



ENVIRONMENTAL PROTECTION AGENCY

(6560-50-P)

[EPA–HQ– OAR–2017–0189; FRL–9962-95-OAR]

Alternative Method for Calculating Off-cycle Credits under the Light-duty Vehicle Greenhouse Gas Emissions Program: Applications from BMW Group, Ford Motor Company, and Hyundai Motor Group

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: The Environmental Protection Agency (EPA) is requesting comment on applications from BMW of North American (BMW), Ford Motor Company (Ford), and Hyundai Motor Group for off-cycle carbon dioxide (CO₂) credits under EPA’s light-duty vehicle greenhouse gas emissions standards. “Off-cycle” emission reductions can be achieved by employing technologies that result in real-world benefits, but where that benefit is not adequately captured on the test procedures used by manufacturers to demonstrate compliance with emission standards. EPA’s light-duty vehicle greenhouse gas program acknowledges these benefits by giving automobile manufacturers several options for generating “off-cycle” carbon dioxide (CO₂) credits. Under the regulations, a manufacturer may apply for CO₂ credits for off-cycle technologies that result in off-cycle benefits. In these cases, a manufacturer must provide EPA with a proposed methodology for determining the real-world off-cycle benefit. These three manufacturers have submitted applications that describe methodologies for determining off-cycle credits. The off-cycle technologies vary by manufacturer and include thermal control technologies such as solar reflective glass/glazing and solar reflective surface coating (paint), a high efficiency alternator, and an efficient air conditioning compressor.

Pursuant to applicable regulations, EPA is making descriptions of each manufacturer's off-cycle credit calculation methodologies available for public comment.

DATES: Comments must be received on or before [**INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION**].

ADDRESSES: Submit your comments, identified by Docket ID No. EPA-HQ-OAR-2017-0189, to the Federal eRulemaking Portal: <https://www.regulations.gov>. Follow the online instructions for submitting comments. Once submitted, comments cannot be edited or withdrawn. The EPA may publish any comment received to its public docket. Do not submit electronically any information you consider to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute.

Multimedia submissions (audio, video, etc.) must be accompanied by a written comment. The written comment is considered the official comment and should include discussion of all points you wish to make. The EPA will generally not consider comments or comment contents located outside of the primary submission (i.e. on the web, cloud, or other file sharing system). For additional submission methods, the full EPA public comment policy, information about CBI or multimedia submissions, and general guidance on making effective comments, please visit <https://www2.epa.gov/dockets/commenting-epa-dockets>.

FOR FURTHER INFORMATION CONTACT: Roberts French, Environmental Protection Specialist, Office of Transportation and Air Quality, Compliance Division, U.S. Environmental Protection Agency, 2000 Traverwood Drive, Ann Arbor, MI 48105. Telephone: (734) 214-4380. Fax: (734) 214-4869. Email address: french.roberts@epa.gov.

SUPPLEMENTARY INFORMATION:

I. Background

EPA's light-duty vehicle greenhouse gas (GHG) program provides three pathways by which a manufacturer may accrue off-cycle carbon dioxide (CO₂) credits for those technologies that achieve CO₂ reductions in the real world but where those reductions are not adequately captured on the test used to determine compliance with the CO₂ standards, and which are not otherwise reflected in the standards' stringency. The first pathway is a predetermined list of credit values for specific off-cycle technologies that may be used beginning in model year 2014.¹ This pathway allows manufacturers to use conservative credit values established by EPA for a wide range of technologies, with minimal data submittal or testing requirements, as long as the technologies meet EPA regulatory definitions. In cases where the off-cycle technology is not on the menu but additional laboratory testing can demonstrate emission benefits, a second pathway allows manufacturers to use a broader array of emission tests (known as "5-cycle" testing because the methodology uses five different testing procedures) to demonstrate and justify off-cycle CO₂ credits.² The additional emission tests allow emission benefits to be demonstrated over some elements of real-world driving not adequately captured by the GHG compliance tests, including high speeds, hard accelerations, and cold temperatures. These first two methodologies were completely defined through notice and comment rulemaking and therefore no additional process is necessary for manufacturers to use these methods. The third and last pathway allows manufacturers to seek EPA approval to

¹ See 40 CFR 86.1869-12(b).

² See 40 CFR 86.1869-12(c).

use an alternative methodology for determining the off-cycle CO₂ credits.³ This option is only available if the benefit of the technology cannot be adequately demonstrated using the 5-cycle methodology. Manufacturers may also use this option for model years prior to 2014 to demonstrate off-cycle CO₂ reductions for technologies that are on the predetermined list, or to demonstrate reductions that exceed those available via use of the predetermined list.

Under the regulations, a manufacturer seeking to demonstrate off-cycle credits with an alternative methodology (i.e., under the third pathway described previously) must describe a methodology that meets the following criteria:

- Use modeling, on-road testing, on-road data collection, or other approved analytical or engineering methods;
- Be robust, verifiable, and capable of demonstrating the real-world emissions benefit with strong statistical significance;
- Result in a demonstration of baseline and controlled emissions over a wide range of driving conditions and number of vehicles such that issues of data uncertainty are minimized;
- Result in data on a model type basis unless the manufacturer demonstrates that another basis is appropriate and adequate.

Further, the regulations specify the following requirements regarding an application for off-cycle CO₂ credits:

- A manufacturer requesting off-cycle credits must develop a methodology for demonstrating and determining the benefit of the off-cycle technology,

³ See 40 CFR 86.1869-12(d).

and carry out any necessary testing and analysis required to support that methodology.

- A manufacturer requesting off-cycle credits must conduct testing and/or prepare engineering analyses that demonstrate the in-use durability of the technology for the full useful life of the vehicle.
- The application must contain a detailed description of the off-cycle technology and how it functions to reduce CO₂ emissions under conditions not represented on the compliance tests.
- The application must contain a list of the vehicle model(s) which will be equipped with the technology.
- The application must contain a detailed description of the test vehicles selected and an engineering analysis that supports the selection of those vehicles for testing.
- The application must contain all testing and/or simulation data required under the regulations, plus any other data the manufacturer has considered in the analysis.

Finally, the alternative methodology must be approved by EPA prior to the manufacturer using it to generate credits. As part of the review process defined by regulation, the alternative methodology submitted to EPA for consideration must be made available for public comment.⁴ EPA will consider public comments as part of its final decision to approve or deny the request for off-cycle credits.

⁴ See 40 CFR 86.1869-12(d)(2).

II. Off-Cycle Credit Applications

A. Denso SAS Air Conditioning Compressor

Using the alternative methodology approach discussed previously, BMW, Ford, and Hyundai are applying for credits for an air conditioning compressor manufactured by Denso that results in air conditioning efficiency credits beyond those provided in the regulations. This compressor, known as the Denso SAS compressor, improves the internal valve system within the compressor to reduce the internal refrigerant flow necessary throughout the range of displacements that the compressor may use during its operating cycle. The addition of a variable crankcase suction valve allows a larger mass flow under maximum capacity and compressor start-up conditions (when high flow is ideal), and then it can reduce to smaller openings with reduced mass flow in mid- or low-capacity conditions. The refrigerant exiting the crankcase is thus optimized across the range of operating conditions, reducing the overall energy consumption of the air conditioning system.

The “5-cycle” methodology does not adequately measure the real-world greenhouse gas reduction benefits of this compressor because the only one of the five tests with the air conditioner operating is conducted under worst-case conditions (high temperature, high solar load, and high humidity), not the more moderate conditions where the technology provides the majority of its benefits.

In December 2014, General Motors (GM) requested off-cycle GHG credits for the use of the Denso SAS compressor. GM worked with Denso to perform bench testing of

compressors with and without the improvements and quantified the impact, which supported an off-cycle credit of 1.1 grams/mile. GM substantiated these results by also performing vehicle tests using the AC17 procedure. After public notice and comment, EPA approved GM's request in September 2015.⁵

The credits calculated for the Denso SAS compressor would be in addition to the credits of 1.7 grams/mile for variable-displacement A/C compressors already allowed under EPA regulations.⁶ However, it is important to note that EPA regulations place a limit on the cumulative credits that can be claimed for improving the efficiency of A/C systems. The rationale for this limit is that the additional fuel consumption of A/C systems can never be reduced to zero, and the limits established by regulation reflect the maximum possible reduction in fuel consumption projected by EPA. These limits, or caps, on credits for A/C efficiency, must also be applied to A/C efficiency credits granted under the off-cycle credit approval process. In other words, cumulative A/C efficiency credits for an A/C system – from the A/C efficiency regulations and those granted via the off-cycle regulations – must comply with the stated limits.

1. BMW

BMW is requesting an off-cycle GHG credit of 1.1 grams CO₂ per mile for the Denso SAS compressor (the same as was approved for GM in 2015). BMW repeated the bench test modeling analysis using vehicle-specific BMW input data, and, like the original

⁵ “EPA Decision Document: Off-cycle Credits for Fiat Chrysler Automobiles, Ford Motor Company, and General Motors Corporation.” Compliance Division, Office of Transportation and Air Quality, U.S. Environmental Protection Agency. EPA-420-R-15-014, September 2015.

⁶ See 40 CFR 86.1868-12.

Denso analysis, demonstrated a benefit of 1.1 grams/mile. Like GM, BMW also ran vehicle tests using the AC17 test. Six tests were conducted on a 3-series BMW, resulting in a calculated benefit of 1.2 grams/mile, thus substantiating the bench test results. Based on these results, BMW is requesting a credit of 1.1 grams/mile for all BMW vehicles equipped with the Denso SAS compressor with variable crankcase suction valve technology, starting with 2016 model year vehicles. Details of the testing and analysis can be found in the manufacturer's application.

2. Ford

Ford is requesting an off-cycle GHG credit of 1.1 grams CO₂ per mile for the Denso SAS compressor (the same as was approved for GM in 2015). Ford cited the bench test modeling analysis referenced in the original GM application, which demonstrated a benefit of 1.1 grams/mile. Ford also ran vehicle tests using the AC17 test. Six tests were conducted on a 2017 Lincoln MKC, resulting in a calculated benefit of 1.5 grams/mile, thus substantiating the bench test results. Based on these results, Ford is requesting a credit of 1.1 grams/mile for all 2017 and later model year Ford vehicles equipped with the Denso SAS compressor with variable crankcase suction valve technology. Details of the testing and analysis can be found in the manufacturer's application.

3. Hyundai

Hyundai is requesting an off-cycle GHG credit of 1.4 grams CO₂ per mile for the Denso SAS compressor. Hyundai repeated the bench test modeling analysis using vehicle-specific Hyundai input data, which demonstrated a benefit of 1.4 grams/mile. Like the

other manufacturers, Hyundai also ran vehicle tests using the AC17 test. Two tests were conducted on a Hyundai Sonata, resulting in a calculated benefit of 9.3 grams/mile, substantially more than the bench test results. Based on these results, Hyundai is requesting a credit of 1.4 grams/mile for all 2015 through 2017 model year Hyundai Sonata models equipped with the Denso SAS compressor with variable crankcase suction valve technology. Details of the testing and analysis can be found in the manufacturer's application.

B. High Efficiency Alternator

Ford is requesting GHG credits for alternators with improved efficiency relative to a baseline alternator. This request is for the 2009 and later model years. Automotive alternators convert mechanical energy from a combustion engine into electrical energy that can be used to power a vehicle's electrical systems. Alternators inherently place a load on the engine, which results in increased fuel consumption and CO₂ emissions. High efficiency alternators use new technologies to reduce the overall load on the engine yet continue to meet the electrical demands of the vehicle systems, resulting in lower fuel consumption and lower CO₂ emissions. Some comments on EPA's proposed rule for GHG standards for the 2016-2025 model years suggested that EPA provide a credit for high-efficiency alternators on the pre-defined list in the regulations. While EPA agreed that high-efficiency alternators can reduce electrical load and reduce fuel consumption, and that these impacts are not seen on the emission test procedures because accessories that use electricity are turned off, EPA noted the difficulty in defining a one-size-fits-all

credit due to lack of data.⁷ Ford proposes a methodology that would scale credits based on the efficiency of the alternator; alternators with efficiency (as measured using an accepted industry standard procedure) above a baseline value could get credits from 0.2 to 1.9 grams/mile. Details of the testing and analysis can be found in the manufacturer's application.

C. Thermal Control Technologies

1. Glass/Glazing

Ford is requesting off-cycle credits for glass/glazing that reduces the amount of solar energy that is transmitted through the windows. By doing so, interior cabin temperatures can be reduced, which results in a reduction in the amount of energy needed to cool the cabin and maintain passenger comfort. Ford's request is fundamentally identical to the request submitted by Chrysler in 2013, which EPA subsequently approved in September of 2015.⁸

Ford's request is for 2010 and later model year vehicles, whereas the credits approved for Chrysler were limited to the model years before 2014 (after which EPA expects that credits would be gained via the regulatory "menu", since the methodology essentially replicates EPA's methodology and produces similar credit values). Note that the regulations limit glass/glazing credits to 2.9 grams/mile for cars and 3.9 grams/mile for trucks, and that EPA will require that these caps be observed for all glass/glazing credits,

⁷ See 77FR 62730, October 15, 2012.

⁸ "EPA Decision Document: Off-cycle Credits for Fiat Chrysler Automobiles, Ford Motor Company, and General Motors Corporation." Compliance Division, Office of Transportation and Air Quality, U.S. Environmental Protection Agency. EPA-420-R-15-014, September 2015.

regardless of the regulatory pathway by which those credits are claimed or granted. This is also true for the caps specified for the total credits from thermal control technologies (3.0 grams/mile for cars and 4.3 grams/mile for trucks). The technical and engineering reasons for these limits remain applicable and are not rendered moot because credits are granted through this public process.

2. Solar Reflective Surface Coating

Ford is requesting off-cycle credits for solar reflective paint. Like glass, by reducing the heat that is transmitted to the interior, interior cabin temperatures can be reduced, which results in a reduction in the amount of energy needed to cool the cabin and maintain passenger comfort. Ford's request is largely similar to the request submitted by Chrysler in 2013, which EPA subsequently approved in September of 2015.⁹ However, there is one significant difference. Chrysler noted two data points regarding the impact of reflective paint: a study by the National Renewable Energy Laboratory (NREL) that determined a cabin air breath temperature reduction of 1.2 degrees C, and a study by the Lawrence Berkeley National Laboratory for the California Energy Commission that showed a reduction of 5-6 degrees C. Chrysler's methodology, which EPA approved, used the more conservative value from the NREL study (as did EPA in our Technical Support Document to establish the menu values for reflective paint). Chrysler's methodology, which does not differ substantially from EPA's methodology outlined in our Technical Support Document, would produce credits of 0.4 grams/mile, comparable to the menu values for a paint with high reflectivity. Ford provided test data that indicated

⁹ "EPA Decision Document: Off-cycle Credits for Fiat Chrysler Automobiles, Ford Motor Company, and General Motors Corporation." Compliance Division, Office of Transportation and Air Quality, U.S. Environmental Protection Agency. EPA-420-R-15-014, September 2015.

a cabin air breath temperature reduction closer to the California Energy Commission study, and the resulting credits would be up to about 2 grams/mile for the highest reflectivity paint, or five times the menu credit value documented in EPA's Technical Support Document. EPA is particularly interested in comments on Ford's data and methodology for these credits because of the different inputs used by Ford as well as the data those inputs are based on and the magnitude of the requested credits compared to the regulatory menu of credits for this technology.

Ford's request is for 2010 and later model year vehicles, whereas the credits approved for Chrysler were limited to the model years before 2014 (after which EPA expects that credits would be gained via the regulatory "menu", since the methodology used by Chrysler essentially replicated EPA's methodology and produced similar credit values). Note that the regulations limit the cumulative credits from thermal control technologies to 3.0 grams/mile for cars and 4.3 grams/mile for trucks, and that EPA will require that these caps be observed for all thermal control credits, regardless of the regulatory pathway by which those credits are claimed or granted. The technical and engineering reasons for these limits remain applicable (a fact that is acknowledged by Ford in their application materials) and are not rendered moot because credits are granted through this public process instead of through the regulatory menu.

III. EPA Decision Process

EPA has reviewed the applications for completeness and is now making the applications available for public review and comment as required by the regulations. The off-cycle

credit applications submitted by BMW, Ford, and Hyundai (with confidential business information redacted) have been placed in the public docket (see ADDRESSES section in this preamble) and on EPA's web site at the following locations:

BMW: <https://www.epa.gov/vehicle-and-engine-certification/bmw-compliance-materials-light-duty-greenhouse-gas-ghg-standards>

Ford: <https://www.epa.gov/vehicle-and-engine-certification/ford-compliance-materials-light-duty-greenhouse-gas-ghg-standards>

Hyundai: <https://www.epa.gov/vehicle-and-engine-certification/hyundai-compliance-materials-light-duty-greenhouse-gas-ghg-standards>

EPA is providing a 30-day comment period on the applications for off-cycle credits described in this action, as specified by the regulations. The manufacturers may submit a written rebuttal of comments for EPA's consideration, or may revise an application in response to comments. After reviewing any public comments and any rebuttal of comments submitted by manufacturers, EPA will make a final decision regarding the credit requests. EPA will make its decision available to the public by placing a decision document (or multiple decision documents) in the docket and on EPA's web site at the same manufacturer-specific pages shown previously. While the broad methodologies used by these manufacturers could potentially be used for other vehicles and by other manufacturers, the vehicle specific data needed to demonstrate the off-cycle emissions

reductions would likely be different. In such cases, a new application would be required, including an opportunity for public comment.

Dated: May 16, 2017.

Byron J. Bunker

Director, Compliance Division

Office of Transportation and Air Quality

Office of Air and Radiation.

[FR Doc. 2017-12737 Filed: 6/16/2017 8:45 am; Publication Date: 6/19/2017]