# DECLARATION OF DR. NICHOLAS LUTSEY

I, Dr. Nicholas Lutsey, declare as follows:

## Background and Experience with the OMEGA Model

1. I am the Program Director of U.S. activities for The International Council on Clean Transportation (ICCT), an independent nonprofit organization founded to provide unbiased research and technical and scientific analysis to environmental regulators. I lead ICCT's electric vehicle and fuels research program and manage its role as the Secretariat for the International Zero-Emission Vehicle Alliance. Through my work at ICCT and past positions, I have substantial experience with the U.S. Environmental Protection Agency's (EPA's) greenhouse gas (GHG) emission standards for light-duty vehicles, including the technical modeling that supports those standards. I collaborated with the agency on the development of its Optimization Model for reducing Emissions of Greenhouse gases from Automobiles (OMEGA), which I provided extensive feedback on while I was conducting a parallel modeling evaluation of vehicle emission-reduction technologies.

2. I received a Bachelor of Science degree in Agricultural and Biological Engineering from Cornell University and an M.S. and Ph.D. in Transportation Technology and Policy from the University of California, Davis.

3. I participated in the development of the 2004 and 2012 GHG emission standards for light-duty vehicles while working with the California Air Resources Board (CARB). From 2003 to 2006, I worked as a research analyst as a consultant to CARB on the development of California's first GHG emission standard for light-duty vehicles.[1] My analysis involved

[1] The Clean Air Act allows California to set its own state standards for emissions from light-duty vehicles, subject to some conditions.

assessing the available technologies to reduce vehicle GHG emissions, the cost of those technologies, the pace at which they can enter the vehicle fleet, and the regulatory timing. I conducted assessments of technology costs and impacts at the per-vehicle and fleet-wide levels.[2] The associated GHG analysis I led provided the fundamental basis for stringency and cost-benefit analysis for California's GHG standards for Model Year (MY) 2009-2016 light-duty vehicles.

4. From 2008 to 2012, I again worked with CARB to analyze the availability and effectiveness of emission-reduction technologies. My initial analysis for CARB was to review the EPA OMEGA modeling of the federal MY 2012-2016 standards and assess how the federal program aligned with California's original MY 2009-2016 standards. Following this, my role was to again lead the regulatory technology and cost assessment for CARB. This included reviewing and contributing to the drafting of the GHG emission standards for MY 2017-2025 vehicles. This was part of a joint technical assessment conducted by CARB, EPA, and the National Highway Traffic Safety Administration (NHTSA) that ultimately led to the adopted MY 2017-2025 standards. I spent hundreds of hours with EPA and NHTSA staff discussing the technical modeling that was necessary to support those regulations.[3] Each agency used a unique tool to analyze technology costs and feasibility—EPA staff used the Optimization Model for reducing Emissions of Greenhouse gases from Automobiles (OMEGA); NHTSA staff used a model generally known as the Volpe model; and CARB used its own regulatory evaluation modeling, of which I led the development.

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[2] Some results of this work are presented in the CARB Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Public Hearing to Consider Adoption of Regulations to Control Greenhouse Gas Emissions from Motor Vehicles (Aug. 6, 2004), available at https://www.arb.ca.gov/regact/grnhsgas/isor.pdf.

[3] NHTSA has statutory authority to set corporate average fuel economy (CAFE) standards.

5. Over the course of that multi-year, interagency collaboration, I developed an intimate understanding of how EPA's OMEGA model functions, including how the inputs and outputs are developed and formatted, as well as the structure of the core model. I spoke at length with EPA staff about their development and operation of the OMEGA model, as I developed CARB's parallel regulatory development modeling. Through this process, I reviewed and provided constructive input to EPA staff regarding the OMEGA approach, inputs, and outputs many times and developed a detailed understanding of EPA's tool.

6. I have co-authored 19 peer-reviewed journal articles and dozens of reports on vehicle technology potential, regulatory design, and policy cost-effectiveness. Most of these technical reports assess the technologies, associated costs, and emission-reduction benefits associated with vehicle policy, and thus are closely related to the foremost questions of the OMEGA modeling. In 2017, I co-authored a report, Efficiency Technology and Cost Assessment for U.S. 2025–2030 Light-Duty Vehicles, which incorporated recent industry research and modeling to update EPA's technology and cost assessments for the MY2017-2025 standards.[4] Our report directly used and modified EPA's OMEGA modeling framework to assess fleet impacts from alternative regulatory and technology scenarios with updated inputs. The reports I co-authored are further detailed in an attached list of publications, which is titled Exhibit A.

7. In 2015, I received the Society of Automotive Engineers (SAE) International Barry D. McNutt Award for Excellence in Automotive Policy Analysis, which SAE awards to "individuals who have made outstanding contributions to the development of improved federal

[4] Lutsey et al., *Efficiency Technology and Cost Assessment for U.S. 2025–2030 Light-Duty Vehicles*, ICCT (Mar. 2017), available at https://www.theicct.org/publications/US-2030-technology-cost-assessment.

automotive policy" in order to recognize "the importance of sound policy analysis."[5] This award is due to my analysis on the technology, cost, and lead-time considerations related to the California and U.S. light-duty vehicle GHG standards and related scholarship in the research literature. I received a Gold Certificate of Appreciation in 2005 and the Gold Superior Accomplishment Award in 2012 from CARB. These CARB awards were for my technical modeling of the 2009-2016 and 2017-2025 regulations, and the underlying technology, cost, and compliance analysis that mirrored the federal OMEGA analysis.

**Purpose and Function of the OMEGA Model**

8. The Clean Air Act requires that GHG emission standards for new motor vehicles "take effect after such period as [EPA] finds necessary to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period."[6]

9. EPA designed OMEGA to provide a factual foundation for that finding. There are "an almost infinite number of technology combinations" that could produce a desired level of emissions reductions.[7] OMEGA is a mathematical accounting tool that uses the best available data to calculate which technology pathway each automaker is likely to follow to reduce vehicle greenhouse gas emissions while maximizing cost-effectiveness. Generally, an accounting model

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5 SAE International, Barry D. McNutt Award for Excellence in Automotive Policy Analysis (accessed on Mar. 20, 2019), https://www.sae.org/participate/awards/barry-d-mcnutt-award-for-excellence-in-automotive-policy-analysis.

6 42 U.S.C. § 7521(a)(2).

7 EPA, Regulatory Impact Analysis: Final Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards ("RIA") at 4-1, Doc. No. EPA-420-R-10-009 (Apr. 2010); *see also* EPA, OMEGA Model Documentation v.1.4.56 at 3, Doc. No. EPA-420-B-16-064 (July 2016), *available at* https://www.epa.gov/regulations-emissions-vehicles-and-engines/optimization-model-reducing-emissions-greenhouse-gases.

organizes factual data according to certain assumptions, which are included as technical inputs using a series of algorithms. I worked collaboratively with EPA, as part of the joint-agency coordination between EPA, CARB, and NHTSA, as EPA was developing OMEGA during its first rulemaking to set GHG standards for cars and trucks and further refining OMEGA in the second rulemaking.

10. The goal of OMEGA is to estimate when and how each automaker will add different emissions-reduction technologies to its vehicle fleet to meet a given Clean Air Act emission standard.[8] As the National Research Council has explained, OMEGA "shows … a demonstration of possibility, not a forecast of the future."[9]

**The Components of the OMEGA Model**

11. The OMEGA model consists of multiple components, all of which are necessary for a user to successfully operate the model and generate outputs. Although I recognize the following is a simplification of the steps the EPA modeling process entails, the principal components of the analysis include the following –

a. input files: these are Microsoft Excel spreadsheets containing raw data. The inputs are loaded into the pre-processors or the core model in order to establish baseline information about the state of vehicles, technology, and costs (specific input files are explained below);

b. pre-processors: some of these are are Microsoft Excel spreadsheets and some are scripted computer programs written in Visual Basic or MATLAB.

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8 RIA at 3 (Apr. 2010).

9 National Research Council, *Cost, Effectiveness and Deployment of Fuel Economy Technologies for Light-Duty Vehicles* at 355-56 (2015), https://www.nap.edu/catalog/21744/cost-effectiveness-and-deployment-of-fuel-economy-technologies-for-light-duty-vehicles.

Pre-processors help organize raw inputs into datasets that can be read by the core model (for example, one pre-processor sorts technology options into groups of technology packages, as explained below);

c. the core model: this is an executable computer program written in the C# programming language. The program receives input files refined by the pre-processors, and applies algorithms to that data in order to determine emission-reduction technology combinations that each manufacturer could apply to the vehicles in its fleet under a given GHG emission limit. The program produces output files that state those specific technology combinations;

d. output files: these are Microsoft Excel spreadsheets detailing OMEGA's calculation of which technologies automakers could deploy to meet the emission limit. The outputs also detail the per-car, per-truck, and combined per-vehicle compliance cost for each auto manufacturer and for the industry as a whole, and the specific emissions estimates;[10] and

e. post-processors: some of these are Microsoft Excel spreadsheets and some are scripted computer programs written in Visual Basic or MATLAB. Post-processors organize certain raw outputs into more usable datasets (for example, the benefits post-processor "produces a national scale analysis of the impacts" of the standard being modeled, including emission reductions, monetized co-benefits, and safety impacts).[11]

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[10] EPA, OMEGA Model Documentation v.1.4.56 at 42, Doc. No. EPA-420-B-16-064 (July 2016).

[11] EPA, Regulatory Impact Analysis: Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards ("RIA"), at 4-110, Doc. No. EPA-420-R-12-016 (Aug. 2012).

12. Of the components of OMEGA described above, I am aware that EPA is withholding part (c), the core model. I am aware that EPA is claiming that this component is deliberative and exempt from release.

**Running the OMEGA Model**

13. To run the OMEGA model, a user gathers the necessary input data. This includes: the market data (a detailed breakdown of all the unique vehicle models on the market from a baseline current market fleet and projections into the near future), the technology data (the available emission-reduction technologies and their corresponding cost), the scenario data (the potential GHG emission limit for the auto industry to comply with), and other inputs (including fuel prices and other relevant, objective factors). Once that data is refined, the core model is ready to run.

14. An EPA flow chart describing the various stages is reproduced below,[12] followed by additional detail describing each stage. This flow chart is consistent with my experience collaborating with EPA staff and applying OMEGA.

[12] Draft TAR, Appendix C, Figure C1., at C-18.

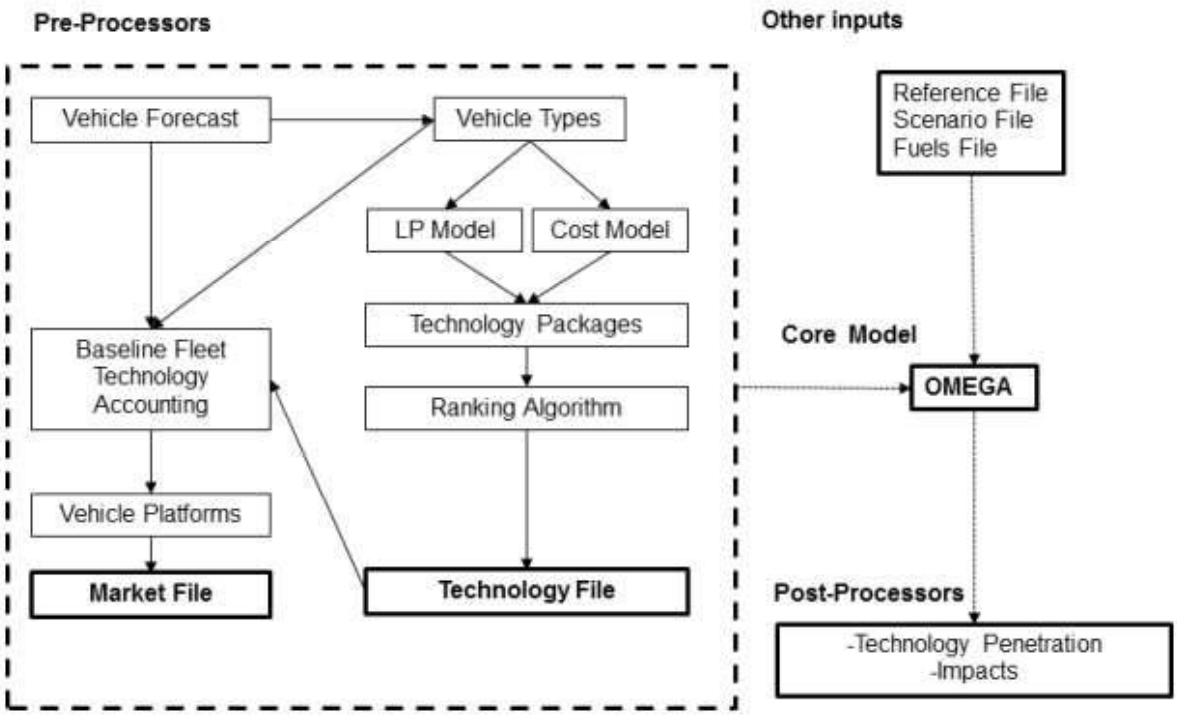


**Figure C.1 Information Flow in the OMEGA Model**

15. *Developing the market file:* The first set of input data is the market file, which provides a description of the vehicle fleet. This file includes several characteristics for each vehicle model: vehicle manufacturer; make and model; powertrain details; projected sales volume; carbon dioxide ($CO_2$) emissions; fuel type; vehicle footprint.[13] One of the pre-processors used to create the market file, the baseline fleet accounting pre-processor, accounts for emission-reduction technologies that vehicles are already equipped with, to avoid the model adding a technology to a vehicle where that technology is already in use.

16. *Developing the technology file:* The second category of input data is the technology file, which describes and ranks emission-reduction technologies available to manufacturers, as further detailed below.

[13] RIA at 3-6 (Aug. 2012); Draft TAR, Appendix C, at C-1.

17. EPA first assembles a portfolio of all vehicle GHG emission-reduction technologies and for each describes the associated cost, effectiveness, compliance credit value, and fuel consumption.

18. A long list of various emission-reduction technologies is compiled, including engine technologies, tires, transmission options, and hybrid and electric vehicle options.

19. Once the list is assembled, the technologies are grouped into technology packages (i.e., combinations of multiple technologies applied together) containing sets of attributes that an automaker could feasibly implement to reduce a vehicle's emissions, based on technical feasibility and their relative cost effectiveness.

20. *Running the OMEGA model:* Each "run" of the OMEGA model is a chain of many thousands of calculations, conducted by algorithms that are written into the source code. Using the input files, the model determines the specific emission standard applicable for each manufacturer and its vehicle class (car or truck). Then the model determines the emission standard applicable to each manufacturer's car and truck sales.[14] For each auto manufacturer, the model adds technology packages until that manufacturer meets the applicable standard. This process yields factual information: the cost to each auto manufacturer, per vehicle, to implement the technology needed to meet a given GHG emission standard.[15] That information is grouped into multiple data outputs, in the form of Microsoft Excel spreadsheet files.

21. *Applying post-processors:* Post-processors convert data outputs from the core OMEGA model into relevant datasets. In particular, the impacts post-processor calculates outcomes like the nationwide non-GHG emissions impacts and consumer fuel savings, based on

[14] RIA 3-27 (2012).
[15] See RIA 3-84 (2012).

the results of the core OMEGA model. The technology penetration post-processor calculates the deployment of different technologies across the fleet, again based on the results of the core OMEGA model.

22. Based on my experience with the development, use, and review of OMEGA, I would characterize it as an accounting tool that does not reflect or apply any policy preferences. The model source code and pre-processor files do not contain or reflect subjective policy judgments. Very few numeric values are hard-coded in the pre- and post- processors or the source code, as the model is meant to be built upon the input-file technology and cost data and the externally determined GHG-emission target.[16] The core model is designed to simply generate output files based on whichever GHG emission standards are set in the scenario input file. I understand that, in the context of the Freedom of Information Act request by the Environmental Defense Fund and the Natural Resources Defense Council and this litigation, EPA has claimed that the core model is exempt from release under the "deliberative process privilege." I do not agree with that assessment. The model is a computational tool—a type of specialized calculator—and thus is not the deliberation of any person at the agency. It is not appropriate for the agency to withhold the use, review, and sharing of an objective, world-class analytical tool.

**Public Use of the OMEGA Model**

23. Since EPA first created the OMEGA Model, EPA has consistently published updated versions of OMEGA. In my experience analyzing the GHG emission standards and tracking regulatory developments in this area, the agencies that have participated in rulemakings

[16] U.S. EPA, Model Documentation: EPA Optimization Model for Reducing Emissions of Greenhouse Gases from Automobiles (OMEGA), Core Model Version 1.4.56, EPA-420-B-16-064 (July 2016), *available at* https://www.epa.gov/regulations-emissions-vehicles-and-engines/optimization-model-reducing-emissions-greenhouse-gases.

have always published their models. This allows the public to understand the factual underpinnings for such determinations, review the models, and provide applicable feedback to the agencies. Such transparency brings confidence and improvement in the immediate modeling and also leads to modeling improvements in future iterations. It allows me, my colleagues at the ICCT, and other members of the scientific and public interest community to use the models themselves to assess the effects of alternative GHG emission standards for vehicles. By making our results from our own use of OMEGA public, we would be able to inform interested members of the public on our findings.

24. As EPA's website indicates, the Agency has regularly published the complete version of OMEGA—including the model inputs, pre-processors, model, and post-processors—which allows members of the public such as myself to run the model ourselves. Since 2010, EPA has released five different updates to the full model, including the original 2010 model and revised versions made in 2012 and again in 2016.

25. I understand that EPA has a complete, revised version of the OMEGA Model, designated version 1.4.59, but has not made this version public. Public interest in the updated OMEGA is particularly great because in August 2018, EPA and NHTSA issued a proposed rule for MY 2021-25 vehicles that would significantly alter the trajectory of the currently adopted GHG emission standards. The proposed rule presents only cost information developed through use of NHTSA's model, called the Volpe Model. The costs presented in the proposal are significantly higher than prior estimates by EPA and NHTSA. Disclosing only one of the two models was a stark departure from the agencies' past practice. This retraction from previous transparency practices gives me – and my colleagues at the ICCT and the broader scientific and public interest community – a lower degree of confidence in the results and provokes questions

about why the results in the Volpe modeling have so greatly departed from the previous rulemaking and joint Draft Technical Assessment Report.[17]

26. Because the current version of OMEGA is not public, my colleagues at ICCT and I are unable to use the model. ICCT staff, including co-authors of papers that I have contributed to, have previously used the OMEGA model to assess the GHG emission standards set by EPA, NHTSA, and CARB for light-duty vehicles.[18]

27. Based on information published in the current rulemaking docket, it appears that EPA staff ran the updated OMEGA model to estimate the impact of altering the MY 2021-2025 standards, and presented this estimate to the Office of Management and Budget.[19] I have reviewed the presentation that EPA staff made to OMB staff describing their modeling work, and this document is attached to my declaration as Exhibit B. In that presentation, the cost of achieving the existing GHG emission standards, as calculated by OMEGA, is dramatically lower than the cost calculated using NHTSA's Volpe model. Because cost is a consideration when EPA sets vehicle emission standards, this presentation suggests that replacing the Volpe calculation with the OMEGA calculation would substantially affect EPA's analysis of whether standards at various levels are appropriate and necessary. However, the latest version of the OMEGA model files were not released with the presentation. Without releasing the complete set

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[17] EPA published a Technical Assessment Report in 2016, known as the Draft TAR, as part of an evaluation of the MY 2022-2025 light-duty vehicle GHG emission standards.

[18] *See, e.g.*, Lutsey et al., *Efficiency Technology and Cost Assessment for U.S. 2025–2030 Light-Duty Vehicles*, ICCT (Mar. 2017), https://www.theicct.org/publications/US-2030-technology-cost-assessment

[19] *See* E.O. 12866 Review Materials for The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks NPRM, File: "Email 5" at 113 (posted Aug. 14, 2018). https://www.regulations.gov/document?D=EPA-HQ-OAR-2018-0283-0453.

of updated OMEGA files, the public is left to wonder why EPA's modeling results differ from the Volpe results, and what insights the OMEGA results could provide.

28. Because the OMEGA model is widely regarded as a state-of-the-art, objective tool, ICCT has used a modified version of OMEGA, tailored to other vehicle markets, to assess the technology and cost implications of GHG standards in other countries.[20]

29. The ICCT's OMEGA-based modeling has been used to help other countries consider GHG standards, including harmonizing to the U.S. standards. Because EPA has not published its latest OMEGA model, we would only be able to use the outdated version of the model in any similar assessment.

[20] Posada, F., et al., Assessing Canada's 2025 passenger vehicle greenhouse gas standards: Technology deployment and costs, ICCT (Sept. 12, 2018), https://www.theicct.org/publications/canada-2025-cafe-standards-techcost

30. Based on my experience researching vehicle technologies and government standards restricting vehicle pollution, it is normal and expected that EPA would publish the OMEGA model. EPA's historic practice of releasing the OMEGA model is aligned with other agencies that I have considered. NHTSA has published its associated analytical modeling for the associated, ongoing rulemaking.[21] CARB publishes its associated analytical details for its associated rulemakings.[22] Moreover, the core model of OMEGA is a technical computational tool that does not contain or reveal any agency deliberations. It is antithetical to that practice for EPA to decline to publish the model now.

I declare under penalty of perjury that the foregoing is true and correct.

Nicholas Lutsey

Dated April 5, 2019

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21 NHTSA, Compliance and Effects Modeling System: The Volpe Model, Downloads, https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system#compliance-and-effects-modeling-system-downloads (last visited Apr. 5, 2019).

22 California Air Resources Board, Advanced Clean Cars: AB1085 Background Materials (last updated Aug. 12, 2014), https://www.arb.ca.gov/msprog/clean_cars/clean_cars_ab1085/clean_cars_ab1085.htm.