

The ITB Group Comments Regarding The Following Dockets

EPA-HQ-OAR-2021-0208, Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards

NHTSA-2021-0053, Corporate Average Fuel Economy Standards for Model Years 2024-2026 Passenger Cars and Light Trucks

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The ITB Group, Ltd. (ITB) would like to provide the comments below regarding the above-referenced dockets. ITB is a global automotive consultancy with specialties in specific vehicle technologies including fuel systems and alternative energy, vehicle efficiency and thermal management, acoustics and, smart surfaces. ITB has an in-depth understanding of technologies deployed globally in these segments and the cost-benefit equations surrounding target applications. ITB's expertise is used to provide global guidance to market participants developing automotive technologies.

I. Introduction – Support for Technology Credits and Incentives

ITB's comments in this document will focus on technology credits and incentives. Our comments are based on data from ITB's proprietary research and key industry data points which reinforce our position about the importance of maintaining and increasing flexibilities for maximum program value at minimum societal cost.

The ITB Group supports continuous improvement in vehicle fuel efficiency and CO₂ emissions. Performance-based standards encourage technology-agnostic development of high-value solutions. Such solutions are expected to benefit the environment as well as the health and welfare of the United States citizens and reduce potential dependency on petroleum. Technology credit flexibilities are an important and cost-effective pathway to reducing vehicle fuel consumption and CO₂ emissions. Furthermore, technology credits provide additional flexibilities for auto manufacturers to meet their specific fleet requirements in the most cost-effective way while reducing national fuel usage and CO₂ emissions.

ITB also supports the limited credit carry-forward proposal that provides additional flexibility for credits earned during MY2016 to MY2020. This provision simply preserves credits that might be lost for future compliance. There is limited lead time before 2023 for automakers to make technical changes to ensure compliance with the tighter requirements proposed by the EPA. The proposed extension of credit life may help bridge the 10 percent decrease in top-line stringency for MY2023 and generally provide flexibility for the industry to meet proposed targets.



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II. Off-Cycle Technologies Provide Real-World Benefit but are Limited by Credit Caps

The basis for EPA GHG and NHTSA CAFE measurements are repeatable vehicle two-cycle testing. Such testing does not include several “off-cycle” driving variables like thermal effects, electrical efficiency, aerodynamics, and acceleration rates. These variables have a significant effect on real-world fuel consumption and GHG emissions. Off-cycle and A/C efficiency technologies provide important reductions in energy consumption which are not measured through two-cycle testing. Automotive suppliers, vehicle manufacturers, and third parties perform testing to quantify real-world off-cycle benefits. For example, the US Department of Energy’s National Renewable Energy Laboratory (NREL) has developed models to calculate real-world impact for different vehicle designs which take into account real-world trip time, duration, and ambient temperature across the United States.

ITB supports increasing technology credit cap(s). If the caps are set at a restrictive level, as they are today, then it may be quite costly to demonstrate that they should be raised in the course of individual technology credit approval submissions. The ITB Group has made an estimate of the credit level possible for a holistic off-cycle and A/C efficiency cap. The latest EPA trends report (2020) shows a 74 gCO₂/mile national fleet difference between average light vehicle two-cycle emissions (282 gCO₂/mile) and adjusted real-world estimate (356 gCO₂/mile) for MY2019. If we assume that 9.5% (27 gCO₂/mile) of the average two-cycle emissions is attributed to exogenous variables like load, grade, wind, rain/snow, tire pressure, etc., that leaves on average 47g of real-world CO₂ emissions due to off-cycle (A/C, thermal, electrical, powertrain and other) variables. This gap is due to off-cycle effects resulting from variation in acceleration, thermal, aerodynamic, and electrical losses. Current and future off-cycle technologies, including autonomous and predictive driving, are expected to provide benefits not contemplated in the current 10 gCO₂/mile cap. Therefore, the current 10 g/mile fleet level cap is low and should be raised. The EPA proposal of a 15 g/mile off-cycle credit cap is reasonable today, but is conservative compared to the 47g real-world vs. 2-cycle gap and may need future adjustment as new technologies are developed.

It is important to encourage new technology development and to do so properly, the technology credit programs should anticipate such new credits. One way to encourage new developments is to set caps in anticipation that technologies will address additional sources of energy losses, like autonomous and predictive driving technologies. Preserving credits will incentivize further development of rapid warm-up, heat retention, passenger comfort, and automated driving technologies.

One concern of the agencies and some third parties is potential technology interaction effects. Rather than set restrictive caps due to this concern, ITB recommends incorporating technology interaction effects into approved credit levels. For example, Section 6.5 of the EU Eco-innovation guidelines require the assessment of potential interaction effects and incorporating this into the technology credit level formula to avoid double counting of benefits where technologies may address the same losses. We recommend flexibility in using vehicle, component, and simulation technologies to calculate technology credit levels, including interaction effects. An alternative ITB recommends is to set a holistic cap reflecting the potential that technologies have to improve real-world fuel consumption and emissions.

Real-world fuel consumption and emissions levels show that off-cycle and A/C emissions caps are too low. The agencies should recognize and incorporate the latest NREL estimate of national A/C fuel usage and CO₂ emissions of 20.8 g CO₂/ mile for cars and 26.0 g CO₂/ mile for trucks. For the A/C efficiency technologies cap, we propose a further 1.1 g CO₂/ mile increase for high-efficiency compressor technology.



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To preserve the original A/C and off-cycle thermal control cap rationale using the new scaling factors referred to above, the following revised credit cap calculations have been made.

Proposed Revised A/C Efficiency and Off-Cycle Thermal Control Credit Cap Levels

A/C Efficiency Cap

Cars: $20.8/11.9 \times 5.0 + 1.1 = 9.8$ g CO₂ / mile
Trucks: $26.0/17.2 \times 7.2 + 1.1 = 12.0$ g CO₂ / mile

Off-Cycle Thermal Control Cap

Cars: $20.8/13.8 \times 3.0 = 4.5$ g CO₂ / mile
Trucks: $26.0/17.2 \times 4.3 = 6.5$ g CO₂ / mile

The agencies currently place a VIN-specific cap on A/C efficiency technologies and a sub-cap on off-cycle thermal control technologies which affect A/C load. ITB recommends that they be converted to fleet-level caps for more flexibility and ease of implementation. Improved flexibility across a fleet average would reduce discounting of real-world benefits.

EPA has approved technologies that exceed the current A/C efficiency and off-cycle thermal control caps. When the caps are reached, vehicle manufacturer adoption of such technologies may artificially slow down. General Motors, for example, estimated that it would not be able to use 55% of the real-world benefit associated with its approved climate control seat technology due to the thermal control sub-cap¹ and the use of other technologies. When the caps are met, alternative technologies may be more costly. Therefore, caps limit manufacturer and supplier investment in otherwise cost-effective off-cycle technologies with high benefits. The ITB Group analyses show that some off-cycle technologies have high benefit/cost ratios. Until the A/C efficiency and thermal control caps are revised, there is a significant risk of artificially higher fuel consumption and CO₂ emissions, if technologies with real-world benefits are not installed in vehicles.

III. Conditional Support for Changing Technology Menu Definitions

The EPA has proposed changing selected off-cycle menu technology definitions. In principle, ITB agrees that menu definitions should be supported by representative data. It is important that the off-cycle menu credits represent accurate estimates of real-world fuel consumption and GHG emissions benefits which cannot be measured in 2-cycle testing. The menu definitions should correspond to the technology(s) tested and emissions reductions associated with verifiable testing and modeling.

The difficulty is that if menu definition changes take effect in 2023, automakers have little to no time to respond. Automakers have developed their compliance plans based on previous definitions. Furthermore, there is no time to start a complete reevaluation of existing technologies which currently meet the definitions, particularly engine and transmission warm-up technologies. In a worst-case scenario, automakers may even remove fuel savings technologies that no longer receive credits.

The EPA proposes changing the definitions which may result in commercialized technologies which may have real-world benefits no longer receiving off-cycle credits. For example, passive cabin ventilation has been shown to provide value, but less than the current menu credit (refer to NREL Presentation 17TMSS-0056). Likewise, active engine and transmission warm-up need not use exhaust waste heat to

¹ <https://www.epa.gov/sites/production/files/2018-02/documents/gm-rquest-ghg-credit-active-climate-control-seats-fe6357-2017-09-29.pdf>

be effective as the EPA concluded in 2012. Active warm-up can involve controlling coolant flow to change component cooling and warming timing. This may include not overcooling with zero coolant flow for rapid engine and transmission warm-up. Revised definitions for effective technologies must be based on evidence of their effectiveness, not prescriptive definitions of exhaust waste heat or secondary coolant loop configurations.

In conjunction with the proposed definition changes, the EPA should consider the real-world benefit of the technologies being “stranded”, or no longer applicable, and should add new menu credit(s) at a level based on the verifiable real-world benefit of the developed and commercialized technologies. Technologies that have been developed and applied based on the original definitions should have a place on the menu commensurate with the verifiable real-world benefit the technology provides.

ITB is aware of several commercialized technology developments with real-world benefits that are not yet credited by the EPA and NHTSA. New technologies under development utilize otherwise wasted thermal energy, moderate vehicle acceleration, and allow longer engine-off periods in real-world driving, among other potential benefits. The EPA should take action on outstanding applications of technologies with verifiable real-world benefits and accelerate their approval, or rejection, and possibly adding them to the off-cycle technology menu.

The EPA should also take this opportunity to add new off-cycle menu technology definitions for items with multiple substantially similar off-cycle credit approvals. For example, active climate control seats have been approved by the EPA for two manufacturers with pending approval for a third manufacturer. Another example is high-efficiency alternators which have been received off-cycle credit approvals.

IV. Improvements to the Off-cycle and A/C Efficiency Credit Programs

The current off-cycle and A/C efficiency program has some limitations which form the basis for making improvements. In general, there are two types of opportunities. First, reducing compliance and approval costs will reduce unnecessary burdens without affecting program effectiveness. Second, streamlining the credit approval processes will make approval faster and timing more certain, therefore increasing the rate of development and implementation of cost-effective fuel-saving and emissions-reducing technologies.

ITB Supports Adding Technologies to the Off-cycle Credit Menus

The A/C and off-cycle menu programs are widely used due to the ease and certainty of applying for pre-validated technology credit levels. Menu credits must be based upon quantification of a technology’s benefits which can be based on formulas to adjust the benefits for different vehicle applications depending on the relevant variables. Ultimately, menu credits and benefit formulas may be just as effective as multiple individual vehicle tests by manufacturers, but at a much lower cost. Numerous examples of existing technology credit approvals in both the United States and Europe demonstrate that formulas can be developed to consider the main effects of a technology and its potential interactions with other technologies. As technologies are developed and proven, and sufficient evidence is available, they should be added to credit menus.



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EPA should consider adding technologies to the off-cycle menu that NHTSA has deemed fuel saving. The NHTSA NPRM lists electric power steering (EPS), improved accessory devices (IACC), and secondary axle disconnect (SAX). NHTSA points out that there is a large opportunity to incorporate IACC for GHG reduction benefits in future model years. As shown in the NHTSA table below, the fuel savings, and emissions reduction impact for these three technologies are high.

Tech Class	IACC	Tech Class	EPS	Tech Class	SAX
SmallCar	1.85%	SmallCar	1.50%	SmallCar	1.40%
SmallCarPerf		SmallCarPerf		SmallCarPerf	
MedCar	2.36%	MedCar	1.30%	MedCar	1.40%
MedCarPerf		MedCarPerf		MedCarPerf	
SmallSUV	1.74%	SmallSUV	1.20%	SmallSUV	1.40%
SmallSUVPerf		SmallSUVPerf		SmallSUVPerf	
MedSUV	2.34%	MedSUV	1.00%	MedSUV	1.30%
MedSUVPerf		MedSUVPerf		MedSUVPerf	
Pickup	2.15%	Pickup	0.80%	Pickup	1.60%
PickupHT		PickupHT		PickupHT	

Additionally, Certain technologies are approved for the European Eco-innovation program and have been extensively evaluated by suppliers, automakers and regulators with confirmation of the technology benefit by the EU Joint Research Commission (JRC). The approved Eco-innovation technologies include the following items, which could be added to the agencies’ off-cycle technology menu list. We note that adjustments in the benefit level formulas may be necessary to reflect different vehicle size and driving patterns in the USA. There may be other proven eco-innovation technologies not listed below.

Approved European Eco-Innovations Which Could be Added to US Off-Cycle Menu

- Coasting (Porsche / BMW)
- Encapsulation (Daimler)
- Enthalpy Storage (Mahle Behr)
- Adaptive SOC (Bosch)

Another example of an off-cycle technology that should be added to the menu list is active climate control seats which are approved by the EPA for General Motors, Hyundai, and Kia. Stellantis (FCA) also has a substantially similar pending request for approval of active climate control seats. An important factor to consider in determining if a menu credit is warranted is its commercialization status. Active climate-controlled seat technology is in production for several auto manufacturers and other manufacturers should receive the same credit benefits to level the playing field.

ITB Supports Credit Approval Process Streamlining

The ITB Group agrees with NHTSA as outlined in its 2024-2026 NPRM (docket: NHTSA-2021-0053) that the Off-cycle credit approval process can be improved. NHTSA proposes setting deadlines for OEM submissions, and ITB suggests that there should also be deadlines for the agencies (EPA/NHTSA) to respond to off-cycle credit request submissions for the off-menu approval pathways. ITB also recommends the development of a formal process for adding technologies to the menus and adjusting menu credits when necessary.



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A. Develop a process for adding technologies to the menu lists

ITB supports the creation of a more formalized process to add technologies to the off-cycle credit menu. An off-cycle or A/C credit menu approval process would allow items to be added to the menu when sufficient data is available. Although two technologies were added to the menu in the previous “SAFE” rule, more technologies could be added to the menu more rapidly. When technologies are added to the menu lists, industry compliance costs are decreased and national fuel consumption and exhaust emissions are reduced.

In the current state, where it is not easy to add technologies to the menu, new developments are handicapped and require significantly higher costs for initial and subsequent approvals. We believe the regulations should encourage new technology developments when sufficient data is available to create a menu credit. It should not be strictly necessary to have multiple lengthy OEM off-cycle credit approval cycles to add a menu credit. Therefore, the agencies should develop a process that allows automakers to apply for adding technologies to the menu lists and which should include public review of such submissions. Creating a process for obtaining menu credit approval will reinforce and create incentives for the development of new energy-saving technologies.

We are certain new autonomous and energy conservation technologies will be developed and existing technologies refined. In the future emissions reductions from off-cycle technologies and A/C efficiency technologies could be credited when used on BEVs, PHEVs, and FCEVs. Such a pathway will become highly relevant when EV emissions account for upstream CO₂ emissions, not just the 0 grams/mile tailpipe emissions. Certain off-cycle and A/C efficiency, technologies, particularly cabin heating technologies help reduce the amount of electric energy used to power a vehicle. Consequently, technologies that reduce EV energy consumption should be recognized when the 0 g/mi electric drive incentive is potentially eliminated after 2026. ITB recommends that a program be developed by the agencies to consider developing a set of EV and autonomous technology off-cycle menu credits in preparation for future rule-making.

B. Establish an off-cycle menu credit adjustment process

Additionally, the agencies should consider adjusting menu credit values either up or down if new vehicle or component testing becomes available. For example, an NREL study² raises questions about the efficacy level of current technology used for active and passive cabin ventilation credits. Establishing a credit adjustment process would allow benefit levels or formulas to be adjusted when new studies are performed or when technology interaction effects are identified.

V. Conditional Support for Vehicle Technology Incentives

ITB supports advanced vehicle technology incentives for full-size pick-up trucks and certain electrified vehicles as detailed below.

A. Advanced Technology Incentives for Full-Size Pick-up Trucks

The ITB Group supports reinstatement of the incentives for full-sized pickup strong hybrid/20% better performance incentive. One improvement in the rule would be to provide a combined penetration

² NREL Presentation 17TMSS-0056, <https://www.nrel.gov/docs/fy18osti/69047.pdf>

requirement rather than independent 10% requirements for multiple types of technologies. This would mean that any combination of strong hybrid and other 20% better performance technologies would fall under one cap. This is an important technology-agnostic requirement, since it is not clear the receptiveness that the market will have for a specific technology. As far as possible, the standards should be flexible and technology-agnostic to incentivize fuel consumption and CO₂ emissions reductions. ITB agrees with the EPA's justification for reinstating the full-size pickup truck credits since full-size pick-up truck technologies are "particularly challenging due to the need to preserve the towing and hauling capabilities of the vehicles."

B. EPA Proposed Advanced Technology Multiplier Credits

ITB conditionally supports the EPA's proposal to extend advanced technology multiplier incentives for battery electric vehicles (BEV), Plug-in Hybrid Vehicles (PHEV), and Fuel Cell Electric Vehicles (FCEV) that sunset in 2025 or 2026 and include a cap. While there have been considerable supplier and OEM investments in these technologies, many of these technologies are still immature and incentives for a certain period of time can provide a catalyst to get more zero-emissions vehicles to the market sooner while reducing investment risk for the automotive industry.

ITB believes that harmonizing the advanced vehicle technology multiplier credit cap with California's Framework Agreements is the appropriate path to allow flexibility in meeting the top line emissions stringency given the short time automakers have to respond to a sharp stringency change by 2023.

VI. Summary of Recommendations and Conclusions

ITB expresses strong support for continuous improvement in vehicle fuel efficiency and CO₂ emissions. One way of reducing real-world fuel consumption and CO₂ emissions are off-cycle technologies. Technology credit flexibilities give automakers credits for applying off-cycle efficiency measures. These technologies provide real-world benefits in an economical way, therefore allowing the automakers to reduce fuel consumption and emissions at the lowest cost. The bottom line is our support for maximum United States environmental protection and fuel security at the lowest industry cost.



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