8. Vehicle Analysis

The Vehicle Technologies Office (VTO) has a comprehensive portfolio of early-stage research to enable industry to accelerate the development and widespread use of a variety of promising sustainable transportation technologies. The research pathways focus on fuel diversification, vehicle efficiency, energy storage, and mobility energy productivity that can improve the overall energy efficiency and efficacy of the transportation or mobility system. VTO leverages the unique capabilities and world-class expertise of the National Laboratory system to develop innovations in electrification, including advanced battery technologies; advanced combustion engines and fuels, including co-optimized systems; advanced materials for lighter-weight vehicle structures; and energy efficient mobility systems. VTO is uniquely positioned to address early-stage challenges due to strategic public-private research partnerships with industry (e.g., U.S. DRIVE, 21st Century Truck Partnership) that leverage relevant expertise. These partnerships prevent duplication of effort, focus DOE research on critical R&D barriers, and accelerate progress. VTO focuses on research that industry does not have the technical capability to undertake on its own, usually due to a high degree of scientific or technical uncertainty, or that is too far from market realization to merit industry resources.

The Analysis (VAN) subprogram provides critical information and analyses to prioritize and inform VTO research portfolio planning through technology-, economic-, and interdisciplinary-based analysis, including target-setting and program benefits estimation. The VAN subprogram supports vehicle data, modeling and simulation, and integrated and applied analysis activities using the unique capabilities, analytical tools, and expertise resident in the National Laboratories. Trusted and public data are critical to VTO efforts and are an integral part of transportation and vehicle modeling and simulation. In addition, VAN supports the creation, maintenance, and utilization of vehicle and system models to explore energy impacts of new technologies relevant to the VTO portfolio. The VAN subprogram also supports integrated and applied analyses that bring together useful findings and analysis of the energy impacts of transportation systems through the integration of multiple models including vehicle simulation and energy accounting of the entire transportation system. The result creates holistic views of the transportation system, including the opportunities and benefits that advanced vehicle technologies create by strengthening national security, increasing reliability, and reducing costs for consumers and businesses. Overall, VAN activities explore energy-specific advancements in vehicles and transportation systems to inform VTO's early-stage research and offer analytical direction for potential and future research investments.

Project Feedback

In this merit review activity, each reviewer was asked to respond to a series of questions, involving multiple-choice responses, expository responses where text comments were requested, and numeric score responses (*on a scale of 1.0 to 4.0).* In the pages that follow, the reviewer responses to each question for each project will be summarized: the multiple choice and numeric score questions will be presented in graph form for each project, and the expository text responses will be summarized in paragraph form for each question. A table presenting the average numeric score for each question for each project is presented below.

Table 81 – Project Feedback

Presentation ID	Presentation Title	Principal Investigator (Organization)	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
van016	Transportation Data Program	Stacy Davis (ORNL)	8-3	3.67	3.50	3.50	3.11	**3.49**
van017	ANL VTO Analysis Modeling Program	Michael Wang (ANL)	8-10	3.45	3.60	3.50	3.30	**3.51**
van018	Light-Duty Vehicle Choice Modeling and Benefits Analysis	Aaron Brooker (ANL/NREL)	8-17	3.35	3.25	3.20	3.25	**3.27**
van023	Assessing Energy and Cost Impact of Advanced Vehicle Technologies	Aymeric Rousseau (ANL)	8-24	3.45	3.40	3.45	3.30	**3.41**
van032	Tracking the Evolution of Electric Vehicles and New Mobility Technology	Joann Zhou (ANL)	8-31	3.45	3.45	3.10	3.25	**3.38**
van033	Transportation Macroeconomic Accounting Models: VISION and Non-Light Duty Energy and Greenhouse Gas (GHG) Emissions Accounting Tool (NEAT)	Joann Zhou (ANL)	8-38	3.40	3.40	3.30	3.25	**3.37**
Overall Average				**3.46**	**3.43**	**3.34**	**3.25**	**3.40**

Presentation Number: van016
Presentation Title: Transportation Data Program
Principal Investigator: Stacy Davis (Oak Ridge National Laboratory)

Presenter

Stacy Davis, Oak Ridge National Laboratory

Reviewer Sample Size

A total of nine reviewers evaluated this project.

Project Relevance and Resources

100% of reviewers indicated that the project was relevant to current DOE objectives, 0% of reviewers indicated that the project was not relevant, and 0% of reviewers did not indicate an answer. 89% of reviewers indicated that the resources were sufficient, 11% of reviewers indicated that the resources were insufficient, 0% of reviewers indicated that the resources were excessive, and 0% of reviewers did not indicate an answer.

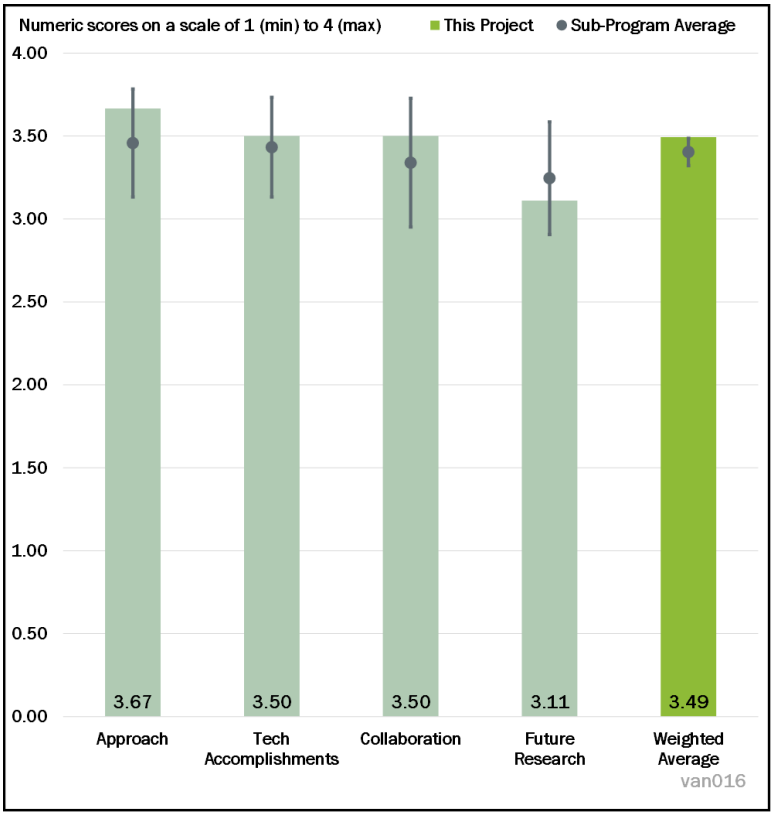

Figure 8-1 - Presentation Number: van016 Presentation Title: Transportation Data Program Principal Investigator: Stacy Davis (Oak Ridge National Laboratory)

Question 1: Approach to performing the work—the degree to which technical barriers are addressed, the project is well-designed and well-planned.

Reviewer 1:
This work clearly addresses a key technical barrier to all work supporting advanced transportation technology research, design, and development (RD&D), availability of, and ease of access to quality transportation data.

The project also specifically lists and addresses barriers from the most recent VTO Multi-Year Program Plan (2011-2015). Its approach addresses Section 2.6 Outreach, Deployment, and Analysis A, B, & C, which discusses the availability of alternative fuel vehicle (AFV) infrastructure, make and model availability, and consumer willingness to purchase an AFV, because it produces and maintains a database of the foundational knowledge required to understand progress on these metrics. It supports Section 3.2 Program Analysis in a similar fashion—by providing the data inputs needed to analyze and model both traditional and advanced vehicle technologies. It provides more targeted outreach for the Vehicle Technologies Office (VTO) through Facts of the Week.

The project approach to overcoming these barriers is well designed and has clear goals—produce the Transportation Energy Data Book (TEDB) annually including interim updates, produce Facts of the Week, and produce special topic reports based on VTO needs. It is entirely feasible, considering it has been completed similarly for multiple decades.

Reviewer 2:
The reviewer observed a thorough approach that reflects the needs of stakeholders and subscribers.

Reviewer 3:
The current approach taken by the investigators is probably most practical and effective given the many challenges associated with collecting and validating data.

Reviewer 4:
The reviewer noted that the Oak Ridge National Laboratory (ORNL) Principal Investigator (PI) continues to successfully address technical barriers and manage the project well.

Reviewer 5:
The reviewer described the project as one of the only transportation-related data resources that compiles information from multiple different sources and is critical for industry and researchers. The reviewer commented the amount of work that goes into this project could be leveraged to gain access to data that is typically inaccessible or of lower quality (e.g., Vehicle Inventory and Use Survey [VIUS] data that was discontinued as of 2002).

Reviewer 6:
Data are the foundation of all research and this project is one of the most critical elements in VTO sponsored research because of its wide-reaching benefits.

Reviewer 7:
TEDB provides several tables and figures to researchers, academics, and investigators, which makes modeling and analysis easier, and combines data from several national agencies and sources. A robust, automatic approach to update these databases would help with more frequent data availability (e.g., each month instead of twice per year). The project is well-established and designed, as demonstrated by the number of citations and the number of people interested in the Fact of the Week (FOTW).

Reviewer 8:
The reviewer mentioned that the technical data collected and compiled is available in multiple formats (e.g., PDF, Excel) and has been widely used to support broader VTO research activities. Some efforts could be made to speed the data collection process through automation and confirmation, and those opportunities should be explored. Reliance on other, private sources of data could be a longer-term threat, both in terms of potential future costs, but especially if the data use becomes more restricted. Longer term strategies could look at partnering with other Federal agencies (Environmental Protection Agency [EPA], National Highway Traffic Safety Administration [NHTSA]), which require manufacturers to report vehicle attribute, sales, and production data as a means of avoiding limitations from privately sourced data (*https://www.epa.gov/automotive-trends/download-automotive-trends-report*).

Reviewer 9:
The reviewer indicated that this program is doing a good and important job, but hoped that there would be some effort to gain more local data going forward. National data is helpful, but state and other sub-national data can vary greatly, especially when it comes to emerging technologies. While this is obviously not feasible for all data, it could be useful for newer, emerging technologies such as electric vehicles (EV) or charging infrastructure.

Given the potential broader impact the data book has with its wide distribution, the reviewer suggested it would be worth spending some time with a data visualization expert to improve most of the charts. Some are terrible, and many are poor. Poor visualizations can be uninformative and potentially misleading (the pie chart on Slide 5, for example). This is not a trivial point because charts are regularly used by the highest decision makers as quick summaries of complex data. It is well worth investing in good design because this entire program is about making data and insights available to modelers and decision makers. Data visualizations translate raw data into insights, and good visualizations can have dramatic impacts on decisions and actions.

Question 2: Technical Accomplishments and Progress toward overall project goals—the degree to which progress has been made and plan is on schedule.

Reviewer 1:
The reviewer noted the project has met its first three milestones and is on track to meet the remaining two based on the facts below.

Facts of the Week have been published each week since the project's inception.

The draft report on transportation energy including and excluding upstream energy was submitted to VTO.

Edition 38.1 of the TEDB has been published.

Key indicators of TEDB visibility and usage, including over 3,000 Google Scholar citations, suggest the product continues to be valuable for a global range of transportation analysts. Similarly, Facts of the Week continue to maintain a large subscriber list greater than 25,000. New TEDB tables and continued updates to the TEDB website and interface to help users find data more quickly add value.

Reviewer 2:
The reviewer observed data sources are updated consistently and frequently, as are outreach emails through the FOTW program.

Reviewer 3:
The project has consistently provided the data service that it was set to provide, and its performance is excellent based on the number of researchers that are utilizing this database (citations and visitors of the VTO website through the FOTW service).

Reviewer 4:
The reviewer acknowledged transit and shared mobility data will be crucial as the transportation system evolves. The reviewer mentioned the project would be bolstered if TEDB were able to summarize shared mobility data that are typically off limits to the general public.

Reviewer 5:
The reviewer appreciated the drive to expand the TDB to include new areas such as transit and shared mobility. The team is encouraged to continue reaching out and being at the leading edge of providing relevant data on new transportation trends to the transportation industry, DOE, and stakeholders. The reviewer suggested continued interest in emerging light-, medium-, and heavy-duty (HD) technologies, on-highway in particular, as new technology deployment in these areas continues to accelerate.

Reviewer 6:
Progress to date is impressive and the data are very beneficial to other programs and the public. It would be great if the TEDB can include more data of recent years. For example, many of the tables only cover data up to 2017, which have almost three years' lag.

However, the reviewer fully acknowledges that this is very challenging and sometimes beyond the control of the investigators because data sources may simply not be available. The reviewer mentioned that more up-to-date data are highly desirable and encouraged the investigators to include as many as possible.

Reviewer 7:
The PI has made measurable progress against performance indicators by successfully issuing FOTW at the expected cadence and publishing updates to the data book as defined in the project plan. However, benchmarking is needed. Slide 11, in particular ("Page Views, Downloads, Citations"), should be benchmarked against other notable government data compilations (e.g. EIA or DOT data resources).

Additionally, only showing data for the performance period is insufficient to evaluate current performance. The reviewer suggested adding comparison data from at least two to three years prior.

In future evaluations, the reviewer suggested the Slide 16 metric ("As of April 2020, there were greater than 25,100 subscribers to the FOTW email distribution each Monday") should be broken out further to include the email open rate. The reviewer recognized the PI's comment that click through rate is not a helpful metric because sufficient information is included in the email.

Reviewer 8:
The project deliverables are on time and within budget.

Reviewer 9:
The reviewer referenced prior comments.

Question 3: Collaboration and Coordination Across Project Team.

Reviewer 1:
The project referred to many other external collaborators and was also acknowledged in many of the other presentations. Tracking the number of projects collaborated on each fiscal year (FY) would probably help to accurately allocate staff resources, as the reviewer is sure these collaborations can vary in the amount of time required to ensure the data is being used correctly.

Reviewer 2:
Project partners include Argonne National Laboratory (ANL) and 6National Renewable Energy Laboratory (NREL), both of which appear to be regularly engaged and an integral part of both FOTW and TEDB processes.

The reviewer highlighted other notable collaborations with private and public entities that provide data for the TEDB (highly valuable network of contacts); other National Laboratories on the total cost of ownership (TCO) team; and other National Laboratories on publishing public-facing summaries of work as FOTW (and to update the TEDB).

Reviewer 3:
It would be useful to consider expanding collaborations beyond National Laboratories by identifying the most frequent data sources cited in the TEDB and engaging them in the data processing process. Coordination across National Laboratories at the moment seems seamless, even though the data connections and exchanges need to be clear.

Reviewer 4:
The project team demonstrated good collaboration with stakeholders and the subscribers to the TDB. The FOTW seems to be an excellent tool for stimulating and facilitating interaction.

Reviewer 5:
The reviewer observed very good collaboration with other DOE laboratories and projects. The data compiled are also widely used by DOE as well as the public.

Reviewer 6:
The ORNL PI coordinates well with key core teams, including the primary audience of the VTO as well as other key laboratories such as NREL (for the Alternative Fuels Data Center [AFDC]) and ANL (for EV market data).

Reviewer 7:
Producing the data book invariably requires seamless collaboration across multiple partners.

Reviewer 8:
The data collection process requires collaboration with public and private entities.

Reviewer 9:
The reviewer indicated no comments.

Question 4: Proposed Future Research—the degree to which the project has effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology and, when sensible, mitigating risk by providing alternate development pathways. Note: if the project has ended, please state project ended.

Reviewer 1:
The reviewer thinks that the existing strategies will probably continue to be effective in the short term, although there are longer term threats to some of the data availability from private entities.

Reviewer 2:
The work is inherently a continuous effort. The TEDB database needs updating and the FOTW needs publishing. Future work entails continuing to complete these tasks, or the TEDB will go out of date and the FOTW will disappear. It might be helpful for the TEDB team to consider what other additional future value could be added to the process. (perhaps automation of data collection for the TEDB).

Reviewer 3:
The reviewer referenced prior comments about extending to state or non-national data.

Reviewer 4:
The proposed future research is tied to the continuation of the TEDB data collection, processing, and distribution. It would be useful to consider the next steps in this effort, including potentially the following:

- Offering the data in other formats, such as shapefiles, structured query language (SQL) relational databases, etc.
- Collecting and providing state level data.
- Automating the process (to the extent that this is possible, recognizing that agencies need to have consistent data handling).
- Formally collecting data feedback from users via surveys and documenting evolving needs.

Reviewer 5:
Future work demonstrates that TDB is responsive to needs of the user community. The reviewer suggests a more proactive approach to expanding the scope of data being gathered and reported. The reviewer recognizes that the mission is driven by the users, but the team may want to consider further stimulating the input. This may be happening anyways and is just not obvious to the reviewer.

Reviewer 6:
Please keep on the good work of maintaining and updating the TEDB and FOTW. The inclusion of transit and shared mobility is a good addition. The reviewer wondered if relevant content related to autonomous vehicles (AVs) and advanced mobility should be included in future publication, if the budget allows.

Reviewer 7:
Proposed future research appears to be the status quo. In the future, please use this section of the AMR presentation to highlight emerging topics that the data book could cover if funding is available based on requests from the stakeholders or insights from the PI.

Reviewer 8:
The future research plan appears to be logical.

Reviewer 9:
The reviewer needs more detail on the types of additional topics that will be covered moving forward.

Question 5: Relevance—Does this project support the overall DOE objectives? Why or why not?

Reviewer 1:
The TEDB includes a number of datasets that provide a fundamental understanding of both the baseline and potential scenarios for national security, economic growth, affordability, and resilience of United States (U.S.) transportation systems, helping to fulfill one of the VTO Analysis Program's three broad objectives, creating and maintaining a strong foundation of data. The FOTW effort particularly focuses on spreading data driven conclusions on how DOE VTO is accomplishing its objectives.

Reviewer 2:
The project is very well aligned with VTO objectives, providing access to a consistent set of transportation energy data to researchers and the public.

Reviewer 3:
The Transportation Data Program seems well in tune with maintaining relevance to the user community and VTO.

Reviewer 4:
High quality data are the foundation of all other DOE research and projects. This is very important and highly relevant work.

Reviewer 5:
This project lays the foundation of the VTO Analysis portfolio pyramid structure. ORNL does an excellent job of keeping this foundation strong year after year. The reviewer stated the project team should consider adding a pop-up question on the DOE FOTW website to provide readers a direct opportunity to share what FOTW should be shown in the future.

Reviewer 6:
Data are the cornerstone of research and decision making in the transportation space. TEDB is one of the only comprehensive resources the community can access.

Reviewer 7:
The high adoption levels of the deliverables speak to its relevance.

Reviewer 8:
The project team provides supporting data that would have to be sourced independently for other VTO research. activities.

Reviewer 9:
The reviewer indicated no comments.

Question 6: Resources—How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

Reviewer 1:
This reviewer indicated sufficient/excessive and explained that the budget is a bit higher than some of the other model development projects. It is not clear how much of the project budget is devoted to staff time to compile these outputs, staff time to serve as a liaison on other VTO projects, and access to private data sources.

Reviewer 2:
The PI has been doing this for decades and has a strong grasp of the complex web of connections needed to pull together such a large data effort.

Reviewer 3:
The team has an established approach in place and sufficient resources to achieve the milestones set in the expected timeline.

Reviewer 4:
It looks like data collection is getting more and more difficult because government agencies are discontinuing some programs and private companies are increasing price tags and data use restrictions. From this perspective, additional resources will be very beneficial. The reviewer suggested that DOE helps investigators address such challenges via an additional budget, as well as other innovative ways (e.g., partnership with private companies so that data can be shared at a relatively lower cost).

Reviewer 5:
Resources appear sufficient for the PI to meet stated milestones in a timely fashion.

Reviewer 6:
Funds seem sufficient to cover multiple updates to the TEDB and to continue with the FOTW efforts.

Reviewer 7:
The resources are sufficient.

Reviewer 8:
The reviewer offered no further comments.

Reviewer 9:
No further comment was indicated by this reviewer.

Presentation Number: van017
Presentation Title: ANL VTO Analysis Modeling Program
Principal Investigator: Michael Wang (Argonne National Laboratory)

Presenter

Michael Wang, Argonne National Laboratory

Reviewer Sample Size

A total of ten reviewers evaluated this project.

Project Relevance and Resources

100% of reviewers indicated that the project was relevant to current DOE objectives, 0% of reviewers indicated that the project was not relevant, and 0% of reviewers did not indicate an answer. 90% of reviewers indicated that the resources were sufficient, 10% of reviewers indicated that the resources were insufficient, 0% of reviewers indicated that the resources were excessive, and 0% of reviewers did not indicate an answer.

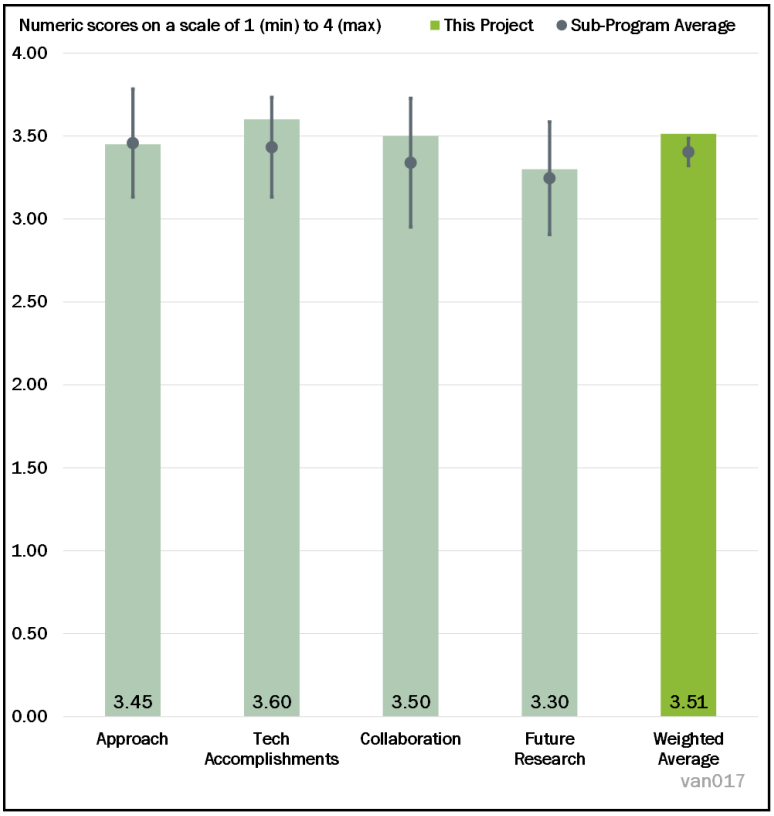

Figure 8-2 - Presentation Number: van017 Presentation Title: ANL VTO Analysis Modeling Program Principal Investigator: Michael Wang (Argonne National Laboratory)

Question 1: Approach to performing the work—the degree to which technical barriers are addressed, the project is well-designed and well-planned.

Reviewer 1:

Continuously updating the Greenhouse gas, Regulated Emissions, and Energy use in Transportation (GREET®) models with the latest information and providing transparent updates, improvements, and assumptions is an excellent approach to help users evaluate energy and environmental impacts of vehicle and fuel systems. While the general approaches described for each of the current tasks are reasonable, the challenge acknowledged in the presentation that there is a "Need to address technology improvements and market changes as time progresses so that the effects can be reflected in GREET® benefits assessment" is especially important for emerging technologies and changing pathways. For Task 1, consider evaluating year to year variability of energy flows as well as time of day differences.

Reviewer 2:

The switch to a consumption-based electricity model is a step towards more accurately modeling overall greenhouse gas (GHG) emissions from electricity use. Collaborations with industry partners are helpful to incorporate relevant future technologies and flows of key materials [e.g., aluminum (Al), steel]

Reviewer 3:

Technical barriers include how to evaluate environmental sustainability; how to evaluate energy and emission benefits of vehicle/fuel systems; and overcoming inconsistent data, assumptions, and guidelines. The first two are explored in the project objectives; specifically, by expanding the analysis envelope to include key impactors like higher resolution electricity grid operations, automotive material supply chain flows, and emerging mobility options. It is unclear how the third barrier is addressed because it is not discussed. Slide 3

lists "developing transparent models," but exposing the data, assumptions, and guidelines to the public is not necessarily overcoming inconsistencies. It is, perhaps, one step toward evaluating inconsistencies. What inconsistencies were overcome, and how?

It would be helpful if the presentation clearly described how the current work overcame each barrier. Slide 3 may have been an attempt but it is not convincing. The project addresses the barriers implicitly, but the presentation should clearly and explicitly explain how. Slide 19 presents a separate list of challenges and barriers that include some of the quad chart barriers and some others.

That said, the project has decently well-defined objectives, including modeling electricity generation and inter-plant/end-use emissions flow; evaluating the automotive steel and Al supply chain; and evaluating GHGs for emerging mobility. The approaches are all well designed and are "right-sized" to accommodate the level of uncertainty in data inputs. In particular, selecting a parametric investigation for objective three is more reasonable than assuming constant values for all parameters.

Reviewer 4:
The reviewer understood the need for these analyses and large modeling frameworks such as GREET®, but there is also quite a lot of disagreement and uncertainty in how certain metrics for life cycle assessment (LCA) should be accounted for. LCA is not an area of expertise for the reviewer, but the reviewer has read enough LCA studies to know about some of the disagreements. For example, many LCA studies about EVs get different results in charging emissions depending on whether the analyst uses average emissions factors versus marginal emissions factors. EVs charging on coal at night, for example, may have a larger emissions contribution compared to the calculation using average emissions in the region. It is unclear what the right choices are, in general, as choices tend to be content- and project-specific. The reviewer recommended providing some greater guidance for how to use these models and understand the assumptions associated with them, and that this should be part of a "user manual" that discusses what assumptions and settings people should consider depending on which type of analysis is being done.

Reviewer 5:
The presentation was focused on the objectives and the outcomes of the project which were clearly articulated with respect to consumption-based emissions and AV GHG emissions. The methodology was not adequately described to enable the reviewer to evaluate the progress made. As an example, it was not clear how GREET® LCA was enhanced to meet the project goals. More details on the derivation process of the consumption-based electricity mixes could have been provided.

Reviewer 6:
This reviewer noted the mission of providing a robust model in GREET® that is relevant and usable by the community. The reviewer would like to know more about how GREET® compares with other LCA models that are commonly used in government and industry, although this may be well outside of the project mission.

Reviewer 7:
The project team used good approaches, such as building on the GREET® model, creating a detailed data analysis, and collaborating with other DOE laboratories, U.S. Driving Research Innovation for Vehicle efficiency and Energy sustainability (U.S. DRIVE), and other industrial associations.

Reviewer 8:
The PI's approach to performing the work is excellent. The project is comprehensive and moves GREET® modeling forward by adding important expansion components.

Reviewer 9:
The team makes good use of existing models to evaluate grid and materials impacts on LCA for vehicles.

Reviewer 10:
GREET® is one of the most widely used tools in transportation energy. The approach is well established and grounded in the realities in policy making.

Question 2: Technical Accomplishments and Progress toward overall project goals—the degree to which progress has been made and plan is on schedule.

Reviewer 1:
The task-specific accomplishments for improving, expanding, and updating the GREET® models' evaluation of grid emissions, Al and steel flow, and cradle-to-grave (C2G) GHG emissions of emerging mobility options with connectivity and automation, all appear to be progressing successfully. As noted in the objectives section, it will be important to continue to assess changes to these areas over time and to incorporate additional detail when it is available.

Reviewer 2:
The project has hit major milestones with respect to updating data and model inputs, and annual model updates seem on track.

Reviewer 3:
The project has made substantial progress toward meeting its objectives, as shown in the milestone chart and as validated in the remaining slides. The data for electricity grid and emissions flow has been collected and analysis has been started (some results presented). Al and steel flow data and qualitative information have been collected. The AV LCA also appears to be complete and its report has been delivered to VTO.

Reviewer 4:
The accomplishments were clearly defined and presented in the maps that demonstrated differences between generation- and consumption-based electricity GHG intensities. Specific California GHG intensity examples are given as well as the emission flows across the United States. The technical accomplishments tied to AV technology emission estimates should be clear with respect to assumptions of AV operations (universal adoption or hybrid connectivity automation and a certain share of regularly driven vehicles?). The sensitivity analysis was helpful to uncover important parameters in GHG emission intensity estimation.

Reviewer 5:
The reviewer appreciated the two versions or approaches in the fuel cycle analysis and the vehicle cycle analysis supporting the C2G analysis.

Reviewer 6:
The consumption-based electricity mix work is very insightful and can help clarify many questions and debates. The reviewer suggested that the results be published as soon as possible. The U.S. automotive steel and Al work is also beneficial, but the reviewer inquired about its application and use in the GREET® model for future LCA: how those components imported to the United States should be addressed; whether trade policies will significantly affect future Al and steel flow; and if yes, how that will change model results.

Reviewer 7:
The PIs have made excellent progress within the first year of work. Future barriers to data accessibility should be targeted and new partnerships may need to be formed in order to get needed data inputs.

Reviewer 8:
Consumption-based emissions estimates will be critical to understanding the real-world sustainability impact of a given vehicle. Additionally, modeling emerging mobility options will help understand what the energy impacts of these technologies will be in the future.

Reviewer 9:
The results comparing generation-based and consumption-based electricity emissions are illuminating.

Reviewer 10:
The reviewer referenced prior comments.

Question 3: Collaboration and Coordination Across Project Team.

Reviewer 1:
Collaboration with other experts is extremely important for a comprehensive model, such as GREET®. Please continue to collaborate with other institutions and users to thoroughly review the assumptions and validate the results of the models.

Reviewer 2:
The project has a number of different partners to address specific topics [e.g., U.S. DRIVE for vehicle automation, Environmental Impact Assessment (EIA) and EPA for emissions, industry associations for Al and steel]. The reviewer argued some incorporation of behavioral factors would be interesting to include in the emissions modeling. Many other groups and National Laboratories have looked at when most EV owners charge vehicles and incorporating that data could be have an impact on emissions, even if the emissions estimates are aggregated over a yearly or quarterly timescale.

Reviewer 3:
The project team appears to have collaborated with key relevant stakeholders, particularly U.S. DRIVE [e.g., original equipment manufacturers (OEMs)] for the AV research, EIA and EPA for the electricity grid research, and the University of Michigan and Al and steel industry groups for the supply chain research. It may be valuable to add other stakeholders to the AV research work, such as an AV development company (e.g., Cruise, Argo AI, Zoox, etc.) or TNCs (e.g., Uber, Lyft) to get a better grasp of how a robot-taxi fleet might operate. Additionally, the team should consider collaborating with other National Laboratories who are working on AV-related projects under Energy Efficient Mobility Systems (EEMS) or other funding.

Reviewer 4:
Collaboration efforts could be enhanced by integrating U.S. DRIVE and Systems and Modeling for Accelerated Research in Transportation (SMART) Mobility research outcomes in the C2G of automated vehicle estimation.

Reviewer 5:
The team demonstrates good collaboration with stakeholders.

Reviewer 6:
There are very good collaborations and coordination across project teams and other departments.

Reviewer 7:
Collaboration with external public and private partners appears to be well-established. In future reviews, the reviewer suggested identifying more partner organizations that could help with the needed data inputs that are not yet readily available to PIs.

Reviewer 8:
Collaboration seems appropriate.

Reviewer 9:
The team appears to work seamlessly.

Reviewer 10:
The reviewer indicated no further comments.

Question 4: Proposed Future Research—the degree to which the project has effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology and, when sensible, mitigating risk by providing alternate development pathways. Note: if the project has ended, please state project ended.

Reviewer 1:
The planned and proposed future work is appropriate. In addition to expanding the consumption-based electricity analysis to the monthly and sectoral level, time of day variability for charging may also be important to consider.

In addition to continued evaluation of emerging technologies of interest, it would be extremely useful for the team to provide user-friendly access to the underlying sources and research for inputs to the model that are organized by topic on a website and document and are ideally cross-referenced from the GREET® Excel input and results areas and/or underlying cells.

Reviewer 2:
The project has a number of expansion items related to the consumption-based electricity analysis. While having monthly and sectoral-level data is helpful, it is also worth examining broader, intra-daily patterns of electricity use [especially for plug-in hybrid electric vehicle (PHEV) and battery electric vehicle (BEV) regional analysis]. Continued updates of material use, and flows seem to be on track, although the current policy situation may further distort normal market behavior.

Reviewer 3:
Each of the future research items are logical next steps toward meeting one of the first two objectives (electricity grid and steel and Al supply chain). There is also an open-ended "continue evaluation of emerging technologies of interest to VTO" goal. There are not any additional decision points, although the team does offer several remaining challenges and barriers.

Reviewer 4:
The researchers have identified a list of extensions of their work tied to GHG intensity. Additional recommendations are tied to time of day consumption-based emission intensity for EV recharging and extensive scenarios of AV operations for GHG intensity estimation.

Reviewer 5:
The reviewer encouraged consideration be given to new emerging technologies in medium-duty (MD) and HD in addition to the light-duty (LD) vehicle applications. It was a good plan to include e-fuels, net zero-emissions vehicles (NZEV) carbon fuels, and other relevant technology trends. The team alluded to future research to expand the sectoral level (Slide 21), but the reviewer would appreciate a more detailed description of which sectors are in the future research plan.

Reviewer 6:
The PIs have effectively planned future work by considering a wide variety of future tasks and recognition of barriers.

The reviewer suggested that more emphasis is placed on end user needs and how modeling could be simplified for web accessible tools based on geographic location, in particular evaluations of electricity generation. Please consider how this will replace or complement the DOE AFDC emissions from the plug-in hybrid geographic tool at https://afdc.energy.gov/vehicles/electric_emissions.html, which is currently widely used by end users and individual consumers when making EV purchase decisions.

Reviewer 7:
Documenting the impact of this research and incorporation into GREET® will be critical to understanding the changes in the model.

Reviewer 8:
The proposed future work is reasonable.

Reviewer 9:
The review offered a few questions and comments. Specifically, the reviewer inquired about the additional benefits envisioned to expand consumption-based electricity analysis to a monthly level and sectoral level. In addition, the reviewer asked if there is any plan to update other major components' LCA analyses. For example, with battery technology and the manufacturing chain quickly evolving, how can the team make sure previous results remain valid and applicable?

Reviewer 10:
No further comments were provided by this reviewer.

Question 5: Relevance—Does this project support the overall DOE objectives? Why or why not?

Reviewer 1:
It is valuable to continue to improve, expand, and update the GREET® models' evaluation of fuel and vehicle cycles for technology pathways of interest because the results of these models are used extensively to support other modeling and research projects, and to estimate potential energy and emissions impacts. In addition, the research that informs the underlying assumptions in GREET® contributes to the data and knowledge of emerging technology pathways.

Reviewer 2:
The GREET® model is a key tool to estimate C2G impacts of vehicle technologies and serves as a baseline for other analyses.

Reviewer 3:
The GREET® modeling framework provides fundamental data and analysis tools to accurately assess different technology options. This allows stakeholders (including the PI) to investigate transportation system impacts on energy affordability, energy security, economy, and the environment, which are all part of DOE VTO's mission. More specifically, it contributes to two of the VTO Analysis Program's three broad objectives: creating and maintaining a strong foundation of data, and building, maintaining, and exercising relevant analytical models.

Reviewer 4:
Very important and relevant work tied to emerging and efficient vehicle technologies emissions estimations is being conducted by the team. The work can be used by researchers focusing on the transportation energy domain for a more accurate externalities cost-benefit analysis of EVs.

Reviewer 5:
LCA work is becoming more and more important in helping understand different vehicle technologies' benefits and tradeoffs in the whole life cycle.

Reviewer 6:
This project makes important advancements to DOE VTO modeling.

Reviewer 7:
The reviewer noted energy estimates of vehicle technologies.

Reviewer 8:
GREET® has served as a foundation for data-driven decision making.

Reviewer 9:
The reviewer had no further comments.

Reviewer 10:
No further comment was offered by this reviewer.

Question 6: Resources—How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

Reviewer 1:
The resources appear to be sufficient. However, the suggestion of additional documentation may require additional resources.

Reviewer 2:
Given the scope of the model developed and data collection, resources seem appropriate.

Reviewer 3:
The resources are sufficient to meet the stated milestones in a timely fashion; the team has been doing this work for a long time.

Reviewer 4:
The team should consider enhancing their analysis by integrating findings from SMART Mobility connected and autonomous vehicles (CAVs) and advanced fuel infrastructure (AFI) efforts before conducting the proposed LCA.

Reviewer 5:
Resources appear to be sufficient. PIs should continually reevaluate what can be accomplished in the overall project timeline.

Reviewer 6:
The resources are appropriate.

Reviewer 7:
The resources are sufficient.

Reviewer 8:
The resources appear to be sufficient.

Reviewer 9:
No further comments were provided by this reviewer.

Reviewer 10:
The reviewer had no further comment.

Presentation Number: van018
Presentation Title: Light-Duty Vehicle Choice Modeling and Benefits Analysis
Principal Investigator: Aaron Brooker (National Renewable Energy Laboratory)

Presenter

Aaron Brooker, National Renewable Energy Laboratory

Reviewer Sample Size

A total of ten reviewers evaluated this project.

Project Relevance and Resources

90% of reviewers indicated that the project was relevant to current DOE objectives, 10% of reviewers indicated that the project was not relevant, and 0% of reviewers did not indicate an answer. 90% of reviewers indicated that the resources were sufficient, 0% of reviewers indicated that the resources were insufficient, 10% of reviewers indicated that the resources were excessive, and 0% of reviewers did not indicate an answer.

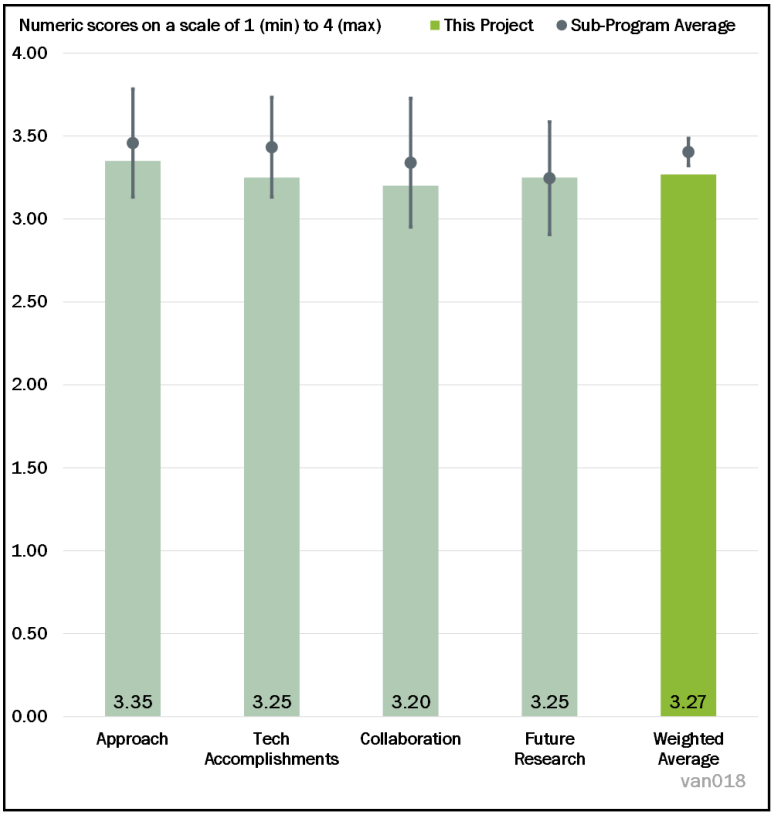

Figure 8-3 - Presentation Number: van018 Presentation Title: Light-Duty Vehicle Choice Modeling and Benefits Analysis Principal Investigator: Aaron Brooker (National Renewable Energy Laboratory)

Question 1: Approach to performing the work—the degree to which technical barriers are addressed, the project is well-designed and well-planned.

Reviewer 1:
The technical approach is presented in great detail. The team should better specify how the barriers that are identified will be captured in the existing Automotive Deployment Options Projections Tool (ADOPT) framework. For example, it is not clear how multi-vehicle household choices are expected to be modeled or how home charging unavailability will be integrated (the team could specify these as penalties or benefits added in the existing framework).

Reviewer 2:
The approach is clearly stated and demonstrates progress towards fulfilling objectives of the program.

Reviewer 3:
The team has a good approach to employing the established ADOPT model and discussing and reviewing model results with stakeholders. Continuing to improve the ADOPT model is very good.

Reviewer 4:
Given a transition from the initial project at another laboratory, NREL has done an excellent job at taking on the work, addressing technical barriers, and designing a feasible effort.

Reviewer 5:
The approach to estimating impacts of vehicle technology R&D seem reasonable and incorporate different policy mechanisms that could drive different scenarios of deployment.

Reviewer 6:
It is difficult for this modeling exercise to keep up with the fast-changing pace in vehicle technologies and consumer preference. It is not clear what the value proposition is.

Reviewer 7:
Using the ADOPT to run scenarios that meet DOE technical targets is a reasonable approach. As noted under "proposed future research" in the presentation, it is important to conduct sensitivity analyses on underlying assumptions in the model. Similarly, it may be valuable to characterize the uncertainty of underlying factors and relationships in the model and to present error bands and confidence intervals where possible, especially for those factors that have high variability in the literature and in future projections.

As mode choice continues to expand, it may be important to consider how travel outside privately-owned passenger vehicles impacts LD vehicle sales, energy use, and emissions.

Reviewer 8:
The reviewer stated that the overall process of examining different models and then applying different policy and regulatory conditions is a good workflow, but is less convinced on some of the technical models. The reviewer is a bit skeptical of the battery model, especially because there would be spillover effects between plug-in and "conventional" hybrid vehicle battery storage technologies. Today, many hybrid electric vehicles (HEVs) have switched over to lithium-ion (Li-ion) batteries, which are very similar to the batteries in PHEVs, so the fact that one market would grow while the other stagnates does not intuitively make all that much sense. The reviewer is also a bit concerned about the age of the validation data. Slide 11 presented data from 2016, which is before Tesla's Model 3 and the Chevy Bolt were in production, along with many other vehicle models, so it may be worth further validation of the split between PHEV and HEV sales. Incorporating other factors- like the planned inclusion of charging availability- may help to clarify the split between the two technologies.

Reviewer 9:
A technical barrier is rigorous modeling and applied analysis is needed to assess program benefits and inform portfolio planning related to research and development (R&D) funded by various VTO focus areas. The project clearly aligns its objective with overcoming this barrier and uses the ADOPT modeling framework to meet the objective. The ADOPT approach itself is well designed and feasible; it is an existing modeling framework that has been used for similar purposes in the past. The approach follows VTO's traditional benefits analysis process, which has proven to be helpful for DOE staff managing research programs (e.g., to run a "no program" or baseline case, collect VTO technology targets, apply those targets to create a "program case," run the "program case," and compare "program" and "no program" to estimate VTO's impact on the market).

It is not clear if the baseline and no-program case has been validated against other modeling frameworks, such as EIA's National Energy Modeling System (NEMS). Perhaps it is not a necessity, but it would be helpful for stakeholders to see how the baseline compares to other baseline estimates. The fact that both ADOPT and FastSim are open source is a big source; it means the analysis is reproducible and (mostly) transparent.

As far as suggestions, the reviewer assumed this is already being done, but it would be great if the final report included a scenario where all of the programs were successful. It would also be helpful to show vehicle miles traveled (VMT) shares rather than (or in addition to) sales shares

One note (which does not fit in the other categories) is that the slides are a little scattered and difficult to follow. It would be helpful to structure them a little more logically.

Reviewer 10:
The reviewer stated a fundamental question as to whether it is possible at all to make a useful forecast of something like technology adoption in vehicles beyond a decade into the future. For those who need a forecasting tool to use to base decisions on, this one appears to be well thought out. The one thing the reviewer

would have liked to see is some fundamental bounds on the possible future outcomes. For example, if the use of internal combustion engine (ICE) vehicles in 2021 was banned and somehow automakers were able to respond and supply the same number of EVs as there are ICE vehicles today, what would the overall fleet look like in 2030? What percentage would be EVs? How much petroleum and energy usage would the vehicle fleet use? This would be a useful calculation as a lower bound to what can be achieved. Likewise, what if all EVs disappear and all that is left are ICE vehicles for the next 30 years? That would be an upper bound. Every single scenario run should then fall between these bounds. The reviewer suggested making sure to note those bounds on every output scenario to place it in context. Basically, there are some simple assumptions that can be made to create some boundaries, and then all of the simulations that are run can be placed within a bounded context.

Question 2: Technical Accomplishments and Progress toward overall project goals—the degree to which progress has been made and plan is on schedule.

Reviewer 1:
The team demonstrates concise accomplishments with respect to electrification success sales comparison. The technical backup slides demonstrate how the model choses the bestselling vehicle option based on the ADOPT cost-benefit analysis and specifies all of the assumptions made. The team's progress is aligned with expected accomplishments and performance indicators are met according to the ADOPT alternative fuel vehicle sales findings.

Reviewer 2:
Progress appears to be on track and there is a substantial demonstration of progress on the LD vehicle side. MD and HD vehicles are in early stages of development. The reviewer is looking forward to further output and progress in this regard in future reports and suggests anticipating the technology trends in the commercial vehicle space. There seems to be a close connection to NREL in developing and demonstrating continued relevance in this sector, as has been demonstrated thus far in the LD sector.

Reviewer 3:
Significant progress has been made on this project by the PIs in its first year at NREL and performance indicators appear positive.

Reviewer 4:
The collection of historical data as well as scenario runs provide valuable data to help understand the role of R&D in energy savings.

Reviewer 5:
Progress, including model improvements and the development and execution of scenarios that are based on DOE technical targets, seems appropriate.

Reviewer 6:
Progress is satisfactory and results provide a lot of insights about future technology improvements' benefits.

Reviewer 7:
The project seems to progress as planned.

Reviewer 8:
The model interface has been improved, and the simulation time is reasonable for a model with this breadth. Some initial scenarios have been run to support benefits results of different vehicle technology pathways. The reviewer said that continued refinement of some of the assumptions, especially with help from key technical offices [e.g., the Bioenergy Technologies Office (BETO), the Hydrogen and Fuel Cells Technology Office (HFTO)] will be critical to ensuring that the input assumptions are aligned with actual program targets and current technology pathways.

Reviewer 9:
The project appears to have made sufficient progress to meet all of its milestones, and the last steps are to compare the no program and program case runs and then write a final report. That said, it is not clear whether the project team has received final confirmation and go-ahead from VTO, BETO, and HFTO to publish the results. This is often the lengthiest step of the process (the "churn"), as some technology managers may want to search for technical targets or assumption adjustments that produce positive market results. Hopefully, the team has locked in vehicle attribute targets and other assumptions (e.g., bar changes after a specific date) to prevent multiple adjustments and schedule delays, especially since the model takes considerable time to run. This could be exacerbated by the final "combined program success" run, where the reviewer assumes either fuel cell vehicles (FCVs) or EVs win out, even though both meet aggressive technical targets. It will be (or perhaps already is) a precariously fine line to walk.

Reviewer 10:
The reviewer referenced prior comments.

Question 3: Collaboration and Coordination Across Project Team.

Reviewer 1:
This process inherently requires a lot of collaboration with DOE (e.g., VTO, BETO, HFTO), and the NREL team appears to be doing that actively. The team also appears to be leaning on ANL- the previous owners of some of this work- to help ease the benefits analysis baton pass.

Reviewer 2:
There is good collaboration with NREL, ANL, VTO, and other stakeholders.

Reviewer 3:
The reviewer observed good collaboration with other DOE laboratories and industry via DOE technology managers.

Reviewer 4:
The work seems to be well distributed among partners.

Reviewer 5:
The collaboration appears to be adequate.

Reviewer 6:
The team's interactions could be strengthened with SMART Mobility AFI and other SMART collaborations to integrate home and public charging projection in the ADOPT platform and capture interdependencies with AFI and estimated vehicle projections.

Reviewer 7:
Collaborating with other experts and benchmarking results against other models will continue to be critically important for refining and validating consumer preference models, like Adopt.

Reviewer 8:
The project team has worked with ANL to incorporate fuel efficiency technologies available and has ongoing meetings with BETO and HFTO. Incorporating those programs earlier in the development phase would have helped some of the preliminary results and should be completed before publishing a final outcomes report, especially since many scenarios are centered around a technology's success.

Reviewer 9:
It would be helpful to have more information on how the PIs are engaging industry beyond only inputs for targets (e.g. U.S. DRIVE). How this project is serving the needs of the other DOE program offices outside of VTO would also be helpful.

Reviewer 10:
The reviewer indicated no comments.

Question 4: Proposed Future Research—the degree to which the project has effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology and, when sensible, mitigating risk by providing alternate development pathways. Note: if the project has ended, please state project ended.

Reviewer 1:
The project has some good future model changes, including aligning with Annual Energy Outlook (AEO) fuel prices and emissions, updating to the latest fuel economy regulations, implementing multi-vehicle household considerations, and accounting for COVID-19 impacts. However, as the AMR presentation mentions, the project involves recurring work, so model development is more of a value-add than a necessity. The team will need to complete the same task (e.g., update inputs, complete benefits analysis, write report) every year for the duration of the project. That is included in the listed future work, so the future work plan is sufficient.

Reviewer 2:
The reviewer would like the team to continue updating the model with the latest and best assumptions from well-established projections, literature, and research, and continue to benchmark segmented results against the latest fleet data. The willingness to pay studies may need to be updated frequently, especially for concepts about nascent technology. As suggested on Slides 17 and 18, breaking out preferences in multi-vehicle households for concepts such as BEV range would be a useful addition to the model's design.

Reviewer 3:
The proposed research covers some key areas with respect to policy uncertainty and fuel prices. The reviewer is a bit less concerned about the short-term effects of COVID-19 on transportation behaviors because some of the most dramatic reductions in transportation have already sprung back to near normal levels, although income effects may have a more substantial impact (similar to other recessions). It might be worthwhile to look at TNC policies that push for electrification, either in parallel with or absent to government policies.

Reviewer 4:
Newer transportation trends will need to be accounted for in future analyses, which this project seems to do.

Reviewer 5:
Future work is a logical extension of the current work, and both are expected to enhance the approach and result in more accurate accomplishments. Go/no-go decisions are noted in the proposed future analysis, but barriers and alternative development pathways are not emphasized in the proposed future research.

Reviewer 6:
The plan for future research is clear and meaningful. No further changes are suggested beyond those already stated.

Reviewer 7:
The proposed future research topics such as fuel price sensitivities, home charging availability, multi-vehicle household impact, and transportation mode shifts are all of interest and relevant. Regarding charging infrastructure, the reviewer suggested to also consider impacts of destination charging and the availability of direct current (DC) fast charging. Given the increasing interest in hydrogen (H_2) fuel cell vehicles, it might be good for investigators to also look at the impacts of H2 refueling infrastructure availability. The reviewer

suggested continuous efforts to improve the ADOPT model to make it more user-friendly (e.g., documentation and user-interface, technical support, etc.) because this is a very powerful tool. The reviewer downloaded the model and wanted to give it a try, but found that the installation step is a bit lengthy and the user interface is not very self-explanatory to new users.

Reviewer 8:
The PIs have effectively planned for future work, however alternate development pathways are unclear.

Reviewer 9:
The proposed future research is faced with many uncertainties and it is not clear what direction the team plans to take.

Reviewer 10:
No further comments were offered by this reviewer.

Question 5: Relevance—Does this project support the overall DOE objectives? Why or why not?

Reviewer 1:
This project supports DOE's objectives of estimating the energy and emission benefits of vehicle technology research.

Reviewer 2:
With the proper collaborations between offices, the project helps to fill a gap between fundamental technology research and overall potential impact on the transportation sector.

Reviewer 3:
This is an essential piece of the VTO Analysis Program portfolio, and clearly contributes to all three of the programs objectives: creating and maintaining a strong foundation of data; building, maintaining, and exercising relevant analytical models; and executing insightful integrated analyses that provide a greater understanding of critical transportation energy problems.

Reviewer 4:
The project directly supports DOE and VTO objectives with a LD benefits analysis that has the capability to account for several techno-economic pathways and scenarios.

Reviewer 5:
This is very relevant work.

Reviewer 6:
The development of modeling that can inform the energy and emission impacts of VTO-supported technologies is a foundational need for DOE.

Reviewer 7:
The project highlights the importance of R&D in vehicle technology that happens at DOE and VTO.

Reviewer 8:
Even though the research question is relevant to DOE objectives, it is not clear how the results from the research can inform decision making going forward.

Reviewer 9:
This reviewer had no further comments.

Reviewer 10:
No further comments were provided by the reviewer.

Question 6: Resources—How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

Reviewer 1:
The team resources are sufficient to complete the work; The PI and others at NREL have considerable experience developing and running ADOPT, as well as considerable experience with advanced vehicle technologies and transportation energy. Additionally, as mentioned before, the team who previously did the work at ANL is available to help "hand off."

Reviewer 2:
The team has access to resources that will assist them with successfully achieving the stated milestones. Collaboration extensions with feedback loops from SMART Mobility project leads could be also fruitful.

Reviewer 3:
The resources appear to be comparable to other projects of this size.

Reviewer 4:
Given the scope of the model developed, the resources seem appropriate.

Reviewer 5:
The resources appear to be sufficient to accomplish milestones on a reasonable timeline.

Reviewer 6:
Finances seem appropriate for a project of this scope.

Reviewer 7:
The resources seem sufficient based on the current work proposal. However, as suggested in Question 8, it will be good to further improve the capability and user interface of the ADOPT model, increase the user base, and provide a more detailed documentation on technology support. If this is included in future work, then the investigators may need additional resource support.

Reviewer 8:
No further comments were provided by this reviewer.

Reviewer 9:
The reviewer indicated no further comments.

Reviewer 10:
The funding seems excessive.

Presentation Number: van023
Presentation Title: Assessing Energy and Cost Impact of Advanced Vehicle Technologies
Principal Investigator: Aymeric Rousseau (Argonne National Laboratory)

Presenter

Ram Vijayagopal, Argonne National Laboratory

Reviewer Sample Size

A total of ten reviewers evaluated this project.

Project Relevance and Resources

100% of reviewers indicated that the project was relevant to current DOE objectives, 0% of reviewers indicated that the project was not relevant, and 0% of reviewers did not indicate an answer. 100% of reviewers indicated that the resources were sufficient, 0% of reviewers indicated that the resources were insufficient, 0% of reviewers indicated that the resources were excessive, and 0% of reviewers did not indicate an answer.

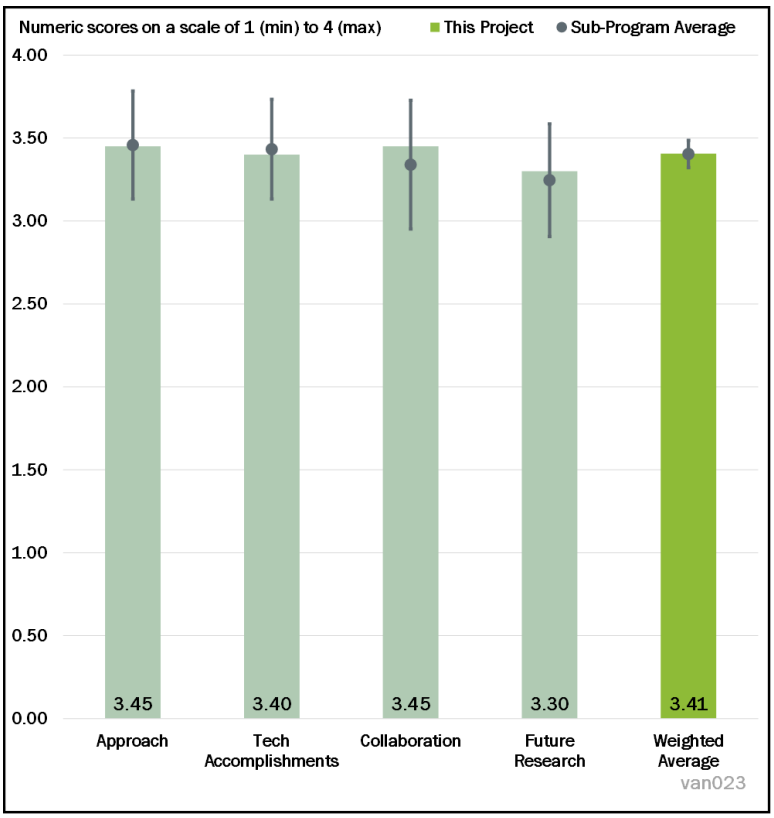

Figure 8-4 - Presentation Number: van023 Presentation Title: Assessing Energy and Cost Impact of Advanced Vehicle Technologies Principal Investigator: Aymeric Rousseau

Question 1: Approach to performing the work—the degree to which technical barriers are addressed, the project is well-designed and well-planned.

Reviewer 1:
Regarding Task 1, the reviewer offered kudos to the team for taking on the difficult topic of disaggregating effects for which the order of application and secondary effects are relevant. The approach- showing a range of values with the minimum being that all technologies are applied- appears to be sound. As the team is no doubt aware, it will be both challenging and important to clearly communicate the range of results and the associated ranges of uncertainty. Key updates, such as those described in Task 2, are particularly important for Autonomie to remain relevant as things change.

Reviewer 2:
The project has already made good use of computing resources and process automation to compile enormous amounts of data about possible technology combinations. Increasing the vehicles and technologies included- with a focus on those responsible for the most miles traveled and fuel consumption- is a good approach to balance the need for more vehicles against the time required to incorporate new resources. Including uncertainty around individual contributions and providing some information about the pathways for technology adoption that account for differences will be helpful in future assessments of fuel economy regulatory costs.

Reviewer 3:
The project specifically aims to address four barriers from Page 2.2-1 of the 2010 VTO Multi-Year Program Plan ([MYPP] 2011-2015): manufacturer's aversion to risks inherent to new technologies (A); constant

advances in technology (F); compute resource cost (B); and sufficient and accurate modeling methodologies (E).

Its approach to addressing these barriers (two tasks) follows: developing a generic process that is flexible across size, class, and vocation, to quantify energy and cost impacts of specific vehicle technologies and applying it to one class (mid-size cars); and updating assumptions, models, powertrain architectures, and sizing methods for light-duty vehicles (LDVs) and medium- and heavy-duty vehicles (M/HDVs) to support the VTO benefit analysis. The data will then be disseminated to relevant stakeholders for a wider research use.

Specifically, the team is expanding to assess individual technology impacts by simulating all technology combinations- in different order permutations- to investigate the impact of each and of different combinations. This approach seems reasonable and appears to be feasible based on the past applications of Autonomie.

- Barrier 1: This approach addresses manufacturers' aversion to new tech investment by clarifying the different potential performance, cost, and efficiency impacts each technology (and combination of technologies) has on different vehicle classes, powertrain types, and vocations.
- Barrier 2: This approach addresses the constant evolution of technology by updating assumptions to match the latest information and providing that data (and results) to stakeholders.
- Barrier 3: This seems to be a very computationally expensive approach, but the reviewer is not sure there is a better way to include all technologies (individually).
- Barrier 4: The approach implements a modeling methodology that is proven and has been trusted by stakeholders (including DOE VTO) for a number of years. This project, in particular, includes several smaller upgrades to the model, which help make the model more accurate to real on-road performance.

Overall, the project approach addresses all four of the technical barriers (as listed in the presentation and below). One potential issue is dissemination of the data and results. Autonomie is proprietary, and it is not clear how much of the input assumptions and outputs will be publicly available to a wider research audience.

Reviewer 4:
The approach seems methodologically solid. Data driven simulations can be accelerated through machine learning (ML) so that the computational process can be faster and reproducible by others (e.g., researchers, academics, the industry). The technical barriers are addressed through high performance computing (HPC) and the further proposed steps seem feasible.

Reviewer 5:
There is a comprehensive approach including a wide variety of LD, MD, and HD vehicle types and duty cycles.

Reviewer 6:
The team has a good approach.

Reviewer 7:
The PIs have developed a solid approach to addressing technical barriers. Building off of years of work, the PIs recognize what is feasible with the allocated resources.

Reviewer 8:
A technology combination analysis will be useful in determining energy impacts of technology packages.

Reviewer 9:
The Autonomie approach is well recognized.

Reviewer 10:
The reviewer really liked that this model gave component-specific benefits and that the implementation order was considered. These are critical considerations to make this model track closer to reality. The reviewer also appreciated some of the other innovations added, such as the inclusion of additional sizing criteria. The only suggestion would be to continue engaging with OEMs to try and accurately map how decisions are being made to their associated elements in the model, especially in things like the ordering of technology implementations.

Question 2: Technical Accomplishments and Progress toward overall project goals—the degree to which progress has been made and plan is on schedule.

Reviewer 1:
The FY 2020 milestones chart looks reasonable. It is nice to see that the team is developing graphical methods to explain the order of contribution and/or range of values for each component in Task 1. For Task 2, the addition of new classes of MD and HD vehicles representing 85% of the fuel consumption and additional sizing criteria is commendable.

Reviewer 2:
The team has made great progress in expanding the technologies included in the model and showing uncertainties of individual technology contributions. Of the projects reviewed, the reviewer stated this one makes the best use of HPC resources and data management practices, which will ultimately make it easier to incorporate new technologies, so continuing with this effort is key.

Reviewer 3:
Individual and cumulative component contributions for the range of vehicles demonstrated here is impressive.

Reviewer 4:
Progress in both task areas has been made in accordance with planned milestones.

Reviewer 5:
The project appears to make progress as planned.

Reviewer 6:
The project seems to be on schedule with significant technical accomplishments. In particular, the component specifications determined to meet and exceed the set requirements would be important literature and can impact future vehicle technology advancements. However, it is important to put forward good documentation and a platform for results reproducibility to help data and methods diffusion for the industry and others.

Reviewer 7:
Very good progress has been made and many insightful results have been produced. Autonomie has become a key data source and reference for many related works. The percent complete reported on Slide 2 in the timeline section is 20%. Considering this is a four-year project and this is the middle of year two, is this percentage a little behind? Investigators might further clarify.

Reviewer 8:
Good progress is demonstrated on a range of vehicle types and duty cycles. The reviewer would appreciate more detail on the factors effecting the light weighting cost impact, both increased cost and lower cost. There is good explanation that secondary benefits can often save cost, and this should be discussed further in the presentation in the future.

Reviewer 9:
At this point, the project team should be done setting up the process and identifying technology combinations, and nearly done gathering VTO targets and performing the large-scale simulation. It is not clear how far along either of the latter two tasks are, although it is clear that progress has been made (generally).

Technical accomplishments include completion of the analysis of fuel consumption and cost impacts of individual technologies for LD HEVs, PHEVs, and BEVs, and expansion of the number of defined truck models and improvement of the truck sizing methodology in Autonomie. The team is still working on gathering VTO targets (Quarter 3 milestone) and appears to have identified technology combinations (Q2 milestone).

The team has made a considerable amount of technical progress, particularly in updating assumptions and improving the model sizing methodology. That said, there is not really a clear crosswalk between the tasks and milestones and the actual accomplishments. The accomplishments- assuming what is shown has all been completed since Q1 of 2020- are impressive, but there is not a clear line of logic (e.g., technical accomplishment X meets milestone A, which marks the completion of Task A.1).

Reviewer 10:
The reviewer indicated no further comments.

Question 3: Collaboration and Coordination Across Project Team.

Reviewer 1:
Collaboration and peer review are particularly important for developing inputs, assumptions, and algorithms for a complex simulation model. The reviewer suggested working extensively with a broad spectrum of experts.

Reviewer 2:
The project seems to have good collaborations and stakeholders that are actively engaged with the use of the tool and results.

Reviewer 3:
The reviewer observed very good collaboration across teams among DOE laboratories as well as industry partners.

Reviewer 4:
This is a very well fleshed out collaborative effort with a good distribution of research tasks and stakeholder engagement.

Reviewer 5:
The collaboration appears to be adequate.

Reviewer 6:
There are excellent collaboration prospects with U.S. DRIVE and industry, other National Laboratories, and research organizations. The reviewer expected more collaborations with academia for state-of-the-art components integration.

Reviewer 7:
There is good collaboration with industry, government, and stakeholders. The reviewer encouraged the project team to continue seeking industry input to maintain relevance to current and future technology trends.

Reviewer 8:
The PIs report improvements in the collaboration. More work may be needed to ensure that the end user feedback is being incorporated into the model design. In particular, it will be helpful to know, in the next update, how user testing and surveys are being used to inform the Autonomie end user interface.

Reviewer 9:
There appears to be collaboration between the project team, stakeholders, and partners, particularly DOE VTO managers, the U.S. DRIVE, 21st Century Truck Partnership (21CTP), and the National Highway Traffic

Safety Administration (NHTSA), but there is very little mention of the benefits from said collaborations beyond bullet two in the summary slide. It would be helpful to document a little more clearly how inputs from these partners are "continuously collected," perhaps by providing a frequency (e.g., monthly check-ins or something similar). The reviewer understood that input is required in some sense (e.g., collecting VTO targets), but documenting the collaboration would be beneficial.

Reviewer 10:
This reviewer indicated no further comments.

Question 4: Proposed Future Research—the degree to which the project has effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology and, when sensible, mitigating risk by providing alternate development pathways. Note: if the project has ended, please state project ended.

Reviewer 1:
The proposed future research looks reasonable and logical. As noted on Slide 21 (Future Research), because electrified powertrains are in an early stage for trucks, the models will need to be updated frequently with new technology assumptions. Also described on Slide 21, the team's plan to provide a database of vehicle characteristics along with the related assumptions will benefit the broader research community and will facilitate review of this model. It is important to maintain a clear and well-organized database of underlying assumptions and methods so that researchers can continuously review the model, especially for emerging and evolving technologies.

Reviewer 2:
The focus on HD trucks is a good area to include, given the impact on overall emissions. The reviewer would potentially include a plan for retiring technologies if the industry is moving away from certain technology options, and would create documentation around criteria for retiring technologies that are no longer in use, in addition to documenting that in publications.

Reviewer 3:
PIs have planned for future project work with reasonable objectives.

Reviewer 4:
Future research is well planned but additional background is required regarding the barriers expected to be faced in this process.

Reviewer 5:
Future research plans are clearly stated and continues to be relevant to evolving technology trends. The reviewer is looking forward to future results in TCO models. Work from the American Transportation Research Institute (ATRI) report is referenced, but it is not clear if this represents any modeling of future impact, or if this is solely a report of demonstrated benefits from in-use technology adoption (e.g., currently available technologies as opposed to future proposed technologies that are not yet in service).

Reviewer 6:
Starting to pay more attention to MD and HD vehicles is a good start. It will be great if- for the VTO benefits analysis- investigators can provide some sensitivity and scenario analyses whether some of the targets are only partially met (it is probably too optimistic to assume that all of the targets will be met at the same time). If the investigators can come up with a most probably scenario, that will also be very helpful. In addition, the reviewer would like to know if any review work comparing how DOE has historically met targets and how that affects projections made by Autonomie exists.

Reviewer 7:
PIs have planned for future project work with reasonable objectives.

Reviewer 8:
EV modeling and public access to the database of vehicle characteristics and assumptions will be important to the success of this project.

Reviewer 9:
It is important to investigate electric trucks.

Reviewer 10:
The future research slide lays out some excellent reasoning for this work and a few next steps, but it does not clearly link up with where the project currently stands. Instead of focusing on justifying the current work, the future research should focus on what the team will specifically be focusing on in the (near) future. From the project presentation, it looks like future research should include topics such as finishing collecting VTO targets; completing vehicle powertrain sizing; estimating fuel consumption and TCO impacts via simulation; and publishing summary reports. Perhaps things like automating the process to reduce simulation time and investigating other potential approaches to reduce the number of required simulations for a single technology could be valuable as well.

Reviewer 11:
No further comments were offered by this reviewer.

Question 5: Relevance—Does this project support the overall DOE objectives? Why or why not?

Reviewer 1:
To establish priorities, it is important that DOE is able to estimate the potential disaggregated energy consumption benefits and the costs of technology targets and specific vehicle technologies.

Reviewer 2:
The project provides comprehensive resources to assess the impact of specific technology adoption on overall vehicle efficiency, with detailed information about how adoption pathways affect the overall impact. The data is one of the most comprehensive and can support other technical and policy analyses.

Reviewer 3:
This project specifically quantifies the impacts of specific (and groups of) technologies funded by DOE VTO, which clearly aligns with at least two of the VTO Analysis Program goals: assist VTO in prioritizing technology investments and inform research portfolio planning; and support quantitative assessment of vehicle and mobility technology impacts.

Reviewer 4:
Well aligned objectives with the DOE and VTO research portfolios were presented. Future research in creating ties between TCO and optimal component combinations will be of great importance.

Reviewer 5:
This is very relevant work, and many other projects and works rely on Autonomie work results.

Reviewer 6:
Quantification of the fuel saving and total cost of ownership benefits of VTO funded technologies is foundational to the VTO Analysis Portfolio.

Reviewer 7:
The project highlights the individual and cumulative impacts of key energy efficient technologies.

Reviewer 8:
It is important to investigate powertrain technologies.

Reviewer 9:
No further comments were provided by this reviewer.

Reviewer 10:
The reviewer indicated no further comments.

Question 6: Resources—How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

Reviewer 1:
Resources for a complex and ongoing project are difficult to assess, but the budget is in scale with other similarly sized projects, and the project appears to be completing its goals.

Reviewer 2:
Given the scope of the project and its ability to build on previous years of work, the resources seem appropriate.

Reviewer 3:
The team has sufficient access to resources. Collaborations with the industry and drivers would strengthen the understanding of TCO.

Reviewer 4:
Time and financial resources are sufficient for PIs to successfully complete the work.

Reviewer 5:
Funding seems sufficient for a project of this size.

Reviewer 6:
The funding is sufficient.

Reviewer 7:
Resources look sufficient for now.

Reviewer 8:
The staff resources appear to be sufficient in terms of expertise. It seems like quite a bit of work, especially because this team is doing a number of other projects using Autonomie. The dollars are certainly sufficient for the level of effort.

Reviewer 9:
No further comments were provided by this reviewer.

Reviewer 10:
The reviewer indicated no further comments.

Presentation Number: van032
Presentation Title: Tracking the Evolution of Electric Vehicles and New Mobility Technology
Principal Investigator: Joann Zhou (Argonne National Laboratory)

Presenter

Joann Zhou, Argonne National Laboratory

Reviewer Sample Size

A total of ten reviewers evaluated this project.

Project Relevance and Resources

100% of reviewers indicated that the project was relevant to current DOE objectives, 0% of reviewers indicated that the project was not relevant, and 0% of reviewers did not indicate an answer. 60% of reviewers indicated that the resources were sufficient, 20% of reviewers indicated that the resources were insufficient, 20% of reviewers indicated that the resources were excessive, and 0% of reviewers did not indicate an answer.

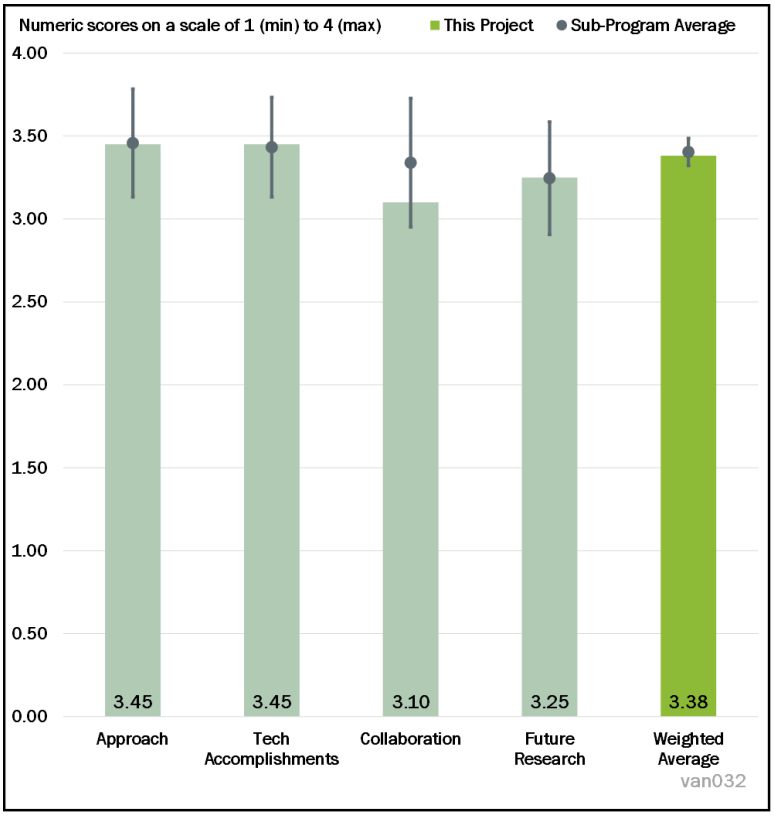

Figure 8-5 - Presentation Number: van032 Presentation Title: Tracking the Evolution of Electric Vehicles and New Mobility Technology

Question 1: Approach to performing the work—the degree to which technical barriers are addressed, the project is well-designed and well-planned.

Reviewer 1:
Gathering, summarizing, analyzing, and publishing EV and new mobility adoption data is a useful process that helps to inform analyses and modeling for a variety of stakeholders.

Reviewer 2:
The data included in this analysis make use of multiple formats, which helps accessibility for other researchers. The reviewer stated there are some challenges given the reliance on private sources for data, both in terms of formatting challenge and the cost for accessing the data.

Reviewer 3:
The reviewer really appreciated that this research is being done. There is very little publicly available data on items like EV sales, and even less on the specifications of different EV models. Keeping track on emerging trends in some of the underlying technologies now will be important for identifying potentially new trends that could be important to incorporate in other related models.

As the reviewer suggested in a review for another study, it would be worth spending some time with a data visualization expert to improve most of the charts that are being published using these data. Many are quite poor and leave the reader without any important insights. Data visualizations translate raw data into insights, and good visualizations can have dramatic impacts on decisions and actions.

Finally, one other potentially interesting area that could be examined with these data is how trends are varying by region or nation. For example, it is known that China is leading the world in EV sales, but how are Chinese

EVs competing when it comes to technological improvements, such as vehicle efficiency? The reviewer stated it could be really important to dig into these types of questions as the locus of automotive innovation could be shifting away from the "west" [with ICEs] and towards China (with EVs).

Reviewer 4:
The approach is good.

Reviewer 5:
After many years of maintaining the work of the electric mobility market data effort, the PI continues to address the identified technical barriers.

Reviewer 6:
The approach is sound, and the project team does an excellent job of tracking LD by EVs in the market. It may be time to consider further expanding work to include MD and HD commercial vehicles [and LD connected vehicles (CV)] as these technologies are beginning deployment. While the population is still small, many OEMs and suppliers have entered the market with announcements and planned technologies in the last year or two.

Reviewer 7:
The highlighted approach will provide a comprehensive picture of e-mobility in the United States.

Reviewer 8:
The data aggregation approach is key to situational awareness.

Reviewer 9:
The approach is presented briefly but comprehensively. Few technical barriers are presented, and it is not clear what the next steps of this project are related to. The approach should also emphasize the importance of preparation of the e-drive sales data for DOE VTO and other offices' models.

Reviewer 10:
The technical barriers are providing quality data on electrification and new mobility technology and responding to VTO and external stakeholder queries. The project approach clearly addresses these barriers by aiming to collect and disseminate data and information on EV sales, attributes, and news, as well as micromobility market and usage. The project is well designed; The methodology and approach are logical and straightforward (e.g., identify, collect, clean, analyze, disseminate), and appears to be feasible under the assumption that the data continues to be available. Now that the team is using Wards data, data availability fails to be an issue any longer, although Wards does not allow the data to be published publicly (as far as the reviewer knew).

A side note is that this project appears to have realigned itself to provide significantly more valuable data and analysis than previously. In past years, it appeared that the PI and team pulled sales data from hybridcars.com and added it to an Excel file to distribute). The monthly e-drive sales spreadsheet has been very disorganized in the past, especially compared to interactive public websites like the Alliance for Automotive Innovation's interactive dashboard (https://autoalliance.org/energy-environment/advanced-technology-vehicle-sales-dashboard/), but the addition of reports on (assuming sales-weighted) electricity consumption rates, electric range, and cumulative energy and emissions impacts is beneficial. Venturing into shared micromobility is likely valuable for VTO and other DOE staff who want to understand the industry and its potential impacts on traditional modes of transportation.

One comment on the visualizations is that the old format—as seen on the ANL sales update website—is borderline impossible to interpret. The reviewer was not sure that it was helpful to present a stacked area plot with so many data series. Developing a basic dashboard like the one linked above would be a very light lift and would make the data and analyses much more accessible.

Question 2: Technical Accomplishments and Progress toward overall project goals—the degree to which progress has been made and plan is on schedule.

Reviewer 1:
The publication of data and reports appears to be on schedule.

Reviewer 2:
To date, projects have been on time, and efficiency improvements and specific technologies and battery chemistries are periodically documented. It would be great to see more information compiled on a monthly and quarterly basis and available in downloadable formats (e.g., Excel, comma-separated values [CSV]).

Reviewer 3:
The accomplishments are well established. Monthly and quarterly sales are important historical data that serve as inputs in several models. Greater spatial granularity (e.g. state-level analysis) would be of interest to the data users.

Reviewer 4:
There is very useful information that is clearly reported in graphic and Excel formats.

Reviewer 5:
Progress is on track and some insightful results have been produced.

Reviewer 6:
Project progress has sufficiently been made as measured against performance indicators.

Reviewer 7:
The research feeds into work that DOE is funding in multiple ways, both with regards to EV trends as well as potential impacts on overall vehicle efficiency and emissions.

Reviewer 8:
The project appears to make solid progress.

Reviewer 9:
Project accomplishments indicate substantial progress toward addressing the technical barriers by meeting the project deliverables. The team is providing quality data and is writing a report for and providing other insights to VTO. That said, the presentation claims that ANL provides monthly sales reports, but the ANL website says, “As of November 2019, Argonne will release e-drive sales by make and model at the beginning of each quarter.” The project team should adjust its messaging to align with this because it does not provide monthly sales data anymore.

Reviewer 10:
The reviewer indicated no further comments.

Question 3: Collaboration and Coordination Across Project Team.

Reviewer 1:
There are a minimal number of collaborators.

Reviewer 2:
Collaboration appears to be adequate.

Reviewer 3:
The collaboration efforts seem reasonable for gathering EV data; however, the team may need to develop additional collaborative efforts to collect and analyze a variety of new mobility data.

Reviewer 4:
Collaborations with other DOE offices seem good, and there seems to be an open path with other data aggregation activities within the Vehicle Analysis (VAN) program. One challenge highlighted is that the data format and quality of EPA test cycle data- which could potentially be improved with more collaboration- would reduce the burden on data collection within this program, which will be important as the number of available EV models increases.

Reviewer 5:
This was a relatively small project—and could certainly do fine without much collaboration—but now it is larger and doing more in-depth analysis. Getting input on vehicle efficiency metrics and other assumptions, perhaps from industry (OEMs or micromobility operators), would provide validation for vehicle efficiency data and metric development, and perhaps enable the PI and team to acquire more data on scooters and bikes.

Reviewer 6:
Collaboration is only between ANL and ORNL. The team is encouraged to consider discussions with OEMs and dataset users on how best to continue serving them. Getting feedback through a survey will enable the team to understand which stakeholders can serve as partners in this effort.

Reviewer 7:
There is good collaboration with ANL and ORNL, but the reviewer encourages continued or increased collaboration with industry, particularly to get a view of future technology trends in evolving markets and applications, and planned new product introductions (e.g., LD, MD and HD).

Reviewer 8:
There is good collaboration with DOE labs, especially good communication and coordination with ORNL. It will be beneficial to further strengthen public facing documents and data sharing.

Reviewer 9:
The project team should be expanded, in particular to non-VTO end users. To improve the greater societal benefits of this project, the team should incorporate more feedback to the design and analysis from non-VTO end users. The next review should include data utilization metrics such as website page views, citations, and benchmarking against other public market data sources. Improvements should continue to be made over time against these metrics.

Reviewer 10:
No further comments were indicated by this reviewer.

Question 4: Proposed Future Research—the degree to which the project has effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology and, when sensible, mitigating risk by providing alternate development pathways. Note: if the project has ended, please state project ended.

Reviewer 1:
Continuing to collect, analyze, and publish electrification and new mobility data will provide a valuable resource for inputs to DOE and other researchers' modeling and analyses. The addition of the plug-in electric vehicle (PEV) model adoption and new mobility technology utilization at the state or regional level would be particularly useful if source data is available.

Reviewer 2:
The project proposes future research that continues current data collection and analysis results dissemination and expands the analysis to include regional electrification impacts. The former are logical next steps for the work, while the latter is a logical expansion.

Reviewer 3:
Proposed research is briefly outlined without explicitly defining barriers and risks. It is not clear how the team is going to overcome the barrier and start sharing regional data with a state by state comparison, and what type of new collaborations and data sources will be used to accomplish the team's goals.

Reviewer 4:
The research plan is sound. It would be interesting to include a correlation of changes in sales trends as a function of federal, regional, or local policy or regulatory activity. The reviewer would also like to know which policies have been most effective at stimulating the adoption of new technologies.

Reviewer 5:
The proposed work of continuous data collection and quantification of national and regional impacts of EVs are beneficial to not only DOE projects, but also to industry and the public.

Reviewer 6:
The team could potentially extend the analysis to the state and city level to help policymakers assess the current baseline in respective states and cities.

Reviewer 7:
Future research appears to be reasonable.

Reviewer 8:
Some of the proposed research focuses on regional impacts of vehicle electrification, which seems to overlap with other VAN programs (e.g. the GREET® team is working to improve emissions models to provide regional information). The reviewer would like to know if this project uses that tool and collaboration to provide an overall analysis of the impact of electrification to date based on trends in sales data, and if the team is planning to develop a different model.

Reviewer 9:
The proposed future research should aim higher. All future research is redundant, with numerous data sources in the private sector. Evaluate these resources and benchmark accordingly for work.

Reviewer 10:
No further comments were provided by the reviewer.

Question 5: Relevance—Does this project support the overall DOE objectives? Why or why not?

Reviewer 1:
Collecting and synthesizing data for electric and new mobility technologies is critical for informing DOE analyses of transportation energy consumption.

Reviewer 2:
The project does a good job of outlining where the current EV market is in terms of sales and technologies, rather than making predictions. Going forward, this data will be important for validating other models related to vehicle adoption.

Reviewer 3:
This project primarily supports one DOE VTO Analysis Program objective, which is creating and maintaining a strong foundation of data. It provides brief analyses offshoots to augment the incoming data, but no large integrated modeling frameworks.

Reviewer 4:
This team effort is very relevant to DOE and VTO data access and distribution objectives. Open access data availability enables further engineering and scientific discovery, and it is very important for researchers and the public to have access to accurate and well-maintained open vehicle sales databases.

Reviewer 5:
This is highly relevant work.

Reviewer 6:
The project supports overall DOE objectives by providing foundational analytical data.

Reviewer 7:
The project covers DOE's research in both environmental and energy modeling, as well as understanding the forces behind market penetration of EVs.

Reviewer 8:
This project provides the data foundation for electrification-related analysis.

Reviewer 9:
The reviewer indicated no further comments.

Reviewer 10:
No further comments were provided by this reviewer.

Question 6: Resources—How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

Reviewer 1:
The reviewer says more could be done with this topic (and references other comments about expanding some of the analyses), which would likely require more resources. Some of the other projects had much larger budgets, but this topic seemed just as important and could be expanded with a slightly larger budget.

Reviewer 2:
The resources are sufficient, and the accomplishments are of great importance, recognizing that the authors were able to analyze the state of micromobility and evaluate levels of use through trips and distances data.

Reviewer 3:
The program budget could potentially be increased to broaden the types of EV-related data that are collected.

Reviewer 4:
Funding appears to be sufficient.

Reviewer 5:
The resources are sufficient.

Reviewer 6:
The resources look sufficient at this time. However, difficulties may arise when some data sources discontinue publication or previously free and low-cost data sources start to charge higher prices. In that scenario, investigators may need more budget support.

Reviewer 7:
The PI should incorporate robotic process automation as much as possible for data collection and analysis.

Reviewer 8:
The project team should work to streamline data collection and validation methods to reduce staff time necessary to incorporate an increasing number of available EV models.

Reviewer 9:
The dollars allotted are quite large compared to the amount of analysis being accomplished, regardless of how high quality the analysis is.

Reviewer 10:
The reviewer had no further comments.

Presentation Number: van033
Presentation Title: Transportation Macroeconomic Accounting Models: VISION and Non-Light Duty Energy and Greenhouse Gas (GHG) Emissions Accounting Tool (NEAT)
Principal Investigator: Joann Zhou (Argonne National Laboratory)

Presenter

Joann Zhou, Argonne National Laboratory

Reviewer Sample Size

A total of ten reviewers evaluated this project.

Project Relevance and Resources

100% of reviewers indicated that the project was relevant to current DOE objectives, 0% of reviewers indicated that the project was not relevant, and 0% of reviewers did not indicate an answer. 90% of reviewers indicated that the resources were sufficient, 10% of reviewers indicated that the resources were insufficient, 0% of reviewers indicated that the resources were excessive, and 0% of reviewers did not indicate an answer.

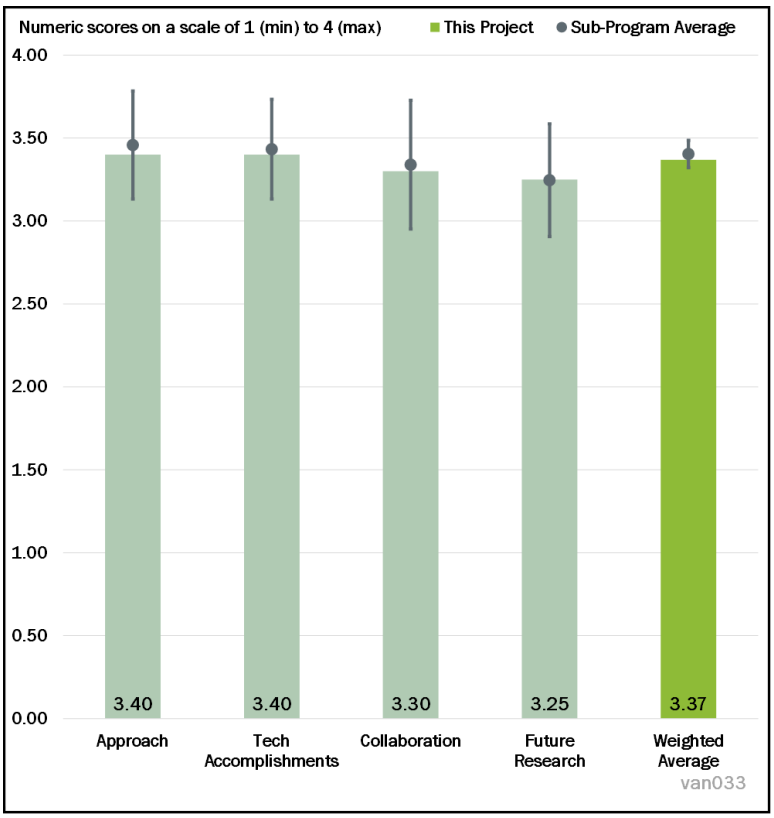

Figure 8-6 - Presentation Number: van033 Presentation Title: Transportation Macroeconomic Accounting Models: VISION and Non-Light Duty Energy and Greenhouse Gas (GHG) Emissions Accounting Tool (NEAT)

Question 1: Approach to performing the work—the degree to which technical barriers are addressed, the project is well-designed and well-planned.

Reviewer 1:
The annual updates to calibrate to the AEO and the Freight Analysis Framework (FAF) and update GREET® inputs are worthwhile endeavors. In addition, the planned enhancements in MD and HD modeling capabilities are sensible. Thorough documentation of assumptions and methods will continue to be crucial.

Reviewer 2:
The reviewer liked this modeling effort and is glad to see it is being used by so many other agencies.

Reviewer 3:
The VISION and NEAT updates are performed regularly to keep the models concurrent with the technological changes and provide a robust assessment of energy and emission effects of vehicle deployment scenarios. The annual updates, calibration efforts, as well as the upgrades and the distribution of the platform to the public are well-designed by and feasible for the team working on this project.

Reviewer 4:
Overall, there is a good approach in terms of model maintenance and improvement.

Reviewer 5:
The PI's approach to performing the work appears sound and the project is well designed and feasible.

Reviewer 6:
Annual updates to VISION and NEAT will incorporate market changes and help refine energy use and GHG emissions estimates. Models are critical to the work done on fuel economy standards.

Reviewer 7:
The approach is based on well-established models such as GREET® and FAF.

Reviewer 8:
The barriers are clearly presented. The FY 2020 enhancement plan seeks to better align with emerging technologies. The reviewer would like more of an explanation of which technologies are planned. A reference was made to the DOE MD and HD R&D portfolio which represents good alignment with stakeholders. Further detail would be helpful.

Reviewer 9:
The model provides public facing resources to examine vehicle energy use, although the reliance on other scenarios (e.g. AEO, FAF) does bake in some assumptions that the user cannot account for and adjust.

Reviewer 10:
The technical barriers (see quad chart) are pretty generic (e.g., "difficulty measuring and evaluating energy and emissions impacts of vehicle technologies"). It might be helpful to instead identify barriers from VTO's most recent MYPP, or perhaps look at the VTO Analysis Program goals and objectives in the most recent Annual Progress Report (APR).

One of the key technical barriers each year for larger modeling frameworks like VISION and NEAT is maintaining and updating inputs, assumptions, and if needed, methodology. The project approach addresses this by utilizing other resources, such as GREET®, for energy and emissions factors and EIA's AEO for calibration. The approach is feasible, as it has been completed annually for several years. It is also relatively transparent, since the model is publicly available on ANL's website.

Additionally, the approach includes an enhancement to improve accuracy and usefulness of the projections, namely, dis-aggregating Class 7 and 8 trucks into sleeper, day, and single-unit segments. This addresses the project's listed barriers by allowing for a more accurate assessment of HD vehicle energy and emissions, since EPA and NHTSA regulations are disaggregated in this fashion. It is also feasible, since data is available (e.g., Polk, EPA, NHTSA).

It would be helpful to know how much the correction factors improved due to the above disaggregation. Hopefully, the PI presents the improvement in those factors when it is available.

It is difficult to see what role the VISION and NEAT modeling framework plays in the DOE VTO suite of models. TRUCK, HDStock, ADOPT, and Market Acceptable of Advanced Automotive Technologies (MA3T) all appear to be more advanced and further along in development. The reviewer would like to know if VISION and NEAT is intended to be more of a tool that stakeholders can "turn knobs" in an online interface to assess impacts of different variables and assumptions.

Question 2: Technical Accomplishments and Progress toward overall project goals—the degree to which progress has been made and plan is on schedule.

Reviewer 1:
The updates and annual calibrations are on track. Vision-online is also a useful addition.

Reviewer 2:
The full model is available for download, and although there is a website version, the reviewer periodically had difficulty accessing it.

Reviewer 3:
Accomplishments are tied to the VTO usage of the models (more than 400 users). It is evident how the project was able to meet performance indicators and enable analysis for SMART Mobility teams (e.g., platooning energy savings evaluation and freight electrification potentials).

Reviewer 4:
Models are released to public and the reviewer is looking forward to utilizing them.

Reviewer 5:
Some additional modeling capabilities and granularity have been added to the VISION model which is desirable.

Reviewer 6:
The PI has made clear progress on updating the model in FY 2019 and 2020, in particular with new VISION-online now available to improve end user experience.

The PI notes that the results of the project are used "extensively by DOE programs and other agencies," and includes an absolute number of users. Future merit evaluations should include user data over time and potentially benchmarking against other publicly available models.

Reviewer 7:
Vision-online will be a useful tool for usability. One thing to consider is whether these tools can be used to improve the AEO 2020 reference case for EVs.

Reviewer 8:
The project is making solid progress.

Reviewer 9:
The team appears to have updated the model's historical data (sales, miles per gallon [MPG], stock, VMT, fuel prices, etc.) and energy/emissions intensities from GREET®, and has calibrated the output to EIA's AEO. That said, it is not clear how well the model performs. If the correction factors are large, then the model is not really doing much aside from running in the background and then publishing AEO energy numbers.

The team also appears to have made progress toward disaggregating Class 7 and 8 trucks into 3, rather than 2, segments. It is not clear how far along the team is, but NREL (on the partner list) has considerable experience doing this.

Reviewer 10:
The reviewer indicated no further comments.

Question 3: Collaboration and Coordination Across Project Team.

Reviewer 1:
The project has key partners to incorporate broader modeling efforts (e.g., NEMS) and accurate vehicle stock.

Reviewer 2:
ANL appears to be collaborating well with both NREL (expert on MD and HD vehicle benefits analysis and modeling) and ORNL (expert on data availability, identification, and acquisition).

Reviewer 3:
The reviewer observed very good collaborations among DOE laboratories.

Reviewer 4:
Collaboration appears to be adequate.

Reviewer 5:
Coordination with NREL appears to be solid. More end-user feedback to inform future priority work could be helpful.

Reviewer 6:
While the collaboration approach looks reasonable, it may make sense to host a user feedback session to help identify any issues and develop a list of potential new features and flexibilities. Since VISION and TEAM is a mature model, it may be helpful to engage with users to evaluate whether any major or minor changes should be considered.

Reviewer 7:
Collaboration between National Laboratories is well-established, but more information needs to be provided with respect to seamless data integration efforts between laboratories. For example, the reviewer would like to know if the baseline data shared through ORNL and NREL is updated annually.

Reviewer 8:
Comments made on Slide 8 are referring to the need for more data. The need includes annual usage, miles driven, usage profiles, vehicle scrappage, turnover rate, vehicle sector, application and vehicle type, etc. The reviewer presumed this data is available from other DOE and partner resources and that this is not a barrier to planned progress.

Reviewer 9:
NREL seems to carry the majority of the analytical burden for this project. Responsibilities could be better divided.

Reviewer 10:
No further comments were provided by this reviewer.

Question 4: Proposed Future Research—the degree to which the project has effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology and, when sensible, mitigating risk by providing alternate development pathways. Note: if the project has ended, please state project ended.

Reviewer 1:
The addition of flexible inputs for new mobility patterns such as annual and lifetime VMT and scrappage rates will be excellent additions. As more data become available on a regional level, a longer-term goal could be to provide regional flexibility.

Reviewer 2:
Continuing to increase the number of MD and HD vehicles included in the model will be helpful. While it is interesting to increase the variables that users can manipulate within scenarios, would they still ultimately be reliant on NEMS scenarios (with different specified conditions)?

Reviewer 3:
Basically, the future research (beyond continuing work in the current FY 2020 and FY 2021 goals) is to make the modeling framework more flexible and usable for a wider range of stakeholders. This seems like it could be a valuable tool, particularly compared to the larger and less easily usable DOE VTO Analysis modeling frameworks.

Reviewer 4:
The reviewer appreciated plans for heterogeneity enhancement and allowance of users to generate scenarios.

Reviewer 5:
The PI has identified valuable heterogeneity enhancements that should be undertaken to maintain the model's value and relevancy.

Reviewer 6:
Additional thoughts on refining the LD component of VISION and NEAT would be interesting.

Reviewer 7:
The team has a great challenge to integrate MD and HD vehicles in the platform and enhance modeling capabilities. More information should be provided with respect to data availability and unavailability of truck data, and how the team is expected to overcome this barrier.

Reviewer 8:
The future work plan is clear and reasonable. This might be out of the control of the investigators of this particular project, but lack of more up to date VIUS data looks to be a concern in the long term for such modeling work, and DOE and other relevant agencies should think of ways to address this issue. It will be beneficial to continue improving the model documentation and public facing sharing.

Reviewer 9:
Future research appears to be reasonable.

Reviewer 10:
The reviewer indicated no further comments.

Question 5: Relevance—Does this project support the overall DOE objectives? Why or why not?

Reviewer 1:
VISION and NEAT are beneficial macroeconomic modeling tools for quickly estimating energy and emission impacts of vehicle and fuel systems scenarios.

Reviewer 2:
The model does a good job of (indirectly) incorporating many potential policy or other societal changes that would impact transportation demand, although details about specific technologies and improvements are more limited than other models.

Reviewer 3:
This project specifically addresses the goals of the VTO Analysis Program as follows: assisting VTO in prioritizing technology investments and inform research portfolio planning; supporting the quantitative assessment of vehicle and mobility technology impacts; and providing insight into transportation and energy use problems for a broad range of internal and external stakeholders. The project does this by supporting one of the broader objectives, which is to build, maintain, and exercise relevant analytical models.

Reviewer 4:
The project helps create the universe of public models to estimate GHG and energy that stakeholders can use to analyze these elements from vehicle technologies.

Reviewer 5:
Tools to increase the understanding of MD and HD vehicles are in dire need.

Reviewer 6:
The work is very relevant to DOE objectives like enhancing tools that estimate GHG emissions and energy use of alternate vehicle technologies with macroeconomic approaches.

Reviewer 7:
The project supports overall DOE objectives by providing core analytical tools.

Reviewer 8:
The project helps create the universe of public models to estimate GHG and energy that stakeholders can use to analyze these elements from vehicle technologies.

Reviewer 9:
The work is relevant.

Reviewer 10:
The reviewer indicated no further comments.

Question 6: Resources—How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?

Reviewer 1:
Given the importance of these models to the research community, the project could benefit from additional funding to address any major outstanding issues or additional research ideas.

Reviewer 2:
The resources are sufficient for the project to achieve milestones in timely fashion.

Reviewer 3:
There is no FY 2020 budget described in the slides, but the work appears to be progressing.

Reviewer 4:
The funding is sufficient.

Reviewer 5:
The resources look sufficient at this time.

Reviewer 6:
Increased resources for FY 2019 were in line with the objectives for launching a web version of the model, which may not need to continue at the same level.

Reviewer 7:
The resources at the team's disposal are sufficient to achieve the project's milestones. A clearer understanding of the data updates and integration across National Laboratories would be useful to demonstrate success of resources integration.

Reviewer 8:
The resources should be sufficient given that NREL and ORNL stay on to provide assistance. It is hard to imagine that the PI—who is a team lead at ANL—has time to do much of the work on both this project and the LD vehicle and EV Sales Analysis project.

Reviewer 9:
No further comments were provided by this reviewer.

Reviewer 10:
The reviewer indicated no further comments.

Acronyms and Abbreviations

ADOPT	Automotive Deployment Options Projects Tool
AEO	Annual Energy Outlook
AFDC	Alternative Fuels Data Center
AFI	Alternative fuel infrastructure
AFV	Alternative fuel vehicle
ANL	Argonne National Laboratory
APR	Annual Progress Report
AV	Autonomous vehicle
BETO	Bioenergy Technologies Office
BEV	Battery electric vehicle
C2G	Cradle-to-grave
CAV	Connected and autonomous vehicle
CV	Connected vehicle
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EEMS	Energy Efficient Mobility Systems
EIA	Energy Information Administration
EPA	U.S. Environmental Protection Agency
EV	Electric vehicle
FAF	Freight Analysis Framework
FOTW	Fact of the Week
GHG	Greenhouse gas
GREET®	Greenhouse gas, Regulated Emissions, and Energy use in Transportation
H_2	Hydrogen
HD	Heavy-duty
HEV	Hybrid electric vehicle
HFTO	Hydrogen and Fuel Cells Technologies Office
HPC	High performance computing

ICE	Internal combustion engine
LCA	Life-cycle analysis
LD	Light-duty
LDV	Light-duty vehicle
MD	Medium-duty
M/HDV	Medium- and heavy-duty vehicle
MYPP	Multi-Year Program Plan
NEAT	Non-light duty Energy and greenhouse gas emissions Accounting Tool
NEMS	National Energy Modeling System
NHTSA	National Highway Traffic Safety Administration
NREL	National Renewable Energy Laboratory
OEM	Original equipment manufacturer
ORNL	Oak Ridge National Laboratory
PHEV	Plug-in hybrid electric vehicle
PI	Principal Investigator
Q	Quarter
R&D	Research and development
RD&D	Research, development, and demonstration
SMART	Systems and Modeling for Accelerated Research in Transportation
TCO	Total cost of ownership
TEBD	Transportation Energy Data Book
TNC	Transportation network company
U.S.	United States
U.S. DRIVE	United States Driving Research and Innovation for Vehicle efficiency and Energy sustainability
VAN	VTO Analysis
VIUS	Vehicle Inventory and Use Survey
VMT	Vehicle-miles traveled
VTO	Vehicle Technologies Office