Mercedes-Benz Supplemental Rebuttal Package

Alternative Method for Calculating Off-Cycle Credits for Mercedes-Benz Vehicles Under the Light-Duty Greenhouse Gas Emissions Program

[EPA-HQ-OAR-2013-0643; FRL-9901-57-OAR]

Submitted August 13, 2014

SUPPLEMENTAL RESPONSE TO COMMENTS

Mercedes Benz ("Mercedes") appreciates the opportunity to provide this supplemental package in response to comments received by EPA regarding Mercedes alternative demonstration application for calculating off-cycle credits for model year ("MY") 2012-2016 vehicles under the light-duty greenhouse gas ("GHG") emissions program (hereinafter "the Petition").[1] Specifically, Mercedes requested GHG credits for start-stop technology, as well as for high efficiency lighting, active seat ventilation and thermal control glazing technologies. The alternative demonstration methodology is available to manufacturers, pursuant to subsection 40 C.F.R. § 86.1269-12(d) of the GHG regulations, as an optional opportunity to receive additional credits for "new and innovative technologies that reduce vehicle CO2 emissions, but for which CO2 reduction benefits are not significantly captured over the 2-cycle test procedures used to determine compliance with the fleet average standards (i.e., 'off-cycle')." 77 Fed. Reg. 62,832 (2012). Mercedes' alternative methodology application is wholly consistent with both the requirements and the intent of the GHG regulations, as well as with EPA's commitment to provide GHG credits for off-cycle technologies to encourage manufacturers to implement such fuel and emission saving technologies into their U.S. fleets. Mercedes urges EPA to approve its Petition.

These supplemental comments reference information contained in Mercedes' Petition and supporting statistical analysis, Mercedes' rebuttal comments and rebuttal statistical attachment, and EPA's previous rulemaking documents where appropriate.

Background

Following EPA's review of the public comments and Mercedes' rebuttal comments submitted to the Agency regarding the Petition, EPA and Mercedes had a series of meetings between February and June 2014. In response to some of the public comments submitted, EPA requested further information regarding start-stop system ("3S") effectiveness and gave Mercedes the opportunity to submit real-world vehicle data from 3S vehicles. Subsequently, Mercedes collected data on start-stop technology effectiveness from instrumented 3S vehicles driven under "worst case" conditions suggested by EPA. Mercedes also provided EPA with additional customer satisfaction information on 3S vehicles. This supplemental customer satisfaction information and data are described further below and in the attached summary presentation. (*See* Supplemental Attachment A: *Off-Cycle Credits for MY2012-2016 Start-Stop System (3S) Vehicles Supplemental Rebuttal Submission and Data Package Summary*).

[1] Mercedes' supplemental rebuttal comments are submitted in response to comments submitted to EPA. The Federal Register notice seeking comment invited MB to file for EPA's consideration written rebuttal comments to respond to comments received from the public during the comment period. 78 Fed. Reg. 60,275, 60,729 (2013). EPA has subsequently requested supplemental responses. Nothing herein is intended to serve as a new or revised application.

This supplemental package addresses only the credits requested by Mercedes for start-stop technology. EPA has indicated that it has all of the information necessary to make a determination on Mercedes' request for credits for high efficiency lighting, active seat ventilation and thermal control glazing technologies in U.S. vehicles.

Summary of Supplemental Package Provided in Response to Comments

The attached Supplemental Attachment A, summarizes two categories of supplemental information Mercedes provided to EPA in response to the public comments on the Petition: (1) additional information on customer satisfaction with 3S vehicles; and (2) additional data on start-stop effectiveness in the real-world. As described below and in Supplemental Attachment A, Mercedes used only the worst case 3S vehicle data combined with extremely conservative assumptions to validate a portion of the GHG credits requested. Mercedes' worst-case, conservative approach demonstrates that 44-79% of the credits requested are verifiable under worst case conditions.

1. ECO Button

Although start-stop enabled is the predominant mode of Mercedes' 3S vehicles, Mercedes' Petition request incorporated a 1% usage factor (i.e., reduction) for the ECO button feature on 3S vehicles to address potential concerns regarding use of the ECO button by U.S. customers. (*See* Petition at 22; *see also* Mercedes Rebuttal Comments at 15-16). Nevertheless, some comments submitted to EPA raised concerns regarding the potential use of the ECO button by Mercedes customers to disable start-stop.[2] Although these comments suggested that U.S. drivers would disable start-stop in higher percentages than the 1% assumed by Mercedes, no data were submitted to EPA to support this assertion.

As a result of these comments, however, EPA asked for additional information regarding ECO button usage and customer satisfaction with 3S technology. Other than the data referenced in the Petition, Mercedes does not have data on U.S. customer usage of the ECO button. Such information is intended to be collected during the new U.S. field survey Mercedes plans to conduct for future model year vehicles, in consultation with EPA.

Mercedes does have customer satisfaction data from 3S vehicles. Specifically, Mercedes performs surveys of new owner satisfaction, both internally and via JD Power. These surveys do not address ECO button usage directly, but do provide a limited ability for respondents to indicate satisfaction with start-stop technology more generally. The survey results demonstrate that only a very small percentage (< 1%) of new vehicle owners express dissatisfaction or concerns with Mercedes start-stop

[2] *See, e.g.*, ACEEE Comments at 2 (citing a proprietary Strategic Vision presentation based on anecdotal survey responses, not quantitative data, of which less than 2% were MB customers). For a complete response to these and similar comments see MB Rebuttal Comments at 16-17.

technology. (*See* Supplemental Attachment A at 3-4). These survey results support Mercedes' field test data provided in the Petition demonstrating that customers use the ECO button to disable the start-stop system less than 1% of trip time. (*See* Petition at 22).

Customer satisfaction survey data do not directly translate into ECO button usage or selection rates, and it would, therefore, be inappropriate to rely only on generalized customer satisfaction data as a surrogate for ECO button usage. Mercedes is confident that its future U.S. instrumented 3S vehicle field test will support its assumption of very low (about 1%) ECO button usage among Mercedes drivers.

Nevertheless, in its conservative validation approach submitted with this supplemental package, Mercedes utilized an overly conservative assumption of 11% ECO button usage. (*See* Supplemental Attachment A at 8). This is 10% greater than the original usage factor used in Mercedes' Petition.

2. Real-world Start-Stop Effectiveness Data from Instrumented 3S Vehicles Under Worst-Case Conditions

As described in Supplemental Attachment A, Mercedes conducted over 50 test runs with instrumented 3S vehicles under various conditions between February and April 2014. The last round of tests was conducted in April 2014 using routes and conditions proposed by EPA. These conditions included:

- Varied time of day to account for different traffic conditions;
- Use of different drivers, including independent contract drivers not employed by Mercedes and not aware of the technology being tested;
- Different driving routes, including 5 and 10 mile routes in "downtown" Ann Arbor, Michigan;
- Cold (14°F to ≤40°F) and Mid-temperature (>40°F to ≤80°F) weather conditions;
- Cold engine starts (parked un-garaged for 8-12 hours);
- Maximum accessories turned "on" and energy consumers (laptop, cell phone, etc.) plugged in during test run; and
- Videos of some of the test runs.

(*See* Supplemental Attachment A at 3-5). Moreover, the three vehicles tested (the CLA 250, E 350 and S 550) represent the powertrains of 92% of MY2014 3S vehicle sales and of 75% of projected MY2015 3S vehicle sales.

Complete data collected from these instrumented vehicle test runs were provided to EPA. The test data contain measurements for several different parameters including "engine off percentage," which is the percentage of time the engine stopped (i.e., start-stop was active) during the total trip. A summary of the data provided to the Agency is

in Supplemental Attachment A at 10. Mercedes used these engine off percentages to calculate a weighted average for the cold and mid-temperature test runs based on the breakdown of the temperature zone vehicle miles traveled (VMTs) used by EPA in the Joint TSD at 5-87. (*See* Supplemental Attachment A at 7). For the hot temperature zone, Mercedes utilized a conservative estimate of 20% due to the lack of instrumented vehicle data from hot weather testing conditions. This represents a significant reduction from the start-stop effectiveness estimate of 88% used for hot temperature conditions in the Petition, which was based on "hot" FTP test results conducted on a vehicle with an outside temperature of 95°F and an interior temperature set to 72°F. (*See* Petition at 13, 21; Rebuttal Comments at 14).

Using the weighted average engine off percentages, Mercedes calculated the "engine off ratio" to be used in the calculation formula for off-cycle credits. The engine off ratio is the product of the engine off percentage and the idle time percentage. Mercedes' real world idle time for its U.S. vehicles is 23.8%. Mercedes' 23.8% idle percentage is supported by statistically robust data from 29 U.S. vehicles instrumented for an average of 13 months across nine different metropolitan areas representing 65% of Mercedes U.S. sales. (*See* Petition at 5-10; *see also* Petition Attachment A: *Statistical Assessment of Idle Time Fraction Calculation in Mercedes-Benz Vehicles*). As described at length in the statistical analyses supporting the Petition and the Rebuttal Comments, Mercedes idle time data are statistically representative of Mercedes U.S. vehicles and driver demographic. (*See* Petition Attachment A: *Statistical Assessment of Idle Time Fraction Calculation in Mercedes-Benz Vehicles*; Rebuttal Attachment 1: *Responses to Public Comments on Petition Attachment A*). Moreover, Mercedes real world idle time of 23.8% is confirmed by independent speed data from Progressive Insurance. (*See* Petition Attachment A: *Statistical Assessment of Idle Time Fraction Calculation in Mercedes-Benz Vehicles* at 19-20, Mercedes Rebuttal Comments at 6-7). Use of Mercedes 23.8% real world idle time, instead of EPA's national estimate used in the GHG rulemaking, is appropriate for a subsection § 86.1269-12(d) alternative demonstration credit application. (*See* Mercedes Rebuttal Comment at 7-9).[3]

Credits Verified by Mercedes 3S Vehicle Data and Conservative Approach

The amount of off-cycle CO2 potential of Mercedes 3S vehicles (i.e., GHG credits) can be calculated using the formula in Supplemental Attachment A at 8. This is based on the same formula used by EPA to determine the default menu table credits, as described in Mercedes Petition at 24-26. The values used in the formula include the engine off ratio described above, as well as the combined on-cycle CO2 improvement (i.e., A/B test results) and the combined on-cycle engine off percentage found in the

[3] In the final GHG rulemaking, EPA contemplated that manufacturers would submit driving activity data to support alternative demonstration pathway applications. To determine overall emissions reductions for certain off-cycle technologies, EPA reasoned that manufacturers would need to "determine not only the emissions impacts during operation but also real-world activity data to determine how often the technology is utilized during actual, in-use driving on average across the fleet." 77 Fed. Reg. at 62,838.

Petition. (*See* Petition at 23, Table 3). In addition, for this supplemental submission, Mercedes utilized an additional 11% reduction factor to conservatively account for potential ECO button usage as described above. (*See* Supplemental Attachment A at 8).

In the Attachment, Mercedes provides a sample credit calculation for a V-6 cylinder vehicle. (*See* Supplemental Attachment A at 8). Mercedes also provides a summary of credit amounts verified by the new 3S vehicle data for each vehicle category (i.e., small-, mid-, and large-size cars and trucks). (*See* Supplemental Attachment A at 9). These credit levels verify 44-79% of the credits requested in the Petition, depending on vehicle size. These credit levels serve as examples that were estimated using the A/B test values provided in Mercedes' Petition. Mercedes envisions that actual credit levels would be based on specific A/B test results for each vehicle model and/or powertrain. To the extent actual credit levels calculated for each MY2012-2016 Mercedes 3S vehicle covered by this application are less than the default credit table values (i.e., 2.5 for passenger cars and 4.4 for trucks) using this approach, EPA should simply provide the default table credits available to Mercedes via 40 C.F.R. § 86.1269-12(b).

Conclusion

Mercedes has demonstrated with actual real world instrumented 3S vehicle testing, conducted pursuant to EPA proposed parameters, and accounting for very conservative reductions for hot temperature conditions and ECO button use, that 44-79% of the credit amounts requested are verifiable under worst case conditions. These percentages are based on conservative assumptions and conditions non-representative of all of Mercedes U.S. vehicles and customers. Mercedes expects that the full credit amounts requested in the Petition will be validated by the next 3S vehicle U.S. field survey.

For all of the reasons stated in Mercedes' Petition and supporting materials, and in the responses above, Mercedes requests that its application for alternative demonstration methodology calculations of GHG credits for vehicles equipped with start-stop technology, high efficiency lighting, active seat ventilation and thermal control glazing technologies be approved for MY 2012-2016.

Supplemental Rebuttal Attachment A

Mercedes-Benz

Supplemental Attachment A

Off-Cycle Credits for MY2012-2016 Start-Stop System (3S) Vehicles Supplemental Rebuttal Submission and Data Package Summary

August 2014

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Mercedes Response to Comments – Eco Button

Mercedes performs surveys of new owner satisfaction, both internally and via JD Power. Survey results from demonstrate that only a very small percentage (< 1%) of new vehicle owners express concerns or dissatisfaction with the start-stop technology.

Mercedes Internal Survey

- Mercedes provides surveys following all new sales experiences. These surveys do not contain specific questions regarding start-stop technology, but do provide customers an un-prompted opportunity to comment on their reaction to vehicle designs and features via "verbatim" comments.
- From January 2013 through March 2014, there were over 65,000 total survey responses from new owners with start-stop vehicles.
- Out of over 200,000 start-stop equipped vehicles sold, and over 65,000 new car survey responses on those vehicles, only 149 survey responses included written verbatim comments about start-stop.
    - 7 out of the 149 respondents provided positive comments expressing satisfaction with start-stop.
    - 142 of the 149 comments expressed unfamiliarity or dissatisfaction with start-stop. These included only 77 negative comments, 38 comments expressing concerns about functionality in specific vehicles, and 28 comments expressing unfamiliarity with the concept or function of start-stop technology.
- These 142 comments—out of more than 65,000 3S vehicle survey responses and over 200,000 3S vehicle sales for MY13-14—represent only about 0.002% of the 3S vehicle survey responses and 0.0007% of 3S vehicle sales.
- While Mercedes believes these comments cannot be directly correlated to ECO button usage, their significantly low occurrence indicates that the new sales customer satisfaction survey responses do not contradict the original assumption in the Petition that less than 1% of customers use the ECO button to disable 3S.

Mercedes Response to Comments – Eco Button (cont.)

Summary of JD Power Survey Data

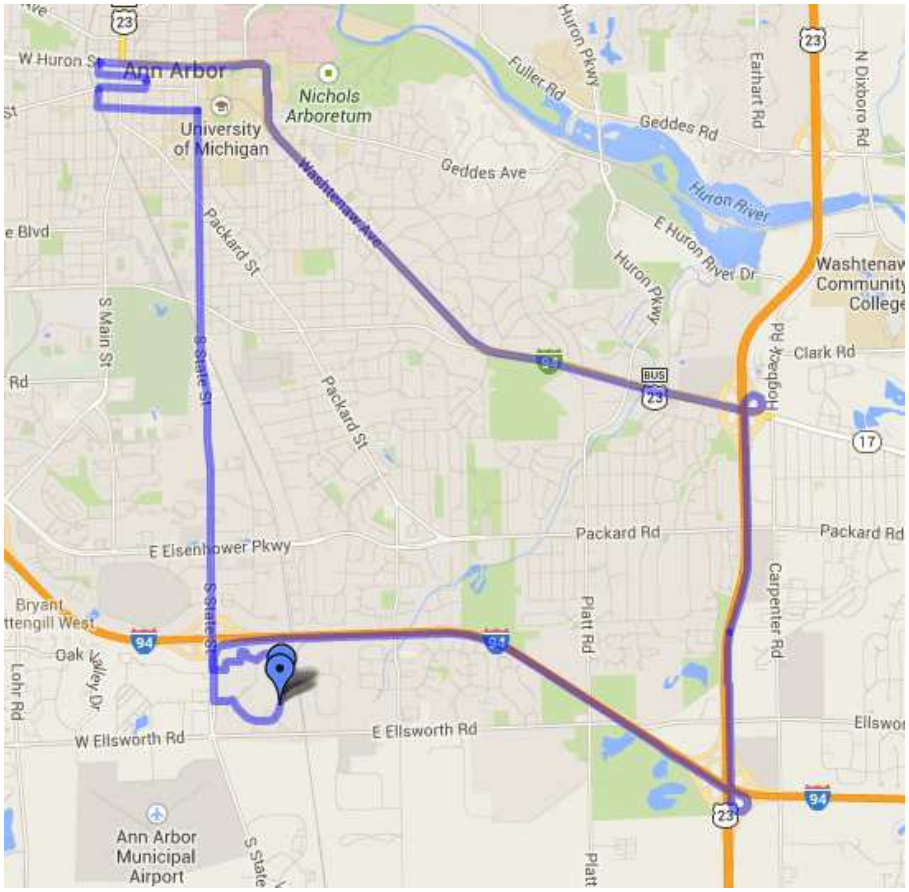
- The JD Power Initial Quality Survey (IQS) provides a measure of owner reported problems during the first months of vehicle ownership, and includes specific questions about start-stop – essentially asking new owners if they have a "problem" with automatic start-stop shutdown, restart or re-engagement. If the respondent indicates yes, then they are provided an additional menu of questions to further describe the nature of the issue.
- Out of the 3,329 total respondents to the IQS survey for MY 2013, 1,158 had vehicles with start-stop technology.
- Out of these, only 19 respondents indicated they had an issue with start-stop. This represents less than 0.00001% of all start-stop vehicles sales for MY2013-2014 so far.
- Of these 19, only 17 answered the follow up drop down questions to further describe the nature of the issue.

Mercedes Response to Comments – Collect Data from Instrumented 3S Vehicles

MB Preliminary Testing Route in Ann Arbor, MI

(designed to achieve Petition's 24% idle time)

14.7 mi



Review of Preliminary Cold Temperature Zone Testing of Instrumented 3S Vehicles

Conditions:

- Cold temperature zone conditions down to 20°F (-7°C)
- Test runs with various drivers (including independent contract drivers)
- CITY ⟶ HIGHWAY and HIGHWAY ⟶ CITY test runs with both COLD and WARM engines
  - Cold engine = vehicles parked outside for at least a work day of (7-8 hours) or overnight
  - Warm engine = vehicles parked outside for at least 30 min

Three vehicles tested:

- CLA 250 4MATIC (2.0l, 4-cylinder, 7-speed transmission)*
- E 350 (3.5l, 6-cylinder, 7-speed transmission)
- S 550 4MATIC (4.7l, 8-cylinder, 7-speed transmission)

Vehicles tested with a significant number of accessories/consumers "on"

- Laptop plugged in to the 12V plug/lighter outlet to record data during the test runs.
- Driver and passenger seat heating ON
- Rear window defrost ON
- Radio/Navigation (Command) ON
- Headlights ON
- Target interior temperature set to 72°F
- Ambient lighting package was "on" in S550 tests.

* Only limited test runs could be conducted on the CLA 250 due to timing and weather conditions.

Preliminary Cold Temperature Zone Testing of Instrumented 3S Vehicles

Overview of Preliminary Cold Temperature Test Results

(18 test runs in 20-32°F)

Cold engine

HWY--->City		
ambient	cold temperature 20°F - 32°F (-7°C - 0°C)	
engine temp	Cold	Warm
S 550 4MATIC	1/10/2014	1/10/2014
	57.37%	**86.28%**
	3/7/2014	3/7/2014
	41.37%	**67.78%**
E 350	3/7/2014	3/7/2014
	54.69%	**77.90%**
	3/19/2014	3/18/2014
	65.50%	**75.11%**

City--->HWY		
ambient	cold temperature 20°F - 32°F (-7°C - 0°C)	
engine temp	Cold	Warm
CLA 250 4MATIC	4/15/2014	N/A
	67.51%	N/A
	4/16/2014	N/A
	82.44%	N/A
S 550 4MATIC	1/12/2014	1/12/2014
	45.03%	**73.40%**
	3/11/2014	3/10/2014
	61.06%	**68.63%**
E 350	3/8/2014	2/24/2014
	54.72%	**75.21%**
	3/24/2014	3/8/2014
	49.80%	**74.13%**

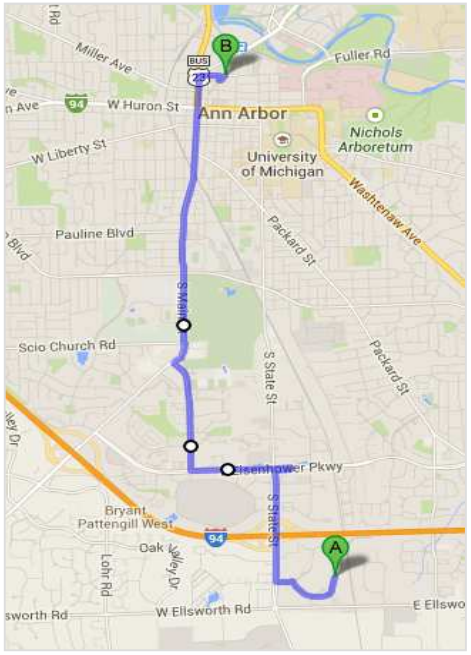
Warm engine

Final Testing of Instrumented 3S Vehicles (Ann Arbor, April 8-16, 2014)

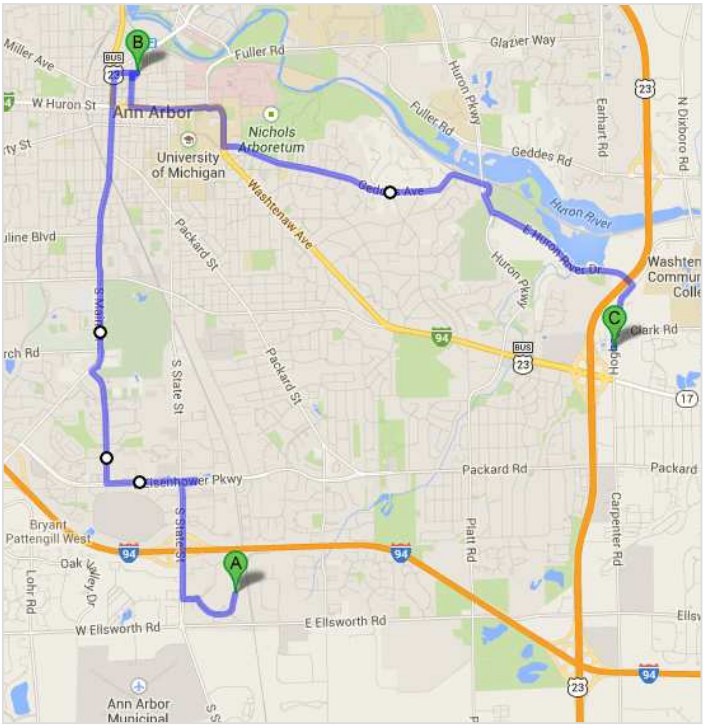
EPA Routes in Ann Arbor, MI

(as proposed by EPA April 3rd, 2014)

5 mi



10 mi



Testing of Instrumented 3S Vehicles (Ann Arbor, April 8-16, 2014)

Worst Case Conditions

- **Vehicles were tested with a significant number of accessories/consumers "on" (see below)**
- **Vehicles not equipped with heated cup holders, but other heating elements were "on" in cold temperature conditions.**
- **Ambient lighting package and rear seat entertainment was "on" in S550 tests.**
- **Charging consumers (i.e., laptop in the outlet or phone in the USB port) do not affect start-stop activation, but tests were conducted with these plugged in.**

Vehicles

- **Three test vehicles representing the powertrains of 92% of MY2014 and 75% of MY2015 projected start-stop vehicle sales.**
  - **CLA 250 4MATIC (2.0l, 4-cylinder, 7-speed transmission)**
  - **E 350 (3.5l, 6-cylinder, 7-speed transmission)**
  - **S 550 4MATIC (4.7l, 8-cylinder, 7-speed transmission)**

Consumers/Conditions

CLA 250 4MATIC:

- USB charging cell phone ✔ ✔
- Cigarette Lighter: charging Notebook ✔ ✔
- Driver and passenger seat heating ✔
- Rear window defrost ✔
- Radio/Navigation On ✔ ✔
- Headlights On ✔ ✔
- target interior temperature: 72°F ✔ ✔

E 350:

- USB charging cell phone ✔ ✔
- Cigarette Lighter: charging Notebook ✔ ✔
- Driver and passenger seat heating ✔
- Rear window defrost ✔
- Radio/Navigation (Command) On ✔ ✔
- Headlights On ✔ ✔
- target interior temperature: 72°F ✔ ✔

S 550 4MATIC:

- 115V socket: video camera ✔ ✔
- USB charging cell phone ✔ ✔
- Cigarette Lighter: charging Notebook ✔ ✔
- Driver and passenger seat heating ✔
- Rear window defrost ✔
- Radio/Navigation (Command) On ✔ ✔
- Headlights On ✔ ✔
- Ambient-light On ✔ ✔
- Rear seat heating ✔
- Heated armrest ✔
- Heated steering wheel ✔
- Rear seat entertainment ✔ ✔
- target interior temperature: 72°F ✔ ✔

✔ Indicates consumer was "on" during cold temp testing

✔ Indicates consumer was "on" during mid temp testing

Summary of Confidential Testing Data Provided to EPA

Test data for EPA (final) Ann Arbor route

Vehicles: CLA 250 4MATIC, S 550 4MATIC, E 350
Test runs: 39
Parameters: time, vehicle speed, RPM, battery-SOC, engine coolant temperature, engine oil temperature, outside and inside temperature
Drivers: 3 different drivers (1 engineer and 2 external independent drivers from MDE Staffing Services)
Temp zones: cold and mid temp zone
Videos: 4

Complete data provided 22nd of April 2014.

Test data for MB (preliminary) Ann Arbor route

Vehicles: CLA 250 4MATIC, S 550 4MATIC, E 350
Test runs: 18
Parameters: time, vehicle speed, RPM, battery-SOC, engine coolant temperature, engine oil temperature, outside and inside temperature
Drivers: 5 different drivers (3 engineers and 2 external independent drivers from MDE)
Temp zones: cold temp zone

Data provided 11th of April 2014.

Results of Instrumented 3S Vehicle Testing (Ann Arbor, April 8-16, 2014)

Public Overview of Test Results

						Engine Off ratio		
	Date	Time	Driver	Ambient Temp	Engine Temp	0-5mi	5-10mi	0-10mi
E 350	8-Apr-14	10:40 AM	Arnie	11-13°C	cold	56.15%	84.24%	68.39%
	8-Apr-14	11:30 AM	Arnie	10-13°C	warm	82.37%	90.62%	86.32%
	9-Apr-14	9:45 AM	Arnie	7-9°C	cold	75.33%	94.59%	84.19%
	9-Apr-14	4:30 PM	Arnie	14-17°C	cold	89.85%	89.23%	89.59%
	10-Apr-14	8:35 AM	Arnie	9-12°C	cold	67.87%	90.78%	74.33%
	10-Apr-14	2:15 PM	Arnie	20-22°C	cold	49.91%	89.34%	65.86%
	11-Apr-14	7:50 AM	Arnie	4-7°C	cold	64.03%	89.67%	75.48%
	11-Apr-14	3:10 PM	Arnie	19-22°C	mid	87.84%	72.93%	84.47%
	13-Apr-14	11:05 AM	Andreas	20-23°C	cold	75.60%	93.46%	82.42%
	14-Apr-14	8:00 AM	Rod	19-22°C	cold	54.38%	73.91%	62.58%
	14-Apr-14	3:00 PM	Rod	13-16°C	cold	69.81%	79.56%	72.66%
	15-Apr-14	9:45 AM	Rod	-3°C - -1°C	cold	31.38%	59.26%	48.13%
	15-Apr-14	2:00 PM	Rod	-1°C -3°C	cold	55.39%	94.26%	70.61%
	16-Apr-14	1:50 PM	Rod	5-8°C	cold	64.50%	88.33%	74.66%
CLA 250 4MATIC	8-Apr-14	9:45 AM	Arnie	7-8°C	cold	61.49%	74.92%	65.29%
	8-Apr-14	4:00 PM	Arnie	15-20°C	cold	65.26%	85.52%	69.91%
	9-Apr-14	8:50 AM	Arnie	4-6°C	cold	47.02%	90.96%	65.34%
	9-Apr-14	2:45 PM	Arnie	13-15°C	cold	56.84%	61.71%	58.13%
	10-Apr-14	9:30 AM	Arnie	11-14°C	cold	75.13%	91.63%	84.49%
	10-Apr-14	3:15 PM	Arnie	20-22°C	cold	85.58%	88.83%	86.65%
	11-Apr-14	9:45 AM	Arnie	11-13°C	cold	76.94%	85.45%	79.89%
	11-Apr-14	4:25 PM	Arnie	19-22°C	cold	80.13%	80.69%	80.38%
	13-Apr-14	9:30 AM	Andreas	18-19°C	cold	51.60%	87.63%	65.43%
	13-Apr-14	2:50 PM	Andreas	24-26°C	cold	91.20%	86.70%	89.41%
	14-Apr-14	3:40 PM	Rod	10-14°C	cold	72.78%	74.96%	73.50%
	15-Apr-14	1:05 PM	Rod	-1 - 2°C	cold	50.09%	83.20%	63.31%
S 550 4MATIC	8-Apr-14	3:00 PM	Arnie	15-18°C	cold	47.76%	91.95%	59.73%
	9-Apr-14	8:00 AM	Arnie	3-5°C	cold	42.50%	78.78%	56.75%
	9-Apr-14	3:40 PM	Arnie	12-14°C	mid	85.65%	77.53%	81.66%
	10-Apr-14	7:45 AM	Arnie	6-9°C	cold	59.47%	85.26%	70.38%
	10-Apr-14	4:10 PM	Arnie	19-20°C	cold	91.25%	88.29%	90.42%
	11-Apr-14	8:45 AM	Arnie	7-9°C	cold	75.47%	93.01%	81.09%
	13-Apr-14	3:50 PM	Andreas	22-25°C	cold	91.74%	94.69%	92.54%
	14-Apr-14	10:30 AM	Rod	14-17°C	cold	53.58%	68.33%	59.37%
	14-Apr-14	4:30 PM	Rod	9-12°C	cold	60.58%	74.25%	65.59%
	15-Apr-14	9:00 AM	Rod	-4°C - -3°C	cold	26.52%	48.73%	34.62%
	15-Apr-14	3:10 PM	Rod	-1 °C- 2°C	cold	35.17%	47.03%	40.37%
	16-Apr-14	9:55 AM	Rod	0-2°C	cold	20.81%	44.52%	32.51%
	16-Apr-14	2:45 PM	Rod	5-6°C	cold	57.96%	75.44%	63.17%

Calculating Weighted Average Engine Off From 3S Vehicle Data and Conservative Hot Temp Assumption

Weighted average engine off percentage can be calculated based on temperature zone vehicle miles traveled.

Extremely conservative assumption can be used for hot temperature zone due to lack of hot conditions in Ann Arbor during April testing.

Breakdown of vehicle miles traveled (VMT) based on EPA MOVES data adjusted for MB system specifications

(Joint TSD at 5-87; Petition at 21)

	Cold	Mid	Hot
Temperature range of MB system	14°F - ≤40°F	>40°F - ≤80°F	>80°F - 104°F
Percentage of VMT in temp zone based on MB system	20.92%	68.75%	9.7%

Average Engine Off Percentage*

Engine Off [%]	Cold	Mid	Hot**	Weighted AVG
Small size car	56%	74%	20%	**65%**
Mid size car	60%	71%	20%	**63%**
Large size car	44%	72%	20%	**61%**
Truck	44%	71%	20%	**60%**

* Using an average of EPA's 5 and10 mile Ann Arbor route.

** Conservative assumption. Not based on real world vehicle data due to lack of hot weather conditions in Ann Arbor.

Calculating Off-Cycle Credits Available Based on Ann Arbor 3S Vehicle Worst Case Data and Further Conservative Reduction for Eco Button Factor

When real world 3S vehicle data are available, the real world engine off ratio can be used.

Further reductions also can be taken into account for Eco button use factor.

$$OffCycle\ CO_2\ Potential = \text{Combined Oncycle } CO_2 \text{ Improvement} \times \frac{Real\ World\ Engine\ Off\ Ratio}{Combined\ On\ Cycle\ Engine\ Off\ Ratio} * (1 - Eco\ button\ factor) - \text{Combined Oncycle } CO_2 \text{ Improvement}$$

Conservative assumption. Not based on real world data.

Example calculation for V-6 cylinder based on 3S vehicle data from EPA 5 and 10 mile route.

Using weighted average engine off percentage with conservative hot assumption, 23.83% idle fraction and conservative Eco button use factor.

$$OffCycle\ CO_2\ potential = 8.1\ [g/m] \times \frac{\mathbf{15.01\%}}{7.2\%} x\ (1 - 0.11) - 8.1[g/m] = \ \mathbf{6.92}\ \ g/m]$$

Calculation values:

Combined on-cycle CO_2 improvement: **8.1 g/mi** (Petition at 23, Table 3)

Combined on-cycle engine off: **7.2%** (10.7% combined on-cycle idle fraction multiplied by 67.3% A/B effectiveness) (Petition at 23, Table 3)

Real world engine off ratio: **15.01%** (3S test vehicle weighted average engine off percentage of 63% multiplied by 23.83% MB idle fraction)

Eco button use factor: **11%** (additional 10% eco button usage assumed beyond the EU vehicle data survey results of only 1%)

Credits Verified by Ann Arbor 3S Vehicle Testing Data and Conservative Eco Button Assumption

Credits Verified by Ann Arbor 3S Vehicle Data for Average of 5 and 10 Mile Route

Engine Off [%]	Cold	Mid	Hot**	Weighted AVG
Small size car	56%	74%	20%	**65%**
Mid size car	60%	71%	20%	**63%**
Large size car	44%	72%	20%	**61%**
Truck	44%	71%	20%	**60%**

Off-cylcle Credits	A/B test improvement [g/mi]	On-cycle idle ratio	A/B effectivenes	Combined on-cycle engine off	Real world engine off	Credits [g/mi]
Small size car	**9.8**	10.7%	68.20%	**7.3%**	**15.5%**	**8.72**
Mid size car	**8.1**	10.7%	67.30%	**7.2%**	**15.0%**	**6.92**
Large size car	**16.9**	10.7%	80.40%	**8.6%**	**14.5%**	**8.46**
Truck	**15.2**	10.7%	79.40%	**8.5%**	**14.3%**	**7.56**

***** Assuming an additional 11% reduction for Eco button use factor, which is a conservative assumption not based on real world data.

Significance of Ann Arbor 3S Vehicle Testing Data

The credit amounts resulting from instrumented 3S vehicle testing data from EPA's 5 and 10 mile route, combined with further reductions for very conservative assumptions for hot temperature conditions and additional Eco button use, verify that at least 44-79% of the credits requested in the Petition are warranted depending on vehicle size.

Credit Amounts

Petition request compared to results from worst case test data from combined 5 and 10 mile route, further reduced by conservative hot temp and for Eco button use assumptions.

Vehicle Size	Credits Requested in Petition [g/mi]	Credits Resulting from 5 and 10 Mile Tests Further Reduced by Conservative Assumptions [g/mi]	%
Small size car	**11.0**	**8.72**	**79%**
Mid size car	**9.1**	**6.92**	**76%**
Large size car	**19.0**	**8.46**	**45%**
Truck	**17.1**	**7.56**	**44%**

Conclusion

- In response to several public comments on the Petition suggesting that actual 3S vehicle data be provided, Mercedes has demonstrated with actual real world instrumented 3S vehicle testing, conducted pursuant to EPA proposed parameters, and accounting for very conservative reductions for hot temperature conditions and Eco button use, that 44-79% of the credits requested are verifiable under worst case conditions.

- These percentages are based on conservative assumptions and conditions non-representative of all of Mercedes U.S. vehicles and customers.

- Mercedes expects that the full credit amounts requested in the Petition will be validated by the next 3S vehicle U.S. field survey.

- Receiving 44-79% of the credits requested will facilitate implementation of a robust 3S vehicle U.S. field test, provide greater certainty in MY2013-2016 GHG credit calculations and planning, and provide incentive to continue to expand penetration of start-stop technology in the U.S. fleet.