Benefits of Large Engine Replacements

Presentation Before
MARAMA

November 13, 2019

DIESEL TECHNOLOGY FORUM

Generating Benefits with Large Engine Repowers

Topics Covered

Background – Why we pursued this project

What are the benefits and how cost effective are they?

How long-lived are these assets and what are the benefits to local communities?

About Us

The Diesel Technology Forum is supported by leaders in advanced diesel engines, vehicles, equipment, components and fuels

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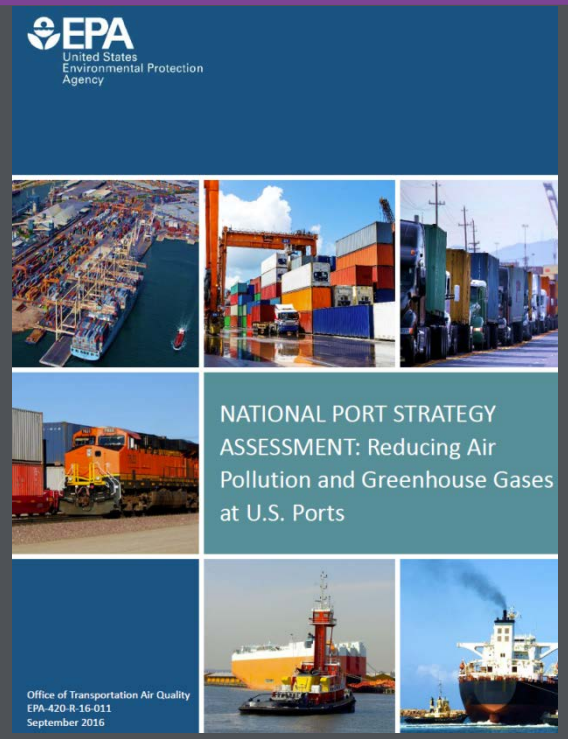
Benefits of Large Engine Repowers



- Tier 3, Tier 4 engine replacements yield substantial benefits
  - Workboat repower is similar to 96 dray truck replacements (30 tons NOx per year)
  - Switch locomotive repower is similar to 36 dray truck replacements (9 tons NOx per year)

TERP
TEXAS EMISSIONS REDUCTION PLAN
A PROGRAM OF THE TCEQ

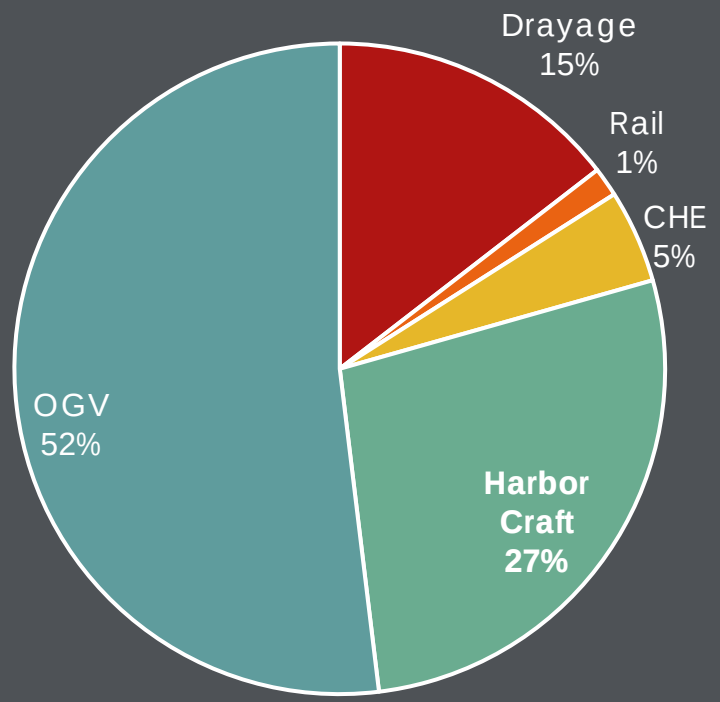
GET MONEY TO UPGRADE OR REPLACE YOUR TRUCK OR EQUIPMENT—AND CLEAR THE AIR!

EDF
ENVIRONMENTAL DEFENSE FUND®
Finding the ways that work

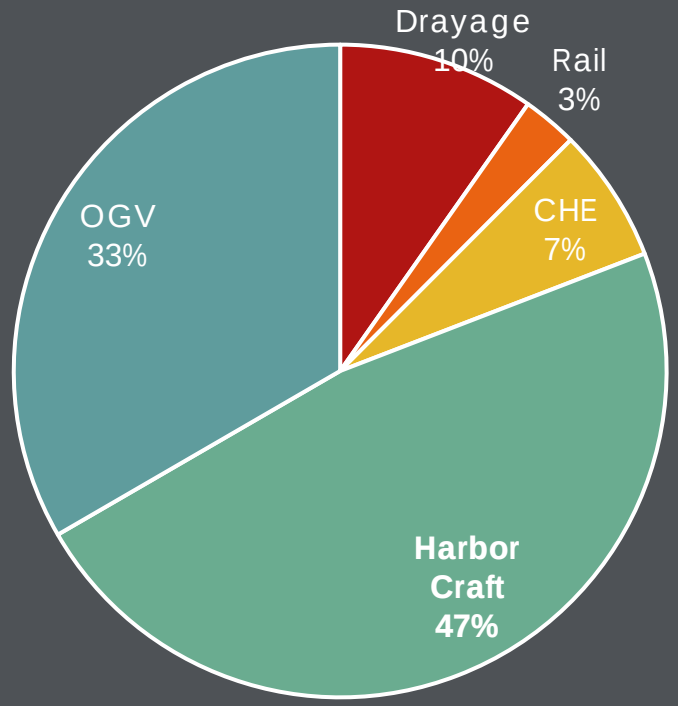
Texas Emission Reduction Program = Large engine replacements are enormously cost effective

Emission Reductions From Tugs and Switchers Matter

PM 2.5 Emissions (2011)

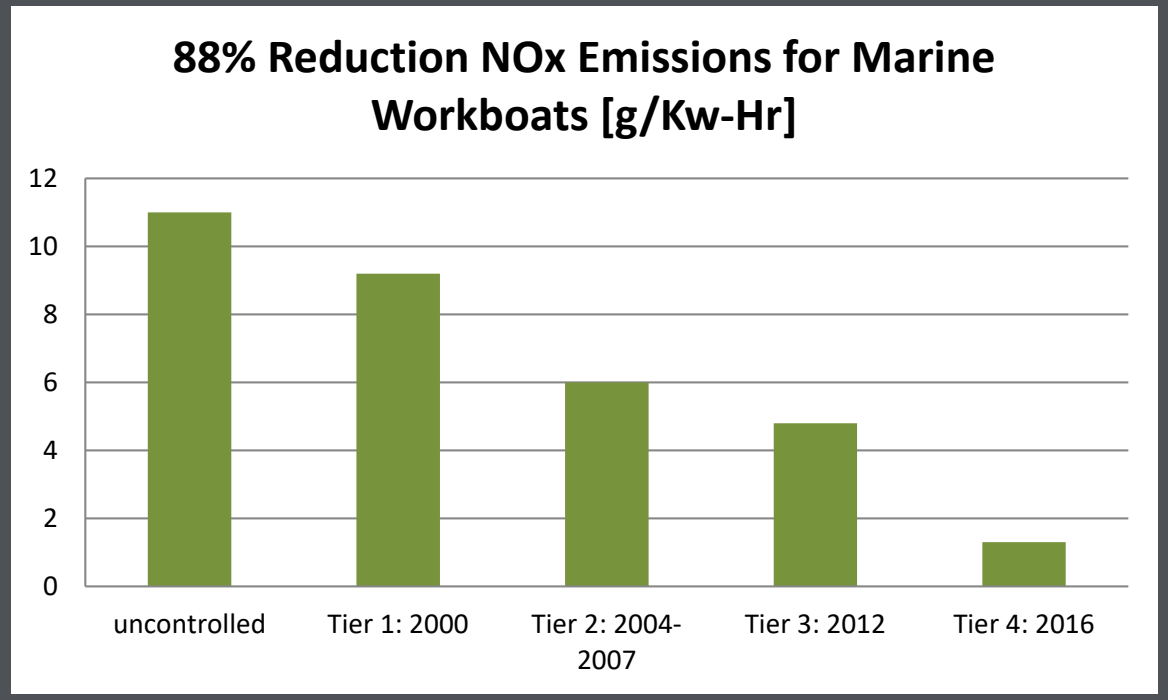


NOx Emissions (2011)



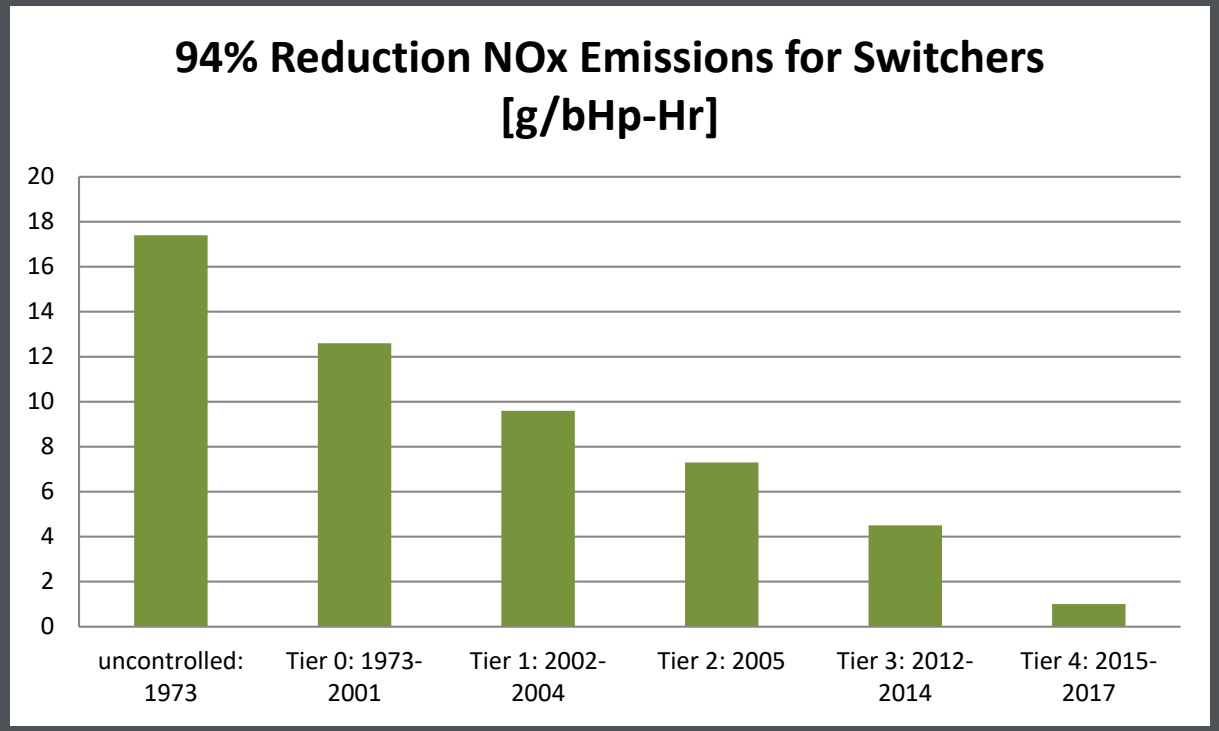
SOURCE: U.S. EPA, *National Port Strategy Assessment (2016)*

Progress to Near Zero Emissions with Clean Diesel Workboats



Typically 2 propulsion engines with additional auxiliary engines

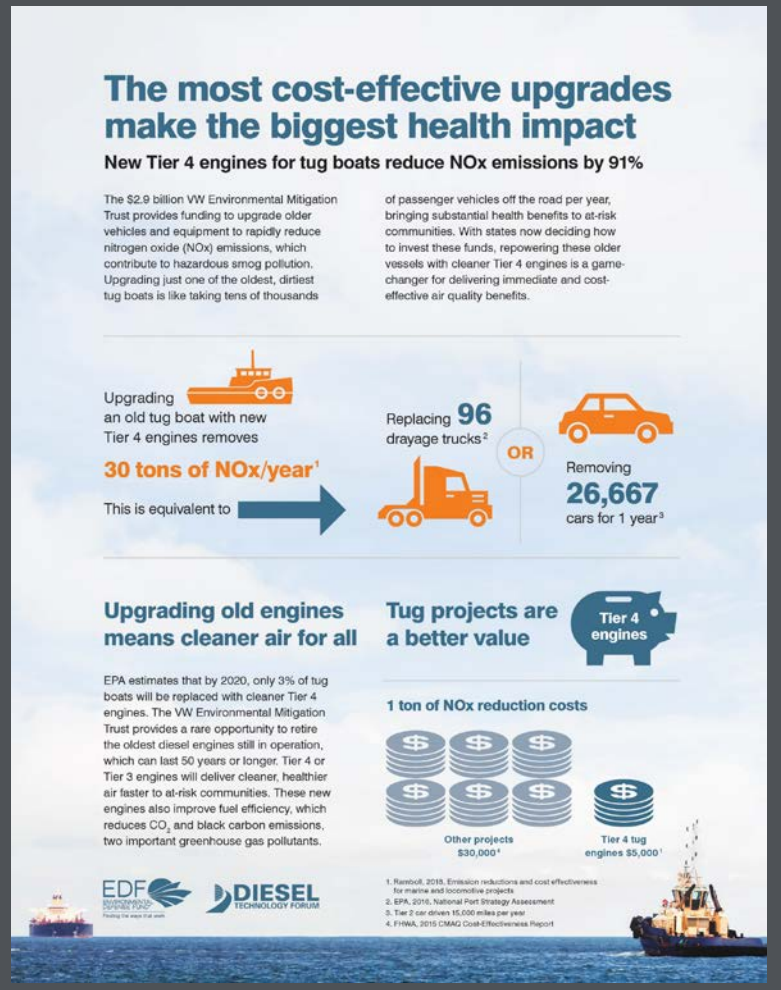
Progress to Near Zero Emissions with Switch Locomotives



New switchers typically use a single engine

Large Engine Repowers Are Among the most Cost Effective

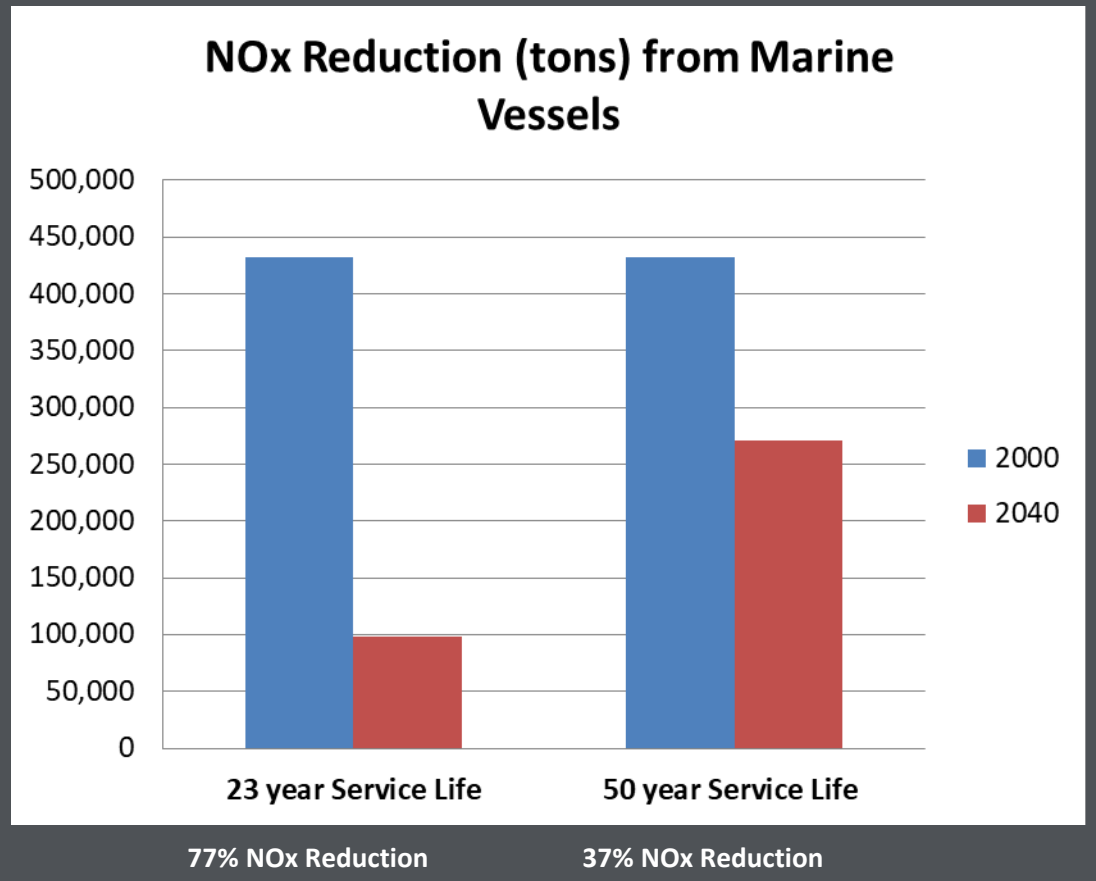
1 ton of NOx eliminated = $15,000



1 ton of NOx eliminated = $5,000

Marine Repowers Are Important For Local Communities

Phase 2 Research Finding: Marine Engines have a service life 2X as EPA emission model assume (50 years as opposed to 23 years)



Why is this important? EPA emissions models overestimate anticipated benefits. **Introducing new clean diesel engines is important to achieve modeled benefits.**

What if marine engines were replaced as quickly as EPA assumed?

New York – New Jersey
8 tons per day

Baltimore
Just under 1 ton per day

Houston - Galveston
4 tons per day

CASE STUDY: Reducing Emissions with Clean Diesel Workboats

pscleanair.org
Puget Sound Clean Air Agency

***"Island Chief"* workboat engine replacement**

- 2 unregulated propulsion engines replaced with 2 Tier 3
- 1 unregulated auxiliary engine replaced with Tier 4

Cost: $225,000

Benefits Provided

- Reduced 3.2 tons of NOx per year
- Eliminated 400 lbs of fine particles

- Saved the operator 45,000 gallons of fuel resulting in 1,000 tons of GHG emissions

BIG Co-Benefits

CASE STUDY: Reducing Emissions with Clean Diesel Switchers

Waste Management New York (WMNY) The WMNY project repowered an old unregulated four-axle 1,200-hp locomotive used in switcher service with a Knoxville Locomotive Works (KLW) Near Zero Emissions Tier 4 Certified 2,300-hp mother-slug locomotive combination.

- 19.4 tons nitrogen oxide (NO_x), a 99 percent reduction annually;
- 0.48 tons particulate matter ($PM_{2.5}$), a 99 percent reduction annually; and
- 26,000 gallons of diesel saved, a 40 percent reduction annually.

BIG Co-Benefits

https://www.epa.gov/ports-initiative/new-york-city-locomotive-repowers-collaborative-efforts-improve-air-quality?fbclid=IwAR2wUx2848cmG_PDQcrY9IlclL_Q2pTcgXvpfDcO-Q_J5V1y0-FNPYpzU5U#outcomes

Summing it Up

- Switcher and Marine Engine Replacements are Among the Most Cost Effective Investments for Reducing Emissions on a $/ton basis
- More emissions can be removed for a single large engine project and deliver immediate benefits to communities
- Category 2 marine engines are 2X as long lived as EPA emissions models assume.
- **Using incentive funds to replace older marine engines faster could go a long way to generate real world benefits as assumed by EPA emissions models.**

Read more about our Large Engine research:

https://www.dieselforum.org/largeengineupgrades

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Perspectives on Permitting & Testing of Stationary Engines

Join industry experts for a deeper dive into emission control strategies for backup power generators including a look at simplifying the permitting process, testing procedures and real-world performance of advanced technologies. You will be provided with an understanding of emissions regulations, the importance of properly written requirements regarding test procedures, a practical understanding of how equipment is used in the field, and a real world understanding of aftertreatment technologies.

LIVE - **November 13, 2019** – 1:00-2:00pm EST

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