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Research Office

Task Force on Supporting Businesses in Reducing Diesel Emissions

Final Report

December 2020

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80th LEGISLATIVE ASSEMBLY
TASK FORCE ON SUPPORTING BUSINESSES IN REDUCING DIESEL EMISSIONS

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December 17, 2020

To: Honorable Peter Courtney, President of the Senate
Honorable Tina Kotek, Speaker of the House

Submitted herewith is the final report of the Task Force on Supporting Businesses in Reducing Diesel Emissions. This Task Force was created with the passage of House Bill 2007 (2019) for the purpose of considering funding strategies to help businesses reduce emissions from diesel engines used in the course of business. The measure specified that it was to evaluate and develop recommendations related to funding strategies for this effort including taxes, fees, and contract requirements or funding set-asides.

Sincerely,

Susheela Jayapal, Task Force Chair

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EXECUTIVE SUMMARY

The Task Force on Supporting Businesses in Reducing Diesel Emissions (Task Force) was created by the Legislative Assembly with the passage of House Bill 2007 (2019). The measure's primary purpose was to phase out older diesel engines in medium- and heavy-duty trucks in Multnomah, Clackamas, and Washington County, first by prohibiting purchase of trucks older than 2010 in those counties by 2025, and then by requiring that all medium-duty diesel trucks and all privately owned heavy-duty diesel trucks be powered by an engine that is 2007 or newer by 2029. The measure also specified that all state-funded construction projects in the tri-county region valued at $20 million or more utilize at least 80 percent clean engines.

Diesel engines power our economy. They provide an efficient, powerful, and durable means of moving people and goods and do the heavy lifting for agriculture and construction trades. Oregon's economy is trade-dependent, meaning that we rely on diesel engines to export Oregon's unique agricultural and high-tech commodities and to import the consumer goods needed in everyday life. According to the Oregon Department of Transportation's most recent freight plan, "…manufacturing, agriculture, construction, and retail trade (freight dependent industries) provided 700,000 jobs and generated $29 billion in personal income. Transportation and warehousing accounted for another 70,000 jobs and $3.2 billion in personal income."[1]

Diesel engines have also become much cleaner over the last two decades. Federal emissions standards implemented in 2007 and 2010 mean newer trucks manufactured after those dates emit approximately 95 percent less particulate matter and nitrogen oxides than older model engines. The same is true for nonroad engines.

As noted, it is their incredible durability that make diesel engines so reliable and valuable. It also means that when they are well-maintained, they can remain in operation for decades. The purpose of this Task Force was to evaluate sources of revenue for incentives to support owners and operators of older engines to upgrade their fleets to the newer, cleaner-burning engines.

The Task Force, created by House Bill 2007, was directed to consider funding strategies to help businesses reduce emissions from diesel engines used in the course of business. The measure specified that it was to evaluate, and develop recommendations related to, funding strategies for this effort, including taxes, fees, and contract requirements or funding set-asides.

[1] Oregon Department of Transportation, *Oregon Freight Plan* (2017) *available at* <https://www.oregon.gov/odot/Planning/Documents/OFP-2017-Amended.pdf> (last visited March 10, 2020).

Given the number of older diesel engines currently in the on-road and off-road fleets, designing a program to retrofit or replace all older diesel equipment is likely beyond any feasible revenue source. Accordingly, the objective of an incentive program would be to speed the transition as much as possible.

During its work, the Task Force met a total of 11 times, covering the following areas:

- current fleet makeup (both on-road and off-road);
- approaches to clean diesel in other states (primarily California, Washington, and Texas);
- technology options to reduce diesel emissions (retrofits, replacement, alternative fuels);
- Volkswagen Settlement and related rulemaking;
- perspectives of diesel engine fleet owners; and
- discussion of programmatic options and revenue options.

While there was some level of consensus among members on programmatic priorities, the Task Force decided not to make specific recommendations, particularly for revenue options. The programmatic priorities that received relative consensus included:

- *geographic preference* - focus efforts in areas where diesel particulate matter is highest;
- *small business* - focus on businesses with fewer than 50 employees, and those subject to regulation under House Bill 2007;
- *equipment type* - pre-2010 medium- and heavy-duty trucks, pre-Tier 4 nonroad equipment;
- *technology* - allow business to determine the type of technology which best suits its needs, including retrofits, repowers, replacement, or alternative fuel repowers;
- *newer used equipment* - allow replacement with cleaner, newer used equipment;
- *subsidy level* - incentives in line with existing subsidies of the federal Diesel Emissions Reduction Act (DERA) program (25 percent of replacement cost, 50 percent of repower cost, 100 percent of retrofit cost); and
- *scrappage* - older equipment replaced should be scrapped or rendered inoperable.

Five sources of revenue and an incentive mechanism were considered: of these options, the first, a tire privilege tax, received the most consensus:

- tire privilege tax; either flat per-tire or variable by-tire price;
- surcharge on sale, lease, and rental of off-road equipment;
- privilege/use tax on sale of new heavy-duty trucks;
- tax on nonroad diesel fuel;
- Congestion Mitigation and Air Quality (CMAQ) funds (existing revenue source); and
- tax credits (incentive mechanism).

There was a level of consensus that bonding revenues would be a good strategy to accelerate impact of the program, and that spreading the burden across a broad tax base would reflect the general societal benefits of cleaner air.

PROCESS

Task Force Overview

The Task Force was established with the passage of House Bill 2007 (2019), which included the provisions in section 19. The Task Force consists of 11 members appointed by the Senate President and Speaker of the House, which includes four legislators (two House, two Senate) who are nonvoting members.

The seven voting members represent local governments from areas with elevated concentrations of diesel particulate matter, organizations concerned with community and health impacts of diesel emissions, the trucking/freight industries, businesses operating equipment powered by diesel engines and that retain the service of subcontractors who operate vehicles and/or equipment powered by diesel engines, and the environmental justice community.

Legislative Charge

House Bill 2007 (2019) charged the Task Force with four primary tasks:

- consider public funding strategies for supporting businesses in reducing emissions from diesel engines used in the course of business;
- evaluate and develop recommendations related to funding strategies that shall include, but not be limited to, taxes, fees, contract requirements, funding set-asides, and strategies employed by other states;
- develop statewide incentive strategies to encourage replacement, repower, or retrofitting of medium- and heavy-duty trucks owned by owners located outside the Tri-County Metropolitan Area (taking into consideration strategies used by adjoining states); and
- identify barriers to small contractor participation in public contracting that exist under clean diesel in public contracting provisions.

Roster

The following individuals served as members of the Task Force[2]:

Susheela Jayapal, Multnomah County Commissioner, is the elected official representative and serves as Chair of the Task Force; Commissioner Jayapal replaced the previous Task Force Chair, Multnomah County Commission Chair, Deborah Kafoury.

Dr. Erika Moseson is one of two members who represent organizations concerned with health and community impacts of diesel emissions.

Mary Peveto, Neighbors for Clean Air Portland, is the other member representing organizations concerned with health and community impacts of diesel emissions.

Jana Jarvis, Oregon Trucking Associations; representing the trucking/freight industries.

Bob Short, CalPortland, and member of the Oregon Concrete and Aggregate Producers Association; representing businesses operating diesel-powered equipment.

Larry Gescher, member of Associated General Contractors; representing businesses that retain the services of subcontractors operating diesel vehicles and equipment.

Maria Hernandez-Segoviano, Portland Public Schools; representing the environmental justice community.

Sen. Michael Dembrow, Senate District 23 (nonvoting member).

Sen. Dennis Linthicum, Senate District 28 (nonvoting member); replaced Sen. Cliff Bentz.

Rep. Rob Nosse, House District 42 (nonvoting member).

Rep. Shelly Boshart Davis, House District 15 (nonvoting member).

Meeting History

The Task Force held a total of 11 meetings during the 2019-2020 interim period. The members had prepared a monthly meeting schedule for 2020, however, the onset of COVID-19 disrupted this schedule resulting in a gap of several months before the Task Force reconvened in July of 2020.

The following is a meeting-by-meeting review of topics considered and deliberated on by the Task Force:

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[2] Oregon Legislative Information System, *Joint Task Force on Supporting Businesses in Reducing Diesel Emissions*, <https://olis.oregonlegislature.gov/liz/2019I1/Committees/JTFRDE/Overview> (last visited December 17, 2020).

September 18, 2019. Election of Task Force chair; background on House Bill 2007 (2019).[3]

October 31, 2019. Review of current fleet, clean diesel regulations, and existing Oregon incentives; Washington and California approaches to addressing diesel emissions.[4]

November 21, 2019. Options for reducing diesel emissions; review of retrofit technology; options for replacement; overview of alternative fuels.[5]

December 19, 2019. Technology Q&A for electric, hydrogen, natural gas, biodiesel and renewable diesel, and technologies used at the Port of Portland.[6]

July 16, 2020. Report on Oregon Nonroad Diesel Emissions Inventory; Update on Volkswagen Settlement funds in Oregon; review/update of Task Force work plan.[7]

August 20, 2020. Fleet owner perspectives on efforts to reduce diesel emissions.[8]

September 17, 2020. Update on rulemaking for Volkswagen Settlement funds; review of how other states fund diesel emissions reduction programs; constitutional limitations on potential funding sources; discussion regarding potential revenue sources.[9]

October 15, 2020. Review of emissions sources, impacted geography, programmatic solutions, and revenue options; continued discussion regarding potential revenue sources.[10]

November 19, 2020. Continued discussion regarding potential revenue sources, review of draft outline for final Task Force report.[11]

December 3, 2020. Continued discussion regarding potential revenue sources; consideration of possible legislative recommendations.[12]

December 17, 2020. Adoption of final Task Force report.[13]

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[3] <https://olis.oregonlegislature.gov/liz/mediaplayer/?clientID=4879615486&eventID=2019091023>
[4] <https://olis.oregonlegislature.gov/liz/mediaplayer/?clientID=4879615486&eventID=2019101007>
[5] <https://olis.oregonlegislature.gov/liz/mediaplayer/?clientID=4879615486&eventID=2019111027>
[6] <https://olis.oregonlegislature.gov/liz/mediaplayer/?clientID=4879615486&eventID=2019121004>
[7] <https://olis.oregonlegislature.gov/liz/mediaplayer/?clientID=4879615486&eventID=2020071012>
[8] <https://olis.oregonlegislature.gov/liz/mediaplayer/?clientID=4879615486&eventID=2020081036>
[9] <https://olis.oregonlegislature.gov/liz/mediaplayer/?clientID=4879615486&eventID=2020091167>
[10] <https://olis.oregonlegislature.gov/liz/mediaplayer/?clientID=4879615486&eventID=2020101017>
[11] <https://olis.oregonlegislature.gov/liz/mediaplayer/?clientID=4879615486&eventID=2020111021>
[12] <https://olis.oregonlegislature.gov/liz/mediaplayer/?clientID=4879615486&eventID=2020121008>
[13] <https://olis.oregonlegislature.gov/liz/mediaplayer/?clientID=4879615486&eventID=2020121065>

ENVIRONMENTAL AND PUBLIC HEALTH EFFECTS OF DIESEL ENGINE EXHAUST

Diesel engine exhaust is a complex mixture of gases and particles that, both on their own and collectively, are associated with a variety of health effects. In 2015, the Oregon Department of Environmental Quality (DEQ) published a comprehensive review of peer-reviewed science examining the health effects of diesel engine exhaust.[14] In summary, that report found exposure to diesel engine exhaust is associated with a variety of effects, including:

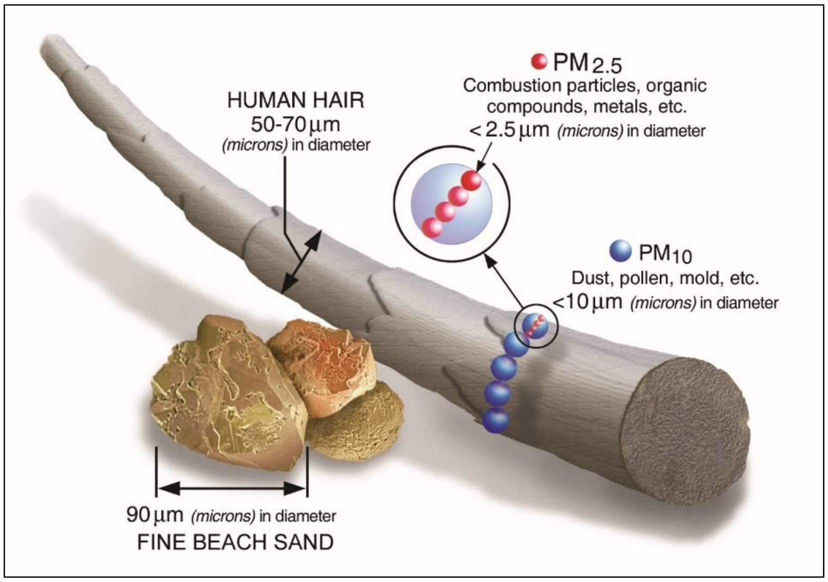
- increased risk of certain cancers, including lung and bladder cancers;
- cardiovascular effects including an increased risk of heart attacks;
- pulmonary effects, such as upper respiratory system irritation and decreased lung functions; and
- neurodevelopmental effects including decreased cognitive function and decreased birth weight.

Of particular concern is diesel particulate matter (i.e., soot.) Particulate matter comes from a variety of sources and is a federally regulated criteria air pollutant. Diesel particulate matter refers specifically to particulate matter associated with diesel combustion. The size of the particulate matter directly relates to its toxicity.

Figure 1 illustrates a cross-section of a piece of human hair, which is about 50-70 microns in diameter. Diesel particulate matter is a form of fine particulate matter, or "PM 2.5," meaning it is 2.5 microns in diameter or smaller. A majority of diesel soot is actually classified as ultrafine, meaning it is 0.2 microns or smaller. The ultrafine nature allows the particulates (and toxic substances attached to the particles) to travel deep into the lungs, even crossing through the alveoli into the blood stream.

[14] Oregon Department of Environmental Quality, *The Concerns about Diesel Engine Exhaust* (2015), *available at* <https://www.oregon.gov/deq/FilterDocs/DieselEffectsReport.pdf>.

Figure 1: Size Comparison for Particulate Matter



Source: U.S. Environmental Protection Agency

Diesel particulate matter is recognized as a Group 1 Carcinogen by the International Agency on Cancer Research (for lung cancer) and as a likely carcinogenic to humans by the Environmental Protection Agency's (EPA's) Integrated Risk Information System. Oregon has long recognized diesel particulate matter as a carcinogen in its air toxics rules and programs.

Aside from its carcinogenic properties, exposure to diesel particulate matter is associated with a variety of respiratory, cardiovascular and pulmonary effects. There is also an emerging but growing body of evidence linking exposure to diesel particulate matter (and other transportation-related pollution) to neurodevelopmental effects causing both chronic disease and short-term exacerbations of multiple illnesses, which contribute to current and future health care expenditures.[15]

In addition to the health effects associated with diesel particulate matter, diesel engines contribute to emissions in the state, a precursor to the formation of ground level ozone.[16] As seen in Figure 2, communities across Oregon, including the Portland Metropolitan area and the Rogue Valley, have experienced increasing levels of ozone in

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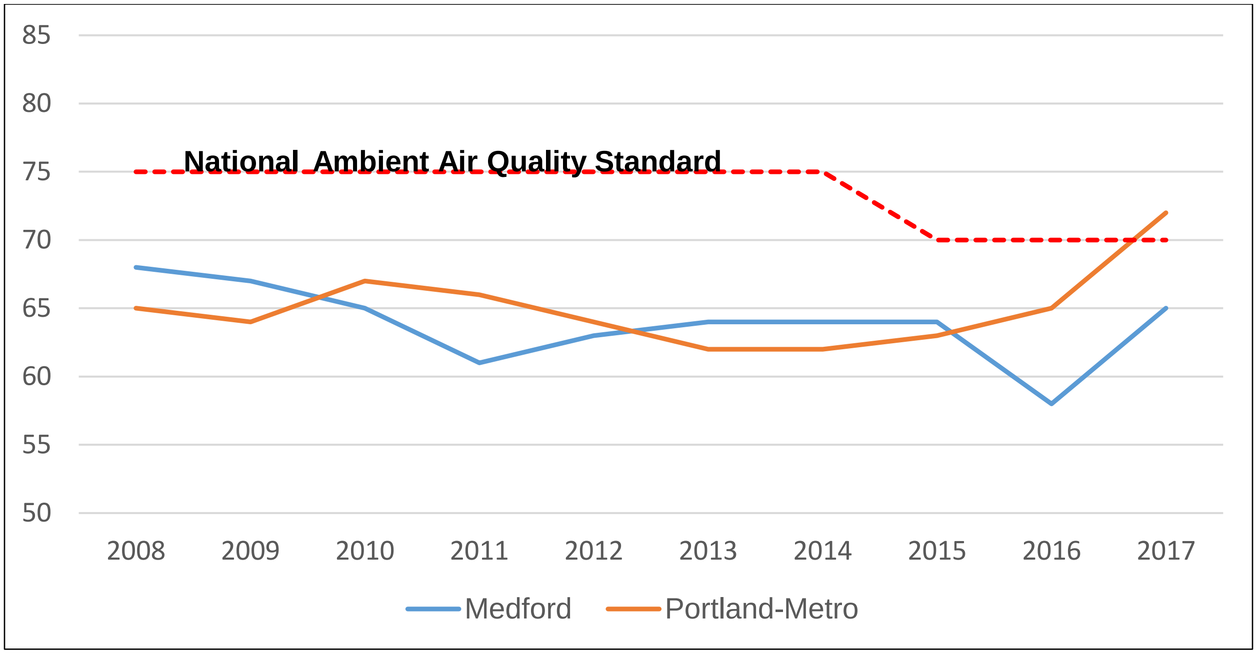
[15] Roberts, A., Lyall, K., Hart, J., Laden, F., Just, A., Bobb, J., Weisskopf, M., *Perinatal air pollution exposures and autism spectrum disorder in the children of Nurses' Health Study II participants*, 121(8) Environmental Health Perspectives (978-984) (2013).

[16] U.S. Environmental Protection Agency, *2017 National Emissions Inventory* (2017), available at: <https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data>.

recent years. Increasing levels of ozone–or smog–leads to a wide variety of health effects including aggravated asthma, decreased lung function and chronic obstructive pulmonary disease (COPD).[17] The state also risks its attainment status of the National Ambient Air Quality Standard for ozone.

Figure 2: Ground-Level Ozone Trends in Oregon



Source: Oregon Department of Environmental Quality

The EPA estimates that cleaning up diesel engines as a result of federal regulations will ultimately reduce documented public health and environmental impacts by more than $296 billion annually. In Oregon alone, the direct and indirect public health and environmental impact of exposure to diesel exhaust could be valued at up to $3.5 billion per year.[18] This is one indicator of how serious and wide-reaching the effects of diesel exhaust exposure can be.

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[17] U.S. Environmental Protection Agency, *Integrated Science Assessment (ISA) for Ozone and Related Photochemical Oxidants Final Report* (April 2020*, available at* <https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=348522>.

[18] Oregon Department of Environmental Quality, *The Concerns about Diesel Engine Exhaust* (2015), *available at* <https://www.oregon.gov/deq/FilterDocs/DieselEffectsReport.pdf>.

HOUSE BILL 2007 (2019) SUMMARY

House Bill 2007 was adopted by the Oregon Legislative Assembly in 2019. The legislation includes a suite of regulatory and voluntary approaches to evaluating and reducing diesel engine emissions. At a high level, the legislation includes the following major provisions:

<table>
<tr><th>Bill Sections</th><th>Description</th></tr>
<tr><td>1-2</td><td>Directs the Environmental Quality Commission and Department of Environmental Quality to establish a grant program by rule for dispersing Oregon's allocation of the Volkswagen Settlement funds. The legislation specifies that in evaluating proposals, the department must give preference to certain projects, including but not limited to:
• projects that support compliance with the regulatory provisions of HB 2007 (2019);
• small fleets;
• projects that support utilization of clean fuels; and
• other criteria established by the Environmental Quality Commission in rule.</td></tr>
<tr><td>3-13</td><td>Establishes dates after which older diesel-powered medium- and heavy-duty trucks cannot be registered or titled within Clackamas, Multnomah, and Washington County. Specifically:

January 1, 2023: A medium-duty or a heavy-duty truck powered by a model year 1996 or older diesel engine cannot be registered.

January 1, 2025:
• A medium-duty truck powered by a model year 2009 or older diesel engine cannot be titled.
• A heavy-duty truck powered by a model year 2006 or older diesel engine cannot be titled.

January 1, 2029:
• A medium-duty truck powered by a model year 2009 or older diesel engine cannot be registered.
• Publicly owned heavy-duty trucks powered by a model year 2009 or older diesel engine cannot be registered.
• Privately owned heavy-duty trucks powered by a model year 2006 or older diesel engine cannot be registered.

The bill provides exemptions, including for trucks retrofitted with a technology that has been certified and approved by the Department of Environmental Quality. The</td></tr>
</table>

	bill also directs the Department of Transportation to report annually on registration and titling trends.
14-15	Directs the Department of Environmental Quality to develop a voluntary emissions labeling program for construction equipment.
16	Modifies the Environmental Quality Commission's civil penalty enforcement authorities.
17-18	Establishes "clean diesel" procurement standards for certain large public works projects located in Clackamas, Multnomah, and Washington County. The section also specifies the procurement standards apply to the following projects: • the Interstate 5 Rose Quarter Project; • the Interstate 205 Abernethy Bridge Project; • the Interstate 205 Freeway Widening Project; • the State Highway 217 Northbound Project; or • the State Highway 217 Southbound Project.
19-20	Establishes a Joint Legislative Task Force on Supporting Businesses in Reducing Diesel Emissions. The Task Force is described in greater detail in the next report section.
21-25	Includes conforming amendments, operative dates, budget appropriations and emergency clause.

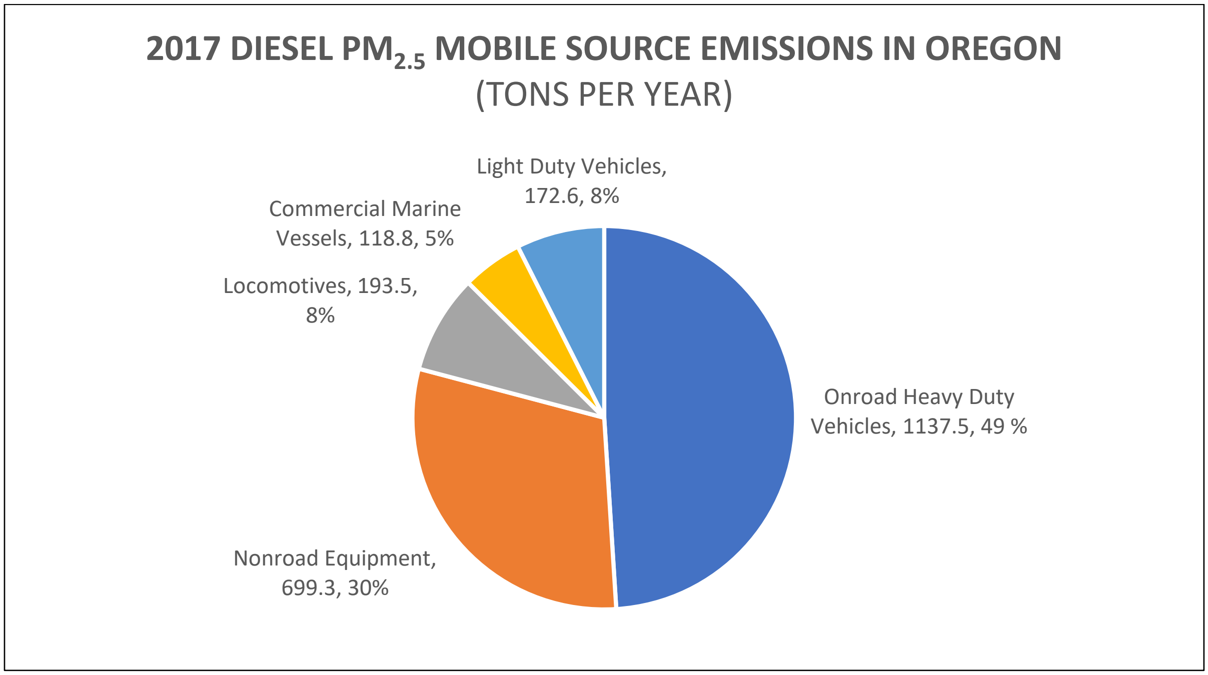
Source: Legislative Policy and Research Office

DIESEL ENGINE EMISSIONS IN OREGON

The Department of Environmental Quality characterizes the magnitude and relative contribution of the sources of diesel engine emissions using emissions inventories. An emissions inventory is a tool used in air quality management to quantify the amount of emissions of a particular pollutant in a set geography over a certain period of time. Data is typically displayed by source or sector categories, and it is important to note that an emissions inventory itself cannot quantify the concentration of a pollutant in the air at a particular point of exposure. The most widely used inventory is the National Emissions Inventory (NEI).

The NEI is a comprehensive and detailed estimate of air emissions of criteria pollutants, criteria precursors, and hazardous air pollutants, including diesel particulate matter, from all human-made and natural sources of air pollution. The NEI is released every three years based primarily upon data provided by state, local, and tribal air agencies for sources in their jurisdictions and supplemented by data developed by the EPA. Figure 3 shows the mobile sources of diesel particulate matter--one element of diesel engine exhaust--in Oregon in the year 2017, the most recent NEI dataset available.

Figure 3: Mobile Sources of Diesel PM2.5 Emissions in Oregon (2017)



Source: U.S. Environmental Protection Agency and Oregon DEQ (Nonroad Sector)

Mobile sources are responsible for the vast majority of emissions in Oregon. Within the mobile source categories, heavy-duty trucks and nonroad equipment are the most significant source categories:

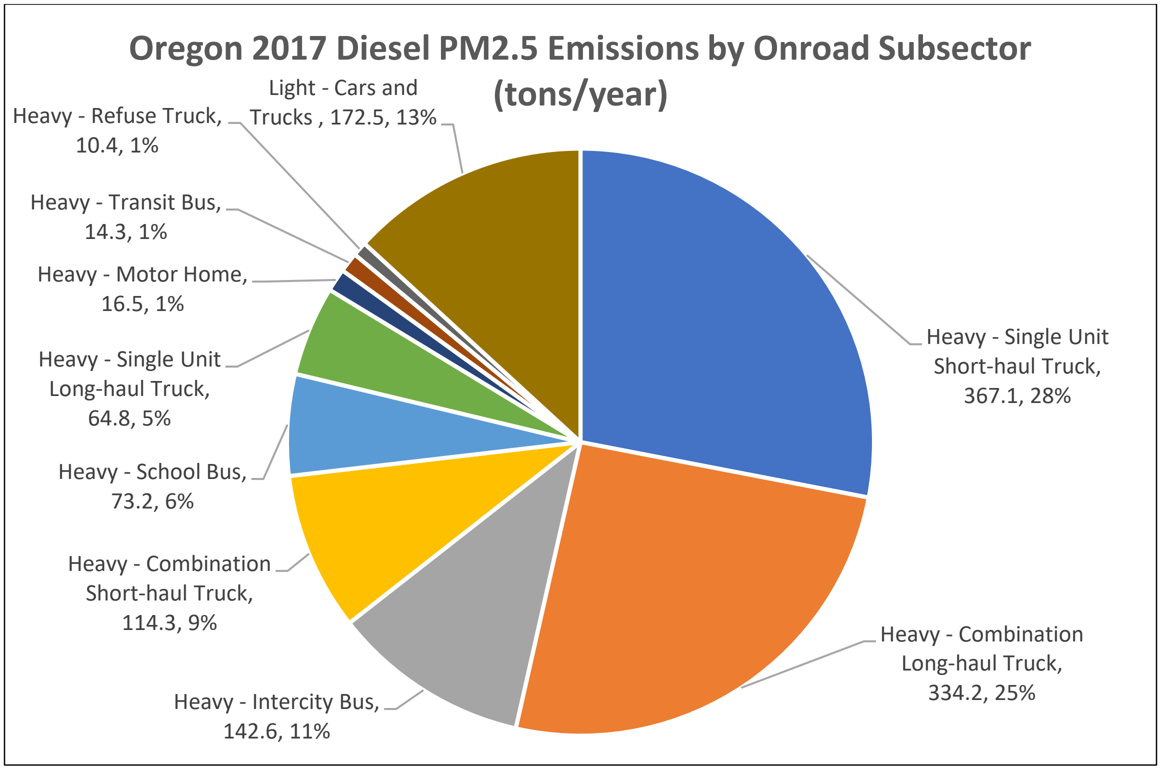
- "Heavy-duty vehicles" refers to trucks with a Gross Vehicle Weight Rating of 14,000 pounds or more. Trucks of this size and nature vary and include in-town delivery trucks, bucket-lift trucks, refuse hauling trucks, school buses and long-haul tractors.

- "Nonroad equipment" refers to the variety of equipment and machinery used in construction, agriculture, mining, and logging. The wide variety of equipment classified as "nonroad," the variable applications and use of that equipment, and lack of registration data all present challenges for characterizing emissions from the nonroad sectors.

On-Road Emissions

Figure 4 further characterizes on-road emissions in Oregon. As seen, heavy-duty trucks (defined as those above 14,000 pounds Gross Vehicle Weight Rating in this context) account for the bulk of emissions in Oregon.

Figure 4: Sources of Diesel PM2.5 Emissions in Oregon by On-Road Sector (2017)



Source: U.S. Environmental Protection Agency

There remains a significant number of older medium- and heavy-duty trucks. Pursuant to HB 2007 (2019), the Oregon Department of Transportation released data illustrating the age of Oregon's registered fleet in the tri-county area and in the rest of the state.[19]

Key data include:

Model Year	Registered Medium- and Heavy-Duty Trucks	
	Clackamas, Multnomah, and Washington County	Statewide
Pre-2007*	14,262	53,934
Pre-2010**	18,751	65,847

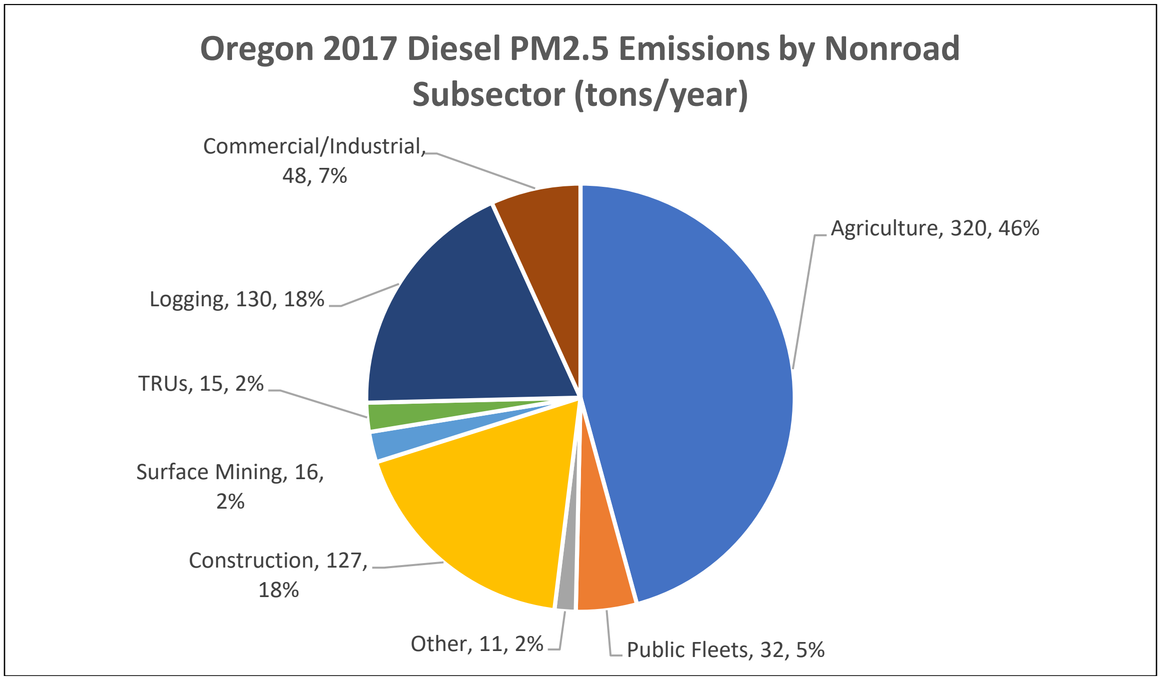
*2007 is the implementation date for the latest tailpipe emissions standard for particulate matter
**2010 is the implementation date for the latest tailpipe emissions standard for NOx

[19] Oregon Department of Transportation, *HB 2007 Report to the Legislature* (2020), *available at* <https://www.oregon.gov/odot/About/GR/HB%202007%20(2019)%20Clean%20Diesel%20Report.pdf>

Nonroad emissions

As mentioned previously, characterizing emissions from nonroad engines can be challenging due to the diverse nature of those engines and the lack of registration or licensing data, as is present for on-road cars and trucks. Recognizing that challenge, in 2017, the Oregon legislature appropriated $500,000 to DEQ to allow the agency to hire a third-party entity to conduct a statewide and cross-sector survey of nonroad diesel engines in Oregon. Unlike the other figures in this report, which use EPA data, Figure 5 is based off this new Oregon-specific inventory.[20]

Figure 5: Sources of Diesel PM2.5 Emissions in Oregon, by Nonroad Subsector (2017)



Source: Eastern Research Group

This Oregon-specific analysis also showed significant variability across the states in terms of sectors' relative contribution to emissions. These findings reiterate the diverse nature of nonroad equipment and its variable applications. For example, in Multnomah County, construction equipment was the largest source of emissions. In Lane County,

[20] Eastern Research Group, *Oregon Nonroad Engine Equipment Survey and Emissions Inventory Final Report* (to Oregon DEQ) (2020), *available at* <https://www.oregon.gov/deq/aq/Documents/orNonroadDieselRep.pdf>.

logging equipment was the largest source of emissions, and in Klamath County, agriculture equipment was the largest source of emissions.

The tables below illustrate statewide equipment counts by sector and tier (i.e., age). Tiers 0, 1, and 2 are generally considered to be the highest priority for emissions reductions treatment.

Table 1: Statewide Nonroad Engine Counts by Sector and Emissions Tier

Logging Equip	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Total
All HP ranges	642	402	256	476	1,070	**2,847**
% 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	16,197	6,576	3,718	5,808	13,419	**45,718**
% 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	3,401	1,674	1,753	1,964	4,389	**13,181**
% 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	20,531	8,771	5,794	8,353	19,119	**62,568**
% of total	33%	14%	9%	13%	31%	

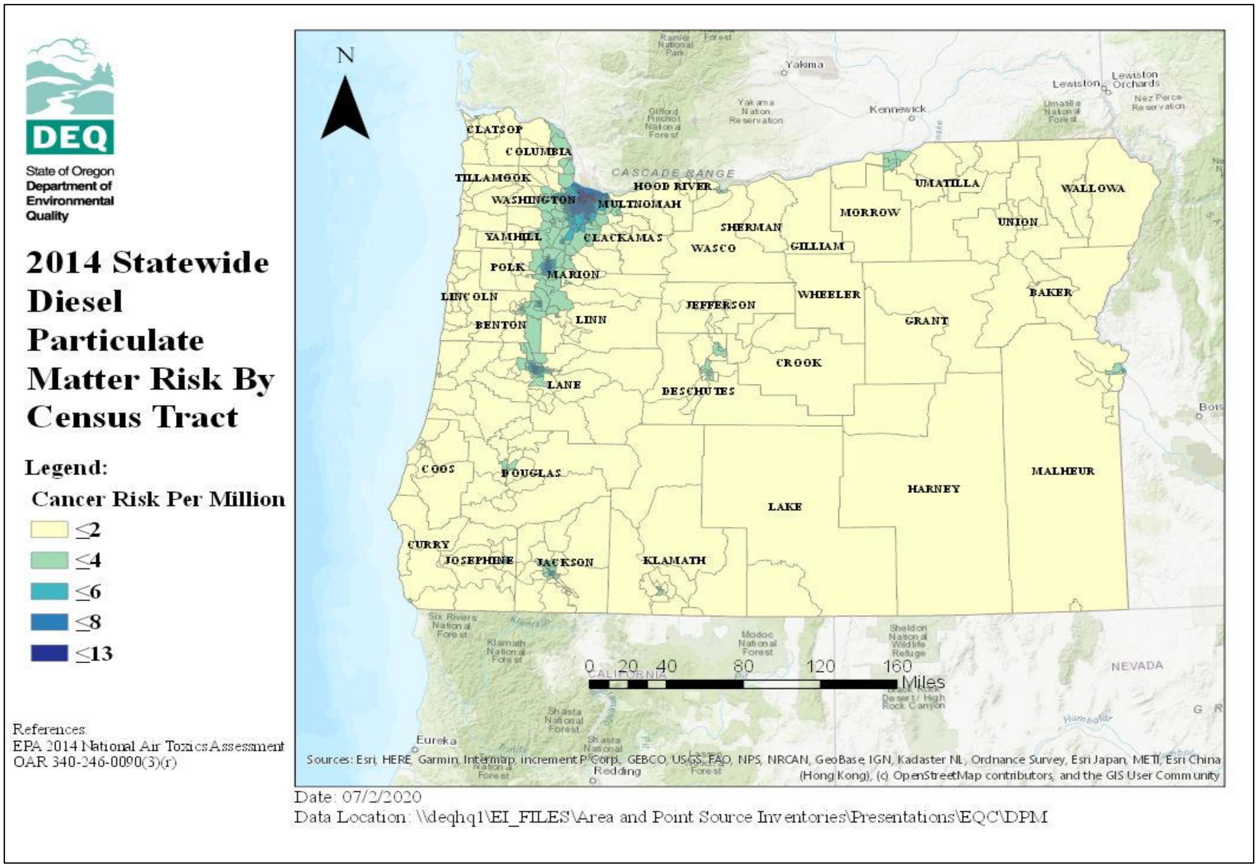
Source: Eastern Research Group

Level of Diesel Particulate Matter in Oregon

The U.S. EPA's National Air Toxics Assessment is the most comprehensive source of ambient concentration data. The data set includes ambient concentrations of hazardous air pollutants and associated human health risks at the national, state, county, and sub-county levels.

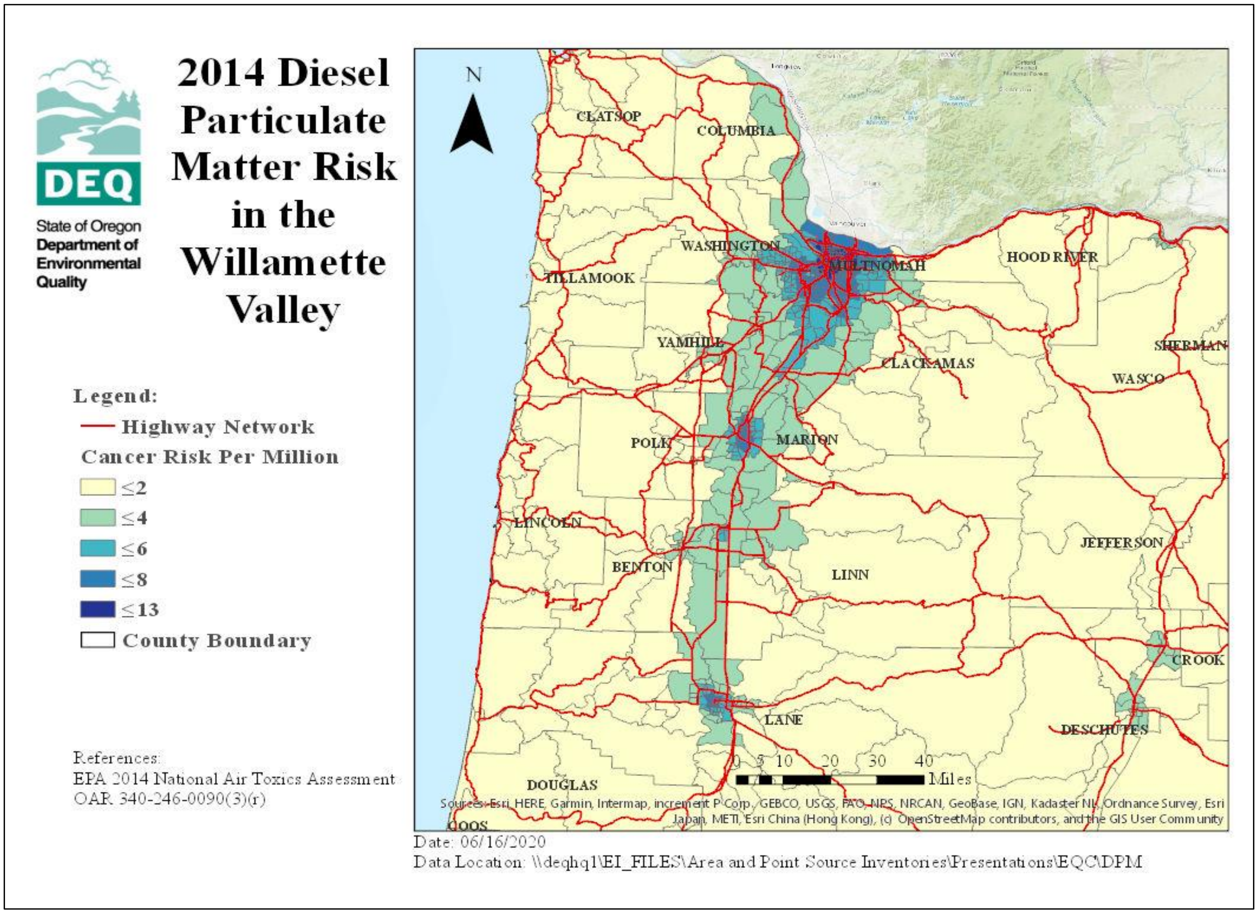
Figures 6 and 7 illustrate the degree to which emissions at the census-tract level exceed the state's Ambient Benchmark Concentration (0.1 ug/m3) for diesel. Ambient Benchmark Concentrations serve as risk evaluation benchmarks and as targets for risk reduction planning. Oregon's benchmarks represent ambient concentrations that would result in a cancer risk of one-in-a-million additional cancers based on a lifetime of exposure.

Figure 6: Statewide Diesel Particulate Matter Cancer Risk by Census Tract (2014)



Source: State of Oregon Department of Environmental Quality

Figure 7: Interstate 5 Corridor Diesel Particulate Matter Cancer Risk by Census Tract (2014)



Source: State of Oregon Department of Environmental Quality

The county-level averages of diesel particulate matter are detailed in the table below. Nineteen of Oregon's 36 counties have county averages exceeding the legislatively established 0.1 ug/m3 health-based standard. This information is available to assist policymakers in evaluating the impact of limiting or prioritizing future investments in certain counties based on levels of pollution.

Table 2: Diesel Particulate Matter by County

COUNTY	AVERAGE CONCENTRATION (UG/M3)
DOUGLAS	0.110
HOOD RIVER	0.136
MALHEUR	0.146
WASCO	0.155
COLUMBIA	0.162
BAKER	0.163
JOSEPHINE	0.168
UMATILLA	0.169
POLK	0.173
DESCHUTES	0.174
BENTON	0.174
JACKSON	0.197
YAMHILL	0.197
LINN	0.242
LANE	0.307
MARION	0.392
WASHINGTON	0.444
CLACKAMAS	0.458
MULTNOMAH	0.785

Source: U.S. Environmental Protection Agency[21]

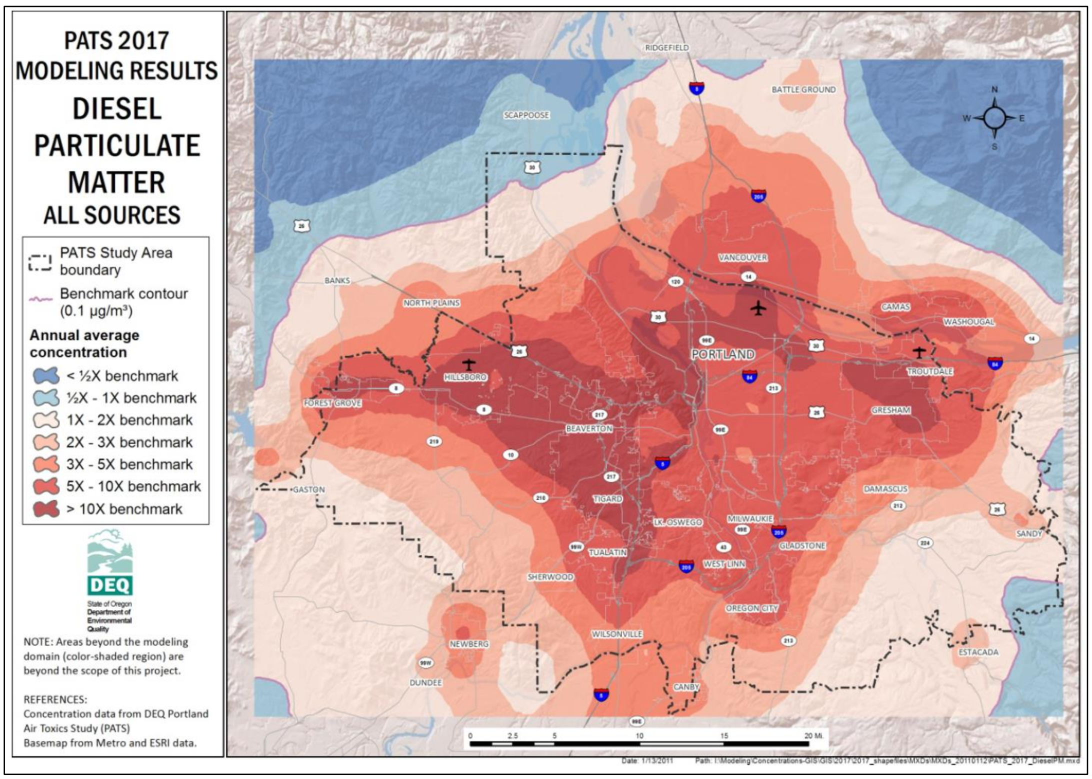
The data in the maps and table above represent census-tract level averages. Certain areas, such as those very near to high traffic corridors, experience ambient concentration of diesel particulate matter much higher than the corresponding census

[21] U.S. Environmental Protection Agency*, National Air Toxics Assessment* (2014*) data available at:* <https://www.epa.gov/national-air-toxics-assessment/2014-nata-assessment-results>*.*

tract average. To assess these small-scale differences, more refined dispersion analysis can be completed. The Department of Environmental Quality has conducted that work for the Portland Metropolitan area.

Figure 8 illustrates the results of that assessment. As shown, this refined spatial analysis showed nearly all areas of the Portland-Metro area experiences unhealthy levels of diesel particulate matter and that certain areas experience levels over ten times Oregon's Ambient Benchmark Concentration. An environmental justice analysis that accompanied this work demonstrated communities of color and lower-income communities are disproportionately impacted by on-road sources of pollution, including diesel-powered vehicles.[22]

Figure 8: Portland Metro Area Diesel Particulate Matter Cancer Risk



Source: Oregon Department of Environmental Quality

While the emissions profile of new trucks and equipment has improved significantly in response to federal emissions regulations, overall diesel emissions and high ambient

[22] Oregon Department of Environmental Quality, *Portland Air Toxics Solutions Committee Report and Recommendations* (2012) *available at*: <https://www.oregon.gov/deq/FilterDocs/PATS2012.pdf >.

concentrations of diesel particulate matter and NOx persist. This is, in part, a result of a growing population and growing registration counts. However, the presence of emission control technology at the time of manufacture is not a guarantee that the engine will stay low-emitting throughout its life. The performance of the engine can degrade due to poor maintenance or intentional actions meant to defeat or circumvent emissions control systems.

While this Task Force has focused on the medium- and heavy-duty fleet, diesel powered pickup trucks are also a significant source of emissions and, based on new work by the EPA, may be particularly susceptible to emission control tampering. In November 2020, the U.S. EPA released "Tampered Diesel Pickup Trucks: A Review of Aggregated Evidence from EPA Civil Enforcement Investigations." This report[23] was the conclusion of a multistate investigation into emission tampering activities and found that approximately 15 percent of all diesel pickup trucks nationally have had emissions control removed or altered. This tampering has led to an excess 570,000 tons of NOx and 5,000 tons of particulate matter (this is ten times higher than the emissions from the Volkswagen cheating scandal). This has an air quality impact of an additional nine million non-tampered trucks on the road.

STRATEGIES TO REDUCE EMISSIONS

Diesel engines produce a number of pollutants that can be harmful to humans and the global climate. The four types of pollutants are as follows:

- ***Carbon monoxide (CO):***[24] a colorless, odorless, and tasteless flammable gas that can cause sudden illness or death when absorbed into the bloodstream; while it does not directly impact climate change, its presence affects the abundance of greenhouse gases such as methane and carbon dioxide;
- ***Nitrogen oxide (NO_X):***[25] a group of highly reactive gases and compounds that can cause respiratory harm, hazy air pollution, acid rain, and nutrient pollution in coastal waters;
- ***Particulate matter (PM):***[26][27] a carbonaceous fine material that can cause headaches, dizziness, and irritation of the eyes, nose, and throat, as well as an

[23] U.S. Environmental Protection Agency, *Tampered Diesel Pickup Trucks: A Review of Aggregated Evidence from EPA Civil Enforcement Investigations* (2020).
[24] National Aeronautics and Space Administration, *Fourteen years of carbon monoxide from MOPITT*, <https://climate.nasa.gov/news/2291/fourteen-years-of-carbon-monoxide-from-mopitt/> (last visited March 3, 2020).
[25] U.S. Environmental Protection Agency, *Nitrogen Dioxide (NO2) Pollution*, <https://www.epa.gov/no2-pollution> (last visited March 3, 2020).
[26] U.S. Department of Labor, Occupational Safety and Health Administration, *Diesel Exhaust/Diesel Particulate Matter*, <https://www.osha.gov/dts/hazardalerts/diesel_exhaust_hazard_alert.html> (last visited March 5, 2020)
[27] U.S. Environmental Protection Agency, *Black Carbon Research*, <https://www.epa.gov/air-research/black-carbon-research> (last visited March 5, 2020).

increased risk of cardiovascular, cardiopulmonary, and respiratory disease; a significant portion of PM is "black carbon," which can impact rain patterns and decrease the reflectivity of snow and ice, hastening melt;

- ***Volatile organic compounds (VOCs):***[28] organic chemicals with high vapor pressure at ordinary room temperature; diesel exhaust contains VOCs such as benzene and formaldehyde, both of which are known carcinogens that can also cause respiratory harm.

Because diesel engines tend to be durable and efficient, they often have long life spans. As a result, many older, less-efficient, less-clean engines remain in service for many years. There are four primary strategies for mitigating the level of pollutants emitted by diesel engine operation.

Retrofit

Retrofits are mechanical solutions designed to reduce emissions and increase efficiency in existing diesel engines and can be an important tool in improving air quality but there are limits to their practicality. Retrofits are not a viable solution on some pieces of off-road equipment and they can block the operations line of sight, creating a safety hazard. While they can improve air quality, retrofits can also lead to increased maintenance, operating costs, and down time, and often need to be replaced within two or three years.

There are six primary types of retrofit applications, which vary in terms of availability, effectiveness, and cost (see Table 3). Successful retrofit programs are a partnership between the manufacturer, installer, and owner, with each party responsible for ensuring the effective design, installation, and maintenance of any diesel retrofit option.[29]

The manufacturer develops solutions appropriately tailored to the technical needs of the vehicle using only verified technologies with proven performance and durability; installers inspect vehicles to ensure they are appropriate for retrofit, performed professionally, and according to manufacturer's specifications; and owners must regularly inspect and maintain both the vehicles and retrofit equipment and also respond to any feedback from monitoring systems. Because of the increased

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[28] Jo-Yu Chin et al, *Gaseous and Particulate Emissions from Diesel Engines at Idle and Under Load: Comparison of Biodiesel Blend and Ultralow Sulfur Diesel Fuels* (2012), *available at* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4339034/pdf/nihms656986.pdf> (last visited March 3, 2020).
[29] Manufacturers of Emission Controls Association (MECA), *Diesel Retrofit Experience for Heavy Duty Vehicles: Presentation to the Joint Task Force on Supporting Businesses in Reducing Diesel Emissions* (November 21, 2019), *available at* <https://olis.oregonlegislature.gov/liz/2019I1/Downloads/CommitteeMeetingDocument/207997> (last visited March 9, 2020).

maintenance and monitoring requirements, they may be a short-term solution for fixed-base local operators.

Table 3: Diesel Retrofit Options, Reductions, and Costs

Option	Pollutant Reductions	Typical Cost
Diesel Oxidation Catalyst (DOC)	CO: 10-60% NO_x: none PM: 20-40% VOCs: 40-75%	\$500 - \$2,000
Diesel Particulate Filter (DPF)	CO: 70-90% NO_x: none PM: 85-90% VOCs: 70-90%	Passive: \$8,000 - \$20,000 Active: \$12,000 - \$30,000
Selective Catalytic Reduction (SCR)	CO: none NO_x: 70-95% PM: 20-30% VOCs: 80%	\$20,000 - \$30,000 (includes DOC or DPF)
Lean NO_x Catalyst (HC-SCR)	CO: none NO_x: 25-40% PM: 85% VOCs: none	\$15,000 - \$20,000
NO_x Adsorber/Lean NO_x Traps (LNT)	CO: none NO_x: 80-90% PM: 85% VOCs: none	No data
Closed Crankcase Ventilation (CCV)	CO: none NO_x: none PM: 100% VOCs: none	\$450 - \$700

Source: Legislative Policy and Research Office
Data: U.S. Environmental Protection Agency, Manufacturers of Emission Controls Association (MECA)

Diesel Oxidation Catalyst (DOC).[30] [31] DOCs are catalytic converters designed specifically for use with diesel engines. They use chemical reactions to oxidize CO, PM, and VOCs, converting the soluble organic fraction of particulate matter into carbon dioxide and water. DOCs are suitable and available for most types of engines but do

[30] U.S. Environmental Protection Agency, *Technical Bulletin: Diesel Oxidation Catalyst Installation, Operation, and Maintenance* (May 2010), available at <https://www.epa.gov/sites/production/files/2016-03/documents/420f10030.pdf> (last visited March 5, 2020).
[31] Manufacturers of Emission Controls Association (MECA), *Retrofitting Emission Controls for Diesel-Powered Vehicles 14-17* (November 2014), available at <http://www.meca.org/resources/MECA_diesel_retrofit_white_paper_1114_FINAL.pdf> (last visited March 9, 2020).

require a minimum exhaust temperature for optimal function, which cannot be achieved in all duty cycles.

- *Pollutant reactions:* DOCs can reduce particulate matter by 40 percent, volatile organic compounds by 75 percent, and carbon monoxide by 60 percent, but do not impact nitrogen oxides. While DOCs themselves require little to no maintenance, problems with fuel control or oil consumption impact performance.
- *Typical cost:* DOCs generally cost between $500 an $2,000 and should remain effective for at least 10,000 hours of operation.

Diesel Particulate Filter (DPF).[32] [33] DPFs use a porous filter to capture particulate matter from diesel exhaust. They must be regenerated by achieving a temperature of approximately 1,100 degrees Fahrenheit, which reduces the captured PM to ash. Regeneration can happen passively in some duty cycles or, alternatively, is actively induced through other sources of fuel or heat in low-temperature applications.

- *Pollutant reactions:* DPFs can reduce CO, PM, and VOCs by up to 90 percent, but do not impact NO_x emissions; cleaning is required every 6-12 months to remove noncombustible materials and ash; DPF maintenance schedules are influenced primarily by engine maintenance and performance; backpressure monitoring systems and routine inspections are required to ensure the filter is performing correctly.
- *Typical cost:* DPFs typically cost between $8,000 and $30,000, with active systems costing more; installation includes vehicle inspection, data logging, and backpressure monitoring systems, and cleaning stations or services are also required; properly installed, DPFs usually remain effective for 10,000 hours or more.

Selective Catalytic Reduction (SCR).[34] [35] SCRs chemically reduce nitrogen oxide molecules into molecular nitrogen and water vapor using a nitrogen-based reagent, such as ammonia or urea. Diesel exhaust is routed through injection ductwork, where the reagent reacts with the pollutants at a specified temperature range. Reagent injection is controlled by an algorithm that estimates the amount of NO_x in the exhaust system. SCRs are typically combined with diesel particulate filters (see above) to achieve broad PM and NO_x reductions.

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[32] U.S. Environmental Protection Agency, *Technical Bulletin: Diesel Particulate Filter, General Information* (May 2010), available at <https://www.epa.gov/sites/production/files/2016-03/documents/420f10029.pdf> (last visited March 9, 2020).
[33] MECA, supra note 7, at 17-22.
[34] U.S. Environmental Protection Agency, *Selective Catalytic Reduction* (June 2019), available at <https://www.epa.gov/sites/production/files/2017-12/documents/scrcostmanualchapter7thedition_2016revisions2017.pdf> (last visited March 9, 2020).
[35] MECA, supra note 7, at 25-28.

- *Pollutant reactions:* SCRs can reduce NOx emissions over 90 percent, VOC emissions by 80 percent, and PM emissions by 30 percent; SCRs must be designed for the specific vehicle and are the preferred strategy for on-road, heavy-duty engine manufacturers to comply with current diesel emission standards; in original equipment manager (OEM) applications, SCRs also reduce fuel consumption by five to seven percent.
- *Typical cost:* SCRs cost roughly $20,000 to $30,000 when installed with either a diesel oxidization catalyst or diesel particulate filter.

Lean NOx Catalyst (HC-SCR).[36] HC-SCRs use micro-porous materials to trap nitrogen oxides in microscopic sites that are fuel- or hydrocarbon-rich, chemically reducing the molecules into nitrogen. Similar to selective catalyst reduction, some HC-SCRs inject diesel fuel or another reductant into the exhaust upstream from the catalyst to serve as a reagent.

- *Pollutant reactions:* HC-SCRs can reduce NO_x emissions by 40 percent and PM emissions by 85 percent.
- *Typical cost:* HC-SCRs cost $15,000 to $20,000 when installed with a diesel particulate filter.

NOx Adsorber/Lean NOx Traps (LNT).[37] [38] LNTs oxidize NO to NO_2 using a precious metal catalyst, then store the NO_2 in an adjacent site as a nitrate, which is periodically removed in a regeneration process that reduces the NO_x to nitrogen. The regeneration process requires the engine to run rich periodically, creating a fuel penalty and increasing carbon dioxide emissions.

- *Pollutant reactions:* LNTs reduce NO_x by 80-90 percent in OEM applications and have demonstrated regeneration at temperatures as low as 392 degrees Fahrenheit.
- *Typical cost:* LNTs are typically limited to smaller engines and light-duty applications.

Closed-Crankcase Ventilation (CCV).[39] The combination of rapidly moving engine parts in the crankcase, exhaust bypass, and lubricating oil leads to atomized engine oil combined with exhaust particles and is a major source of particulate matter in diesel engines. CCVs are filter devices fitted to the crankcase filter vent.

  - *Pollutant reactions:* CCVs can capture up to 100 percent of PMs emitted from the crankcase and can be combined with diesel oxidization catalysts and

[36] MECA, supra note 7, at 28-29.
[37] MECA, supra note 7, at 29-31.
[38] W. Addy Majewski, *NOx Adsorbers* (February 2020), available at <https://dieselnet.com/tech/cat_nox-trap.php> (last visited March 9, 2020).
[39] MECA, supra note 7, at 31-32.

diesel particulate filters to reduce PM emissions from both the crankcase and tailpipe; filter elements must be replaced at normal oil change intervals.

- *Typical cost:* CCVs cost between $450 and $700.

Repower

Another option for reducing pollutant emission is replacing the existing engine in a vehicle or piece of equipment with an updated version that achieves lower emissions levels. Such a replacement provides the benefit of emission reduction technologies not available in the original engine. All such replacement engines typically carry standard parts warranties and emissions component warranties and can significantly reduce particulate matter, carbon monoxide, nitrogen oxide, and volatile organic compound emissions.

Replace

Diesel engine regulations enacted in the last 20 years have significantly reduced particulate matter and nitrogen oxide emissions in diesel vehicles and equipment. Replacing older diesel vehicles and equipment with newer engines built after current regulations went into effect can be an effective way to reduce emissions.

Diesel Trucks.[40] Diesel truck engines manufactured in model year (MY) 2010 utilize current technology like SCRs and DPFs to produce 98 percent less PM and NO_x emissions than engines produced in MY1988. A wide range of factors influence the decision to invest in newer trucks, including public and private incentives, regulations, warranty, maintenance, business needs, and economic conditions.

The price of diesel trucks varies widely, depending on use and features. For the purposes of rulemaking, the California Air Resources Board assumed a composite price of a new Class 8 diesel truck is $110,000 and the cost depreciates by 50 percent after four years. Data presented to the Task Force suggests current prices for a Class 8 diesel truck are $113,000 to $125,000, with a depreciation of 50 percent after four years.

Nonroad Diesel in Public Contracts.[41] Manufacturing regulations for nonroad diesel equipment for MY 2014 and newer reduced PM by 96 percent and NO_x by 93 to 96 percent, with similar reductions for MY 2011 and newer bulldozers and mining equipment. Nonroad diesel equipment varies widely by project, with smaller equipment

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[40] Diesel Technology Forum, *Presentation for the Oregon JTF on Supporting Businesses in Reducing Diesel Emissions November 21, 2019*, available at <https://olis.oregonlegislature.gov/liz/2019I1/Downloads/CommitteeMeetingDocument/207981> (last visited March 11, 2020).
[41] *Id.*

replaced more readily than medium or large equipment. There are generally fewer retrofit options for nonroad diesel equipment, and replacement costs vary widely.

Emissions Benefits of Alternative Fuels

Modern diesel engines have significantly reduced emissions using the technologies described above. Another way to reduce emissions from diesel engines is to use cleaner alternative fuels that produce fewer tailpipe emissions. Diesel fuel typically contains as much as 5,000 parts per million (ppm) of sulfur, a natural lubricant that also results in high nitrogen oxide and particulate matter emissions. The U.S. Environmental Protection Agency (EPA) has regulated sulfur content of diesel fuel since 1993.

From 2006 to 2010, the EPA phased in ultra-low-sulfur diesel (ULSD) standards, which require all highway fuel sold in the United States to contain no more than 15 ppm sulfur.[42] ULSD is required for use in all model year 2007 and later highway vehicles, and higher sulfur content fuel may harm those engines. ULSD was phased in for nonroad, locomotive, and marine diesel engines from 2007 to 2014.

Alternative fuels vary widely in their potential outcomes, appropriate applications, and required investment. Some can be used in existing diesel engines, while others require significant retrofits or new vehicles. The U.S. Department of Energy (DOE) tracks nationwide retail prices of alternative fuels (see Table 4).[43]

Table 4: Price Changes for Alternative Fuels – July-October 2019

Fuel Type	July 2019	October 2019	Change in Price July – Oct.	Units of Measurement
Gasoline	$2.76	$2.68	-$0.08	per gallon
Diesel	$3.04	$3.08	$0.04	per gallon
CNG	$2.21	$2.20	-$0.01	per GGE
LNG	$2.76	$2.69	-$0.07	per DGE
Ethanol (E85)	$2.36	$2.28	-$0.08	per gallon
Propane	$2.83	$2.76	-$0.07	per gallon
Biodiesel (B20)	$2.86	$2.87	$0.01	per gallon
Biodiesel (B99/B100)	$3.62	$3.73	$0.11	per gallon

Source: Legislative Policy and Research Office
Data: U.S. Department of Energy

[42] U.S. Department of Energy, *Diesel Fuel Standards and Rulemakings*, https://www.epa.gov/diesel-fuel-standards/diesel-fuel-standards-andrulemakings (last visited March 10, 2020).
[43] U.S. Department of Energy, *Clean Cities Alternative Fuel Price Report* (October 2019), available at <https://afdc.energy.gov/files/u/publication/alternative_fuel_price_report_oct_2019.pdf> (last visited March 10, 2020).

Biodiesel and Renewable Diesel.[44] [45] Biodiesel is a renewable, biodegradable fuel manufactured from vegetable oils, animal fats, or recycled restaurant grease for use in diesel engines. Renewable diesel is biomass-derived fuel suitable for use in diesel engines. It is chemically similar to petroleum diesel.

Biodiesel and renewable diesel are typically blended with diesel as B5 (up to five percent biodiesel) and B20 (up to 20 percent biodiesel). Blends can be used in most engines manufactured after 1994 without modification with similar fuel consumption, horsepower, and torque. Biodiesel also increases the lubricity of fuel, helping to offset the loss of sulfur in ULSD.

Biodiesel appears to reduce PM, CO, and VOCs in engines produced before model year 2010, but the primary benefit of biodiesel and renewable diesel is reduced greenhouse gas emissions over the lifecycle of the fuel because CO_2 released during combustion is offset by the CO_2 sequestered while growing the feedstocks used to produce the fuel.

All diesel fuel sold in the state must be at least B5; fuel sold for use by locomotive and marine diesel engines and home heating is exempt.[46] Higher blends are available from retailers throughout the state.[47]

Electric.[48] [49] Electric vehicles (EVs) use onboard rechargeable batteries to store energy to power electric motors. EVs have no tailpipe emissions but may have upstream emissions from the production of electricity.

Because of their limited range and need to charge, EVs are best suited to dedicated routes that allow trucks to return to established charging locations. EV infrastructure improvements will be required for other use cases. Medium- and heavy-duty EVs are available, but options are limited and are not yet cost-effective for most business models.

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[44] 3 U.S. Department of Energy, *Alternative Fuels Data Center: Biodiesel*, <https://afdc.energy.gov/fuels/biodiesel.html> (last visited March 10, 2020).
[45] U.S. Department of Energy, *Alternative Fuels Data Center: Renewable Hydrocarbon Biofuels*, <https://afdc.energy.gov/fuels/emerging_hydrocarbon.html> (last visited March 10, 2020).
[46] ORS 646.922
[47] U.S. Department of Energy, *Alternative Fueling Station Locator*, <https://afdc.energy.gov/stations/#/find/nearest?location=Oregon&fuel=BD> (last visited March 10, 2020).
[48] U.S. Department of Energy, *Alternative Fuels Data Center: Electricity*, <https://afdc.energy.gov/fuels/electricity.html> (last visited March 10, 2020).
[49] Oregon Legislature Joint Committee on Transportation, *Electrification of Medium and Heavy Duty Truck Fleets*, (November 19, 2019) available at <https://olis.oregonlegislature.gov/liz/2019I1/Committees/JCT/2019-11-19-14-00/Agenda> (last visited March 10, 2020).

Hydrogen.[50] [51] Hydrogen vehicles use H_2 to power fuel cells that drive electric motors. Hydrogen gas is an abundant resource and contains more than triple the energy per pound of diesel. Hydrogen fuel cells are lighter than electric batteries and allow for a range that is more competitive with existing diesel trucks.

Medium- and heavy-duty hydrogen vehicles are not yet available for purchase. Hydrogen is still expensive to manufacture and transport, and infrastructure investment will be required to make hydrogen a viable alternative to diesel.

Hydrogen vehicles produce no emissions, though there are emissions associated with the production of H_2 gas.

Natural Gas.[52] [53] Natural gas is a mix of hydrocarbons, primarily methane, that can be sourced as a fossil fuel or a renewable when sourced from organic materials like landfills through anaerobic digestion. Natural gas currently accounts for about 30 percent of energy use in the country, but only about two-tenths of a percent of natural gas is used for transportation fuel. Natural gas is sold in two forms: compressed (CNG) in a gaseous state at a pressure up to 3,600 pounds per square inch, or liquified (LNG) by supercooling the gas below its boiling point.

Medium- and heavy-duty natural gas vehicles (NGVs) are available new and through qualified retrofitters. NGVs have an increased incremental cost of $35,000 to $100,000 over medium- and heavy-duty diesel vehicles and require dedicated fuel stations. NGVs are best suited to high-mileage, centrally fueled fleets that allow NGVs to refuel over an extended time.

Natural gas produces 90 percent less NO_x emissions than diesel, and renewable sources produce 500 percent less greenhouse gases over their lifecycle than diesel.

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[50] U.S. Department of Energy, *Alternative Fuels Data Center: Hydrogen*, <https://afdc.energy.gov/fuels/hydrogen.html> (last visited March 10, 2020).
[51] Oregon Legislature Joint Task Force on Supporting Businesses in Reducing Diesel Emissions, *Technology Questions and Answers: Hydrogen* (December 19, 2019) available at <https://olis.oregonlegislature.gov/liz/2019I1/Committees/JTFRDE/2019-12-19-13-30/Agenda> (last visited March 10, 2020).
[52] U.S. Department of Energy, *Alternative Fuels Data Center: Natural Gas*, <https://afdc.energy.gov/fuels/natural_gas.html> (last visited March 10, 2020).
[53] NW Natural presentation to the Joint Task Force on Supporting Businesses in Reducing Diesel Emissions, *Natural Gas as an Alternative to Diesel (*November 21, 2019) available at <https://olis.oregonlegislature.gov/liz/2019I1/Downloads/CommitteeMeetingDocument/207982> (last visited March 10, 2020).

EXISTING INCENTIVE PROGRAMS IN OREGON

The Department of Environmental Quality operates the state's existing incentive programs for retrofitting, repowering, or replacing older diesel engines. Those incentives are funded through three revenue streams, described below. These revenue streams carry with them specific parameters to which grants or other expenditures must adhere.

Diesel Emissions Reduction Act

Since passage of the federal Diesel Emissions Reduction Act (DERA) in 2005, the U.S. EPA has funded diesel emissions reduction projects either through competitive grants (70%) or through state allocations (30%) with additional matching incentive funds. The focus of DERA grants in Oregon has been on vehicle and equipment replacement, funding advanced exhaust control retrofits, or replacing older diesel engines with newer, cleaner-burning engines. Between 2008 and 2018, a total of $14.6 million was spent on DERA projects within Oregon to treat more than 800 diesel engines.

In recent years, Oregon has focused its DERA state allocation resources on retrofitting or replacing older school buses (~$480,000/year). While school buses do not represent the largest source of diesel emissions in Oregon communities, the emissions that are produced by older school buses impact vulnerable populations (children) and the buses are driven in close proximity to where people live. In addition, these funds assist school districts with meeting the retrofit and replacement requirements in ORS 468A.796 (2019). DEQ plans to integrate nonroad equipment projects in current and future rounds of state allocation funding to assist construction contractors with meeting local and state clean diesel contracting standards that will go into effect in 2022.

Congestion Mitigation and Air Quality

Oregon DEQ is appropriated by the legislature $500,000 per biennium of Oregon's federal Congestion Mitigation and Air Quality (CMAQ) funds allocation to reduce harmful diesel emissions from older more polluting vehicles and equipment. DEQ has used funds to pay for the installation of diesel exhaust control retrofit devices on older school buses in the David Douglas School District in the Portland area. Based on guidance from the Oregon Department of Transportation (ODOT), future projects must generate a net emissions reduction from a transportation project and they must be consistent with a long-range transportation plan. Past projects have focused on exhaust control retrofits and future projects could include similar equipment purchases that measurably reduce emissions. Future projects will likely focus on decommissioning older diesel engines and supporting the transition to newer, cleaner technologies.

Volkswagen Settlement Funds

As part of a nationwide settlement between the United States Government and Volkswagen, Oregon is allocated $72.9 million in funds to be used towards projects that mitigate the excess NOx emissions resulting from emissions-cheating violations. This initial allocation to the State of Oregon, based on registration share of VW diesels by state, must be spent in 10 years, by the deadline of October 2, 2027. The court settlement agreement establishes the types of projects that can be funded, and the amounts of funding available for different projects, by equipment model year, type, and owner.[54]

Oregon's share of settlement funds is being dispersed through two programs based on direction provided by the legislature:

- **Volkswagen School Bus Program:** SB 1008 (2017) directed Oregon DEQ to retrofit or replace at least 450 older school buses across the state. To date, DEQ has addressed 262 buses. While most school districts have chosen to purchase new, lower-emission diesel school buses, some are prioritizing exhaust control retrofit technology and alternative-fueled vehicles.

- **Volkswagen Grant Program:** As directed by HB 2007 (2019), Oregon DEQ is developing a competitive grant program for disbursing the Volkswagen funds remaining after the school bus mandate is completed – approximately $40 million. In the fall of 2020, the department was seeking public comment on proposed rules for governing the grant program. The agency expects to begin issuing grants with the funds in 2021.

[54] U.S. Environmental Protection Agency, *Detailed Comparison of VW Eligible Mitigation Action 1-9 and Eligible Mitigation Action #10 (DERA Option) For FY 2019 State DERA Grants* (2019) available at <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100WKF6.pdf>.

EVALUATION OF REVENUE OPTIONS

The Task Force reviewed several options for possible revenue sources for an incentive program, including approaches utilized in Washington, California, and Texas. Several of the revenue sources that are used in those states, however, would not be applicable to a clean diesel incentive program in Oregon because of provisions of the Oregon Constitution.

Article IX, section 3(a) of the Oregon Constitution[55] specifies that revenue from any tax levied on motor vehicle fuel or any other product used for the propulsion of motor vehicles, or any tax or excise levied on the ownership, operation, or use of motor vehicles, "shall be used exclusively for the construction, reconstruction, improvement, repair, maintenance, operation, and use of public highways, roads, streets and roadside rest areas in this state." Because this limitation does not exist in many other states, those states can utilize revenues from their diesel incentive programs in a way that Oregon could not duplicate.

Following a comprehensive review of revenue sources for clean diesel programs in other states, the following revenue sources were dismissed from additional consideration:[56]

- smog abatement fees (collected on new vehicles registered by DMV);
- diesel fuel barrel sale privilege taxes (for on-road uses);
- surcharges on light-, medium- and heavy-duty truck registration;
- light-duty vehicle title fees;
- commercial motor carrier safety inspection fees;
- vehicle transfer fees;
- hazardous substance taxes (provided the substance is used to propel motor vehicles);
- over-dimension permit fees;
- Oregon commercial registration fees;
- farm vehicle certification fees; and
- docking fees for commercial freight vehicles at Oregon public ports.

55 Constitution of Oregon, 2019 Edition *available at* <https://www.oregonlegislature.gov/bills_laws/Pages/OrConst.aspx>.
56 Oregon Legislature Joint Task Force on Supporting Businesses in Reducing Diesel Emissions, *Revenue Options Worksheet* (October 15, 2020) *available at* <https://olis.oregonlegislature.gov/liz/2019I1/Downloads/CommitteeMeetingDocument/226782>.

The remaining options for funding a diesel emissions incentive program were considered as follows: [57] [58]

***Privilege Tax on Sale of New Tires*.** Many states today tax tires for various purposes, though most are connected to the use of, or disposal of, used tires. Tire taxes can be levied by states at the wholesale level or at the retail level, depending on how they are calculated, while the federal government can tax tires at the manufacturer or importer level. Washington and Ohio tax new tire sales at $1 per tire, while California does so at $1.75 per tire.

Similar to the vehicle privilege tax enacted by House Bill 2017 (2017), which imposes a tax on vehicle dealers for the privilege of selling new vehicles, rather than taxing any entity for the ownership or use of a motor vehicle, the Office of Legislative Counsel has speculated that a tire privilege tax could likewise be considered not subject to Article IX, section 3(a), allowing revenues to be used for a diesel emissions reduction program.

The Legislative Revenue Office (LRO) estimates that a $1 per new tire privilege tax on all tires sold in Oregon would generate approximately $3.1 million per year. If the revenues were bonded, a 10-year bond could generate a yield of $24 million; a 15-year bond would generate $32 million; and a 20-year bond would generate $38 million.

They were also asked to outline how a tax based on a percentage of the price of new tires would operate. Tires can vary in price from about $60 to more than $1,000 per tire, based on materials and intended use. LRO estimates that a per-tire privilege tax of 0.77 percent would generate roughly the same amount as a $1 per-tire tax.

Either option (variable or per-tire) would also require administration and set-up costs. While a per-tire tax could be levied at the wholesale level (saving on administrative costs due to the lower number of pay points), a variable tax could only be collected as a point-of-sale tax (POST), which would require a higher amount of administrative costs, as well as compensation to retailers for the cost of collection. LRO estimates that a one percent POST per tire would generate roughly $4 million per year in gross revenue. It is likely that up to three percent POST can be imposed (generating $12 million per year) without a significant impact on market consumption and the number of new tires sold in Oregon.

57 Oregon Legislature Joint Task Force on Supporting Businesses in Reducing Diesel Emissions, *Revenue Options Summary* (November 19, 2020) *available at* <https://olis.oregonlegislature.gov/liz/2019I1/Downloads/CommitteeMeetingDocument/226895>.
58 Oregon Legislature Joint Task Force on Supporting Businesses in Reducing Diesel Emissions, *Revenue Options Supplemental Materials* (December 3, 2020) *available at* <https://olis.oregonlegislature.gov/liz/2019I1/Downloads/CommitteeMeetingDocument/226967>.

Surcharge on Sale, Lease, and Rental of Off-Road Equipment. Texas imposes a 1.5 percent surcharge on the sale price or lease/rental amount of off-road diesel equipment sold, rented, or leased, and also applies it to the storage, use, or consumption of such equipment in Texas. This tax generates approximately $65-$70 million per year. The funds are expended primarily to aid and incentivize reduced emissions in off-road equipment diesel emissions.

The Legislative Revenue Office estimates that a similar but proportional surcharge in Oregon would be approximately 13.56 percent the size of the Texas program, meaning that a similar surcharge of 1.5 percent would generate roughly $9 million each year. Revenues from such a program could be used to incentivize clean diesel mitigation in off-road equipment, or in all diesel engines.

Privilege Tax and Use Tax on New Heavy-Duty Vehicles. The vehicle dealer privilege tax imposed by House Bill 2017 set the rate at 0.5 percent of the price of new light-duty vehicles, generating roughly $22 million per year. If this tax were also applied to heavy-duty vehicles (exceeding 26,000 lbs. GVWR), the Legislative Revenue Office estimates that it could generate approximately $4.6 million per year.

A vehicle privilege tax would also be accompanied by an equivalent use tax, imposed on vehicles purchased in another state but titled in Oregon. A use tax was created as a companion to the vehicle privilege tax by House Bill 2017. LRO estimates that a use tax on heavy-duty vehicle sales would generate an additional $1.45 million per year. However, unlike a privilege tax, the use tax is subject to Article IX, section 3(a) and would thus be deposited into the State Highway Fund.

Tax on Nonroad Diesel Use. The gasoline used by motor vehicles on state highways is taxed and dedicated to the State Highway Fund; however, a small percentage of gas taxes collected are used for nonroad uses, such as all-terrain vehicles, boats, small aircraft, and yard maintenance equipment. This money is collected into what is colloquially known as the “Lawnmower Fund” and is used to fund senior and disabled public transportation services, as it is not subject to Article IX, section 3(a) of the Oregon Constitution.

Neither Oregon nor the federal government tax diesel fuel intended for off-road uses, such as construction and mining equipment or motor vehicles used in agriculture or logging. This form of diesel is often called “red diesel” or “dyed diesel” because it is dyed red. Some on-road uses, such as transit and school buses, are also exempt from diesel taxes.

Because it is not subject to the State Highway Fund restrictions, a tax on red diesel could be levied and used for a diesel emissions mitigation program. Like the gas tax, this tax would be collected at the terminal level, rather than the retail level, and would thus have low administrative overhead, and would also provide a relatively stable funding source. The Legislative Revenue Office estimates that such a tax could generate roughly $1.7 million per year for each penny of tax levied on each gallon of red diesel sold in Oregon. If a tax equivalent to Oregon's gas tax were to be levied on nonroad diesel (40 cents per gallon) the revenue generated would be approximately $47 million per year.

General Obligation Bonds. While many revenue streams can be bonded, general obligation (GO) bonds are backed by Oregon's General Fund. If the policy in question is determined to provide a general social benefit (such as public health through improved air quality) then General Fund revenues can be used to back bonds that generate proceeds for a clean diesel program. Using bond proceeds provides the advantage of generating a large amount of money in a short time period, as revenues are used to pay back the bond over a longer time horizon.

The Legislative Revenue Office estimates that if Oregon were to create a diesel emissions reduction program proportionate to California's $1 billion program, the state would need to sell approximately $85 million in bonds, which would require an annual debt service of about $8.2 million for 15 years.

CMAQ Set-Aside for Clean Diesel. Congestion Mitigation and Air Quality (CMAQ) Program funds are provided to states by the Federal Highway Administration to improve congestion and address transportation-related air quality issues. In recent years, Oregon has received approximately $20 million in CMAQ funds annually. Since 2007, Oregon has dedicated $500,000 per biennium of CMAQ funds to support clean diesel projects administered by DEQ; the remaining funds are disbursed to several communities in Oregon via a funding formula developed and approved by the Oregon Transportation Commission.

While this would not provide a new revenue source, the Legislative Assembly could divert additional CMAQ funds toward clean diesel projects; however, this revenue stream is subject to continued congressional appropriation, and any CMAQ-funded work would need to conform to both federal and state CMAQ guidance.

Tax Credits. Tax credits do not provide a revenue source but can offer an incentive mechanism. Tax credits are effective when they are focused to achieve their objective. For incentivizing businesses and individuals to modernize trucks and engines, they need to be of significant size to be appealing and to make the transition economically effective. It is also recommended that tax credits be: (1) capped to defined annual amounts, (2) easy to verify and time limited, and (3) include sufficient side boundaries to ensure that an Oregon program does not become a solution for other states' problems.

A tax credit moves the onus for achieving the objective from the government agencies to the businesses and individuals receiving the credit, and can be made even more effective if they are coupled with penalties for noncompliance. A tax credit program could also be coupled with a prohibition on renewing the registration on older trucks, with the tax credit proportional to how early, prior to the retirement age of the vehicle, the credit is applied.

Tax credits can be financed by the General Fund or can be supplemented from other sources of revenue which would be used to backfill the source of the tax credit.

CONSIDERATIONS FOR INCENTIVE PROGRAM DESIGN

Over time, older diesel vehicles will be retired through attrition. However, due to the cost, durability, and reparability, these vehicles can often remain in use for 30 to 40 years or more. That means that older, more polluting diesel engines will continue to be used in Oregon unless their use is restricted and/or incentives are made available to upgrade or replace those engines.

Focusing in on incentives, it is important to note the large number of older (pre-2010) on-road diesel engines that are still in use today across the state.[59] Also, recent data collected as part of the DEQ's Nonroad Diesel Emissions Inventory indicate that Oregon's nonroad fleet is generally older with a higher than expected number of Tier 0 and Tier 1 engines still in operation.[60] Due to the large volume of older diesel engines that remain in both the on-road and nonroad fleets, it is not likely any new revenue source and incentive program could meet the total demand. Because of this, the Task Force invested significant time discussing and evaluating the implications of various incentive program design elements and decisions. This section is a summary of those design elements and their implications on emissions benefits, program administration, and incentive beneficiaries.

Eligible Investments

As detailed earlier in this report, the Task Force received briefings from various industry experts on the costs and benefits of various investments, including emissions control retrofits, engine repower projects, new engines, and fuel-switching. Given the wide variability in the diesel fleets and business needs, Task Force discussions generally concluded that an incentive program should leave all options on the table and provide maximum flexibility for fleet owners and operators to identify solutions that meet their needs.

59 Oregon Department of Transportation, *HB 2007 Report to the Legislature* (2020) *available at* <https://www.oregon.gov/odot/About/GR/HB%202007%20(2019)%20Clean%20Diesel%20Report.pdf>.
60 Eastern Research Group, Inc., *Oregon Nonroad Diesel Equipment Survey and Emissions Inventory – Final Report to DEQ* (August 2020) *available at* <https://www.oregon.gov/deq/aq/Documents/orNonroadDieselRep.pdf>.

This approach is consistent with other state-specific incentive programs, most notable in California and Texas. Both states use the incentive or reimbursement *amounts* to drive investment in the cleanest technologies (for example, both states offer very generous and easy-to-access incentives for hybrid and electric medium-duty trucks) while maintaining a certain level of subsidy for fleet owners to scrap an older truck and replace it with newer and cleaner conventional diesel trucks.

The Task Force spent considerable time discussing the merits and challenges of emission retrofit devices. Many acknowledge that, absent a regulatory mandate, there is little incentive for an engine owner to install and maintain a retrofit device. In the early 2000s, Oregon provided a tax credit for diesel engine retrofits that was only used once in the entire lifespan of the tax credit program. However, the passage of HB 2007 (2019) introduced regulatory requirements for older medium- and heavy-duty trucks, including a retrofit compliance pathway. This may create new demand for retrofit projects and the Task Force agrees that while retrofits likely will not be a preferred option for many businesses, they should continue to be one option in a suite of investments qualifying for incentives.

Incentive Program Priorities

The Task Force discussed three approaches to focusing or prioritizing new incentives:

1. geographic areas with the highest levels of diesel particulate emissions;
2. geographic areas with the most vulnerable populations; and
3. vehicle and equipment sectors regulated under HB 2007, or those where reductions would have the greatest impact.

Emission inventories identify which areas of the state have the highest amount of diesel particulate emissions. The most recent assessments available provide diesel particulate matter emissions concentrations at the county level. It is well understood that DPM concentrations can vary at the neighborhood scale and even block-by-block within a neighborhood. However, since the most reliable and consistent data is at the county level, funding could be focused on the counties with the highest concentrations of diesel particulate matter emissions.

The second geographic option for incentive funding could be focusing investments in communities that are considered to be vulnerable. This would also include areas where people suffer from disproportionate and excessive environmental exposures to diesel particulate matter emissions as well as other land, air, and water toxics that can have cumulative acute and chronic effects.

The third option discussed would prioritize the type of vehicles and equipment that are regulated under HB 2007 or are the most polluting. This includes pre-2007 and 2010 trucks registered in Clackamas, Multnomah, and Washington County, and those trucks and engines that are older model vehicles and equipment (pre-2007 or Tier 0-2). In the on-road sector, the heaviest vehicles emit the greatest amount of diesel particulate matter based on the size of their engines and the greater amount of work performed. For the nonroad sector, land clearing and earth moving activities are often associated with the greatest amount of diesel emissions.

Taken together, these program priorities would help to reduce diesel emissions in communities currently experiencing the greatest harm from those emissions. These approaches are also not mutually exclusive, meaning a new incentive program could, for instance, prioritize incentives to modernize the oldest trucks and equipment used in geographic areas with the highest levels of diesel particulate matter.

DEQ will soon have experience prioritizing incentive funding using similar methods under a new program being implemented in the Spring of 2021. The Environmental Quality Commission will consider proposed rules under ORS 468A.805(3) (2019) in early 2021 that will create a new competitive grant program using Environmental Mitigation Trust funds secured through the Volkswagen Settlement agreement. The legislature directed DEQ to prioritize remaining trust funds to incentivize diesel emission reduction grants within Clackamas, Multnomah, and Washington County.

The Task Force also discussed using any new state program to address projects, priorities, or investments not likely to qualify for funding under Oregon’s three existing programs. This could include:

- Incentives to scrap older trucks and replace them with newer (post-2010) used trucks.
- Provide higher reimbursement rates than currently allowed under Volkswagen or DERA, for projects or investments identified as particularly important in Oregon.
- Incentives for fleets located in areas of the state with elevated levels of diesel particulate matter emissions outside Clackamas, Multnomah, and Washington County (for example, counties along the I-5 corridor).
- Investments in emerging technologies and alternative fuels. This could include projects to convert fleets to renewable natural gas, promote the utilization of renewable diesel and electrification where the technology and use-case makes sense and is viable.

Disbursement Methods

If Oregon establishes program guidelines for new incentive eligibility based on age, type, geography, amount of usage, and emissions benefits, it must also select a disbursement method to support the program. Certain methods are more effective at providing fleet transition funding quickly and easily while others are better at achieving specific emissions benefits among target regions and/or equipment. The Task Force discussed the implications of various models and researched approaches in other states, such as California, Texas, and Washington.

Voucher approach*.* A voucher approach provides a rapid funding process with limited ability to target investments. A voucher program provides set amounts of funding to vehicle dealerships to reduce the price that qualified applicants must pay when they purchase qualifying trucks or equipment. This program design option is effective at driving investment into new technology due to the relatively rapid availability of revenue to support the purchase of new equipment. Because vouchers are typically used for the purchase of new equipment, the program should be paired with a requirement to scrap older, more polluting diesel equipment so the program can effectively verify the emissions reductions benefits.

First-come, first-served*.* This approach provides an efficient funding process with the ability to target investments. A first-come, first-served grant program provides set amounts of reimbursement to qualified applicants upon receipt of a completed application. Businesses seeking funding are incentivized to submit applications quickly to ensure they are first in line and most likely to receive a grant award. This option provides Oregon with an opportunity to establish program requirements, expedite the review and award process, and achieve emissions reductions benefits more quickly than a competitive grant approach. It also has the benefit of providing a streamlined approach that can reduce administrative burdens on fleet owners and managers, providing certainty about the availability of funding for early applicants. This approach can include mandatory scrappage of older, more polluting diesel equipment, which is necessary to verify reductions in diesel emissions.

Competitive grant approach*.* This is a deliberative funding process with the ability to finely target investments but may be less efficient at disbursing incentive funds. A competitive grant program provides set amounts of reimbursement to the most qualified applicants by requiring an evaluation of all proposals against criteria. The competitive approach forces all applicants to strive to meet as many program requirements as possible. While this type of disbursement method may help ensure that program goals are met, it can also create barriers to participation among small businesses that lack capacity to participate, owners of specialized diesel equipment, or applicants in nontargeted geographic areas. If achieving specific equipment, applicant, or geographic requirements are most important to program performance, and oversubscription is a concern, this approach may be a good fit. This approach can include mandatory scrappage of older, more polluting diesel equipment, which is necessary to verify reductions in diesel emissions.

Revolving loan fund. This is a financing option to provide below-market-rate loans to qualified applicants and incentivize the purchase of new, low-emissions vehicles and equipment while maintaining ongoing funding for future projects. This financing option can easily be paired with a first-come, first-served application process to ensure program goals are met by diesel emissions reduction projects requesting financing.

Oregon could consider strategies to minimize or avoid administrative burdens on the truck/equipment owners. While additional information may be required based on program design and goals, some minimum information is required to process requests for funding to reduce diesel emissions, including:

1. older diesel vehicles/equipment engine family name, annual usage, and location(s) of usage;
2. business or individual contact information, taxpayer identification number, and federal System for Award Management registration;
3. complete project description including total cost, timeline, and proof of solicitation of three bids to ensure cost competitiveness;
4. certification and photo evidence of destruction of older vehicles, equipment, and engines; and
5. payment documentation detailing actual costs to determine appropriate reimbursement amount.

Establishing Incentive and Reimbursement Rates

Consideration for setting reimbursement/subsidy rates should include extensive conversations with Oregon’s existing diesel fleet owners and operators to determine industry practices and equipment resale rates. To be an attractive alternative to selling old vehicles and equipment on the open market, an incentive program that requires scrappage must “pencil” or provide funding towards the purchase of new equipment that is at least equal to the resale value of the old equipment. The Task Force evaluated the reimbursement rates by equipment, project type, and ownership used in existing programs, such as:

- eligible mitigation actions under the Volkswagen Settlement;
- Diesel Emissions Reduction Act cost-sharing requirements;
- California’s Carl Moyer Fund;
- California’s Proposition 1B Good Movement Program;
- Texas’ Emissions Reduction Plan Program; and
- previous tax credit programs in Oregon.

The Task Force generally agreed, in surveys, that reimbursement rates used in the Volkswagen and DERA programs were effective.

Allowing flexibility to adjust reimbursement rates over time based on changes in market conditions, regulatory landscape, and policy goals will allow Oregon’s diesel emissions reduction programs to set rates that are competitive among a range of options available to fleet managers and continue to deliver emissions reductions.

Oregon can consider using reimbursement rates to drive investment decisions, as is done with the federal Diesel Emissions Reduction Act and the Volkswagen Settlement programs. These programs provide higher reimbursement rates for cleaner technologies to increase incentives to transition older diesel vehicles and equipment into zero-emissions technologies. Additionally, allowing reimbursement for the purchase of newer, used equipment that meets the most stringent emissions standards will allow program participants to choose the technology that best suits their needs.

Scrapping older diesel engines

One of the most important metrics in any diesel reduction incentive program is the number of older diesel engines permanently removed from service. Therefore, clear documentation of engine destruction and scrappage is necessary to achieve the goals of any replacement projects performed as part of an incentive program. This documentation should include at least:

1. photographic evidence of engine and chassis destruction; and
2. attestation of vendor and/or vehicle owner that the engine was properly destroyed.

Because of the importance of this step, compliance activities associated with engine and chassis destruction should be a high priority and resources could be made available to ensure award recipients are completing the scrapping tasks properly. Scrappage of the older engine is of equal importance in the context of repower projects. Obviously, scrappage is not necessary in emissions retrofit projects.

Conclusion

The Task Force received briefings on strategies to reduce emissions, including newer trucks and nonroad equipment, and alternative technologies such as electric engines and renewable fuels. Hydrogen technology, while promising, is still in the prototype stage. Retrofits offer limited short-term advantages and are relatively inexpensive but may come with higher maintenance and operating costs and a short lifespan. Natural gas is an available technology but requires expensive start-up costs for new vehicles and dedicated fueling stations. On a more promising front, renewable diesel is becoming more widely available, reduces both greenhouse gas and tailpipe emissions, and has achieved cost parity with fossil diesel. Unlike traditional biodiesel, renewable diesel is chemically identical to fossil diesel, meaning it can be dropped in with no modification needs to the engine and no negative effects on the engine’s operation.

In most cases, cost is a chief impediment to the transition to newer engines and adoption of alternative technologies. Additionally, the Task Force heard that successful projects rely in flexible incentives, allowing fleets to identify technologies or upgrades that meet their unique operational needs. While the cost of replacing the entire Oregon diesel fleet with modern, less-polluting equipment is far too large for a public financing project, substantial progress has been made by other states with incentive programs designed to speed the transition to cleaner equipment. Public incentives for entities regulated by House Bill 2007 is especially important.