EPA Decision Document: Off-Cycle Credits for Hyundai Motor Group and Kia Motors Corporation

United States Environmental Protection Agency

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Compliance Division
Office of Transportation and Air Quality
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EPA United States Environmental Protection Agency

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I. Introduction

EPA's light-duty vehicle greenhouse gas (GHG) rules include opportunities for manufacturers to generate CO_2 credits for technologies that provide CO_2 reductions not captured by the 2-cycle emissions test. There are three pathways by which manufacturers can generate off-cycle credits: (1) a pre-determined "menu" of technologies and credits that is available for 2014 and later model years, (2) a testing-based option, and (3) an alternative methodology that includes opportunity for public comment. These are described in more detail in Section II.

Pursuant to those rules, Hyundai Motor Group (Hyundai) and Kia Motors Corporation (Kia) submitted applications requesting off-cycle credits for high-efficiency alternators and for engine idle stop-start systems. The application covers 2010 and later model year vehicles.

EPA published a notice in the *Federal Register* on August 14, 2019 announcing a 30-day public comment period for these applications.[1] EPA received no adverse comments regarding the methodologies presented for determining the credits sought from these technologies by Hyundai and Kia, and is hereby approving the technologies, methodologies for determining credits, and credit levels as described in the applications from Hyundai and Kia and in the *Federal Register*.

Section II of this document provides background on EPA's off-cycle credits program. Section III provides EPA's decision. This decision document applies only to the applications referenced herein.

II. EPA's Off-cycle Credits Program

EPA's light-duty vehicle greenhouse gas (GHG) program provides three pathways by which a manufacturer may accrue off-cycle carbon dioxide (CO_2) credits for those off-cycle technologies that achieve CO_2 reductions in the real world but where those reductions are not adequately captured on the test procedure used to determine compliance with the CO_2 standards. The first is a predetermined list of credit values for specific off-cycle technologies that may be used beginning in model year 2014.[2] 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. In cases where additional laboratory testing can demonstrate emission benefits of an off-cycle technology, a second pathway allows manufacturers to use a broader array of emission tests (known as "5-cycle" testing because the

[1] 84 FR 40405, Aug 14, 2019.
[2] See 40 CFR 86.1869-12(b).

methodology uses five different testing procedures) to demonstrate and justify off-cycle CO_2 credits.[3] The additional emission tests allow emission benefits to be demonstrated over some elements of real-world driving not captured by the GHG compliance tests, including high speeds, hard accelerations, and cold temperatures. Credits determined according to this methodology do not undergo additional public review. The third and last pathway allows manufacturers to seek EPA approval to use an alternative methodology for determining the off-cycle CO_2 credits.[4] This option is only available if the benefit of the off-cycle 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 CO_2 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 above) 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 CO_2 credits:

- A manufacturer requesting off-cycle credits must develop a methodology for demonstrating and determining the benefit of the off-cycle technology 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 CO_2 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.

[3] See 40 CFR 86.1869-12(c).
[4] See 40 CFR 86.1869-12(d).

- 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.[5] EPA will consider public comments as part of its final decision to approve or deny the request for off-cycle credits.

Although these credits are requested under regulatory provisions that don't explicitly require limitations, or caps, on credit values, EPA is stipulating here that credits for technologies for which there is a regulatory cap must be held to the applicable regulatory cap, if such credits are approved by EPA. For example, for reasons described in the implementing rulemaking documents and analyses, EPA established caps on thermal technology credits of 3.0 grams/mile for cars and 4.3 grams/mile for trucks. The rationale for these caps is applicable regardless of the off-cycle pathway being used to achieve such credits. EPA also established caps on technologies that improve the efficiency of air conditioning systems (5 grams/mile for cars and 7.2 grams per mile for trucks). Thus, credits approved in this Decision Document are being approved only to the extent that the regulatory caps on credits for certain technologies or categories of technologies are not exceeded.

III. EPA Decisions on Off-cycle Credit Applications

The applications for off-cycle credits from Hyundai and Kia were prepared and submitted by the Hyundai America Technical Center, Inc. (HATCI) and were identical across the two companies except for some narrow company-specific information. For these reasons, this Decision Document addresses both jointly, rather than being repetitive.

A. High-Efficiency Alternator

Hyundai and Kia requested GHG credits for alternators with improved efficiency relative to a baseline alternator, for the 2010 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 CO_2 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 CO_2 emissions. Hyundai and Kia proposed a methodology that would scale credits based on the efficiency of the alternator (as measured using an accepted industry standard procedure). This approach was first brought to EPA in 2017 by Ford, and EPA approved the methodology in a December 2017 Decision Document.[6] Details of the testing and analysis can be found in the manufacturer's application. EPA reviewed the application for completeness and made it available for public review and comment as

[5] See 40 CFR 86.1869-12(d)(2).

[6] *EPA Decision Document: Off-Cycle Credits for BMW Group, Ford Motor Company, and Hyundai Motor Company*, Office of Transportation and Air Quality, U.S. Environmental Protection Agency, EPA-420-R-17-010.

required by the regulations. The Hyundai and Kia off-cycle credit applications (with confidential business information redacted) are available in the public docket and on EPA's web site at https://www.epa.gov/ve-certification/compliance-information-light-duty-greenhouse-gas-ghg-standards.

EPA did not receive any adverse comments on the applications from Hyundai and Kia. EPA received joint comments from the Alliance of Automobile Manufacturers (AAM) and the Association of Global Automakers that were supportive and recommended timely approval of the methodologies for determining off-cycle credits. EPA has evaluated the application and finds that the methodologies described therein are sound and appropriate. Therefore, EPA is approving the credits requested by VW for the 2010-2011 model years. Caps or limits on credits that are specified in the regulations also apply to the credits being approved in this document. These credits must be reported to EPA not later than May 1, 2020, the date on which reporting of GHG credits for the 2019 model year is due. All information necessary to determine the total Megagrams of credits must be included in the reporting to EPA, and the total Megagrams for each fleet and model year should be included in a summary of credit averaging, banking, and trading.

B. Stop-Start System

Hyundai and Kia applied for engine idle stop-start credit covering 2012-2016 model year vehicles with stop-start technology, including hybrid electric vehicles and plug-in hybrid electric vehicles. Based on the analysis presented in their application, they requested a credit of 3.7 grams/mile for vehicles with stop-start technology that are not hybrids, and 3.8 grams/mile for hybrid electric and plug-in hybrid electric vehicles. The methodology used by Hyundai and Kia was essentially the same as that used by Mercedes and approved by EPA in September of 2014.[7] This methodology is based on the following analyses:

- Estimate or measure the total idle fraction as a percentage of all vehicle operation in the real-world;
- Estimate or measure the percentage of idle fraction that the stop-start system is enabled out of all the available idle time (i.e., eligible stop-start percentage or stop-start system effectiveness);
- Determine the benefit of the stop-start system in grams per mile based on A-B emissions testing (i.e., technology on and off);
- Multiply the eligible real world stop-start time (relative to the 2-cycle eligible time) by the stop-start system benefit to estimate the idle stop-start credit; and,
- For vehicles that allow the driver to disable the stop-start system, the frequency of disablement by the driver must be determined.

The Mercedes application and EPA's Decision Document are both available on EPA's website; however, for convenience the table below shows a comparison of the key inputs to the methodologies approved by EPA for Mercedes and proposed by Hyundai and Kia.

[7] "EPA Decision Document: Mercedes-Benz Off-cycle Credits for MYs 2012-2016." U.S. Environmental Protection Agency, EPA-420-R-14-025, September 2014.

Input	Mercedes (as approved by EPA)	Hyundai-Kia (proposed in application)
Idle Time Fraction	22.7	22.7
System Effectiveness	52%	59.4%
Driver Disablement	11%	1.6%
Credit (g/mi)	~3.5-4.5	3.7-3.8

EPA did not receive any adverse comments on the applications from Hyundai and Kia. EPA received joint comments from the Alliance of Automobile Manufacturers (AAM) and the Association of Global Automakers that were supportive and recommended timely approval of the methodologies for determining off-cycle credits. The comments suggested that EPA revise the default credit value for this technology in the regulations and adjust credit caps accordingly. Such a request is outside the scope of this Decision Document and would have to be considered by EPA in a subsequent rulemaking action.

EPA has evaluated the application and finds that the methodologies described therein are sound and appropriate. Therefore, EPA is approving the credits requested by Hyundai and Kia for the 2010-2011 model years. Caps or limits on credits that are specified in the regulations also apply to the credits being approved in this document. These credits must be reported to EPA not later than May 1, 2020, the date on which reporting of GHG credits for the 2019 model year is due. All information necessary to determine the total Megagrams of credits must be included in the reporting to EPA, and the total Megagrams for each fleet and model year should be included in a summary of credit averaging, banking, and trading.