

**EPA Decision Document:**

**Off-Cycle Credits for Toyota Motor North  
America**

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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.

Toyota Motor North America, Inc. (Toyota) submitted applications requesting off-cycle credits for use of the Denso Electric Scroll Air Conditioning Compressor Variation B (ESB), a cold-storage evaporator, and a seat heater engine control technology. EPA published a notice in the *Federal Register* on April 1, 2020 announcing a 30-day public comment period for the Denso ESB Compressor application.<sup>1</sup> EPA published a notice in the *Federal Register* on October 9, 2020 announcing a 30-day public comment period for the cold-storage evaporator and seat heater engine control technology applications.<sup>2</sup>

EPA received no adverse comments regarding the methodologies presented for determining the credits sought from these technologies by Toyota, and is hereby approving the technologies, methodologies for determining credits, and credit levels as described in the applications from Toyota 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>3</sup> This pathway allows manufacturers to use conservative credit values established by EPA for a wide range of

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<sup>1</sup> 85 FR 18227, April 1, 2020.

<sup>2</sup> 85 FR 64143, October 9, 2020.

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

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 methodology uses five different testing procedures) to demonstrate and justify off-cycle CO<sub>2</sub> credits.<sup>4</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>5</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 for model years prior to 2014 to demonstrate off-cycle CO<sub>2</sub> 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<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.

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

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

- 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.<sup>6</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. Denso ESB Compressor**

Toyota Motor North America, Inc. (Toyota) applied for off-cycle credits using the alternative demonstration methodology pathway for the Denso Electronic Scroll Air Conditioning Compressor Variation B with pressure adjusting valve technology. This technology improves the efficiency of the electric scroll compressor using a pressure adjusting valve to optimize back pressure on the fixed scroll and reduce mechanical losses.

EPA reviewed the application for completeness and made it available for public review and comment as required by the regulations. The Toyota off-cycle credit application (with confidential business information redacted) is available in the public docket and on EPA's web site at <https://www.epa.gov/ve-certification/toyota-motor-north-america-compliance-materials-light-duty-greenhouse-gas-ghg>.

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<sup>6</sup> See 40 CFR 86.1869-12(d)(2).

EPA did not receive any adverse comments on the application from Toyota. EPA received comments from the Alliance of Automotive Innovators (AAI) that were supportive and recommended timely approval of the methodologies for determining off-cycle credits. AAI and Motor & Equipment Manufacturers Association (MEMA) also recommended that the Denso ESB technology not be subject to the 40 C.F.R. § 86.1868-12(b) cap on air conditioning credits. Due to the similarities between the AAI and MEMA comments, the comments and EPA's responses have been combined below.

**In the preamble to the recent Safer Affordable Fuel-Efficient (SAFE) Vehicles final rule, EPA discusses that “the cap only applies to credits based on the menu.”**

This language is found at 85 FR 25238 in a section discussing the 10 grams/mile menu credit cap described in 40 C.F.R. § 86.1869-12(b)(2). EPA finds no plausible way of interpreting this as a reference to the 40 C.F.R. § 86.1868-12(b) A/C credit cap. Furthermore, when responding to comments proposing changes to the A/C credit cap (85 FR 25231) EPA states that it “decided not to adopt any changes to the caps.”

**The A/C credit cap was created 10 years ago, and new technologies warrant an increased cap.** The off-cycle credit process does not give EPA the authority to increase the A/C credit cap. EPA recently considered increasing the A/C credit cap as part of the SAFE Rule and decided not to.

**Toyota has, like other manufacturers, demonstrated additional benefits on an air conditioning system that already includes sufficient technologies to exceed the A/C credit cap.**

This A/C efficiency credit cap was intended to limit the total amount of credit applied to A/C systems.

**The ESB compressor is different than the Advanced A/C Compressor credit that was added to 40 C.F.R. § 86.1868-12(a)(2) in the SAFE Rule, and thus shouldn't be subject to the A/C credit cap.**

The ESB compressor credit is subject to the A/C efficiency credit cap because it is an A/C efficiency credit. Similarities or differences to technologies in the predefined A/C credit table (40 C.F.R. § 86.1868-12(a)) aren't relevant.

EPA has evaluated the application and finds that the methodologies described therein are sound and appropriate. Therefore, EPA is approving the Denso ESB credit requested by Toyota for the 2016 and later model years. Caps or limits on credits that are specified in the regulations also apply to the credits being approved in this document, as discussed above. Specifically, the Denso ESB compressor is found to be an A/C efficiency technology that must be subject to the applicable regulatory caps described in 40 C.F.R. § 86.1868-12(b). 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. Cold-Storage Evaporator**

Toyota Motor North America, Inc. (Toyota) applied for off-cycle credits using the alternative demonstration methodology pathway for Cold-Storage Evaporator HVAC Technology. This technology utilizes phase change material in the HVAC evaporator of vehicles equipped with engine Start & Stop technology to extend the time that cold air can be delivered to the cabin with the engine and compressor off. This reduces the amount of time the engine would otherwise operate solely for the purpose of cooling the cabin.

EPA reviewed the application for completeness and made it available for public review and comment as required by the regulations. The Toyota off-cycle credit application (with confidential business information redacted) is available in the public docket and on EPA's web site at <https://www.epa.gov/ve-certification/toyota-motor-north-america-compliance-materials-light-duty-greenhouse-gas-ghg>.

EPA has evaluated the application and finds that the methodologies described therein are sound and appropriate. No adverse comments related to the cold-storage evaporator credit application were submitted to the docket. Therefore, EPA is approving cold-storage evaporator credit requested by Toyota for the 2017 and later model years. Although this technology is a component of the A/C system, EPA does not consider this to be an A/C efficiency technology. Therefore EPA does not consider this credit to be subject to the 40 C.F.R. § 86.1868-12(b) A/C efficiency credit cap. 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.

## **C. Seat Heater Engine Control Technology**

Toyota Motor North America, Inc. (Toyota) applied for off-cycle credits using the alternative demonstration methodology pathway for a Seat Heater Engine Control Technology. This technology is a hybrid control strategy that reduces fuel consumption during warm up while the seat heater is turned on. When the seat heater is used, less thermal energy is required from the engine to maintain comfort. This strategy lowers the target engine coolant temperature threshold allowing the engine to turn off earlier and more frequently to reduce fuel consumption.

EPA reviewed the application for completeness and made it available for public review and comment as required by the regulations. The Toyota off-cycle credit application (with confidential business information redacted) is available in the public docket and on EPA's web site at <https://www.epa.gov/ve-certification/toyota-motor-north-america-compliance-materials-light-duty-greenhouse-gas-ghg>.

EPA has evaluated the application and finds that the methodologies described therein are sound and appropriate. No adverse comments related to the seat heater engine control credit application were submitted to the docket. Therefore, EPA is approving the credits requested by Toyota for the 2019 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.