# EPA Decision Document: Off-Cycle Credits for Toyota Motor North America

United States Environmental Protection Agency

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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 $CO_2$ 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, Toyota Motor North America, Inc. (Toyota) submitted an application requesting off-cycle credits for an occupant-based, targeted cooling system (the "Rear S-Flow" system), which reduces the thermal load on the air conditioning system through targeted cooling of only the occupied cabin areas. The application covers 2023 and later model year vehicles.

Previously EPA published a notice in the *Federal Register* on June 20, 2019 announcing a 30-day comment period for a prior Toyota application for the "Front S-Flow" system.[1] EPA received no adverse comments regarding the methodology presented for determining the credits sought from the "S-Flow" technology by Toyota. EPA is hereby approving the Rear HVAC Only S-Flow and Rear and Front HVAC Full S-Flow technology described in Toyota's application dated October 21, 2022, along with the credit levels as described in the application from Toyota.

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 application 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

[1] 84 FR 28811, June 20, 2019.
[2] 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 $CO_2$ 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.

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

Toyota Motor North America, Inc. (Toyota) applied for off-cycle credits using the alternative demonstration methodology pathway for an occupant-based, targeted cooling system (the "Rear S-Flow" system), which reduces the thermal load on the air conditioning system through targeted cooling of only the occupied cabin areas. The application covers 2023 and later model year vehicles. The new Toyota application uses the methodology previously approved by EPA for Toyota S-Flow systems and extends the application to Toyota vehicles with Rear HVAC systems.

EPA did not receive any adverse comments on the prior Toyota S-Flow application which was submitted for public comment. EPA received comments that were supportive and recommended timely approval of the S-Flow methodology for determining off-cycle credits. One commenter also recommended the S-Flow technology should not be subject to the cap on thermal load reduction technologies.[6]

EPA disagrees with the suggestion that these technologies should not be subject to existing regulatory caps. Thermal control technologies are all predicated on achieving on thing: reducing the amount of work that has to be done by the air conditioning system, generally by reducing the heat transfer into the vehicle (glass and paint technologies), by moving heated air out of the vehicle (active or passive

[5] See 40 CFR 86.1869-12(d)(2).
[6] See EPA Decision Document: Off-Cycle Credits for Toyota Motor North America (EPA-420-R-19-015, October 2019) for a detailed discussion of the comments received regarding the Toyota S-Flow methodology for determining off-cycle credits.

ventilation), or by targeting cooling to occupants so the A/C system doesn't need to cool the entirety of the vehicle interior (seat ventilation). The methods and technologies noted in the previous sentence are classified by EPA regulations as thermal control technologies, credits from this group are capped at 3 grams/mile for cars and 4.3 grams/mile for trucks. EPA finds that Toyota's S-Flow system is likewise a thermal control technology that must be subject to these caps, applied on a per-vehicle basis. The S-flow system is much like seat ventilation (which is subject to the regulatory caps) in that both apply targeted air flow to cool occupants in a more direct fashion than broadly cooling the whole vehicle interior.

The Toyota Rear S-Flow off-cycle credit application (with confidential business information redacted) is available on EPA's website at https://www.epa.gov/ve-certification/toyota-motor-north-america-compliance-materials-light-duty-greenhouse-gas-ghg.

EPA has reviewed Toyota's Rear S-Flow application and has determined the methodology is consistent with the prior approved application. Therefore, EPA is approving the credits requested by Toyota for the 2023 and later model years. Front S-Flow credits approved in EPA-420-R-19-015 may not be combined with those approved in this Decision Document, EPA-420-R-23-018. 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 S-Flow technology is found to be a thermal load reduction technology that must be subject to the applicable regulatory caps for such technologies (3 grams/mile per vehicle for cars and 4.3 grams/mile per vehicle for trucks). 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 the credit averaging, banking, and trading.