

**EPA Decision Document:**

**Off-Cycle Credits for American Honda  
Motor Company, Ford Motor Company,  
and Nissan North America, Inc.**

**EPA Decision Document:**

**Off-Cycle Credits for American Honda  
Motor Company, Ford Motor Company,  
and Nissan North America, Inc.**

Compliance Division  
Office of Transportation and Air Quality  
U.S. Environmental Protection Agency

# EPA Decision Document: Off-Cycle Credits for American Honda Motor Company, Ford Motor Company, and Nissan North America, Inc.

---

## 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, American Honda Motor Company ("Honda"), Ford Motor Company ("Ford"), and Nissan North America, Inc. ("Nissan") submitted applications requesting off-cycle credits. Nissan and Honda applied for credits from high-efficiency alternators, and Ford applied for credits from a new air conditioning compressor technology.

EPA published a notice in the *Federal Register* on February 6, 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

---

<sup>1</sup> 85 FR 6945, Feb. 6, 2020.

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

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 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.

---

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

<sup>4</sup> See 40 CFR 86.1869-12(d).

- 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.<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**

Honda and Nissan 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. Honda and Nissan proposed to use this now-accepted methodology. EPA has previously approved credits for high-efficiency alternators using

---

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

this methodology for Ford Motor Company, General Motors Corporation, Fiat Chrysler Automobiles, Hyundai, Kia, 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 applications from Honda and Nissan. 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 Honda and Nissan for the 2017 and later model years. 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. Valeo Air Conditioning Compressor with Variable Bleed Valve**

Using the alternative methodology approach discussed above, Ford applied for credits for an air conditioning compressor manufactured by Valeo that results in air conditioning efficiency credits beyond those provided in the regulations. Valeo's air conditioning compressor with variable bleed valve improves energy consumption compared to the current generation compressor technology. The variable bleed valve improves the coefficient of performance under low and mid load conditions decreasing CO<sub>2</sub> emissions. The variable bleed valve is designed to vary the bleed valve diameter, making it smaller to control internal control gas for improved coefficient of performance, but also be able to increase for liquid start up conditions. The optimized valves reduce losses within the A/C compressor, thus increasing efficiency. The additional variable bleed valve improves the compressor relative to previous externally controlled variable displacement compressor designs.

The credits calculated for the Valeo air conditioning compressor with variable bleed valve would be in addition to the credits of 1.7 grams/mile for variable-displacement A/C compressors already allowed under EPA regulations. 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, and EPA has typically required that A/C-related technologies for which credits are sought through the off-cycle program must also comply with these limits. The rationale for the limits 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 for a typical A/C system. To date, EPA has required that these limits, or caps, on credits for A/C efficiency be applied to A/C efficiency credits granted under the off-cycle credit approval process. In other words, EPA has required that cumulative A/C efficiency credits for an A/C system – from the A/C efficiency regulations and those granted via the off-cycle regulations – comply with the stated limits.

The Ford application contained an analysis supporting their conclusion that the variable bleed valve is complementary to other A/C efficiency technologies and, as such, should not be limited by the cap. However, the fundamental approach of the A/C efficiency improvement program is premised on limits

to the overall impact of the A/C system on CO<sub>2</sub> and fuel economy, and EPA therefore established caps based on a finite level of improvement (i.e. A/C operation will always use some energy, fuel or electric power) that is achievable. These caps or limits to improvements in A/C efficiency were considered when establishing the GHG standards. Had the Agency believed that improvements beyond the menu were possible, the caps may have been different and the level of the final GHG standard may have been set to a different stringency level.

Since both the total impact of the A/C system on CO<sub>2</sub> used to establish the GHG standards was premised on some nominal car and truck levels not specific to any vehicle, it is difficult to use the test results on any individual technology to determine what a new cap or limit should be, since the A/C system operates with interactions across all A/C components and parts of the system. This is consistent with Ford's identification of system interactions with the Denso SAS and Valeo VBV compressors and the A/C menu technologies. In the February 2020 *Federal Register* notice the Agency requested comment on a conceptual framework whereby AC17 test results would be used to determine a new, A/C system-specific cap that would account for the actual A/C-related emissions of the system and all the A/C efficiency technologies. The Alliance for Automotive Innovation responded in their comments on the *Federal Register* notice, suggesting that the AC17 test was not suitable for the type of analysis that EPA was suggesting. Further, this conceptual approach remains just that – a concept – and it has not matured to the point where EPA has confidence that it would work. While we still believe that the opportunity for improvements has a theoretical limit, we understand that technologies may exist outside of the A/C credit menu that go beyond the current cap limits and that provide real-world CO<sub>2</sub> reductions. However, we are not yet convinced of a methodology whereby the interactions between the A/C menu technologies and other compressor technologies can be adequately parsed such that the caps established in the GHG rulemaking should be exceeded.

EPA has evaluated the application and finds that the methodologies described therein to determine the proposed 1.1 gram/mile credit are sound and appropriate. Therefore, EPA is approving the credits requested by Ford for all Ford vehicles using this technology. As determined above, EPA finds that caps or limits on credits that are specified in the regulations also apply to the credits being approved in this document. Credits for the 2019 and prior model years 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. Ford must include all information necessary to determine the total Megagrams of credits in the reporting to EPA, and they should also include the total Megagrams for each fleet and model year in a summary of credit averaging, banking, and trading.