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Subject: Alternative Method Off-Cycle Credit Application Approval Request by VWGoA for High-Efficiency Alternators for MYs 2016-2019

Volkswagen Group of America (VWGoA) requests approval of off-cycle greenhouse gas ("GHG") credits for high-efficiency alternator technology in accordance with the provisions of 40 CFR 86.1869-12(d). VWGoA requests approval to use a scalable GHG credit value of 0.16 gram/mile CO2 per 1% efficiency improvement above a baseline efficiency level of 67% VDA[1].

VWGoA's requested credit value and table of efficiency-specific credits per model type are listed in Attachment 1. Volkswagen's proposed baseline and scalable credits are also consistent with analyses in EPA's rulemaking documents, the EU Technical Guidelines for Eco-Innovations, and the basis described in Volkswagen's attached application. This request and credit value are also consistent with previous approvals issued by the Environmental Protection Agency to other manufacturers[2]. This credit value would be applied to all vehicle categories that use high-efficiency alternator technology for 2016, 2017, 2018 and 2019 model years.

To reduce the burden and to streamline the review process, VWGoA has patterned this application on modeling, engineering methods, analytical methods, and credit determinations that the Agency has already approved for similar high-efficiency alternator technology used by other manufacturers. VWGoA agrees with assessment of other Manufacturers that this "template" approach can encourage accelerated adoption of high-efficiency alternator technology by reducing the resources and time required for redundant data collection and analysis.

The Agency has supported this approach in a memo from August of 2018[3] that states the following in support of this technology -

- GHG improvements for the high efficiency alternators in applications approved by EPA (including EPA ALPHA modeling results) are relatively consistent across manufacturers and could serve as the basis for a menu credit for high efficiency alternators
- Multiple manufacturers employed similar methodologies to document the GHG benefits of using the high efficiency alternator technology methodologies
- These methodologies were designed to cover a variety of operating conditions (e.g., seasons, driving speeds, distances) and different vehicle types (cars and trucks) with different electrical loads and alternator controls

- Results are aligned with results from EPA's ALPHA model, which also predicted a similar impact of a high efficiency alternator on vehicle GHG emission

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The memo summarizes EPA's technical assessment that, "for alternators with an efficiency higher than the 67% baseline level, an off-cycle menu credit in the range of 0.16 grams/mile CO2 per % improvement would be appropriate on average"

This application meets the requirements of 40 CFR 86.1869-12 in that neither the 2-cycle test procedure (used to determine manufacturer compliance with fleet-average GHG standards) nor the 5-cycle test procedure outlined in 40 CFR 86.1869-12(c) adequately measure the real-world emission reduction attributable to the use of high-efficiency alternator technology.

VWGoA requests that the Agency accept its previous recognition of an equivalent alternative demonstration program for high-efficiency alternator used by other manufacturers - satisfies the pre-approval requirement in 40 CFR 86.1869-12(d)(1).

The high-efficiency alternator technology is not subject to the credit exclusion provisions of 40 CFR 86.1869-12(a) because it does not relate to safety-critical systems, crash avoidance systems or safety standard compliance.

VWGoA appreciates the Agency's consideration of this application. Should you have further questions please contact Sashi Velnati of VWGoA's EEO Office at (248)754-4848 or e-mail: Sashi.Velnati@vw.com.

Sincerely yours,
Volkswagen Group of America, Inc.

Velnati Sashi VWPKI D62E1C9FE5B1132E

Digitally signed by Velnati Sashi VWPKI D62E1C9FE5B1132E
Date: 2020.05.01 01:33:02 -04'00'

Sashi Velnati
Engineering and Environmental Office

Enclosure

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1. Verband der Automobilindustrie efficiency, the internationally accepted industry standard for measuring alternator efficiency. EPA-OTAQ memorandum to docket EPA-HQ-OAR-2018-0283 entitled "Potential Off-Cycle Credit Levels for High Efficiency Alternators and Advanced Air Conditioning Compressors," dated Aug. 1, 2018.
2. *See* "EPA Decision Document: Off-Cycle Credits for General Motors and Toyota Motor Corporation," EPA-420-R-18-014, June 2018; "EPA Decision Document: Off-Cycle Credits for Fiat Chrysler Automobiles and Toyota Motor Corporation," EPA-420-R-18-015, June 2018; "EPA
3. EPA-OTAQ memorandum to docket EPA-HQ-OAR-2018-0283 entitled "Potential Off-Cycle Credit Levels for High Efficiency Alternators…" dated August 1, 2018

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Attachment 1

Request for Scalable Off-Cycle Greenhouse Gas Credit for High-Efficiency Alternators

Introduction

To provide electrical energy for the vehicle's batteries and electrical systems, alternators are used to convert mechanical energy from the internal combustion engine to electrical energy. The additional mechanical load from the alternator results in the increased consumption of fuel and subsequent CO_2 emissions. The energy conversion process involves a variety of mechanical and electrical losses, therefore high efficiency alternators can reduce these losses thereby reducing the alternator load on the engine and offering better fuel economy and lower CO_2 emissions.

The alternator efficiency is the ratio of the alternator output power to the power supplied to the alternator. EPA used a baseline alternator efficiency of 65% in its Joint TSD for the 2017-2025 GHG regulation, based on a 2008 Delco-Remy Alternator. The EU approved methodology for calculating eco-innovation credit uses a baseline efficiency of 67% defined from the "Verband der Automobilindustrie" (VDA). Furthermore, the VDA defined an accepted industry standard for measuring alternator efficiency.

In the Federal Register Final Rule for 2017-2025 EPA already indicated that 68% VDA would be an appropriate threshold to begin awarding high efficiency alternator off-cycle credits: "The 68% VDA number stated by the Alliance of Automobile Manufacturers seems to be appropriate starting point given current technology ..."[1]

Based on EPA's comments and in harmonization with the European Commission's decision VWGoA recommends that 67% VDA baseline efficiency is used for the high efficiency alternator off-cycle credit calculation. VWGoA's request substantiates EPA's technical assessment that "GHG emissions benefits for high efficiency alternators were fairly consistent across manufcturers, conditions and vehicle types." The Agency concluded that the scalable GHG credit value that was already reviewed and approved for other manufacturers "could serve as the basis for a [generalized] menu credit for high efficiency alternators." This credit request adopts EPA's table of credit values contained in EPA's technical assessment[2] and is applicable to all vehicle categories.

Approach to Quantifying Off-Cycle GHG Benefit

Increased electrical loads on the vehicle in on road conditions allow high efficiency alternators to generate a higher greenhouse gas benefit outside the conditions of the Federal Test Procedure and the Highway Fuel Economy Test. Therefore, VWGoA proposes the use of a single scalable credit value that accounts for all vehicle categories.

Rationale for Using the Alternative EPA-approval Methodology

The High efficiency alternator technology is currently not part of the pre-approved technology menu. VWGoA considered both the 5-cycle and alternative methodologies for requesting the credit. Although the 5- cycle methodology tends to captures a broader range of driving parameters, the potential for greenhouse gas benefits from high efficiency alternators can be fully realized when customers experience high accessory loads on a regular basis, loads which are not fully captured in the 5-cycle methodology. Vehicle systems are continuing to become increasingly complex with increasing accessory loads

1. 77 FR 62731

2. "EPA Decision Document: Off-Cycle Credits for Fiat Chrysler Automobiles and Toyota Motor Corporation," EPA-420-R-18-015, June 2018; "EPA "EPA Decision Document: Off-Cycle Credits for BMW Group, Ford Motor Company, and Hyundai Motor Company" EPA-420-R-17-010, December 2017

from entertainment accessories, climate control functions, and interior/exterior lighting options. This is one of the reasons why VWGoA is pursuing off-cycle credits under the alternative demonstration methodology pursuant to 40 CFR § 86.1869-12(d).

EPA/NHTSA Final Rule 2021-2026 GHG and Fuel Economy Standards (SAFE Part-2)

This application is requesting off-cycle credits for retroactive model years prior to MY21 and thus does not reflect the changes in the proposed rule for MYs 2021-2026. On March 31st, 2020 EPA and NHTSA released the new MY2021-2026 GHG and Fuel Economy (CAFE) Rule with revised standards for those model years, otherwise referred to as SAFE Rule Part-2. The rule proposes to include high-efficiency alternators to the pre-defined off-cycle menu. The credit values basis is proposed to be 0.16 g/mi CO2 per percent improvement in alternator efficiency above 67% VDA efficiency, rounded to the nearest 0.1 g/mi.

Electrical load during 2-cycle and on-road driving conditions

In granting off-cycle credits for high-efficiency alternators, EPA has accepted a large body of electrical load data for LDV and LDT models operated under on-road driving conditions and 2-cycle test pattern driving conditions. Ford's data demonstrated a credit basis of 297 Watts for 2-cycle test electrical load and 588 Watts for on-road driving conditions. That data was used to determine electrical saving values resulting from the use of high efficiency alternator. Toyota conducted 2-cycle electrical load testing of additional models. That testing showed electrical load under 2-cycle test conditions that is similar to Ford's 2-cycle test data. If 2-cycle electrical loads are similar, on-road electrical loads can be considered similar. On the basis of the Agency approved submissions and other information, the Agency concluded in a memo filed in 2018 that "GHG emissions benefits for high efficiency alternators were fairly consistent across manufacturers, conditions and vehicle types," and "could serve as the basis for a [generalized] menu credit for high efficiency alternators"[3].

The following table summarizes the available data from previous applications along with power consumption values from VWGoA's 2-cycle testing.

3. EPA-OTAQ memorandum to docket EPA-HQ-OAR-2018-0283 entitled "Potential Off-Cycle Credit Levels for High Efficiency Alternators…" dated August 1, 2018

Table 1

		2-cycle testing	
Manufacturer	**Model**	**Electrical load [Watt]**	**Ave. [Watt]**
VW Group	Q5	342	**307**
	Jetta	272	
FCA	14 vehicles which represent a cross section FCA's products	additional 262.85 [W] in real world compared to 2-cycle testing	
Toyota	RAV4 with engine-stop function	252	**308**
	RAV4 without engine-stop function	364	
Ford	Fusion	275	**297**
	F-150	318	
GM	Impala	233	**276**
	Sierra	319	
Hyundai	Sorento	236	**224**
	Tuscon	212	
Nissan	Rogue	309	**295**
	Altima	281	

Durability

High-efficiency alternators installed within VWGoA vehicles are subject to the same durability requirements as other full useful-life components installed on VW products. VWGoA requires that alternators must meet all the durability requirements of 40 CFR §86.1869- 12(d) and are not subject to any deterioration factors that would reduce the benefits of the high efficiency alternator.

Credit Calculation Approach

Pursuant to the basis to use the scalable credit values utilized by various manufacturers whose applications for credits were approved, VWGoA is requesting off-cycle greenhouse gas credit values of 0.16 gram/mile CO2 per 1% efficiency improvement over a baseline efficiency level of 67% VDA. The credit is calculated as follows

Off-cycle Credit = (eta-0.67)*0.16 (eta: is the efficiency value of the alternator)

Corresponding scalable credit values is provided in the table below.

Table 2

% VDA	Credit (g/mi)
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.x (TBD)

Consistent with the credit equation and table shown above, VWGoA calculated the model-specific and fleet-wide credit values in accordance with 40 CFR 600.510-12(c) considering vehicle lifetime miles for the applicable category of vehicles and total production volume.

Scope of Credit Calculation

Utilizing the credit calculation approach outlined above and the scalable credit (Table 2), VWGoA calculated the model-specific and fleet-wide credit values in accordance with 40 CFR 600.510-12(c) considering vehicle lifetime miles for the applicable category of vehicles and total production volume. Attachment 2 of this application lists the applicable 2016 through 2019 models, their related sales, applicable VDA values, and model-specific and fleet-wide GHG credit calculations.

Summary

VWGoA requests EPA's approval of off-cycle greenhouse gas credit value of 0.16 gram/mile CO2 per 1% efficiency improvement over a baseline efficiency level of 67% VDA for all VWGoA's 2016-2019 MY vehicles from with high-efficiency alternator technology.

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Additional High Efficiency Alternator EPA Decision Document References

- EPA Decision Document: Off-Cycle Credits for Fiat Chrysler Automobiles and Toyota Motor Corporation (EPA-420-R-18-015, June 2018
- EPA Decision Document: Off-Cycle Credits for American Honda Motor Company, Ford Motor Company, and Nissan North America, Inc. (April 2020, EPA-420-R-20-007)
- EPA Decision Document: Off-Cycle Credits for BMW Group, Ford Motor Company, and Hyundai Motor Company (December 2017, EPA-420-R-17-010, About PDF)
- EPA Decision Document: Off-Cycle Credits for General Motors and Toyota Motor Corporation (EPA-420-R-18-014, June 2018)

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Attachment 2

Model-specific details, Model Type identifier, Alternator efficiency, Alternator efficiency measurement method, Alternator part identifier, Manufacturer of the part and Calculation of fleet-wide off-cycle greenhouse gas credit values

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