

Diesel Emissions Quantifier (DEQ)

Presentation to NASEO

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What is DEQ?

- Estimator for evaluating clean diesel projects and upgrade options for medium-heavy and heavy-heavy duty diesel engines
- Interactive, web-based tool for users without modeling experience
- New release coming in April 2017



What DEQ Does

- Assesses onroad, nonroad, locomotive and marine projects
- Accepts user-specific inputs for engine specs and usage
- Allows for multiple upgrades (emission control devices, idle reduction, replacements, alternative fuels, etc.)
- Provides annual and lifetime estimates for
 - *Baseline emissions (in short tons)*
 - *Reduced emissions (in short tons and % of baseline)*
 - *Cost effectiveness (total project and/or capital costs)*
 - *PM related health benefits (needs updating)*



What DEQ Doesn't Do

- Does not estimate
 - *Emissions from C3 marine engines*
 - *GHG reductions except for CO₂ when fuel usage is reduced*
 - *Offsets for emissions from power plants*
 - *Black carbon emissions*
 - *Health benefits from NO_x, HC and CO reductions*
- Cannot be used for SIPs or Conformity



How DEQ works

- For engine or vehicle replacements:
DEQ estimates emissions from both the old and new engines. The difference is the estimated emission reduction resulting from the replacement.
- For other upgrades (emission controls, idle reduction, etc.):
DEQ applies EPA or CARB verified emission reduction factors to the baseline emissions. The result is the estimated emission reduction from the upgrade.



Assumptions in DEQ

- CNG, LNG and LPG engine/vehicle replacements use diesel criteria pollutant factors as a surrogates.
 - *No good data source for alternative fuel & engine factors*
 - *Alternative fuel engines must meet diesel standards*
 - *Converts alternate fuel to diesel-equivalent gallons for CO₂*
- Median life is used in estimating lifetime reductions; this may be edited, but the value is capped.
- For nonroad, locomotive and marine, assigns baseline engine year or tier when only one of these is entered.



Data sources for DEQ

- Onroad – MOVES2014a (in-use data)
- Nonroad
 - *Factors & formulas from the NONROAD model*
 - *EPA regulatory documents*
- Locomotive – EPA regulatory documents
- Marine – EPA regulatory documents
- Emission reductions from EPA and CARB verification and certification programs



Strengths of DEQ

- Easy to use
- Projects can be saved for later editing and review
- Inputs and results are downloadable in Excel format
- Historic baseline data
 - *Onroad beginning 1985*
 - *Nonroad, locomotive and marine beginning 1973*
- Specific emission factors for running, duty-cycle idling & hoteling for onroad vehicles
- Duty-cycle specific factors for line haul locomotives



Limitations of DEQ

- No NO_x reduction with switch from ULSD to alternative fuel (may see reductions from newer engine or other upgrade)
 - *Uses ULSD factors for criteria pollutants*
 - *Have factors for B5 and B20 for onroad vehicles*
- No offset of power plant emissions for electric engine/vehicle replacements or electrified parking spots
- Health benefits module needs updating



Create New Project – onroad, nonroad or locomotive

Project Name

Fleet Type

State

To estimate Total Cost for this project, enter funding amounts in the fields below.

Total costs reflect all funding related to this project, including capital and administrative costs.

EPA Awarded Funds \$

Mandatory Cost Share \$

Voluntary Cost Share \$

Leveraged Funds \$

Other \$

To estimate Capital Cost Effectiveness for each upgrade, enter the unit and labor costs on the 'Add Upgrade' or 'Edit Upgrade' screen.

You may estimate both Total Cost Effectiveness and Capital Cost Effectiveness.



Add Vehicle or Engine Group – onroad, nonroad or locomotive

Add a Vehicle or Engine Group

Onroad Vehicle: ?

[Long Haul - Combination](#)

[Long Haul - Single Unit](#)

[Refuse Hauler](#)

[School Bus](#)

[Short Haul - Combination](#)

[Short Haul - Single Unit](#)

[Transit Bus](#)

Nonroad Equipment:

[Agriculture](#)

[Construction](#)

[Ports and Airports](#)

[Rail](#)

[Stationary](#)

Locomotive:

[Line Haul Locomotive](#)

[Passenger Locomotive](#)

[Switch Locomotive](#)



Define a Vehicle Group - onroad

Group Name

Type

Target

Class or Equipment

Quantity

Engine Model Year

Upgrade Year ?

Fuel Type ?

If you do not have specific data for all of the fields below, select 'Get Default Values' (some defaults are not available). After the default values have been loaded, you may edit the fields for which you have specific data. For more information, see the [Default Values Document](#).

[Get Default Values](#)

Annual Fuel Volume (in gallons for group)

Diesel-equivalent Gallons (for group)

Annual Miles Traveled (per vehicle)

Annual Idling Hours (per vehicle) ?

Annual Hoteling Hours (per vehicle) ?

[Get Estimated Remaining Life](#) ?

Remaining Life (in years at time of upgrade)

Define a Vehicle Group – nonroad and locomotive

Type **Nonroad** ▾

Target Fleet **Ports and Airports** ▾

Class or Equipment **Select...** ▾ ?

Quantity **Select...**

ACRefrigeration

Aerial Lifts

Airport Support Equipment

Cranes

Forklifts

Light Commercial Air Compressors

Light Commercial Gas Compressors

Light Commercial Generator Sets

Light Commercial Pressure Washer

Light Commercial Pumps

Light Commercial Welders

Enter either Engine Model Year or Tier, or both if known.
If either field is left blank, a default value will be assigned.
If you select Tier 4, also enter the Tier 4 engine model year.

Engine Model Year **Select...** ▾

and/or Tier **Select...** ▾

Upgrade Year **Select...** ▾

Fuel Type **Select...**

Group Name **loco**

Type **Locomotive** ▾

Target Fleet **Locomotive** ▾

Class or Equipment **Line Haul Locomotive** ▾

Duty Cycle **Select...** ▾

Quantity **Select...**

Line Haul

Switch

Enter either Engine Model Year or Tier, or both if known.
If either field is left blank, a default value will be assigned.

Engine Model Year **Select...** ▾

and/or Tier **Select...** ▾

Upgrade Year **Select...** ▾

Fuel Type **Select...**



Add an Upgrade – onroad, nonroad or locomotive

Action	Upgrade	Cost per Unit		Percent Reduction				
		Upgrade	Labor	NO _x	PM2.5	HC	CO	CO ₂
No upgrades have been applied.								

Add an Upgrade

Idling Control Strategies:	Emissions Control Devices:	Replacements:	Fuel Options:	Aerodynamic Devices:
Auxiliary Power Unit	Diesel Oxidation Catalyst	Engine Replacements	Biodiesel (B5)	Trailer Bubble / Tails
Electrified Parking Space	Diesel Oxidation Catalyst + Closed Crankcase Ventilation	Vehicle Replacements	Biodiesel (B20)	Trailer side skirts
Fuel Operated Heater	Diesel Oxidation Catalyst + Diesel Particulate Filter		Other Fuel Options	Other Aerodynamic Devices
Other Idling Control Strategies	Diesel Particulate Filter			
	Exhaust Gas Recirculation + Diesel Particulate Filter	Tire Technology:		
	Selective Catalytic Reduction + Diesel Particulate Filter	Single Wide Tires		
	Other Emissions Control Devices	Other Fuel Efficient Tire		



Add an Upgrade - onroad

Upgrade Type

Upgrade

New Engine Model Year

Annual Gallons Fuel Reduced (for group)

For best cost effectiveness results, enter the costs for every upgrade in your project. Your results will be skewed if you enter costs for only some of the upgrades.

Upgrade Cost Per Unit \$

Labor Cost Per Unit \$

Percent of Emissions Reduced ?

NO_x %

PM_{2.5} %

HC %

CO %

CO₂ %

Upgrade Type

Upgrade

Annual Idling Hours Reduced (per vehicle)

Annual Hoteling Hours Reduced (per vehicle)

Upgrade Cost Per Unit \$

Labor Cost Per Unit \$

Percent of Emissions Reduced ?

NO_x %

PM_{2.5} %

HC %

CO %

CO₂ %



Add an Upgrade – nonroad and locomotive

Upgrade Type

Upgrade

New Engine Model Year

and/or New Tier

New Horsepower

Annual Gallons Fuel Reduced (for group)

For best cost effectiveness results, enter the costs for every upgrade in your project. Your results will be skewed if you enter costs for only some of the upgrades.

Upgrade Cost Per Unit \$

Labor Cost Per Unit \$

Percent of Emissions Reduced ?

NO_x %

PM2.5 %

HC %

CO %

CO₂ %

Upgrade Type

Upgrade

Upgrade Cost Per Unit \$

Labor Cost Per Unit \$

Percent of Emissions Reduced ?

NO_x %

PM2.5 %

HC %

CO %

CO₂ %



Create New Project – marine

Project Name

Fleet Type

State

Application

* Each vessel

The DEQ ca category 3 engines.

Engines

- Ferry/Excursion
- Tug Boat/ Tow Boat
- Commercial Fishing
- Commercial Charter Fishing
- Crew and Supply
- Pilot
- Work Boat
- Other
- Ocean Going Vessels

To estimate Total Cost below.
Total costs reflect all fun

enter funding amounts in the fields
ding capital and administrative costs.

EPA Awarded Funds \$

Mandatory Cost Share \$

Voluntary Cost Share \$

Leveraged Funds \$

Other \$



Add Engine Group – marine

Add an Engine Group

[Propulsion](#)

[Auxiliary](#)

[<< Back to My Projects](#)

[Quantify Project Emissions](#)



Define an Engine Group - marine

Group Name

Type **Propulsion** ▾

Engine Quantity **Select...** ▾

Enter either Engine Model Year or Tier, or both if known.
If either field is left blank, a default value will be assigned.

Engine Model Year **Select...** ▾

and/or Tier **Select...** ▾

Upgrade Year **Select...** ▾

Horsepower

Horsepower **500**

Cylinder Displacement (in liters) **Select...** ▾ ?

Annual Usage Hours (per engine) **Select...**

Fuel Type **Select...**

Annual Fuel Volume (in gallons for group) **Select...**

Diesel-equivalent Gallons (for group) **Select...**

Remaining Life (in years at time of upgrade) **Select...** [? Remaining Life ?](#)

- size < 0.9
- 0.9 <= size <1.2
- 1.2 <= size <2.5
- 2.5 <= size <3.5
- 3.5 <= size <5.0
- 5.0 <= size <15.0
- 15.0 <= size < 20.0
- 20.0 <= size < 25.0



Emission Results

Emissions Results [?]

Here are the combined results for all groups and updates entered for your fleet.¹

<u>Annual Results (short tons)</u>	NO_x	PM2.5	HC	CO	CO₂	Fuel²
Baseline for Upgraded Vehicles	2.314	0.091	0.164	0.759	192.6	17,349
Amount Reduced After Upgrades	0.000	0.018	0.082	0.303	0.0	0
Percent Reduced After Upgrades	0.0%	20.0%	50.0%	40.0%	0.0%	0.0%

<u>Lifetime Results (short tons)</u>	NO_x	PM2.5	HC	CO	CO₂	Fuel²
Baseline for Upgraded Vehicles	4.627	0.182	0.328	1.517	385.1	34,698
Amount Reduced After Upgrades	0.000	0.036	0.164	0.607	0.0	0
Percent Reduced After Upgrades	0.0%	20.0%	50.0%	40.0%	0.0%	0.0%



Cost Effectiveness

Lifetime Cost Effectiveness (\$/short ton reduced)

Capital Cost Effectiveness (unit & labor costs only)		\$0	\$68,580	\$15,248	\$4,120	\$0
Total Cost Effectiveness (includes all project costs)		\$0	\$0	\$0	\$0	\$0

¹ Emissions from the electrical grid are not included in the results.

² In gallons; fuels other than ULSD have been converted to ULSD-equivalent gallons.

<u>Remaining Life</u>	long haul: Long Haul - Combination Class 8	2.0 years
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Health Benefits

Note: For comparison purposes only. The Health Benefits module data is out of date and will be updated when resources become available.

This section estimates the health benefits resulting from your project's reduction of PM 2.5, based on the inputs you have entered.

You may select up to five counties where the emission reductions will take place and allocate a percentage of the reductions to each of the counties selected. The percentages must total 100 percent.

State	County	Percent
Michigan ▾	Washtenaw ▾	30
Michigan ▾	Wayne ▾	70
Select State.. ▾	Select Count ▾	
Select State.. ▾	Select Count ▾	
Select State.. ▾	Select Count ▾	
Total		100



Health Benefit Results

The table below shows the estimated PM2.5 reductions and health benefits by county and as a total for your project. Results are based on the inputs you have entered.

Annual Benefits represent the dollar value of health benefits resulting from reduced exposure to PM2.5. These benefits include the reduction of premature mortality, chronic bronchitis, asthma attacks, non-fatal heart attacks, and other health problems. The dollar values are based on studies used by EPA when estimating the health benefits of environmental rules.

Annualized Costs are based on the unit and labor costs you have entered. They have been annualized over the remaining life of the upgraded fleet.

Health Benefits Results

County and State	Annual Diesel PM2.5 Reduction (short tons)	Annual Benefits
Washtenaw, Michigan	0.032	\$20,000
Wayne*, Michigan	0.074	\$99,000
Total	0.106	\$120,000

Annualized Unit & Labor Costs for the Project: \$0



For More Information

DEQ website

www.epa.gov/cleandiesel/diesel-emissions-quantifier-deq

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Questions about DEQ or the DERA option

cleandiesel@epa.gov

877-623-2322