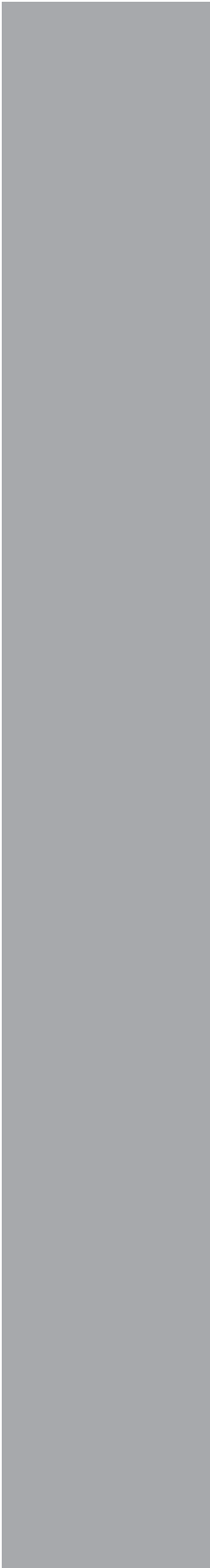


**EPA Decision Document:  
Off-Cycle Credits for North American  
Subaru, Inc.**



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Compliance Division  
Office of Transportation and Air Quality  
U.S. 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<sub>2</sub> credits for technologies that provide CO<sub>2</sub> 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 North American Subaru, Inc. ("Subaru") submitted applications requesting off-cycle credits. Subaru applied for high efficiency alternator and pulse width modulated brushless motor off-cycle GHG credits.

EPA published a notice in the *Federal Register* on October 5, 2020 announcing a 30-day public comment period for these applications.<sup>1</sup> EPA received no adverse comments regarding the methodologies presented for determining the credits sought by these manufacturers, and is hereby approving the technologies, methodologies for determining credits, and credit levels as described in the manufacturers' applications 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<sub>2</sub>) credits for those off-cycle technologies that achieve CO<sub>2</sub> reductions in the real world but where those reductions are not adequately captured on the test procedure used to determine compliance with the CO<sub>2</sub> standards. The first is a predetermined list of credit values for specific off-cycle technologies that may be used beginning in model year 2014.<sup>2</sup> 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

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<sup>1</sup> 85 FR 62724, October 5, 2020.

<sup>2</sup> See 40 CFR 86.1869-12(b).

methodology uses five different testing procedures) to demonstrate and justify off-cycle CO<sub>2</sub> credits.<sup>3</sup> 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<sub>2</sub> credits.<sup>4</sup> 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 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<sub>2</sub> 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<sub>2</sub> 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.

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<sup>3</sup> See 40 CFR 86.1869-12(c).

<sup>4</sup> 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.<sup>5</sup> 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**

#### **A. High-Efficiency Alternators**

Subaru requested GHG credits for alternators with improved efficiency relative to a baseline alternator, for the 2017 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<sub>2</sub> 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<sub>2</sub> emissions. Some comments on EPA's proposed rule for GHG standards for the 2017-2025 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. Since then, however a methodology has been developed that scales 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. Subaru proposed to use this now-accepted methodology. EPA has previously approved credits for high-efficiency alternators using this methodology for Ford Motor Company, General Motors Corporation, Fiat Chrysler Automobiles,

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<sup>5</sup> See 40 CFR 86.1869-12(d)(2).

Hyundai, Kia, Honda, Nissan and Toyota Motor Company. EPA reviewed the application for completeness and made it available for public review and comment as required by the regulations.

EPA did not receive any adverse comments on the application from Subaru. EPA received comments from the Alliance for Automotive Innovation 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 Subaru for the 2017 and later model years. 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.

The table below shows the credits that have been approved for the high efficiency alternator for Subaru for model years 2017 and later.

High Efficiency Alternator on % of Baseline Level	
VDA efficiency ( % )	Credit ( g/mile )
67	0.0
68	0.2
69	0.3
70	0.5
71	0.6
72	0.8
73	1.0
74	1.1
75	1.3
76	1.4
77	1.6
78	1.8
79	1.9
80	2.1
81	2.2

## **B. Pulse Width Modulated Brushless Motor**

Using the alternative methodology approach discussed above, Subaru applied for pulse width modulated (PWM) brushless motor greenhouse gas credits beyond those provided in the regulations. The PWM brushless motor system uses circuit switching instead of mechanical switching. The mechanical switching mechanism uses brushes to deliver current to motor windings. By implementing the brushless motor mechanism, frictional losses are reduced because there is no physical contact between stator and commutator. There is also a reduction in heat losses with the PWM brushless motor compared to the mechanical switching motor.

EPA received comments from the Alliance for Automotive Innovation (AAI) supportive of this application while disagreeing with Subaru’s request to include the A/C on portion under the credit cap.<sup>6</sup> AAI claimed the PWM brushless motor technology most directly affect(s) the operation of a vehicle’s electrical (charging and battery) systems while only indirectly relate(d) to the efficiency of the air conditioning system itself.

These AAI comments are similar to and reference comments submitted by the Alliance of Automobile Manufacturers (AAM) on a prior Toyota application for a PWM brushless motor where the Agency found the A/C credit caps apply when the PWM blower motor is operating when the A/C is ‘ON’. EPA found the comments provided by AAM to be without merit.<sup>7</sup>

The AAI comments to the Subaru PWM blower motor application did not provide any new arguments beyond those which the Agency has previously found to be without merit. The Agency is again concluding that the AAM and the AAI comments on the A/C credit cap not being applicable when the PWM blower motor is operating and the A/C is ‘ON’ are without merit.

The following table shows the approved credits for the Subaru brushless motor system for model years 2019 and later.

Brushless Motor Credits	Total Credit (g CO2/mi)	A/C On (g CO2/mi)	A/C Off (g CO2/mi)
Manual A/C	0.4	0.2	0.2
Automatic A/C	0.4	0.3	0.1

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<sup>6</sup> The Alliance for Automotive Innovation represents manufacturers producing cars and light trucks sold in the U.S. The organization was formed in 2020 and includes motor vehicle manufacturers, original equipment suppliers, technology and other automotive-related companies and trade associations.

<sup>7</sup> EPA Decision Document: Off-Cycle Credits for Toyota Motor North America, EPA-420-R-19-015, October 2019