

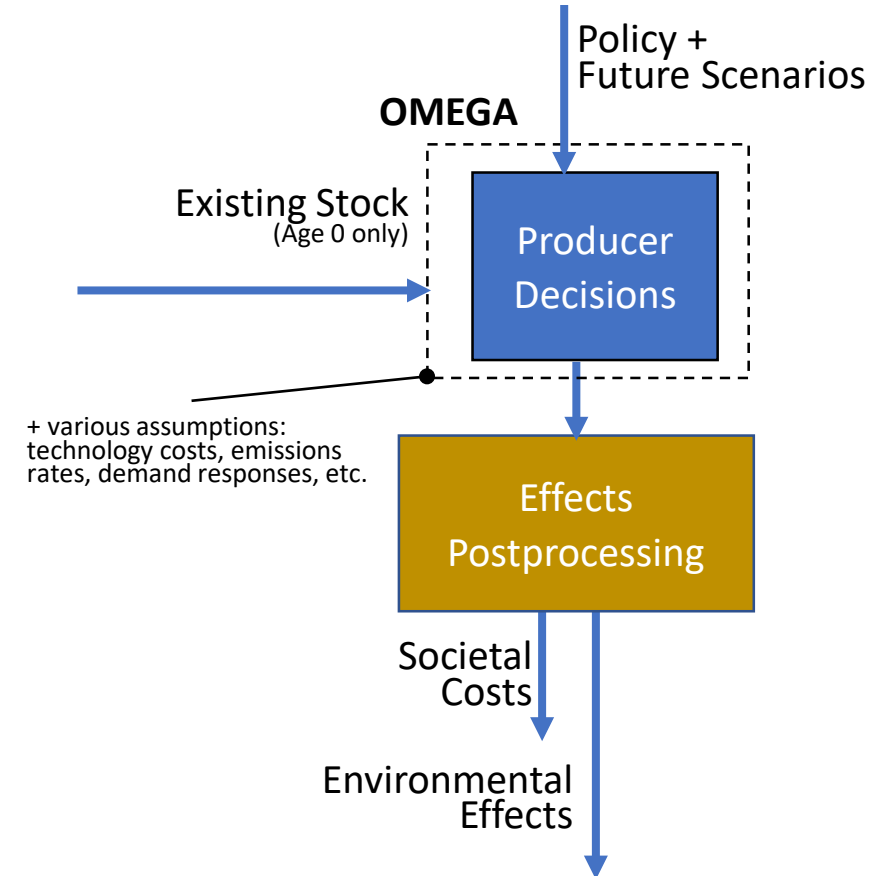
OMEGA Overview

EPA Presentation to NAS Phase 3 Light-duty Committee

June 16, 2020

What is OMEGA?

- A system of modeling tools for supporting analyses of GHG emissions-reducing policy alternatives
 - Preprocessing of inputs characterizing technologies and existing vehicle stock
 - Producer compliance decision logic
 - Postprocessing of effects
- Provides costs and benefits accounting of fleet average GHG standards
 - Total technology costs
 - Fuel costs
 - Emissions damages (criteria pollutants and GHG's)
 - + other societal costs and benefits



How has OMEGA been used previously?

- What have we used it for?
 - 2010 LD GHG NPRM/FRM
 - 2010 Interim Joint TAR analysis of potential 2017-2025 GHG standards alternatives
 - 2012 LD GHG NPRM/FRM
 - 2016 Draft TAR
 - 2016 Proposed Determination
- OMEGA's producer decision modeling has been used to generate cost-minimizing compliance pathways for each manufacturer
 - Evaluate the relative cost and effectiveness of available technology packages and apply them to a defined fleet to meet a footprint-based fleet emissions standard
 - Determine achieved GHG level by regulatory class and manufacturer, assuming fleet averaging and unlimited car-truck transfers within each company
 - Future years modeled independently using approx. 5 year time steps with interpolation between

Rethinking OMEGA for the future

- The state of the world is changing; there is a growing diversity of options within the light-duty sector...
 - *Expanded focus beyond traditional model of privately owned cars and trucks*
 - Potential changes in mobility demand and new mobility services, including the use of LDVs for delivery services, shared and autonomous fleets, and micro-mobility
 - *Expanded focus beyond ICE vehicles*
 - EV technology and markets have evolved significantly since initial OMEGA development, and will likely continue to evolve
- In the more than 10 years since OMEGA was first created, our model design capabilities and available tools have expanded
 - Greater availability of open source license coding software (E.g. Data handling tools like Python's Pandas)
 - Vehicle simulation capacity has increased since 2010
 - Adoption of Response Surface modeling of technologies^{*1}
 - Enabled vehicle-level characterization of existing stock^{*2}
 - Capability to run 100,000's of vehicle simulations
 - Feedback from stakeholders and learnings over time

^{*1} Moskalik, A., Bolon, K., Newman, K., and Cherry, J. (2018) "Representing GHG Reduction Technologies in the Future Fleet with Full Vehicle Simulation," SAE Technical Paper 2018-01-1273, doi:10.4271/2018-01-1273.

^{*2} Kevin Bolon, Andrew Moskalik, Kevin Newman, Aaron Hula, Anthony Nearn, Brandon Mikkelsen, "Characterization of GHG Reduction Technologies in the Existing Fleet," SAE Technical Paper 2018-01-1268, 2018, doi:10.4271/2018-01-1268.

Sample of feedback and suggested frameworks

- 2015 NAS Report, “Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicles”
(emphasis added)
 - Recommendation 10.1 “Economic-engineering models of manufacturer decision making that take into *account costs and consumer responses* should also be developed as part of the assessment of the rule.”
 - Recommendation 10.7 “... consider how to develop a reference case for the analysis of societal costs and benefits that includes accounting for the potential opportunity costs of the standards in terms of alternative vehicle attributes forgone.”
 - Recommendation 10.10 “... study more thoroughly *consumer and manufacturer behavior in response to the rule*. The uncertainty of choices consumers and manufacturers make in response to the standards may be greater than the uncertainty related to efficiencies and costs of the technologies.”

Sample of feedback and suggested frameworks

- Bento et al., 2018 Science, Volume 362 Issue 6419
(emphasis added)
 - “a benefit-cost analysis for fuel economy standards grounded on basic economic principles must consider the behavior of *consumers and automakers...*”
 - “it must consider a range of parameter values and assumptions to *account for inherent uncertainty...*”
 - “a comprehensive analysis would allow automakers to comply with standards by adjusting vehicle prices, improving fuel economy, and altering performance and other vehicle attributes”
 - “would also recognize that technology is *determined by automaker investments*, while accounting for *learning-by-doing and knowledge spillovers* that, over time, may lower the compliance costs”
 - “Modeling of the interaction between new and used vehicle markets is critical to determine the resulting size of the total fleet and its composition”
 - “Prices, fuel economy, and other attributes determine the total cost of ownership, which affects total vehicle miles traveled (VMT), as well as willingness to pay for vehicle”
 - “A comprehensive protocol should also consider costs and benefits that arise from ‘external effects,’ including GHG emissions, energy security, local air pollution, safety, and traffic congestion, which are affected by fleet size and its composition and the total number of miles driven.”

OMEGA Future Vision: Guiding principles

An open source compliance and effects modeling tool that is transparent and user-friendly, and has the flexibility to evaluate a broad range of transportation policy, technology and market scenarios.

Transparent

Stakeholders should be able to inspect the model and assumptions used, and explore the impact of using different assumptions.

User-friendly

Stakeholders should be able to revise the assumptions and generate results without unusual computing capability, extensive training, or restrictive licensing.

Forward-looking

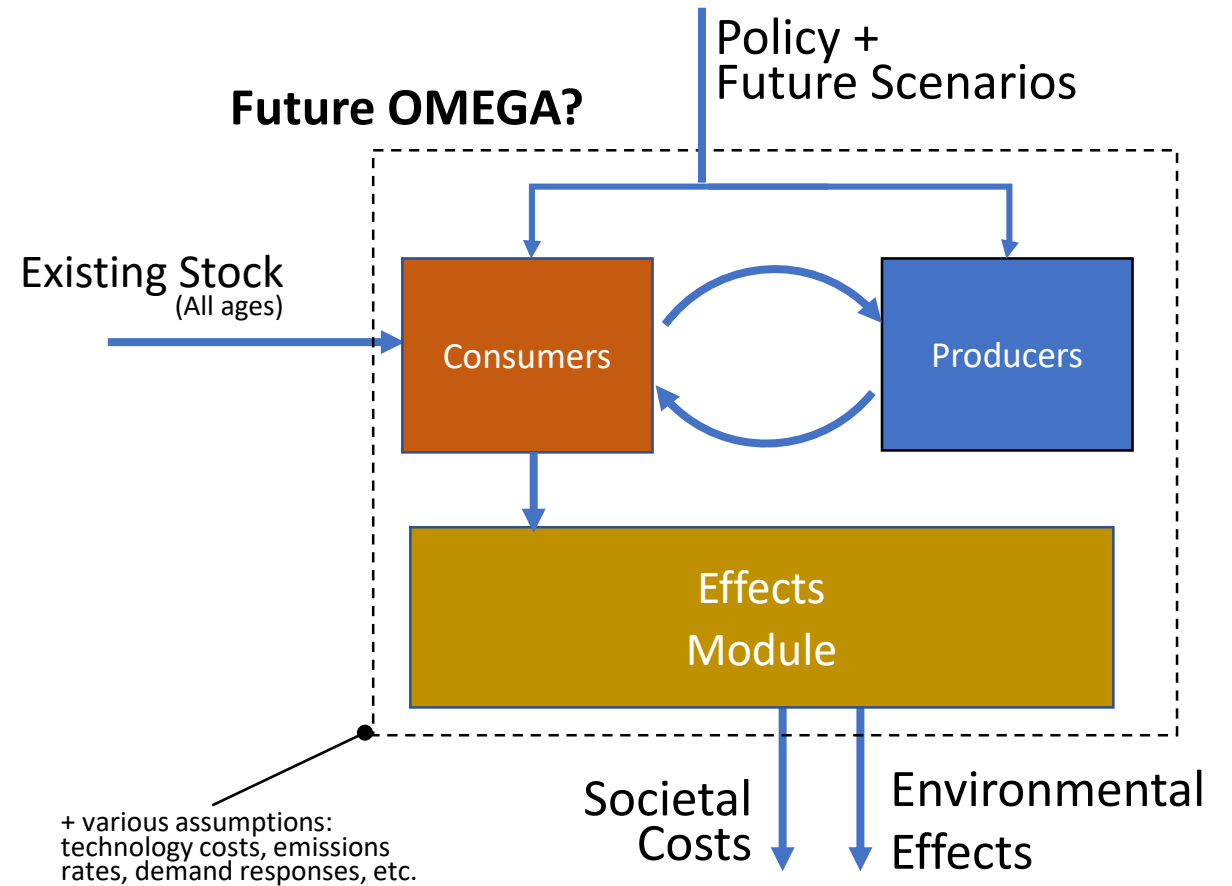
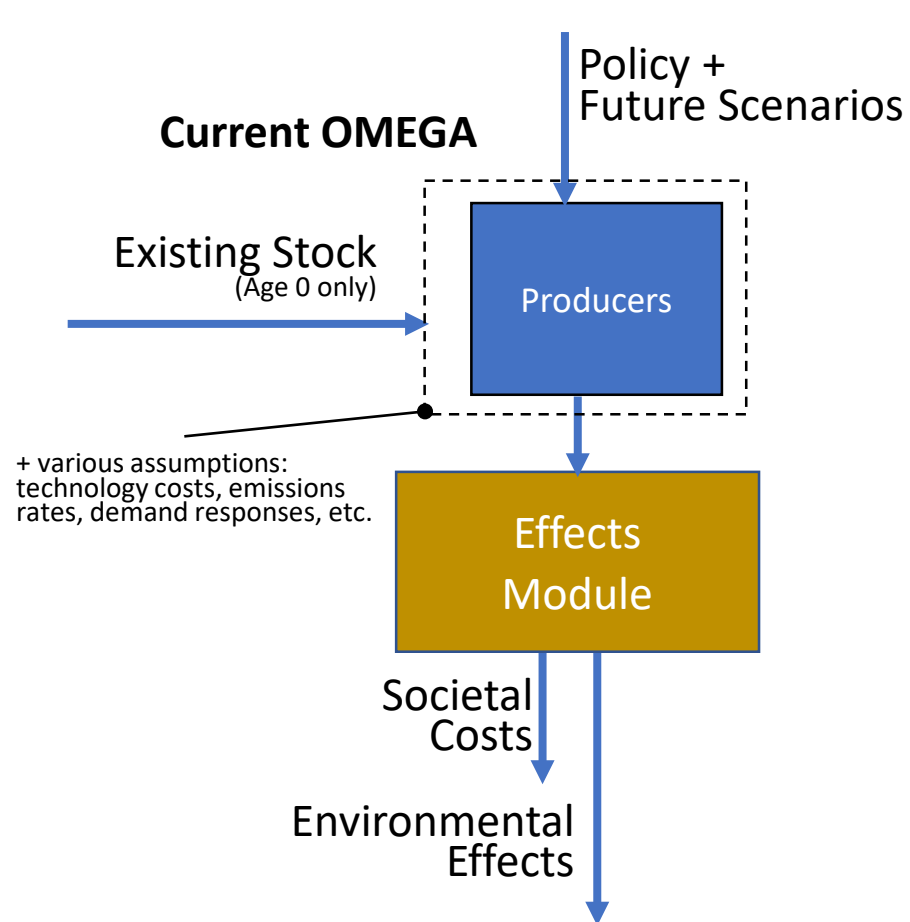
The model should be able to consider points sufficiently far into the future to cover the decision making time horizon of individual and firm decisions makers.*

Flexible

The model should be adaptable for evaluating different policy structures, different technology and fleet assumptions, and different representations of market response.

* Individual decisions include vehicle purchase, holding, and use decisions. Firm decisions include vehicle design and development, and research, investment, and capital equipment lifetimes.

What might a future OMEGA look like?



What might a future OMEGA look like?

- ① Expanded boundaries to include pre- and post-processing steps?
- ② Addition of consumer response component?
 - Allow different consumer responses to EVs and ICEs?
 - Model the stock of vehicles and their use over time based on the overall demand for mobility?
- ③ Model strategic producer decisions over the entire analysis period?
- ④ Addition of consumer-producer decision feedback loop?

