Midterm Evaluation of Light-Duty Vehicle Greenhouse Gas Emissions Standards for Model Years 2022-2025

Related Topics

- Regulations for GHG emissions from passenger cars & trucks
- Fuel Economy
- Light-duty models for GHG emissions

On this page:

Overview

As part of the 2012 rulemaking establishing the model year (MY) 2017-2025 light-duty vehicle greenhouse gas (GHG) standards, EPA made a regulatory commitment to conduct a Midterm Evaluation (MTE) of the standards for MY 2022-2025. As a part of this process, EPA examed a wide range of factors, such as developments in powertrain technology, vehicle electrification, light-weighting and vehicle safety impacts, the penetration of fuel efficient technologies in the marketplace, consumer acceptance of fuel efficient technologies, trends in fuel prices and the vehicle fleet, employment impacts, and many others.

EPA's regulations require several formal steps in the MTE process, including opportunities for public input.

- Step 1: Draft Technical Assessment Report (TAR) issued jointly with the National Highway Traffic Safety Administration (NHTSA) and the California Air Resources Board (CARB) with opportunity for public comment. (July 2016)
- Step 2: The Former EPA Administrator made a Proposed Determination with opportunity for public comment. (November 2016) (This step was reevaluated under the direction of former EPA Administrator Scott Pruitt)
- Step 3: The EPA Administrator must make a final determination with regard to whether the standards remain appropriate or should be changed by April 1, 2018.

Mid-term Evaluation Final Determination

On April 2, 2018, the Administrator signed the Mid-term Evaluation Final Determination which finds that the model year 2022-2025 greenhouse gas standards are not appropriate in light of the record before EPA and, therefore, should be revised. The Federal Register Notice announcing the Administrator's decision is available for review below.

Federal Register Notice: Mid-term Evaluation of Greenhouse Gas Emissions Standards for Model Year 2022-2025 Light-duty Vehicles (PDF)
(11 pp, 634 K, published April 13, 2018, About PDF)

The Mid-term Evaluation Process

Reconsideration of the Midterm Evaluation Final Determination

On March 15, 2017, former EPA Administrator Scott Pruitt and Department of Transportation Secretary Elaine Chao announced that EPA intended to reconsider the final determination, issued on January 12, 2017, that recommended no change to the greenhouse gas standards for light duty vehicles for model years 2022-2025. EPA announced it woud reconsider that determination in coordination with NHTSA.

The Mid-term Evaluation process was established as a part of the 2012 final GHG emissions standards for model years 2017-2025, requiring EPA to determine no later than April 1, 2018, whether the standards for model years 2022-2025 established are appropriate. In accord with this schedule, EPA announced that it intended to make a new Final Determination regarding the appropriateness of the standards no later than April 1, 2018.

- Federal Register Notice: Notice of Intention to Reconsider the Final Determination of the Mid-Term Evaluation of Greenhouse Gas Emissions Standards for Model Year 2022-2025 Light Duty Vehicles (PDF) (2 pp, 185 K, published March 22, 2017)
- Alliance of Auto Manufacturers Letter to former Administrator Pruitt EXIT
- EPA provided opportunities for the public to comment on its reconsideration of the previous Mid-term Evaluation determination, with a public comment period that closed on October 5, 2017 and a public hearing held on September 6, 2017 in Washington DC. Comments and the hearing transcripts are available at www.regulations.gov in public docket EPA-HQ-OAR-2015-0827.

Previous Steps in the Midterm Evaluation Process

On January 12, 2017, Administrator Gina McCarthy signed her determination to maintain the current GHG emissions standards for model year (MY) 2022-2025 vehicles. Her final determination found that automakers are well positioned to meet the standards at lower costs than previously estimated.

Highlights of Administrator McCarthy's January 2017 Final Determination

- Automakers have a wide range of technology pathways available to meet the MY2022-2025 standards, at slightly lower per-vehicle costs than previously predicted. The standards are achievable with very low penetration of strong hybrids, electric vehicles and plug-in hybrid electric vehicles, consistent with the findings of a comprehensive 2015 National Academy of Sciences study.
- The standards will save consumers money, significantly reduce GHG emissions and fuel consumption, and provide benefits to the health and welfare of Americans.
- Automakers have outperformed the standards for the first four years of the program (MY2012-2015) and manufacturers are adopting fuel efficient technologies at unprecedented rates, all while vehicle sales have increased for 7 consecutive years.

Administrator McCarty's determination was based on an extensive technical record, created over 8 years of research, review of several hundred published reports, hundreds of stakeholder meetings, and multiple opportunities for the public to provide input. This Final Determination follows the November 2016 release of EPA's Proposed Determination and the July 2016 release of a Draft Technical Assessment Report (TAR), issued jointly by the EPA, the National

Highway Traffic Safety Administration (NHTSA), and the California Air Resources Board (CARB). EPA provided opportunities for public comment for both the Draft TAR and the Proposed Determination.

Cover Letter -- EPA Administrator's signed Cover Letter to the Final Determination.

Final Determination Document -- Final Determination on the Appropriateness of the Model Year 2022-2025 Light-duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation (PDF) (33 pp, 560 K, January 2017, EPA-420-R-17-001).

Response to Comments Document -- Final Determination on the Appropriateness of the Model Year 2022-2025 Light-duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation: Response to Comments (PDF) (174 pp, 1.58 MB, January 2017, EPA-420-R-17-002).

Proposed Determination

On November 30, 2016, Administrator McCarthy proposed to determine that the MY 2022-2025 standards remain appropriate and that a rulemaking to change them is not warranted. This proposed determination was based on the robust technical record including the draft TAR, input from the auto industry and other stakeholders, and updated analyses. The public comment period for this proposed determination ended on December 30, 2016.

Highlights of the Proposed Determination

- Auto manufacturers can meet the MY 2022-2025 standards at slightly lower per-vehicle costs than predicted in the TAR, and lower costs than predicted in the 2012 rulemaking that established the standards.
- The current standards will save consumers money and provide benefits to the health and welfare of Americans.
- Automakers have a wide range of technology pathways available to meet the standards. Standards are achievable with very low penetration of strong hybrids, electric vehicles and plug-in hybrid electric vehicles. This finding is consistent with the conclusions the National Academy of Sciences found in a comprehensive 2015 study.
- Automakers have outperformed the standards for the first four years of the program (MY2012-2015) and manufacturers are adopting fuel efficient technologies at unprecedented rates, all while vehicle sales have increased for 6 consecutive years. There are over 100 car, SUV, and pickup versions on the market today that already meet 2020 or later standards.

Cover Letter –- EPA Administrator's signed Cover Letter to the Proposed Determination.

Proposed Determination Document -- Proposed Determination on the Appropriateness of the Model Year 2022-2025 Light-duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation (PDF)

(268 pp, 6.38 MB, EPA-420-R-16-020, November 2016)

Technical Support Document to the Proposed Determination -- Proposed Determination on the Appropriateness of the Model Year 2022-2025 Light-duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation: Technical Support Document (PDF) (719 pp, 18 MB, EPA-420-R-16-021, November 2016)

Notice of Availability of a Proposed Order: Proposed Determination on the Appropriateness of the Model Year 2022-2025 Light-duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation (PDF) (2 pp, 199 K, published December 6, 2016)

For additional documents supporting EPA's analyses for the Proposed Determination, see the Advanced Light-Duty Powertrain and Hybrid Analysis (ALPHA) Tool and the Optimization Model for reducing Emissions of Greenhouse gases from Automobiles (OMEGA) pages.

Draft Technical Assessment Report (TAR)

EPA, NHTSA, and CARB jointly issued a Draft TAR for public comment in July 2016. The Draft TAR was a technical report, not a decision document, and examined a wide range of issues relevant to the 2022-2025 standards.

Highlights of the Draft Technical Assessment Report:

- **Automakers are innovating in a time of record sales and fuel economy levels**. The results of the Draft TAR show that manufacturers are adopting fuel economy technologies at unprecedented rates. Car makers and suppliers have developed far more innovative technologies to improve fuel economy and reduce GHG emissions than anticipated just a few years ago.
- **Our new analysis shows that the standards can be met largely with more efficient gasoline powered cars – we continue to project that only modest penetration of hybrids and only low levels of electric vehicles are needed to meet the standards**. The Draft TAR shows that manufacturers can meet the current standards for MY 2022-2025 with conventional gasoline vehicles that use internal combustion engines with well-understood technologies. This is consistent with what the National Academies of Science found in a comprehensive 2015 study. Manufacturers can meet the standards at similar or even lower costs than what was anticipated in the 2012 rulemaking with substantial fuel savings payback to consumers.
- **The National Program preserves consumer choice, even as it protects the environment and reduces fuel consumption.** The National Program is designed to ensure that consumers can continue to buy the differing types of vehicles they need, from compact cars, to SUVs, to larger trucks suitable for towing and carrying heavy loads. Owners of every type of new vehicle

will enjoy gasoline savings and improved fuel economy with a reduced environmental footprint.

- **Executive Summary** -- Draft Technical Assessment Report: Midterm Evaluation of Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards for Model Years 2022-2025 – Executive Summary (PDF)
  (15 pp, 588 K, EPA-420-D-16-901, July 2016)
- **Draft Technical Assessment Report**: Midterm Evaluation of Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards for Model Years 2022-2025 (PDF)
  (1217 pp, 36.5 MB, EPA-420-D-16-900, July 2016)
- **Appendices** -- Draft Technical Assessment Report: Midterm Evaluation of Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards for Model Years 2022-2025 (PDF)
  (118 pp, 5.6 MB, EPA-420-D-16-900app, July 2016)
- Notice of Availability of Midterm Evaluation Draft Technical Assessment Report for Model Year 2022–2025 Light Duty Vehicle GHG Emissions and CAFE Standards (PDF)
  (4 pp, 229 K, published July 27, 2016)

For additional documents supporting EPA's analyses for the Proposed Determination, see the Advanced Light-Duty Powertrain and Hybrid Analysis (ALPHA) Tool and the Optimization Model for reducing Emissions of Greenhouse gases from Automobiles (OMEGA) pages.

EPA Technical Projects to Inform the Midterm Evaluation

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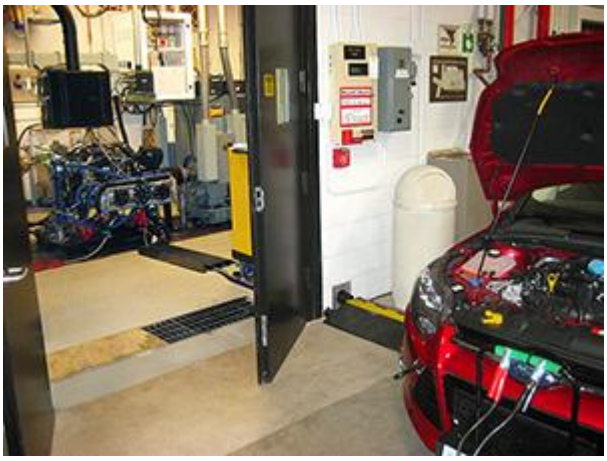
  EPA's National Vehicle and Fuel Emissions Laboratory (NVFEL), Ann Arbor, MI

  Through the National Center for Advanced Technology (NCAT) located at EPA's National Vehicle and Fuel Emissions Laboratory (for more information, see: Vehicles and Fuels Emission Testing) in Ann Arbor, Michigan, we are researching future advanced engine and transmission

technologies to support modeling, advanced technology testing, and demonstrations (for more information, see: Benchmarking Advanced Low Emission Light-Duty Vehicle Technology).

- This study examines the mass reduction potential for a full-size light-duty pickup truck.
  - Mass Reduction and Cost Analysis—Light-Duty Pickup Truck Model Years 2020-2025 (PDF) (1018 pp, 54.9MB, EPA-420-R-15-006, June 2015)
  - CAE Baseline and Lightweight Models (ZIP) (71 MB, June 2015)



NVFEL's National Center for Advanced Technology

State-of-the-art cost teardown studies, with FEV, for fuel efficient technologies, including mild hybrids and diesel vehicles

- Research on consumer issues, including an assessment of vehicle affordability, a study of willingness-to-pay for various vehicle attributes, and content analysis of auto reviews
  - Searching for Hidden Costs: A Technology-Based Approach to the Energy Efficiency Gap in Light-Duty Vehicles (PDF) (55 pp, 1.0 MB, EPA-420-D-15-010, November 2015)
  - Searching for Hidden Costs: Presentation made at the University of Michigan Energy Institute's Conference on Transportation, Economics, Energy, and the Environment (TE3)
  - Searching for Hidden Costs: A Technology-Based Approach to the Energy Efficiency Gap in Light-Duty Vehicles, Presentation made at the Association of Environmental and Resource Economists Annual Conference

- Work on economic issues, including new studies on VMT rebound and manufacturer cost reduction through "learning by doing":
  - Final Report and Peer Review Report for Cost Reduction through Learning in Manufacturing Industries and in the Manufacture of Mobile Sources (PDF) (265 pp, 3.37 MB, EPA-420-R-16-018, November 2016)
  - The Rebound Effect from Fuel Efficiency Standards: Measurement and Projection to 2035 (PDF) (80 pp, 629KB, EPA-420-R-15-012, June 2015)

        - Peer Review (PDF) (193 pp, 2.9MB, EPA-420-R-15-013, June 2015)
- Development of modeling tools:
    - Vehicle simulation modeling (ALPHA - Advanced Light-Duty Powertrain and Hybrid Analysis)
    - Technology feasibility and cost model (OMEGA - Optimization Model for reducing Emissions of Greenhouse gases from Automobiles)
    - Technology packages efficiencies (Response Surface Model)
    - Continued investigation into potential consumer choice modeling:
        - Consumer Vehicle Choice Model Documentation (PDF) (62 pp, 701 K, EPA-420-B-12-052, August 2012)
        - Testing a Model of Consumer Vehicle Purchases (PDF) (42 pp, 883 K, EPA-420-D-15-011, December 2015)
- In addition to working with CARB and NHTSA, EPA is collaborating with DOE on projects involving vehicle light-weighting and battery cost modeling, and Environment and Climate Change Canada/Transport Canada EXIT on projects involving aerodynamics, vehicle light-weighting, EXIT all-wheel drive vehicles, and other areas.
- In addition to these projects supporting the MTE, EPA issues The EPA Automotive Trends Report.

EPA Publications Informing the Midterm Evaluation

Throughout the MTE process, EPA's goal was to publish as much of our research as possible in peer-reviewed journals. EPA staff have published the following peer-reviewed papers so far since 2013. EPA staff attended numerous technical conferences, and assessed hundreds of papers in the literature on the wide range of factors considered for the MTE.

The following papers are not available for download due to copyright restrictions; however, we are providing links to the abstract and ordering information on the journals' websites.

The following links exit the site EXIT

- "Consumer willingness to pay for vehicle attributes: What do we Know?" David Greene, Anushah Hossain, Julia Hofmann, Gloria Helfand, Robert Beach. Transportation Research Part A 118 (2018) 258-279.
- "Re-searching for hidden costs: Evidence from the adoption of fuel-saving technologies in light-duty vehicles. Hsing-Hsiang Huang, Gloria Helfand,

Kevin Bolon, Robert Beach, Mandy Sha, Amanda Smith. Transportation Research Part D 65 (2018) 194-212.

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- "Critical factors affecting life cycle assessments of material choice for vehicle mass reduction," Troy Hottle, Cheryl Caffrey, Joseph McDonald, Rebecca Dodder. Transportation Research Part D 56 (2017) 241-257.
- "Searching for Hidden Costs: A Technology-Based Approach to the Energy Efficiency Gap in Light-Duty Vehicles," Helfand et al. (2016), Energy Policy 98: 590-606.
- "Developing the AC17 Efficiency Test for Mobile Air Conditioners," SAE Technical Paper 2013-01-0569, 2013, doi:10.4271/2013-01-0569, Sciance, F., Nelson, B., Yassine, M., Patti, A., and Rao, L.
- "Maneuver-based Battery-in-the-Loop Testing - Bringing Reality to the Lab," SAE Int. J. Alt. Power, 2(1):2013, doi:10.4271/2013-01-0157, Dagci, O., Pereira, N., and Cherry, J.
- "Development of Advanced Light-Duty Powertrain and Hybrid Analysis Tool," SAE Technical Paper 2013-01-0808, 2013, doi:10.4271/2013-01-0808, Lee, B., Lee, S., Cherry, J., Neam, A., Sanchez, J., and Nam, E.
- "Modeling and Validation of Power-Split and P2 Parallel Hybrid Electric Vehicles," SAE Technical Paper 2013-01-1470, 2013, doi:10.4271/2013-01-1470, Lee, S., Lee, B., McDonald, J., Sanchez, L., and Nam, E.
- "Modeling and Validation of Lithium-Ion Automotive Battery Packs," SAE Technical Paper 2013-01-1539, 2013, doi:10.4271/2013-01-1539, Lee, S., Lee, B., McDonald, J., and Nam, E.
- "Cost-Effectiveness of a Lightweight Design for 2017-2020: An Assessment of a Midsize Crossover Utility Vehicle," SAE Technical Paper 2013-01-0656, 2013, doi: 10.4271/2013-01-0656, Caffrey, C., Bolon, K., Harris, H., Kolwich, G., Johnston, R., and Shaw, T.

The following papers are not subject to copyright protection because they are Government works; however, foreign copyrights may apply.

- "Predictive GT-Power Simulation for VNT Matching on a 1.6L Turbocharged GDI Engine," SAE Technical Paper 2018-01-0161, 2018, Dennis Robertson, Graham Conway, Chris Chadwell, Joseph McDonald, Daniel Barba, Mark Stuhldreher, Aaron Birckett
- "Modeling and Controls Development of 48V Mild Hybrid Electric Vehicles," SAE Technical Paper 2018-01-0413, 2018, SoDuk Lee, Jeff Cherry, Michael Safoutin, Anthony Neam, Joseph McDonald, Kevin Newman
- "Modeling and Validation of 48V Mild Hybrid Lithium-Ion Battery Pack," SAE Technical Paper 2018-01-0433, 2018, SoDuk Lee, Jeff Cherry, Michael Safoutin, Joseph McDonald, Michael Olechiw

- "Benchmarking a 2016 Honda Civic 1.5-liter L15B7 Turbocharged Engine and Evaluating the Future Efficiency Potential of Turbocharged Engines," SAE Technical Paper 2018-01-0319, 2018, Mark Stuhldreher, John Kargul, Daniel Barba, Joseph McDonald, Stanislav Bohac, Paul Dekraker, Andrew Moskalik
- "Constructing Engine Maps for Full Vehicle Simulation Modeling," SAE Technical Paper 2018-01-1412, 2018, Paul Dekraker, Daniel Barba, Andrew Moskalik, Karla Butters
- "Characterization of GHG Reduction Technologies in the Existing Fleet," SAE Technical Paper 2018-01-1268, 2018, Kevin Bolon, Andrew Moskalik, Kevin Newman, Aaron Hula, Anthony Neam, Brandon Mikkelsen
- "Representing GHG Reduction Technologies in the Future Fleet with Full Vehicle Simulation," SAE Technical Paper 2018-01-1273, 2018, Andrew Moskalik, Kevin Bolon, Kevin Newman, Jeff Cherry
- "Evaluation of Emerging Technologies on a 1.6 L Turbocharged GDI Engine," SAE Technical Paper 2018-01-1423, 2018, Graham Conway, Dennis Robertson, Chris Chadwell, Joseph McDonald, John Kargul, Daniel Barba, Mark Stuhldreher
- "Selective Interrupt and Control: An Open ECU Alternative," SAE Technical Paper 2018-01-0127, 2018, Logan Smith, Ian Smith, and Scott Hotz
- "Potential Fuel Economy Improvements from the Implementation of cEGR and CDA on an Atkinson Cycle Engine," SAE Technical Paper 2017-01-1016, 2017, doi:10.4271/2017-01-1016, Schenk, C., Dekraker, P.
- "Modeling and Validation of 12V Lead-acid Battery for Stop-Start Technology," SAE Technical Paper 2017-01-1211, 2017, doi:10.4271/2017-01-1211, Lee, S., Cherry, J., Safoutin, M., McDonald, J.
- "Fleet-Level Modeling of Real World Factors Influencing Greenhouse Gas Emission Simulation in ALPHA," SAE Technical Paper 2017-01-0899, 2017, doi:10.4271/2017-01-0899, Dekraker, P., Kargul, J., Moskalik, A., Newman, K., Doorlag, M., Barba, D.
- "Characterizing Factors Influencing SI Engine Transient Fuel Consumption for Vehicle Simulation in ALPHA," SAE Technical Paper 2017-01-0533, 2017, doi:10.4271/2017-01-0533, Dekraker, P., Stuhldreher, M., Kim, Y. (SwRI).
- "The Energy Efficiency Gap in EPA's Benefit-Cost Analysis of Vehicle Greenhouse Gas Regulations: A Case Study," Journal of Benefit-Cost Analysis, 2015, doi:10.1017/bca.2015.13, Gloria Helfand and Reid Dorsey-Palmateer EXIT
- "Air Flow Optimization and Calibration in High-Compression-Ratio Naturally Aspirated SI Engines with Cooled-EGR," SAE Technical Paper 2016-01-0565, 2016, doi:10.4271/2016-01-0565, Lee, S., Schenk, C., and McDonald, J.

- "Cost-Effectiveness of a Lightweight Design for 2020-2025: An Assessment of a Light-Duty Pickup Truck," SAE Technical Paper 2015-01-0559, 2015, doi:10.4271/2015-01-0559, Caffrey, C., Bolon, K., Kolwich, G., Johnston, R., and Shaw, T.
- "Analysis of Technology Adoption Rates in New Vehicles," SAE Technical Paper 2014-01-0781, 2014, doi:10.4271/2014-01-0781, Hula, A., Alson, J., Bunker, A., and Bolon, K.
- "Estimating GHG Reduction from Combinations of Current Best-Available and Future Powertrain and Vehicle Technologies for a Midsized Car Using EPA's ALPHA Model," SAE Technical Paper 2016-01-0910, 2016, doi:10.4271/2016-01-0910, Kargul, J., Moskalik, A., Barba, D., Newman, K., and Dekraker, P.
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- "HIL Development and Validation of Lithium Ion Battery Packs," SAE Technical Paper 2014-01-1863, 2014, doi:10.4271/2014-01-1863, Lee, S.,

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- "Predictive GT-Power Simulation for VNT Matching on a 1.6L Turbocharged GDI Engine," SAE Technical Paper 2018-01-0161, 2018, Dennis Robertson, Graham Conway, Chris Chadwell, Joseph McDonald, Daniel Barba, Mark Stuhldreher, Aaron Birckett
- "Modeling and Controls Development of 48V Mild Hybrid Electric Vehicles," SAE Technical Paper 2018-01-0413, 2018, SoDuk Lee, Jeff Cherry, Michael Safoutin, Anthony Neam, Joseph McDonald, Kevin Newman
- "Modeling and Validation of 48V Mild Hybrid Lithium-Ion Battery Pack," SAE Technical Paper 2018-01-0433, 2018, SoDuk Lee, Jeff Cherry, Michael Safoutin, Joseph McDonald, Michael Olechiw
- "Benchmarking a 2016 Honda Civic 1.5-liter L15B7 Turbocharged Engine and Evaluating the Future Efficiency Potential of Turbocharged Engines," SAE Technical Paper 2018-01-0319, 2018, Mark Stuhldreher, John Kargul, Daniel Barba, Joseph McDonald, Stanislav Bohac, Paul Dekraker, Andrew Moskalik
- "Constructing Engine Maps for Full Vehicle Simulation Modeling," SAE Technical Paper 2018-01-1412, 2018, Paul Dekraker, Daniel Barba, Andrew Moskalik, Karla Butters
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- "Representing GHG Reduction Technologies in the Future Fleet with Full Vehicle Simulation," SAE Technical Paper 2018-01-1273, 2018, Andrew Moskalik, Kevin Bolon, Kevin Newman, Jeff Cherry
- "Evaluation of Emerging Technologies on a 1.6 L Turbocharged GDI Engine," SAE Technical Paper 2018-01-1423, 2018, Graham Conway, Dennis Robertson, Chris Chadwell, Joseph McDonald, John Kargul, Daniel Barba, Mark Stuhldreher

EPA Presentations Regarding the Midterm Evaluation

EPA also has publicly presented information about our work in numerous forums.

Click the links below to view selected presentations:

- EPA presentations regarding the MTE
- EPA presentation regarding the ALPHA tool

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