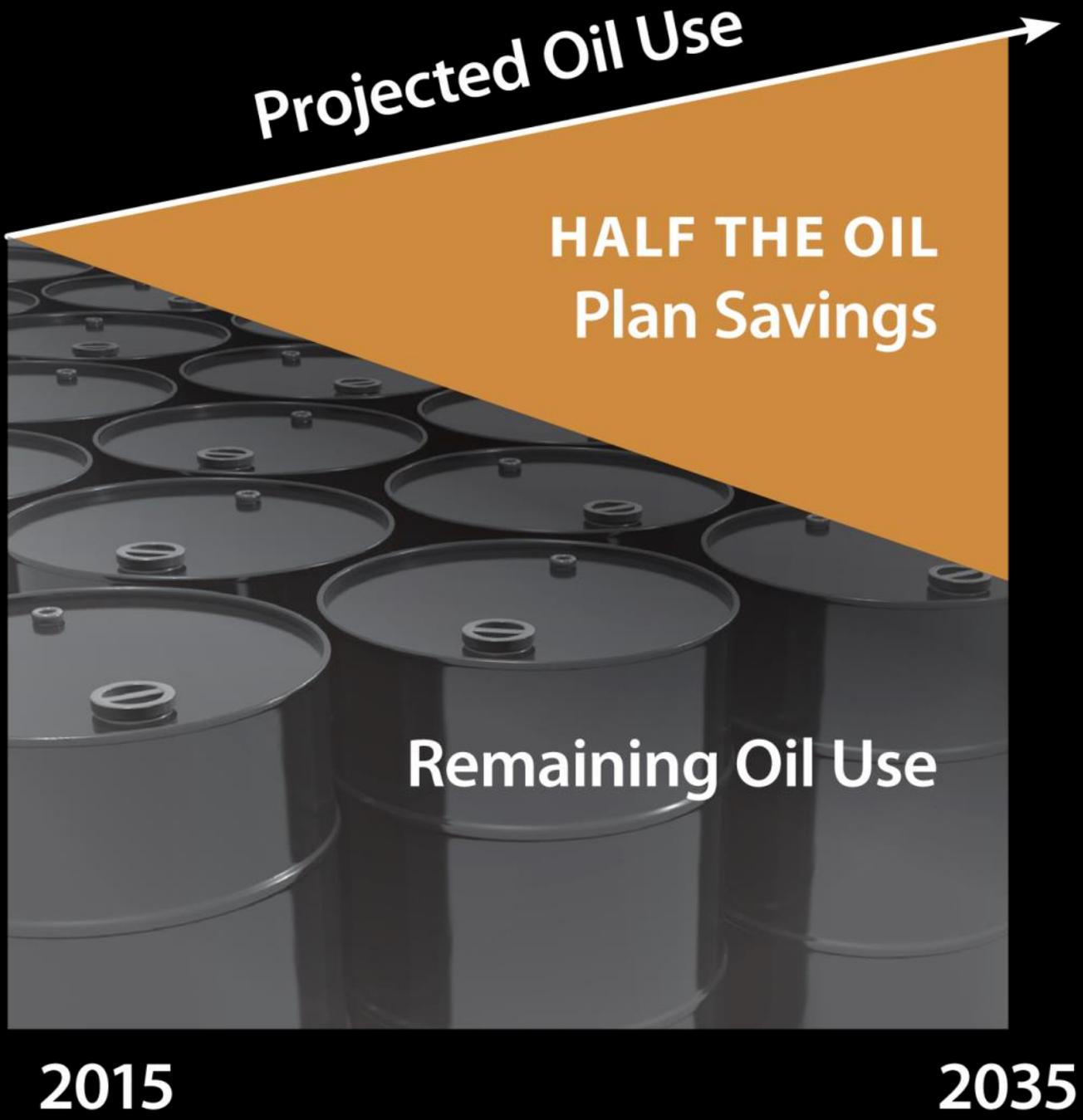


Opportunities to Reduce Emissions from Heavy-Duty Trucks

Don Anair
Research and Deputy Director
Clean Vehicles Program
Union of Concerned Scientists

ARB Symposium on Heavy-Duty Vehicles
April 22, 2015



Projected Oil Use

**HALF THE OIL
Plan Savings**

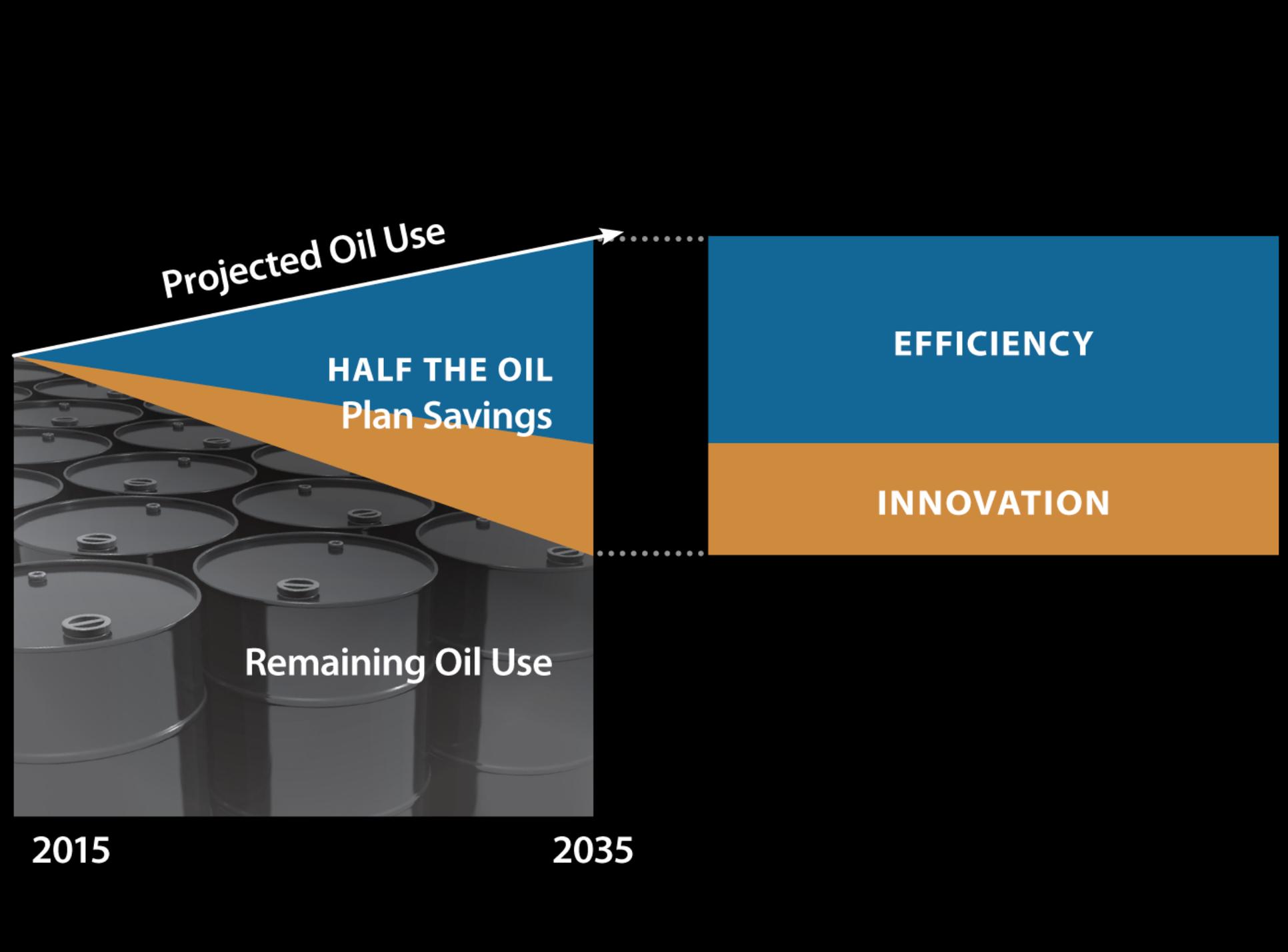
Remaining Oil Use

EFFICIENCY

INNOVATION

2015

2035



Tractor-Trailer Energy Losses

Engine Losses: 58-59%

Inertia/Braking: 0-2%

Aerodynamic Losses: 15-22%



Auxiliary Loads: 1-4%

Drivetrain: 2-4%

Rolling Resistance: 13-16%

Class 2B/3 Pickups and Vans

Gasoline and Diesel Technologies:

- Low friction lubricants
- Friction reduction
- Turbo charging and downsizing
- Stop/Start
- Transmissions
- Improved Accessories
- Aero and tire improvements
- Weight reduction
- Aftertreatment improvements

Improvement by 2025 from 2010 levels:

- 28% improvement
- 11.3 mpg -> 15.7 mpg
- Payback in less than 3 years



Vocational Trucks

Technologies:

- Improved Combustion
- Engine friction reduction
- Turbocharger Improvements
- Hybridization
- Powertrain Integration
- Improved Transmission
- Electrified Accessories
- Aero and tire improvements
- Weight reduction

Improvement by 2025 from 2010 levels:

- 21% to 49% improvement
- 9.7 mpg -> 14.3 mpg
- Payback in 4 years



Tractors and Trailers

Technologies:

- Engine friction reduction
- Engine downsizing
- Waste heat recovery
- Dual stage turbocompounding
- AMT and engine downspeeding
- Electrified Accessories
- Aero and tire improvements
- Idle reduction
- 6X2 drive axle
- Weight reduction
- Aftertreatment improvements

Improvement by 2025 from 2010:

- 35% to 50% improvement
- 5.8 mpg -> 10.7 mpg
- Payback in 10 to 17 months

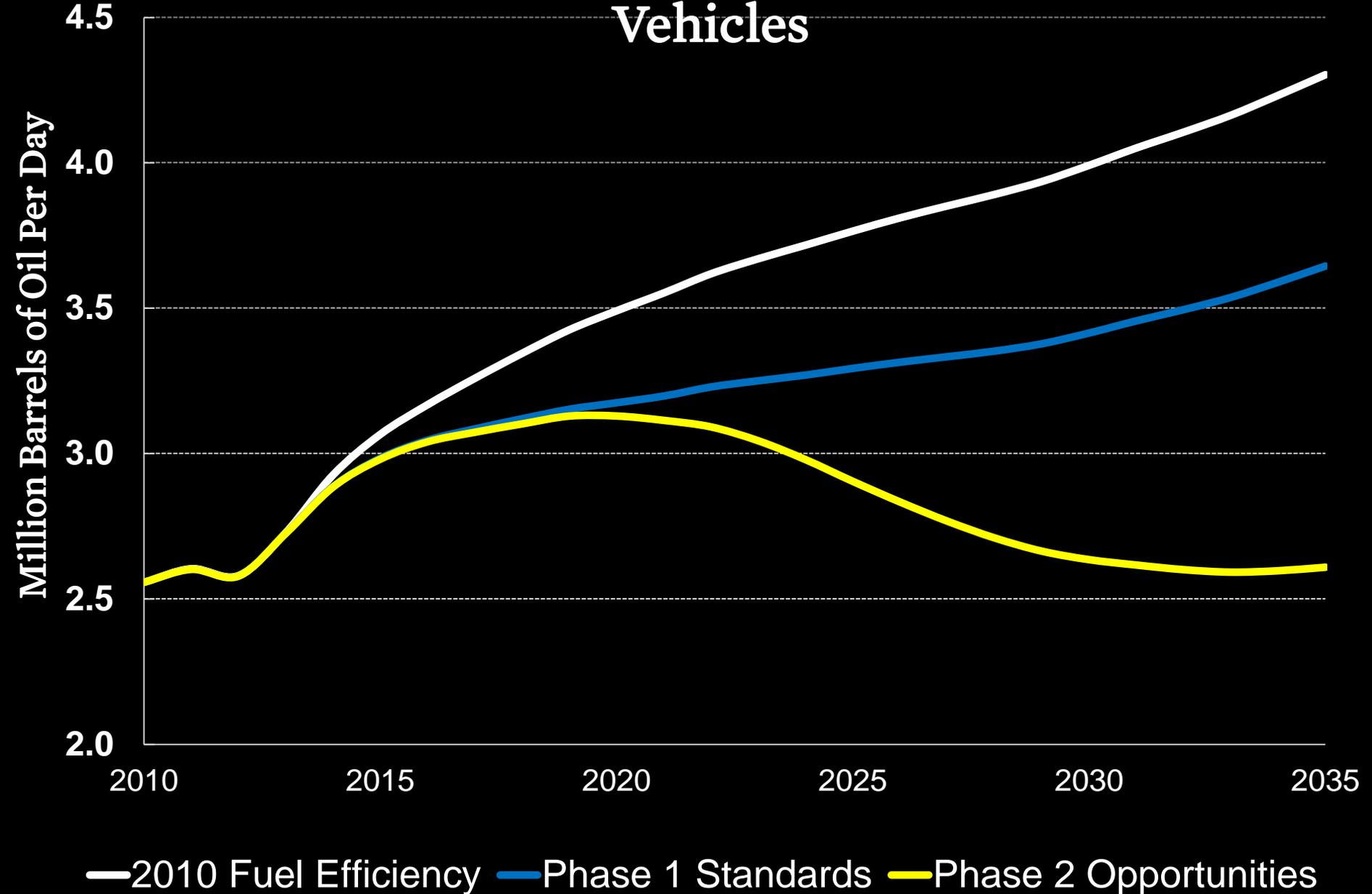


40% by 2025

Vehicle Category	Portion of Medium- and Heavy-Duty Vehicle Use	Fuel Consumption Reduction from 2010
Tractor-Trailers	66%	46%
Vocational Vehicles	19%	32%
Heavy-Duty Pickups and Vans	15%	28%
Total Reductions		40%

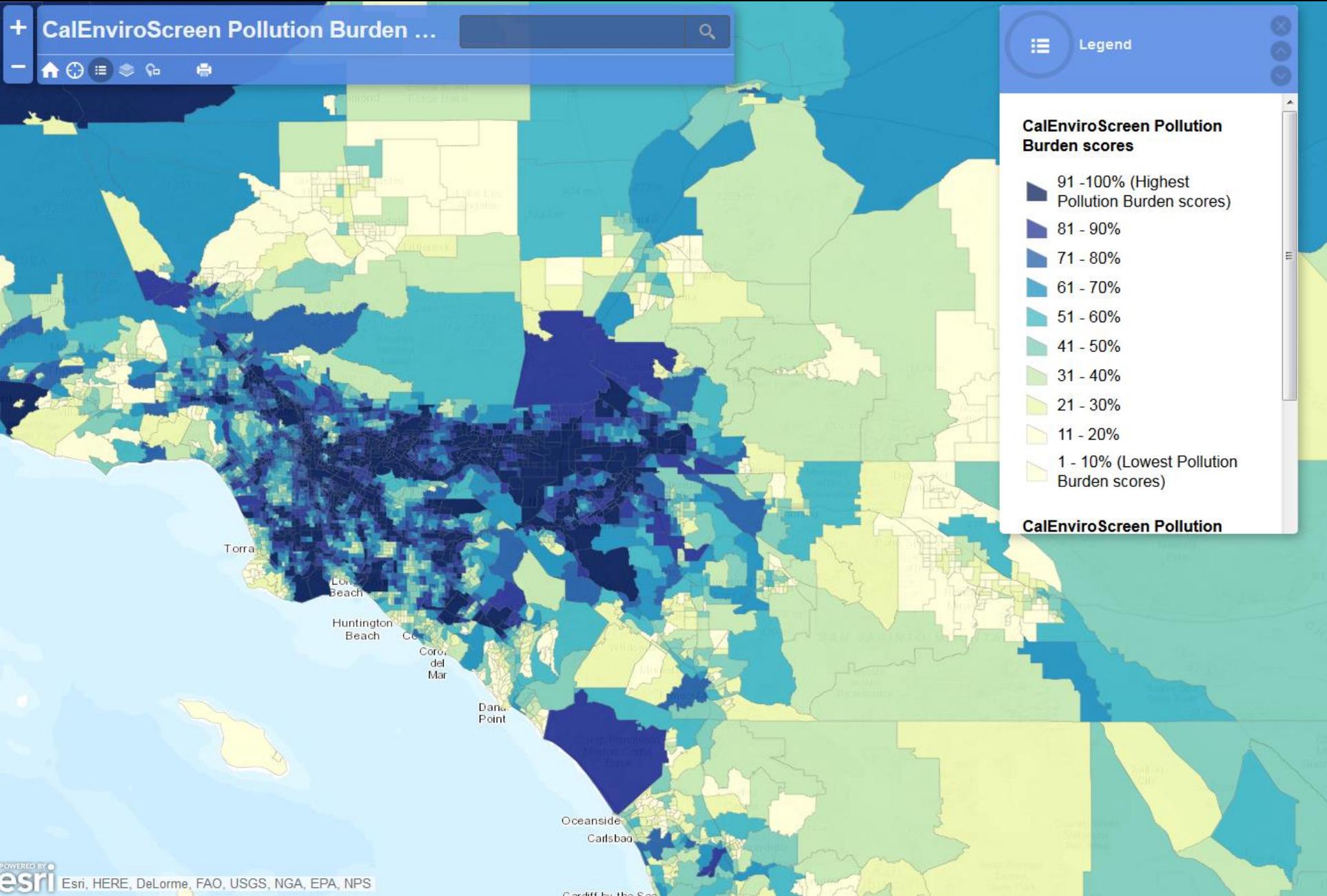
23 months : payback compared to new 2010 trucks

U.S. Fuel Usage from Medium- and Heavy-Duty Vehicles





Los Angeles Region Pollution Burden



Strong efficiency and greenhouse gas standards coupled with policies to support innovation and deploy advanced technologies are necessary to address climate change, unhealthy air, oil consumption, and environmental inequality