

**United States of America Environmental Protection Agency
and
National Highway Traffic Safety Administration, Department of
Transportation Programmes
for
Greenhouse Gas Emissions Standards and Fuel Efficiency Standards
for Medium- and Heavy-Duty Engines**

The United States Department of Transportation's National Highway Traffic Safety Administration (NHTSA) and the U.S. Environmental Protection Agency (EPA) recently completed a final rulemaking for the first time addressing greenhouse gases and fuel efficiency from heavy- and medium-duty engines, referred to as the Heavy-Duty National Program. The program is detailed in rulemaking documents published on September 15, 2011 and will be applicable as described in those documents for vehicles built for 2014-2018 model years.

Overview of the Heavy-Duty National Program

The Heavy-Duty National Program will reduce fuel use and GHG emissions from medium- and heavy-duty vehicles, from semi trucks to the largest pickup trucks and vans, as well as all types and sizes of work trucks and buses in between. The program will improve energy security, benefit consumers and businesses by reducing costs for transporting goods, and spur growth in the clean energy sector.

Vehicles covered by this program make up the transportation segment's second largest contributor to oil consumption and GHG emissions. This comprehensive program is designed to address the urgent and closely intertwined challenges of dependence on oil, energy security, and global climate change.

The agencies estimate that the combined standards will reduce CO₂ emissions by about 270 million metric tons and save about 530 million barrels of oil over the life of vehicles built for the 2014 to 2018 model years, providing \$49 billion in net program benefits. The reduced fuel use alone will enable \$50 billion in fuel savings to accrue to vehicle owners, or \$42 billion in net savings when considering technology costs. A second phase of regulations is planned for model years beyond 2018.

Need to Reduce Fuel Consumption and Greenhouse Gases from Vehicles

The U.S. has two intertwined and critically important needs - to reduce oil consumption and to address global climate change. NHTSA and EPA have adopted the Heavy-Duty National Program to meet these needs by reducing fuel use and GHG emissions from on-highway transportation sources. The effect of these actions will be to improve energy security, increase fuel savings, reduce GHG emissions, and provide regulatory certainty for manufacturers.

Setting fuel consumption standards for the heavy-duty sector will improve U.S. energy security by reducing the dependence on foreign oil. Net petroleum imports now account for approximately 60

percent of U.S. petroleum consumption. Transportation accounts for about 77 percent of the U.S. domestic oil use, and heavy-duty vehicles account for about 17 percent of transportation oil use. Transportation sources emitted 29 percent of all U.S. GHG emissions in 2007 and have been the fastest-growing source of U.S. GHG emissions since 1990. The primary GHGs of concern from transportation sources are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and hydrofluorocarbons (HFC). The heavy-duty sector addressed in these joint rules accounted for nearly six percent of all U.S. GHG emissions and 20 percent of transportation GHG emissions in 2007. Within the transportation sector, heavy-duty vehicles are the fastest-growing contributors to GHG emissions.

Benefits and Costs of the HD National Program

The agencies estimate that the combined standards will reduce CO₂ emissions by about 270 million metric tons and save about 530 million barrels of oil over the life of model year 2014 to 2018 vehicles.

Overall, EPA and NHTSA estimate that the Heavy-duty National Program will cost the affected industry about \$8 billion, while saving vehicle owners fuel costs of about \$50 billion over the lifetimes of model year 2014-2018 vehicles, discounted at three percent. In addition to fuel savings, the agencies have estimated monetized benefits from CO₂ reductions, improved energy security, reduced time spent refueling, as well as possible increased driving accidents, traffic congestion, and noise. When considering all these factors, the HD National Program yields \$49 billion in net benefits to society over the lifetimes of model year 2014-2018 vehicles, discounted at three percent.

Using technologies commercially available today, the majority of vehicles will see a payback period of less than one year, while others, especially those with lower annual miles, will experience payback periods of up to two years. For example, an operator of a semi truck can pay for the technology upgrades in under a year, and have net savings up to \$73,000 over the truck's useful life.

In addition to the benefits from reduced CO₂, the EPA has estimated the benefits of reduced ambient concentrations of particulate matter and ozone resulting from the HD National Program. Air quality will improve and health impacts from these air pollutants will be reduced, with estimated monetized health-related benefits ranging from \$1.3 to \$4.2 billion in 2030, discounted at three percent. These calendar year benefits do not represent the same time frame as the model year lifetime benefits described above, so they are not additive.

In total, the combined standards will reduce GHG emissions from the U.S. heavy-duty fleet by approximately 76 million metric tons of CO₂-equivalent annually by 2030. The potential impacts of the program that are not quantified and monetized in the analysis include the health and environmental impacts associated with changes in ambient exposures to toxic air pollutants, and the benefits associated with avoided non-CO₂ GHGs (methane, nitrous oxide, HFCs).

Scope of Standards for Heavy-Duty Engines and Vehicles

The agencies have each adopted complementary standards under their respective authorities covering model years 2014-2018, which together form a comprehensive Heavy-Duty National Program. EPA and NHTSA have adopted standards for CO₂ emissions and fuel consumption, respectively, tailored

to each of three main regulatory categories: (1) combination tractors; (2) heavy-duty pickup trucks and vans; and (3) vocational vehicles. Each of these is described further below. EPA has additionally adopted standards to control HFC leakage from air conditioning systems in pickups and vans and combination tractors. Also exclusive to the EPA program are EPA's N₂O and CH₄ standards that will apply to all heavy-duty engines, pickups and vans.

For purposes of this program, the heavy-duty fleet incorporates all on-road vehicles rated at a gross vehicle weight at or above 8,500 pounds, and the engines that power them, except those covered by the current GHG emissions and Corporate Average Fuel Economy standards for model year 2012-2016 passenger vehicles.

Heavy-duty vehicles include both work trucks and commercial medium and heavy-duty on-highway vehicles as defined by the Energy Independence and Security Act (EISA). Heavy-duty engines affected by the final standards are generally those that are installed in commercial medium- and heavy-duty trucks and buses. The agencies' scopes are the same except that EPA is including recreational on-highway vehicles (RV's, or motor homes) within its rulemaking, while NHTSA is not including these vehicles.

The agencies developed these rules collaboratively under their respective authorities: the EPA adopted GHG emissions standards under the Clean Air Act, and NHTSA adopted fuel efficiency standards under EISA. The goal of the joint rulemakings is to present coordinated federal standards that help manufacturers to build a single fleet of vehicles and engines that are able to comply with both.

Final Standards

It is important to note that the joint standards cover not only engines but also complete vehicles, allowing the agencies to achieve the greatest possible reductions in fuel consumption and GHG emissions, while avoiding unintended consequences. The majority of these vehicles carry payloads of goods or equipment, in addition to passengers. To account for this in the regulatory program, two types of standard metrics have been adopted: payload-dependent gram per mile (and gallon per 100-mile) standards for pickups and vans; and gram per ton-mile (and gallon per 1,000 ton-mile) standards for vocational vehicles and combination tractors. These metrics account for the fact that the work to move heavier loads burns more fuel, and emits more CO₂ than in moving lighter loads.

CO₂ and Fuel Consumption Standards

Both EPA's and NHTSA's joint final standards as detailed in the rulemaking documents apply to three main heavy-duty regulatory categories:

Combination Tractors: Heavy-duty combination tractors – the semi trucks that typically pull trailers - are built to move freight. Freight transportation customers choose tractors primarily based on two major characteristics: the gross vehicle weight rating (GVWR, which establishes the maximum carrying capacity of the tractor and trailer) and cab type (sleeper cabs provide overnight accommodations for drivers). Operators also consider the tractor roof height when mating with trailers for the most efficient configuration. The agencies have adopted differentiated standards for nine sub-categories of combination tractors based on three attributes: weight class, cab type and roof height. The standards will phase in to the 2017 levels. These final standards will achieve from nine to 23 percent reduction in emissions and fuel consumption from affected tractors over the 2010 baselines.

Heavy-Duty Pickup Trucks and Vans: The agencies are setting corporate average standards for heavy-duty pickup trucks and vans, similar to the approach taken for light-duty vehicles. Each manufacturer's standard for a model year depends on its sales mix, with higher capacity vehicles (payload and towing) having numerically less stringent target levels, and with an added adjustment for 4-wheel drive vehicles. The standards will phase in with increasing stringency in each model year from 2014 to 2018. The EPA standards adopted for 2018 (including a separate standard to control air conditioning system leakage) represent an average per-vehicle reduction in GHG emissions of 17 percent for diesel vehicles and 12 percent for gasoline vehicles, compared to a common baseline. NHTSA is setting corporate average standards for fuel consumption that are equivalent to EPA's standards (though not including EPA's final air conditioning leakage standard). The final NHTSA standards represent an average per-vehicle improvement in fuel consumption of 15 percent for diesel vehicles and 10 percent for gasoline vehicles, compared to a common baseline. To satisfy lead time requirements under EISA, NHTSA standards will be voluntary in 2014 and 2015. Both agencies are providing manufacturers with two alternative phase-in approaches that get equivalent overall reductions. One alternative phases the final standards in at 15-20-40-60-100 percent in model years 2014-2015-2016-2017-2018. The other phases the final standards in at 15-20-67-67-67-100 percent in model years 2014-2015-2016-2017-2018-2019.

Vocational Vehicle Standards: Vocational vehicles consist of a very wide variety of truck and bus types including delivery, refuse, utility, dump, cement, transit bus, shuttle bus, school bus, emergency vehicles, motor homes, tow trucks, and many more. Vocational vehicles undergo a complex build process, with an incomplete chassis often built with an engine and transmission purchased from different manufacturers, which is then sold to a body manufacturer. In these rules, the agencies are regulating chassis manufacturers for this segment. The agencies have divided this segment into three regulatory subcategories - Light Heavy (Class 2b through 5), Medium Heavy (Class 6 and 7), and Heavy Heavy (Class 8), which is consistent with the engine classification. After engines, tires are the second largest contributor to energy losses of vocational vehicles. The final program for vocational vehicles for this phase of regulatory standards is limited to tire technologies (along with the separate engine standards). The standards represent emission reductions from six to nine percent, from a 2010 baseline.

EPA's N₂O, CH₄ and Air Conditioning Leakage Standards

In addition to the CO₂ standards described above, EPA has adopted standards for N₂O and CH₄ emissions. N₂O and CH₄ are important GHGs that contribute to global warming, more so than CO₂ for the same amount of emissions. While today's gasoline and diesel engines emit relatively low levels of N₂O and CH₄ emissions, EPA's standards will act to cap emissions to ensure that manufacturers do not allow the N₂O and CH₄ emissions of their future engines to increase significantly above the currently controlled low levels.

Air conditioning (A/C) systems contribute directly to GHG emissions through leakage of HFC refrigerants, which are powerful GHG pollutants. EPA has adopted standards to assure that high-quality, low-leakage components are used in each air conditioning system designed for heavy-duty pickup trucks and vans, and semi trucks. The standard for larger A/C systems (capacity above 733 grams) is measured in percent total refrigerant leakage per year, while the standard for smaller A/C systems (capacity of 733 grams or less) is measured in grams of refrigerant leakage per year.

Program Flexibilities

EPA's and NHTSA's final HD National Program provides flexibilities to manufacturers in terms of how they can comply with the new standards. These flexibilities are expected to provide sufficient lead time for manufacturers to make necessary technological improvements and reduce the overall cost of the program, without compromising overall environmental and fuel consumption objectives.

The primary flexibility provisions are an engine averaging, banking, and trading (ABT) program and a vehicle ABT program. These ABT programs will allow for emission and fuel consumption credits to be averaged, banked, or traded within each of the defined averaging sets. There are three weight-based averaging sets for two of the regulatory categories: combination tractors and vocational vehicles. The pickup trucks and vans are one fleetwide averaging set, and there are four averaging sets for engines.

In addition to the general ABT programs, EPA is providing engine manufacturers and heavy-duty pickup and van manufacturers the added option of using CO₂ credits to offset CH₄ or N₂O emissions that exceed the applicable emission standards based on the relative global warming potentials of these emissions.

The structure of the ABT program for HD engines is based closely on earlier EPA ABT programs for HD engines; the program for pickup trucks and vans is built on the existing light-duty GHG and fuel economy credit carry-forward, carry-back, and trading provisions; and first-time ABT provisions are adopted for other HD vehicle manufacturers that are as consistent as possible with the provisions for other categories.

The agencies adopted three additional optional credit opportunities. The first is an early credit option intended for manufacturers who demonstrate improvements in excess of the standards prior to the model year that they become effective. The second is a credit program intended to promote implementation of advanced technologies, such as hybrid powertrains, engines with Rankine cycle waste heat recovery systems, and electric or fuel cell vehicles. The last is a credit intended to apply to new and innovative technologies that reduce vehicle CO₂ emissions and fuel consumption, for which the benefits are not captured over the test procedure used to determine compliance with the standards (i.e., "off-cycle").

Preamble and Regulatory Text

The preamble and regulatory text for this programme can be found in the files below. They are also accessible through the web site shown in the "For More Information" section below.

<http://www.gpo.gov/fdsys/pkg/FR-2011-09-15/pdf/2011-20740.pdf>

For More Information

The final rule and related documents can be accessed electronically on NHTSA's web site and on EPA's web site at:

www.nhtsa.gov/fuel-economy

www.epa.gov/otaq/climate/regulations.htm