State of Oregon

Department of Environmental Quality Memorandum

Date: November 30 2020

To: Joint Task Force on Supporting Businesses in Reducing Diesel Emissions

From: Matt Davis - DEQ

Subject: Supplemental Information for Task Force Discussions

This memo responds to requests for additional information related to three issues:

- The number of older nonroad diesel engines in use throughout Oregon;
- The cost-effectiveness on a "per-ton basis" of various emissions reduction strategies; and
- Evaluation of tax credits previously available in Oregon for clean diesel investments

We hope the information provided, as well as the source materials referenced throughout this memo are helpful. Agency staff will attend the Task Force meeting scheduled for December 3rd 2020 to present this information. Please do not hesitate to contact Matt Davis (davis.matthew@deq.state.or.us) in the meantime with any clarifying or additional questions.

Nonroad Diesel Engines in Oregon

In 2020, Eastern Research Group – under contract with DEQ – completed and published a comprehensive Nonroad Diesel Engine Emissions Inventory. That work was funded via a special appropriation by the Oregon Legislature in 2017. The study methodology and results were shared with this Task Force at its July 2020 meeting.

The tables below illustrate statewide equipment counts by sector and Tier (i.e. age). Tier 0, 1 and 2 are generally considered to be the highest priority for emissions reductions treatment. The total cost of addressing all older engines is dependent on a variety of key factors, most importantly:

- The nature of the equipment – which varies widely in the nonroad context from skid-steers, to agriculture tractors, to large stick boom cranes.
- The nature of the treatment (e.g. retrofit, repower, replacement)
- The reimbursement or subsidy rate an incentive program provides

Logging Equip	**Tier 0**	**Tier 1**	**Tier 2**	**Tier 3**	**Tier 4**	**Total**
All HP ranges	*642*	*402*	*256*	*476*	*1070*	**2847**
% of total	22.6%	14.1%	9.0%	16.7%	37.6%	
Agricultural Equip	**Tier 0**	**Tier 1**	**Tier 2**	**Tier 3**	**Tier 4**	**Total**
All HP ranges	16197	6576	3718	5808	13419	**45718**
% of total	**35.4%**	**14.4%**	**8.1%**	**12.7%**	**29.4%**	

Surface Mining	**Tier 0**	**Tier 1**	**Tier 2**	**Tier 3**	**Tier 4**	**Total**
All HP ranges	291	118	67	104	241	**822**
% of total	35.4%	14.4%	8.1%	12.7%	29.4%	
Construction/Mining	**Tier 0**	**Tier 1**	**Tier 2**	**Tier 3**	**Tier 4**	**Total**
All HP ranges	3401	1674	1753	1964	4389	**13181**
% of total	25.8%	12.7%	13.3%	14.9%	33.3%	

The Table below reflects the sum totals from all sectors above.

All Sectors	**Tier 0**	**Tier 1**	**Tier 2**	**Tier 3**	**Tier 4**	**Total**
All HP ranges	20531	8771	5794	8353	19119	**62568**
% of total	33%	14%	9%	13%	31%	

Among the study methodologies was a random-sample fleet survey of key sectors. The study was not resourced to complete a "census" style count of all engines in the state. Rather, ERG surveyed key sectors with the assistance of industry associations. The surveys included assessing the number and Tier (i.e. age) of equipment and extrapolating that to generate statewide estimates. Note the final report provided statewide figures for logging and agriculture. ERG estimates they surveyed approximately 11% of all mining and construction fleets. The tables above extrapolate the age distribution of the approximately 1,400 mining/constructions engines they received data on to generate statewide estimates of engine counts.

Source materials

- Oregon Nonroad Engine Equipment Survey and Emissions Inventory, Eastern Research Group. Available at: https://www.oregon.gov/deq/aq/Documents/orNonroadDieselRep.pdf
- Presentation to Task Force available at: https://olis.oregonlegislature.gov/liz/2019I1/Downloads/CommitteeMeetingDocument/224767

Cost-Effectiveness of Emissions Reduction Strategies

Generally speaking, investments in clean diesel technology are found to be an extremely cost-effective environmental and public health strategy that also benefits the owners and operators of diesel equipment. In its evaluation[1] of the Diesel Emissions Reduction Act program, the US Environmental Protection Agency notes "Each federal dollar invested in clean diesel projects has leveraged as much as $3 from other government agencies, private organizations, industries, and nonprofit organizations,

[1] DERA Fourth Report to Congress, EPA. Available at: https://www.epa.gov/sites/production/files/2019-07/documents/420r19005.pdf

generating between $11 and $30 in public health benefits. Each federal dollar invested in DERA also results in over $2 in fuel savings."

The most comprehensive evaluation of the cost-effectiveness of various emissions reduction strategies on per-ton of pollutant basis is prepared by the Federal Highway Administration as part of a routine evaluation of the Congestion Mitigation and Air Quality Improvement program (CMAQ).

The table below is from the most recent CMAQ cost-effectiveness analyses, published in July 2020. DEQ advises paying close attention to the cost-per-ton estimates for fine particulate matter (PM2.5) and NOx, the two pollutants of particular concern in Oregon.

Project Type	CO	NOx	VOCs	PM_{10}	$PM_{2.5}$	Total Median Cost per Ton
Dust Mitigation				A	B	$ 15,932
Idle Reduction Strategies	A	A	A	B	B	$ 58,999
Diesel Engine Retrofit Technologies	B	B	C	D	D	$ 407,684
Intermodal Freight Facilities and Programs	B	A	C	D	D	$ 494,834
Carsharing	A	B	B	D	E	$ 766,199
Incident Management	B	B	D	D	D	$ 1,071,991
Transit Service Expansion	A	C	C	E	F	$ 2,766,431
Traffic Signal Synchronization	C	D	F	D	F	$ 3,042,950
Park and Ride	A	C	D	E	F	$ 3,622,288
Natural Gas Re-Fueling Infrastructure	A	B	D	F	F	$ 3,675,107
Electric Vehicle Charging Stations	A	C	D	F	F	$ 6,380,581
Transit Amenity Improvements	B	D	D	F	G	$ 7,457,446
Rideshare Programs	B	D	D	F	G	$ 8,194,085
Roundabouts	D	D	F	G	F	$ 8,786,402
Extreme Temperature Cold-start Technologies	B	F	D	F	F	$ 10,850,034
Bikesharing	B	G	F	F	G	$ 13,834,816
Bicycle and Pedestrian Improvement Projects	B	D	E	F	H	$ 19,423,016
Intersection Improvements	D	F	F	H	H	$ 30,823,921
Employee Transit Benefits	D	F	F	H	I	$ 50,281,268
Subsidized Transit Fares	D	F	F	H	I	$ 50,281,268
Heavy-Duty Vehicle Replacements	D	D	F	I	I	$ 69,830,233

Median Cost-Effectiveness (Dollars per Ton Reduced)	
A	<10,000
B	10,000 - 50,000
C	50,000 - 100,000
D	100,000 - 500,000
E	500,000 - 1,000,000
F	1,000,000 - 5,000,000
G	5,000,000 - 10,000,000
H	10,000,000 - 20,000,000
I	>20,000,000

It is important to note that the FHA advises against using these figures in evaluating or prioritizing investments of non-CMAQ funds. This is primarily because the cost-effectiveness figures are derived only from CMAQ projects – which are subject to CMAQ-specific expenditure guidelines.

FHA also advises that its analyses use all reported project costs – not just the share of costs covered by CMAQ. That is to say, the cost-per-ton estimates may be lower when only considering the costs covered by CMAQ and assuming that without CMAQ support the project would otherwise not have occurred. This is particularly true in the instances of projects with high *total costs*, such as vehicle replacement.

DEQ suggests closely reading the section of the report focused on Heavy-Duty Engine Replacements. The analysis focuses heavily on school and transit busses. The results may be difficult to extrapolate meaningfully to other scenarios, such as replacing medium- and heavy-duty trucks.

Finally, cost-effectiveness is an important consideration in the design of an incentive program, but should be considered in the context of other factors, such as: benefit to vulnerable communities, cost-sharing requirements, and encouraging adoption of new and emerging technology. For example, school bus replacements traditionally do not score well in a pure cost-effectiveness test. However, they are widely seen as a clean diesel priority because the projects improve air quality around young children, a population particularly susceptible to the harmful effects of diesel engine exhaust.

Source material

- CONGESTION MITIGATION AND AIR QUALITY IMPROVEMENT (CMAQ) PROGRAM 2020 Cost-Effectiveness Tables Update, FHA. Available at: https://www.fhwa.dot.gov/environment/air_quality/cmaq/reference/cost_effectiveness_tables/fhwahep20039.pdf

Review of Tax Credit Programs

There are currently no tax credit programs available for clean diesel investments in Oregon, however three such programs existed previously:

1. Diesel Truck Engine tax credit:[2] For the purchase of new, cleaner heavy duty truck engines; tax credits range between $900 and $425 per engine, inversely related to the size of the fleet. Heavy duty trucks purchased from Oregon dealers qualify.
2. Diesel Retrofit tax credit:[3] 50% of the cost to purchase and install advanced exhaust controls on highway and non road diesel engines.
3. Diesel Repower tax credit:[3] 25% of the cost to repower a diesel engine with a cleaner engine; limited to nonroad engines only and requires scrapping of the old engine.

Oregon DEQ prepared a formal analyses of these programs and their effectiveness upon their sunset. That evaluation is attached as Appendix 1. Key points from that analysis include:

- The retrofit tax credit was only used once in its entire existence. DEQ attributes this low utilization to the fact that while retrofits are extremely cost-effective at reducing diesel particulate matter, they represent an added burden to the vehicle owner in terms of increased maintenance. Additionally, while other concurrent programs such as DERA are/were competitive, they do cover 100% of the project costs. Implementation of HB 2007 may create some demand for retrofit installations, as retrofitting is one compliance pathway for older trucks registered in Clackamas, Multnomah and Washington counties.
- The Diesel Truck Engine tax credit was widely used, although its impact on accelerating the transition to newer trucks was likely limited. The low value of the credit relative to the costs of a new truck meant is was of most value to fleets making bulk purchases, such that the cumulative value was worth the administrative burden and deferred benefit.
- The agency could not quantify air quality benefits attributable to the diesel truck tax credit, because scrappage of older vehicles was not a requirement. Nor did application materials require an applicant to indicate if the truck was a fleet *addition* versus a truck *replacement*.
- The repower tax credit was widely used, but not to the degree that the total annual cap was reached. Repowering, as opposed to vehicle or equipment replacement, makes the most economic sense when the equipment itself retains a significant economic value as the vehicle and the engine ages, e.g., a towboat, construction crane or bulldozer. The program's utilization was consistent with this reality and was used extensively in marine projects.

[2] Section 29, chapter 618 Oregon Laws 2003
[3] Sections 12 and 13, chapter 855, Oregon Laws 2007

APPENDIX 1 – Clean Diesel Tax Credit Review (2013)

Tax Credit Review – SB 319

Briefing paper for Senate Committee on Natural Resources and Environment

Prepared by Oregon Department of Environmental Quality, Air Quality Division

Diesel Retrofit tax credit[4]

What is the public policy purpose of this credit? Is there an expected timeline for achieving this goal?

> Diesel engines produce a complex exhaust mixture of gases and fine particulates, with the primary focus on diesel particulate matter, that contribute to a variety of public health and environmental concerns like increased risk for cancer, cardiovascular disease, respiratory disorders like asthma and bronchitis. The particulates in diesel are also considered a potent climate change factor. Scientists at the National Oceanographic and Atmospheric Administration and elsewhere have theorized that the black carbon component found in diesel exhaust may be up to 2000 times more powerful than CO_2 as a climate change agent on an equivalent basis. The California Office of Environmental Health Hazard Assessment concluded that diesel particulate is one of the top five most hazardous pollutants for children due to increased risk for asthma. The Environmental Quality Commission concluded, in evaluating air toxics, that exposure to diesel exhaust increases risk for cancer when adopting an Oregon health benchmark for diesel particulate.
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> In 2008, at the Legislature's direction, the Environmental Quality Commission adopted goals to reduce cancer risk from diesel exposure to one in a million by 2017 and, as an element of that goal, that fifty percent of 1973 and older school buses are replaced and remaining buses upgraded with advanced exhaust controls by 2013. Achieving the goal required a total reduction of 1410 tons in addition to what will be achieved from turnover to newer, cleaner engines. Current program efforts have achieved reductions of about 30 tons total since 2007.

Who (groups of individuals, types of organizations or businesses) directly benefits from this credit?

> Currently over 95 percent of Oregonians live in areas that exceed the Oregon health benchmark for exposure to diesel particulate. Population subgroups that are especially susceptible to the health effects associated with diesel PM exposure include the elderly, children and people with existing heart disease, lung disease and diabetes. All Oregonians exposed to diesel exhaust above benchmark would benefit from emission reductions facilitated by each of the tax credits.

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[4] Sections 12 and 13, chapter 855, Oregon Laws 2007
Retrofit tax credits – 50% of the cost to purchase and install advanced exhaust controls on highway and non road diesel engines.

This tax credit requires 50% usage in Oregon for at least three subsequent years and the project must also meet a cost effectiveness limit of no more than $250,000 per ton of diesel particulate reduced.

The annual cost from direct and indirect public health and environmental impacts in Oregon from exposure to diesel exhaust is estimated at $2 billion per year.

Owners of highway and non-highway diesel powered equipment, e.g., trucks, buses, construction, logging and agricultural equipment, fishing vessels, towboats and railroads, would directly benefit the retrofit tax credit when installing aftermarket exhaust controls on qualifying vehicles and equipment. There are ten Oregon based dealers who offer exhaust control retrofitting products and services that would also see benefits from sales supported by the tax credit.

What is expected to happen if this credit fully sunsets? Could adequate results be achieved with a scaled down version of the credit? What would be the effect of reducing the credit by 50%?

Even with offering the most aggressive discount in the country on this hardware only one applicant has applied for this credit since inception. Sunsetting this tax credit would result in no material difference in clean diesel efforts, although offering other forms of publicly based assistance is crucial to ensuring ongoing progress with this particular strategy.

There are a number of reasons why there is such little activity with this credit. Retrofit devices are extremely cost effective in reducing diesel emissions, delivering very high value to the community relative to their cost, but represent an added burden to the vehicle owner in terms of increased maintenance. Those fleets that have installed retrofit exhaust devices have done so supported by competitive federal grants that cover 100 percent of costs. Grants are considered more attractive to the recipient even though they are competitive, whereas with tax credits the application process is not competitive and every qualifying project could secure assistance.

What background information on the effectiveness of this type of credit is available from other states?

No other state offers a tax credit program for clean diesel activities. Washington, California, Texas, New Jersey and Massachusetts offer state funded grant programs whose funding is derived from a combination of general fund, state bonds and fees.

Is use of the tax credit an effective and efficient way to achieve this policy goal?

Yes, compared to value of avoided public health and environmental impacts.

The particulate emissions of the truck that utilized the retrofit tax credit were reduced by 90 percent. Over the first three years of project life the cost to reduce pollution is calculated at $118,300 per ton reduced, well below the cost effectiveness limit established by rule to spend no more than $250,000 per ton reduced. This also compares favorably to the value of avoided direct and indirect public health and environmental impacts from highway engines estimated by EPA at $733,000 per ton emitted per year. Over the life of this truck, the cumulative benefit would be valued at $301,000 achieved with a tax credit expenditure of $10,647.

The retrofit tax credit can be used to help Oregon applicants secure competitive federal grants and at the same time prevents them from receiving more than 100 percent of eligible project costs in any form of public assistance. It does this by basing allowable costs on the direct contribution by the applicant to the project. The tax credit becomes factor in securing federal grants because project evaluation guidelines award points for applicants who request less than

the federal maximum allowed for a given retrofit or repower project. Any funding contribution to the project by the applicant, the tax credit reducing the net exposure by the applicant, increases the chances for awards to Oregon projects. A project was awarded during the 2009-2010 funding cycle based on this strategy.

What other incentives (including state or local subsidies, federal tax expenditures or subsidies) are available that attempt to achieve a similar policy goal?

Federal – Diesel Emissions Reduction Act through direct allocation to states (30 percent of all funds available) and (70 percent) through competitive regional and national opportunities. This program was recently reauthorized for five years but the proposed appropriation for FY 2011 is reduced by 20% from previous years and is zeroed out in the FY 2012 budget.

Congestion Mitigation and Air Quality Program through allocation to metropolitan planning organizations in locations with documented, current and historic, violations of federal air quality standards. Although diesel emission reduction projects are regarded as a program priority within CMAQ, a variety of other air quality and traffic congestion related project requests makes this a challenging funding opportunity for clean diesel work.

Grant programs tend to be more attractive but they are also competitive in that only a few of otherwise qualifying projects are funded. Tax credits can serve as a supplemental tool in addition to grants but can also be used as a stand alone incentive for project owners attracted to the certainty of financial assistance once they know they meet tax credit qualifications.

Could this credit be modified to make it more effective and/or efficient? If so, how?

Being mindful of the current economic pressures facing the state budget, we present for the committee's consideration, without recommendation, a possible opportunity to improve program effectiveness.

Retrofit tax credit Presumably increasing the percentage of project costs covered by the tax credit would increase its usage, along with the air quality benefits from this very effective strategy, but it is uncertain that offering any tax credit value less than full cost would generate any substantial increase in activity.