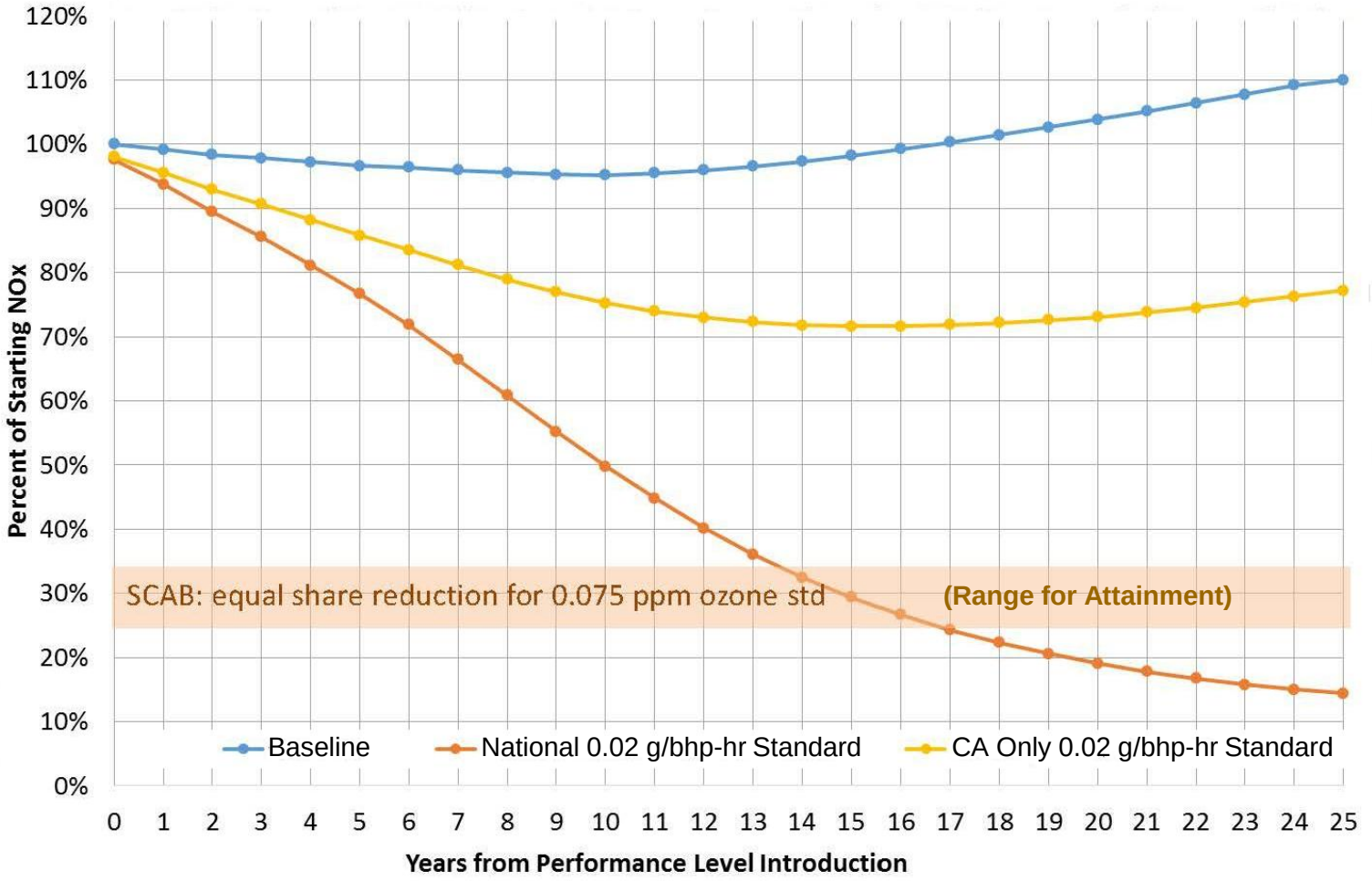
- Battery Electric
- Fuel Cell/Hybrid
- Natural Gas/Hybrid
- Extended Range Catenary/Wayside
- Alternative Fuels/ 90% Cleaner than Current 2010 Emission Standards

Zero-Emission Truck Projects

ID	Task Name
2	**Battery Electric Trucks**
3	**Balqon**
4	Development
5	Validation
6	Fleet Evaluation
7	Gen 2 Development
8	Validation
9	Fleet Evaluation
10	
11	**US Hybrids**
12	Development
13	Validation
14	Fleet Evaluation
15	
16	**Transpower**
17	Development
18	Validation
19	Fleet Evaluation
20	
21	**Fuel Cell Truck**
22	Development
23	Validation
24	Fleet Evauation
25	Gen 2 Development
26	Validation
27	Fleet Evaluation
28	
29	**Hybrid with AER**
30	**Capstone/Kenworth**
31	Development
32	Validation and Testing
33	Fleet Evaluation
34	
35	**Volvo PHEV**
36	Development
37	Validation and Testin
38	
39	**Trolley Trucks**
40	**Volvo**
41	Development
42	Validaton
43	Fleet Evaluation
44	
45	**Transpower**
46	Development
47	Validation
48	Fleet Evaluation



Emissions Analysis of a Statewide vs National Introduction of a New Technology*



Source: Presentation by Mr. Cory Palmer, ARB at the Symposium on California's Development of its Phase 2 Greenhouse Gas Emission Standards for On-Road Heavy-Duty Vehicles (April 22, 2015)