

**EPA Decision Document:
Off-cycle Credits for Fiat Chrysler
Automobiles, Ford Motor Company, and
General Motors Corporation**

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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 an opportunity for manufacturers to generate CO₂ credits for technologies that provide CO₂ reductions not captured by the 2-cycle emissions test. Pursuant to those rules, Fiat Chrysler Automobiles (FCA), Ford Motor Company (Ford), and General Motors Corporation (GM) submitted applications requesting off-cycle credits for a variety of technologies and model years. FCA and Ford submitted applications that describe methodologies for determining off-cycle credits from high efficiency exterior lighting, solar reflective glass/glazing, solar reflective paint, and active seat ventilation. Ford's application proposed methodologies for determining the off-cycle benefits from active aerodynamic improvements (grill shutters), active transmission warm-up, active engine warm-up technologies, and engine idle stop-start. GM's application described the real-world benefits of an air conditioning compressor with variable crankcase suction valve technology. FCA's application is limited to 2009 through 2013 model year vehicles. Ford requested the credits described in the application for 2012 and 2013 model year vehicles. GM's request for their air conditioning compressor technology was limited to the 2013-2015 model years. EPA published a notice in the *Federal Register* on June 3, 2015 announcing a 30 day public comment period for these applications.¹ EPA received no adverse comments regarding the credits sought from these technologies by FCA, Ford, and GM, and is hereby approving the technologies, methodologies for determining credits, and credit levels as described in the applications from the manufacturers and in the *Federal Register*. EPA received comments only from the Alliance of Automobile Manufacturers, a trade group representing 12 vehicle manufacturers, including FCA, Ford, and GM. The comments were supportive and recommended approval of the methodologies for determining off-cycle credits, noting that approval "will encourage further investment in real-world GHG emission reducing technologies."

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 (CO₂) credits for those off-cycle technologies that

¹ 80FR 31598, June 3, 2015.

achieve CO₂ reductions in the real world but where those reductions are not adequately captured on the test procedure used to determine compliance with the CO₂ 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 methodology uses five different testing procedures) to demonstrate and justify off-cycle CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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.

² See 40 CFR 86.1869-12(b).

³ See 40 CFR 86.1869-12(c).

⁴ See 40 CFR 86.1869-12(d).

- 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 CO₂ 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.
- 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.

III. EPA Decisions on Off-cycle Credit Applications

A. Fiat Chrysler Automobiles

Fiat Chrysler Automobiles (FCA) applied for off-cycle credits using the alternative demonstration methodology pathway for the following technologies: high efficiency exterior lighting, solar reflective glass/glazing, solar reflective paint, and active seat ventilation. All of these technologies are described in the predetermined list of credits available in the 2014 and later model years. The methodologies described by FCA are generally equivalent to those used by EPA to establish the predetermined list of credits in the regulations, and would result in the same credit values as described in the regulations. The application covers 2009-2013 model year vehicles. EPA reviewed the application for completeness and made it available for public review and comment as required by the regulations. The FCA off-cycle credit application (with confidential business information redacted) is available in the public docket and on EPA's web site at <http://www.epa.gov/otaq/regs/ld-hwy/greenhouse/ld-ghg.htm>.

EPA did not receive any adverse comments on the application from FCA. EPA has evaluated the application and finds that the methodologies described therein are sound and appropriate. Therefore, EPA is approving the credits requested by FCA.

B. Ford Motor Company

Ford Motor Company (Ford) applied for off-cycle credits using the alternative demonstration methodology pathway for the following technologies: high efficiency exterior lighting, solar reflective glass/glazing, solar reflective paint, active seat ventilation, active aerodynamics, active transmission

⁵ See 40 CFR 86.1869-12(d)(2).

warm-up, active engine warm-up, and engine idle start-stop. All of these technologies are described in the predetermined list of credits available in the 2014 and later model years. The methodologies described by Ford are generally equivalent to those used by EPA to establish the predetermined list of credits in the regulations, and would result in the same credit values as described in the regulations. The application covers 2012-2013 model year vehicles. EPA reviewed the application for completeness and made it available for public review and comment as required by the regulations. The Ford off-cycle credit application (with confidential business information redacted) is available in the public docket and on EPA's web site at <http://www.epa.gov/otag/regs/ld-hwy/greenhouse/ld-ghg.htm>.

EPA did not receive any adverse comments on the application from Ford. EPA has evaluated the application and finds that the methodologies described therein are sound and appropriate. Therefore, EPA is approving the credits requested by Ford.

C. General Motors Corporation

GM applied for off-cycle credits for the Denso SAS air conditioner compressor with variable crankcase suction valve technology. GM requested an off-cycle GHG credit of 1.1 grams CO₂ per mile for this technology. EPA currently provides air conditioner (A/C) GHG credits for reduced reheat using an externally-controlled variable displacement compressor (EVDC), which provides significant efficiency improvements compared to the baseline fixed displacement compressors that were the norm at the time EPA created the GHG program. Under the regulations, the credit for using an EVDC is 1.7 grams of CO₂ per mile.⁶ The EVDC design from Denso and used by GM further improves the efficiency of the A/C compressor through the addition of a variable crankcase suction valve (variable CS valve). The Denso SAS compressor improves the internal valve system within the compressor to reduce the internal refrigerant flow necessary throughout the range of displacements that the compressor may use during its operating cycle. The variable CS valve can provide a larger mass flow under maximum capacity and compressor start-up conditions, when high flow is ideal, then reduce to smaller openings with reduced mass flow in mid or low capacity conditions. The refrigerant exiting the crankcase is optimized across the range of operating conditions, creating benefits for the energy consumption of the A/C system.

The "5-cycle" methodology would not adequately measure the real world GHG reduction benefits of either the EVDC or the variable CS valve. Only one of the five tests is conducted with the air conditioner on and that test cycle represents worse case conditions (e.g., high temperature, solar load, and humidity) and would not represent the real world benefits of the technology. Therefore, GM chose to determine the off-cycle credits through use of an alternative methodology.

GM worked with Denso to perform bench testing of EDVC with and without the variable CS valve and quantified the difference. Based on this analysis, GM determined an off-cycle credit of 1.1 grams of CO₂ per mile were appropriate. GM substantiated these results by also performing vehicle tests using the AC17 test procedure. EPA reviewed the application for completeness and made the application available for public review and comment as required by the regulations. The GM off-cycle credit

⁶ See 40 CFR 86.1868-12.

application (with confidential business information redacted) is available in the public docket and on EPA's web site at <http://www.epa.gov/otaq/regs/ld-hwy/greenhouse/ld-ghg.htm>.

EPA did not receive any adverse comments on the application from GM. EPA has evaluated the application and finds that the methodologies described therein are sound and appropriate. Therefore, EPA is approving the credits requested by GM.