



---

NISSAN NORTH AMERICA, INC.  
One Nissan Way  
Franklin, TN 37067

October 25, 2019

Mr. Linc Wehrly  
Light Duty Vehicle Center  
Compliance Division  
Office of Transportation and Air Quality  
U.S. Environmental Protection Agency  
2000 Traverwood Drive  
Ann Arbor, MI 48105

Subject: Request for Off-Cycle GHG Credit for High-Efficiency Alternator Technology

Dear Mr. Wehrly,

In accordance with the provisions of 40 CFR 86.1869-12(d) Nissan requests approval of off-cycle greenhouse gas (“GHG”) credits for high-efficiency alternator technology. Nissan requests approval to use a scalable GHG credit value of 0.16 gram/mile CO<sub>2</sub> per 1% efficiency improvement above a baseline efficiency level of 67% VDA<sup>1</sup>. Nissan’s requested credit value (and table of efficiency-specific credits in Attachment 1) are identical to the Environmental Protection Agency’s technical assessment of values<sup>2</sup> that the Agency has stated “...*would be appropriate on average*” for off-cycle menu credits. Nissan’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 testing and analysis described in Nissan’s attached application. Moreover, this request and credit value are also consistent with previous approvals issued by the Environmental Protection Agency to other manufacturers.<sup>3</sup> This credit value would be applied to all vehicle categories that use high-efficiency alternator technology for 2017 and subsequent model years.

To reduce burden and streamline the review process, Nissan 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. This “template” approach can encourage accelerated adoption of high-efficiency alternator technology by reducing the cost and time otherwise required for redundant data collection and analysis. The Agency has already accepted<sup>2</sup> that these methods have demonstrated

robust, verifiable, real-world emission benefits with strong statistical significance. Also the Agency has accepted<sup>2</sup> that these methods demonstrate baseline and controlled emissions over a wide range of driving conditions.

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.

Nissan respectfully 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).

Nissan stipulates that high-efficiency alternator technology is not subject to the credit exclusion provisions of 40 CFR 86.1869-12(a) as it relates to safety-critical systems, crash avoidance systems or safety standard compliance.

Nissan respectfully requests that the Agency notify us when this application has been officially received and accepted.

If you have any questions or comments, please contact Mr. Shota Horiguchi of Nissan Technical Center North America at (248)488-4654, e-mail: [Shota.Horiguchi@nissan-usa.com](mailto:Shota.Horiguchi@nissan-usa.com).

Best Regards,



Keiichi Kitahara  
Director, OEM Projects  
Corporate & External Affairs  
Nissan North America, Inc.

Footnotes:

1. Verband der Automobilindustrie efficiency, the internationally accepted industry standard for measuring alternator efficiency.
2. 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.
3. 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

Decision Document: Off-Cycle Credits for BMW Group, Ford Motor Company, and Hyundai Motor Company,” EPA-420-17-010, Dec. 2017.

- Attachments:
1. Off-Cycle Credit Application for High-Efficiency Alternator
  2. Model-specific and fleet-wide GHG credit calculations (Business Confidential)

(Redacted) cc:  
Maurice Hicks, NHTSA  
Otto Matheke, NHTSA

\*\*\*\*\*

## Attachment 1

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

#### Executive Summary

Nissan is requesting approval of off-cycle greenhouse gas (GHG) credit for vehicles equipped with high-efficiency alternator technology. This request uses a methodology that calculates credits based on efficiency of the alternator (as measured using the accepted industry standard procedure (“VDA”<sup>1</sup>) relative to a baseline alternator. Nissan references two U.S. Environmental Protection Agency (EPA)-approved methodologies as a template for this request. This request combines elements that are analogous to those approved for Ford Motor Company<sup>2,7</sup> and Toyota Motor Corporation<sup>3,8</sup>. Also Nissan’s request substantiates EPA’s technical assessment<sup>4</sup> that “*...GHG emissions benefits for high efficiency alternators were fairly consistent across manufacturers, conditions and vehicle types*”. The Agency concluded<sup>4</sup> 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<sup>4</sup> and is applicable to all vehicle categories.

This approach uses the electrical load factors developed by EPA’s full vehicle simulation analysis and published in EPA’s Technical Support Document<sup>5</sup> Table 5-18.

#### Introduction

The EPA and the U.S. Department of Transportation’s National Highway Traffic Safety Administration (NHTSA) have issued rules to reduce GHG emissions and improve fleet average fuel economy. Under the Clean Air Act, EPA established national GHG standards. Separately NHTSA established Manufacturers’ Average Fuel Economy (CAFE) standards under the Energy Policy and Conservation Act and the Energy Independence and Security Act.

In 40 CFR 86.1869-12(c) and (d) EPA established two alternate pathways for manufacturers to generate GHG credits for technologies whose real-world CO<sub>2</sub>-reducing contributions are not adequately captured by the 2-cycle test (used to determine manufacturer compliance with fleet-average GHG standards). The Agency created these two additional mechanisms to encourage manufacturers to adopt technologies that produce real-world CO<sub>2</sub> reductions. These two pathways for generating off-cycle credits are:

- **Using EPA’s 5-cycle test procedure (which includes a greater range of operating conditions than the 2-cycle test procedure):** If the 5-cycle test is able to adequately capture a given technology’s CO<sub>2</sub>-reduction contribution a vehicle manufacturer may apply for GHG

credit using this option. The manufacturer’s application will contain 5-cycle test data generated by the manufacturer. After EPA review and approval, EPA can authorize a GHG credit. If the 5-cycle test procedure is insufficient to characterize the emission reduction attributable to an off-cycle technology, the manufacturer may request EPA approval of an “alternative demonstration program”.

- **Using an “alternative demonstration program”:** For technologies that are not adequately characterized by either 2-cycle or 5-cycle testing, the vehicle manufacturer can develop an alternative methodology to measure CO<sub>2</sub>-reduction contribution (see 40 CFR 86.1869-12(d)(1)(i-iv)). The alternative methodology itself is subject to Agency and public review and comment. If the Agency accepts the alternative methodology, the manufacturer conducts testing and submits the results to the Agency. Those test results are also subject to Agency and public review and comment. After public comment, EPA review and approval, EPA can authorize a GHG credit.

In accordance with the provisions of 40 CFR 86.1869-12(d), 49 CFR 531.6(b) and 49 CFR 533.6(b) Nissan proposes to use an “alternative EPA-approved methodology” to determine a scalable off-cycle greenhouse gas credit for the use of high-efficiency alternator technology. This credit will apply to all vehicle categories in 2017 and subsequent model years. Off-cycle fuel consumption credits will be calculated according to 40 CFR 600.510-12(c)(3). Nissan proposes to use the efficiency-specific credit table set forth below which is based on EPA’s technical assessment<sup>4</sup>.

\*\*\*\*\*

### **Technology Description**

Automotive alternators convert mechanical energy (produced by fuel consumption in combustion engines) to electrical energy used in vehicle systems. Improving mechanical-energy-to-electrical-energy conversion efficiency reduces, *ceteris paribus*, fuel consumption and CO<sub>2</sub> production.

The accepted industry standard for characterizing alternator efficiency is the test procedure promulgated by the Verband der Automobilindustrie<sup>1</sup> (“VDA”). The VDA efficiency rating procedure weights four different alternator speeds at 50% of the maximum current charge. EPA has accepted<sup>4</sup> that a VDA efficiency rating of 67% is the “zero-level” baseline for a credit application. That is, any alternator with VDA efficiency greater than 67% may become eligible for an off-cycle greenhouse gas credit. In the GHG Final Rule EPA indicated that “... 68% VDA seems to be the appropriate starting point” for off-cycle GHG credits for high efficiency alternator technology. Consistent with other EPA-approved GHG high-efficiency alternator off-

cycle credit applications, Nissan proposes to use 68% VDA as the starting point for credit determinations.

Nissan uses high efficiency alternator technology in certain current models and plans this technology for future models. This high efficiency alternator technology meets the criteria for greenhouse gas credit, with EPA acceptance.

**Analysis of electrical loads of Nissan models under 2-cycle driving conditions.**

In granting off-cycle credits for high-efficiency alternators, EPA has accepted a large body electrical load data for LDV and LDT models operated under on-road driving conditions and 2-cycle test pattern driving conditions<sup>2, 8</sup>. Ford’s data demonstrated a credit basis of 297 Watts for 2-cycle test electrical load and 588 Watts for on-road driving conditions.<sup>8</sup> That data was used to determine electrical saving values resulting from the use of high efficiency alternator. The EPA-accepted unified on-road saving value is 41 Watts, and the EPA-accepted unified 2-cycle saving value is 21 Watts.<sup>8</sup> Toyota conducted 2-cycle test electrical load testing of additional models<sup>3</sup>. That testing showed electrical load under 2-cycle test conditions that is similar to Ford’s 2-cycle test data. EPA has accepted<sup>3</sup> that a demonstration of comparable 2-cycle test electrical loads can obviate the need for additional on-road data. That is, if 2-cycle electrical loads are similar, on-road electrical loads can be considered similar. On the basis of these Agency approved submissions and other information, the Agency concluded<sup>4</sup> “...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”.<sup>4</sup> Nissan’s testing and this credit application is consistent with EPA’s conclusion.

Nissan has conducted 2-cycle testing on Nissan models equipped with high-efficiency alternator technology (currently Nissan Rogue and Nissan Altima). That data (shown below) is comparable to both Ford data<sup>2,8</sup> and Toyota data<sup>3,7</sup> that have been accepted by EPA.

Table of electrical load values under the 2-cycle test procedure

Manufacturer	Carline	Electrical load [W]	Average electrical load [W]
Nissan	Rogue (LDT)	309	295
	Altima (LDV)	281	
Toyota <sup>7</sup>	RAV4 with start-stop	252	308
	RAV4 without start-stop	364	
Ford <sup>8</sup>	F150 (LDT)	318	297
	Fusion (LDV)	275	

Also, Nissan’s data aligns with EPA’s conclusion<sup>4</sup> that “for alternators with an efficiency higher than the 67% baseline level, an off-cycle menu credit in the range of 0.16 gram/mile CO<sub>2</sub> per % improvement would be appropriate...”

**Calculating the GHG Benefit of High-Efficiency Alternator Technology**

The GHG benefit calculation technique that EPA has approved for other manufacturers has led the Agency to conclude that a table of credit values (shown below) “would be appropriate” for all vehicle categories.

% 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

This credit calculation uses a minimum credit threshold of 68% VDA<sup>1</sup> in accordance with EU Technical Guidelines for Eco-Innovations<sup>6</sup> and EPA’s own rulemaking documents<sup>4,5</sup>.

This is the credit table that Nissan asks EPA to accept for Nissan’s use. Approval of these table values allows Nissan flexibility in implementing alternators from different suppliers with different VDA values without the need to create a separate credit request for each component.

**Durability**

High-efficiency alternator technology adopted by Nissan is subject to the same durability requirements as other full-useful life components installed on Nissan products. Suppliers of high-efficiency alternator technology must demonstrate that the component meets Nissan’s durability and reliability requirements for performance and VDA efficiency for vehicle full useful life.

Nissan adopts only alternators that successfully pass all durability and deterioration requirements. Nissan attests that these high-efficiency alternators are expected to meet EPA requirements for in-use durability over full useful life of the vehicle in which they are installed. No deterioration-related reduction in GHG benefit is applicable to these components.

## Conclusion

Based upon:

- The requirements of 40 CFR 86.1869-12, and
- The information, data, and analysis presented in this document, and
- EPA's previous approval of a similar request by Ford Motor Company<sup>8</sup>, and
- EPA's previous approval of a similar request by Toyota Motor Corporation<sup>7</sup>
- EPA's findings and EPA's docket submission<sup>4,5</sup>

Nissan respectfully requests EPA approval of:

- An off-cycle greenhouse gas credit value of 0.16 gram/mile CO<sub>2</sub> per 1% efficiency improvement over a baseline efficiency level of 67% VDA<sup>1</sup> and
- The resulting table of efficiency-specific credit values shown below

% 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

Nissan also requests EPA's agreement to continue to use this credit table for future models to generate additional off-cycle greenhouse gas credits based on high-efficiency alternator technology.

Consistent with the credit equation and table shown above, Nissan will calculate 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. A list of the applicable 2017-2018 models, their related sales, applicable VDA values, and model-specific and fleet-wide GHG credit calculations are shown in Attachment 2.



Thank you for your consideration of Nissan's request for off-cycle greenhouse gas credits for high-efficiency alternator technology.



Keiichi Kitahara  
Director, OEM Projects  
Corporate & External Affairs  
Nissan North America, Inc.

References:

1. Verband der Automobilindustrie efficiency, the internationally accepted industry standard for measuring alternator efficiency.
2. "EPA Decision Document: Off-Cycle Credits for BMW Group, Ford Motor Company, and Hyundai Motor Company" EPA-420-R-17-010, December 2017
3. "EPA Decision Document: Off-Cycle Credits for Fiat Automobiles and Toyota Motor Corporation" EPA-420-R-18-015, June 2018
4. EPA-OTAQ memorandum to docket EPA-HQ-OAR-2018-0283 entitled "Potential Off-Cycle Credit Levels for High Efficiency Alternators..." dated August 1, 2018.
5. Joint Technical Support Document: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards Page 5-66, EPA-420-R-12-901, August 2012
6. European Commission Implementing Decision (EU) 2016/588, April 14, 2016
7. "Toyota Motor Corporation Application for High Efficiency Alternator Off-Cycle GHG Credit", EPA-HQ-OAR-2018-0168-002, September 22, 2017
8. "Ford Motor Company Application for High-Efficiency Alternator Off-Cycle GHG Credit", EPA-HQ-OAR-2017-0189-006, June 21, 2016

\*\*\*\*\*

**Attachment 2**

Calculation of model-specific and fleet-wide off-cycle greenhouse gas credit values

**CONFIDENTIAL BUSINESS INFORMATION**

