7. Vehicle Analysis

The Vehicle Technologies Office (VTO) has a comprehensive portfolio of early-stage research to enable industry to accelerate the development and widespread deployment of a variety of promising sustainable transportation technologies. The research focus areas include 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 research and development (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 VTO Analysis (VAN) subprogram supports the planning and execution of technology, economic, policy, and interdisciplinary analyses to inform and prioritize VTO research portfolio planning, including activities such as research target-setting and impacts estimation. VAN supports vehicle data, modeling and simulation, and integrated and applied analysis activities using the unique capabilities, analytical tools, and expertise resident in the U.S. Department of Energy's (DOE) national laboratory system. These activities explore advancements in vehicles and transportation systems and resulting energy impacts to inform early-stage R&D 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 7-1 – Project Feedback

Presentation ID	Presentation Title	Principal Investigator (Organization)	Page Number	Approach	Technical Accomplishments	Collaboration	Future Research	Weighted Average
VAN016	Transportation Data Programs	Stacy Davis (Oak Ridge National Laboratory)	7-4	3.50	3.50	3.38	3.50	3.48
VAN017	ANL VTO Analysis Modeling Program	Michael Wang (Argonne National Laboratory)	7-9	3.67	3.67	3.67	3.83	3.69
VAN021	Transportation Energy Evolution Modeling (TEEM) Program	Ruixiao Sun (Oak Ridge National Laboratory)	7-13	3.50	3.00	3.50	3.25	3.22
VAN023	Assessing Energy and Cost Impact of Advanced Vehicle Technologies	Ram Vijayagopal (Argonne National Laboratory)	7-16	3.50	3.50	3.50	3.50	3.50
VAN032	Tracking the Evolution of Electric Vehicles and New Mobility Technology	Joann Zhou (Argonne National Laboratory)	7-18	3.50	3.33	3.17	3.50	3.38
VAN045	Analysis of Electric Heavy-Duty Driving and Infrastructure Requirements Within A Regional Area	Marcus Alexander (EPRI)	7-22	3.50	3.50	3.25	N/A	3.46
VAN047	Integrated Modeling and Technoeconomic Assessment of Electric Vehicle Community Charging Hubs	Eleftheria Kontou (University of Illinois)	7-24	3.00	3.33	3.00	3.33	3.21

Presentation ID	Presentation Title	Principal Investigator (Organization)	Page Number	Approach	Technical Accomplishments	Collaboration	Future Research	Weighted Average
VAN059	Deploying Charging Infrastructure to Catalyze Market Adoption of Electric Vehicles and Improve Mobility Health and Economic Outcomes in Disadvantaged Communities	Corey Harper (Carnegie Mellon University)	7-28	2.33	2.67	3.17	3.00	2.69
VAN060	Quantifying New and Used Plug-in Electric Vehicle Market Dynamics in Disadvantaged Communities	John Helveston (George Washington University)	7-31	3.50	3.50	3.33	3.67	3.50
VAN061	Transportation Electrification Impact Study	Eric Wood (National Renewable Energy Laboratory)	7-34	3.63	3.75	3.75	3.38	3.67
Overall Average				3.36	3.38	3.37	3.44	3.38

Presentation Number: VAN016
Presentation Title: Transportation Data Programs
Principal Investigator: Stacy Davis, Oak Ridge National Laboratory

Presenter

Stacy Davis, Oak Ridge National Laboratory

Reviewer Sample Size

A total of four reviewers evaluated this project.

Project Relevance and Resources

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

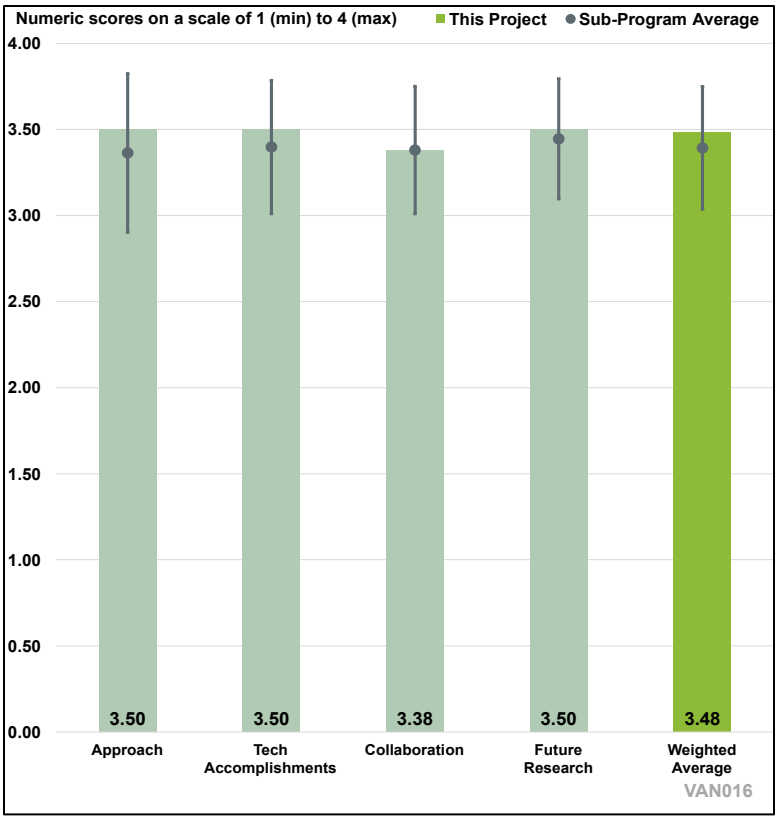

Figure 7-1. Presentation Number: VAN016 Presentation Title: Transportation Data Programs Principal Investigator: Stacy Davis, Oak Ridge National Laboratory

Question 1: Please comment on the degree to which technical barriers are addressed. Is the project well designed, and is the timeline reasonably planned?

Reviewer 1

This project provides a valuable platform to gather and consolidate data that can support research, technology development, and decision making on transportation. The project is designed well with a reasonable timeline. It would be nice to see more outreach efforts on promoting the Transportation Energy Data Book (TEDB) and Fact of the Week outside of DOE/national laboratories. It would be nice to gather user feedback on the format of the TEDB, as the over 400-page PDF is less likely to be the way most people utilize the tool and may potentially prevent an individual data table to be updated at an ad-hoc and timely fashion. Considering most users may rely heavily on the search function to find a data table from specific topics, exploring a more interactive online interface may be more user-friendly.

Reviewer 2

The TEDB is a tried and true approach and there is no need to change. The Fact of the Week (FOTW) is a great way to spread VTO Analysis and there is no reason to change the current approach. Regarding additional medium- and heavy-duty vehicle (MHDV) analysis, investigating the potential for updated and new data is important. The approach, which includes, literature review, Experian, and 2021 Vehicle Inventory and Use Survey (VIUS) data, is reasonable.

Reviewer 3

The bulk of the project funding and work is to update the TEDB. Having a consistent data source that is used across DOE (and other federal agencies?) is useful to eliminate duplicate work and inconsistencies in analysis findings. The approach and process has been refined over 41 editions. Improving the data and outputs to include visualizations/dashboarding and application programming interface (API) is a good addition. Though as mentioned in comments, updating the data more frequently seems necessary in today's environment. The work on medium/heavy truck usage and scrappage is interesting and useful. The reviewer wondered if the work is duplicated, or done differently, by other federal agencies (Energy Information Administration, U.S. Department of Transportation [DOT]/National Highway Traffic Safety Administration) to where the analysis and results are inconsistent across the government.

Reviewer 4

The technical barriers are unclear but appear in the Multi-Year Program Plan 2011–2015; Section 2.6 Outreach, Deployment and Analysis A, B, C; and Section 3.2 Program Analysis. No other reference to these barriers was found in the Annual Merit Review (AMR) presentation or the TEDB Edition 40. However, a precise match for the text was located in a 2010 DOE/EERE report from the Vehicle Technologies Program, titled Multi-Year Program Plan 2011 – 2015. The reviewer assumed that the TEDB will be released on schedule (that is good) and sees from the response to reviewer comments from the previous year that improving the API was cited as an area of improvement and that work continues (that is also good).

Question 2: Please comment on the technical progress that has been made compared to the project plan.

Reviewer 1

This project has a long history with a proven record of accomplishments. It is nice to see that improvements are continuously being implemented, and future implementation of API function will be a great addition.

Reviewer 2

The reviewer stated that it was great to hear that the backend of the TEDB is getting a bit of an overhaul, and that some new user-facing features are being worked on. FOTW is a boon to VTO as an organization and amazing that over half of VTO site visits were through FOTW. The reviewer found the analysis "shorts" to be thought-provoking as well. The reviewer was happy to hear that the laboratories collaborated on the additional MHDV analysis and jumped into the new VIUS dataset with most of the basic/initial analysis (relevant to many of us modelers) being completed.

Reviewer 3

The reviewer stated that the FOTW seems to be a good path to get new users/laypeople to the VTO webpage which seems to be a significant reason for its use and also a key output of this work. The work on medium/heavy truck usage and scrappage is interesting and useful. The reviewer thought it was understandable that not enough data to quantify scrappage were available. The 2021 VIUS data analysis study will be interesting and provide useful knowledge updates that have been lacking since 2002.

Reviewer 4

In-lieu on an explicit description of specific technical barriers to overcome, the reviewer made a few guesses. It can be seen from the Responses to Previous Reviewer Comments section (on Slide 13) that automating the data book API was identified as a potential area for improvement during the

2023 AMR. Based upon Technical Accomplishments presented on Slide 8, the reviewer assumed that some of this work was accomplished. From the Approach – Description on Slide 5 of the presentation, there was insufficient data in the past to develop scrappage rates for trucks and that TEDB Edition 41 will include such scrappage rates, based upon a University of Tennessee study. An understanding of scrappage rates are critical to fleet turnover, and fleet turnover fosters the transition to cleaner transportation. This contribution could be important.

Question 3: Please comment on the collaboration within the project team. Are there specific contributions made by industry, national laboratories, or other external entities? Are there areas where more collaboration is needed?

Reviewer 1

The project shows great collaboration within the project team. This work requires a lot of effort coordinating with data sources, and the team seems to do a good job. Transportation has always been intertwined with other sectors, such as urban planning and socioeconomics, so it may be beneficial to include some of the relevant entities/data sources that may be useful for transportation energy related research.

Reviewer 2

This work is inherently collaborative; TEDB requires working with a myriad of federal agencies and other organizations to compile and update data. FOTW requires working with VTO leadership and the folks who completed the highlighted individual analyses. The collaboration with the National Renewable Energy Laboratory (NREL) is unique in that Oak Ridge National Laboratory (ORNL) was able to leverage intra-DOE freight truck expertise to maximize value-add for the new VIUS (and explore other potentially valuable datasets).

Reviewer 3

The TEBD is ORNL only. The medium-/heavy-duty truck collaboration between ORNL and NREL on this project seems to be working well. Argonne National Laboratory (ANL) is an unfunded partner and provides data to ORNL for this work.

Reviewer 4

Collaboration seems to have been limited to NREL ($40,000) and ANL; perhaps this is all that is required. Additional collaboration might be warranted with academic researchers, the United States Government (USG) such as DOT, the Environmental Protection Agency (EPA), etc., and other national laboratories (Lawrence Berkeley National Laboratory [LBNL] for heavy-duty trucks, for instance). Such collaboration and coordination can help to harmonize USG messaging on such topics.

Question 4: Please comment on the proposed future research. Has the project clearly defined a purpose for future work? To what extent will future work likely achieve its targets?

Reviewer 1

Future work is clearly defined and achievable. The reviewer would also like to encourage the team to consider making improvement on the user interface of TEDB, with the amount of data in the collection, it can be overwhelming for users, especially general public, who want to find quick facts and data that is relevant to them. The reviewer said it may be nice to have more filtering/categorization function on the web interface to help the user navigate the data without going through hundreds of pages or browsing a laundry list of tables. The reviewer also said it may be beneficial to move the official TEDB from a gigantic PDF publication to more user friendly, interactive dashboard/table web interface in the future.

Reviewer 2
The reviewer had nothing further to add here other than to continue updating and publishing the TEDB! VTO should find ways to push this into the public, whether that is on social media (LinkedIn, Twitter/X) or elsewhere.

Reviewer 3
The reviewer believes that future research to continue the TEDB is clear. The other aspects of future research were more vague.

Reviewer 4
The bulk of this future work involves regularly publishing transportation data which does occur on a timely basis. As such, the reviewer assumed that the project is clearly defined. As noted in the previous year's reviewer comments, API development is important and the reviewer suspects that it will continue to merit ongoing effort and funding. Fostering academic research that makes use of and/or leverages the TEDB could be of future value (the reviewer thought of the recent University of Tennessee vehicle scrappage analysis by Green and Leard in this context).

Question 5: Please comment on the relevance of the project. Does the project support the overall VTO subprogram objectives?

Reviewer 1
This project is highly relevant to the mission of DOE and VTO. The reviewer commented that it is very valuable to support research and making policies for transportation energy at VTO.

Reviewer 2
"Create and maintain a strong foundation of data" is clearly addressed by this project.

Reviewer 3
The work to provide a consistent data source that is used across DOE (and other federal agencies?) is useful to eliminate duplicate work and inconsistencies in analysis findings. With so many data sources available that is produced/updated more frequently and likely in more or different detail, it would be interesting for the project to do a user workshop to understand how/if people use the data, what data users feel is missing/could be improved, and what other data sources they use instead of/in addition to the TEDB data.

Reviewer 4
Public awareness of the Transportation Fact of the Week is important and indirectly supports the overall VTO mission. The TEDB is also useful in this regard. The reviewer suspects that researchers (from VTO and elsewhere) that are in need of such data are likely to obtain it directly from other USG sources. With that said, researchers do reach for the TEDB when a quick, off-the-cuff energy statistic is required.

Question 6: Please provide comments on the resources of the project. Are the resources sufficient for the project to achieve the stated milestones in a timely fashion?

Reviewer 1
The resource seems adequate to accomplish milestones in a timely fashion.

Reviewer 2
The resources are sufficient. A good bang-for-the-buck for VTO.

Reviewer 3

The TEDB funding is sufficient, but perhaps too high. The reviewer would expect data access and automation would decrease the effort and cost compared to previous years. But it is not clear to the reviewer how much manual work is required to interact with the many sources (likely with changing staff and data practices). The medium-/heavy-duty truck work funding is sufficient, but could likely be expanded given the complexity in the truck market.

Reviewer 4

The reviewer presumed that the TEDB has been and will be released on schedule, so the resources are adequate. Funding for API development is important and should be continued. Funding directed towards the incorporation of new analysis, such as scrappage rates from the University of Tennessee study, is also important and should be continued, possibly increased, should the need be found to exist. Likewise, collaboration with NREL on medium- and heavy-duty truck data and analysis is important and may need to be funded at rates greater than $40,000. LBNL is also engaged in important heavy-duty truck-related research that may be of value. Also, consider funding to expand the data offerings from Wards Auto, J.D. Power, Experian, etc. While much of this data is generally prohibited from unregulated public circulation, it should be possible to aggregate the data in a manner that is still useful to the general public, while maintaining business confidentiality. This data would be of great value internally to researchers that may produce derivative data products that can be made public.

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 three reviewers evaluated this project.

Project Relevance and Resources

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

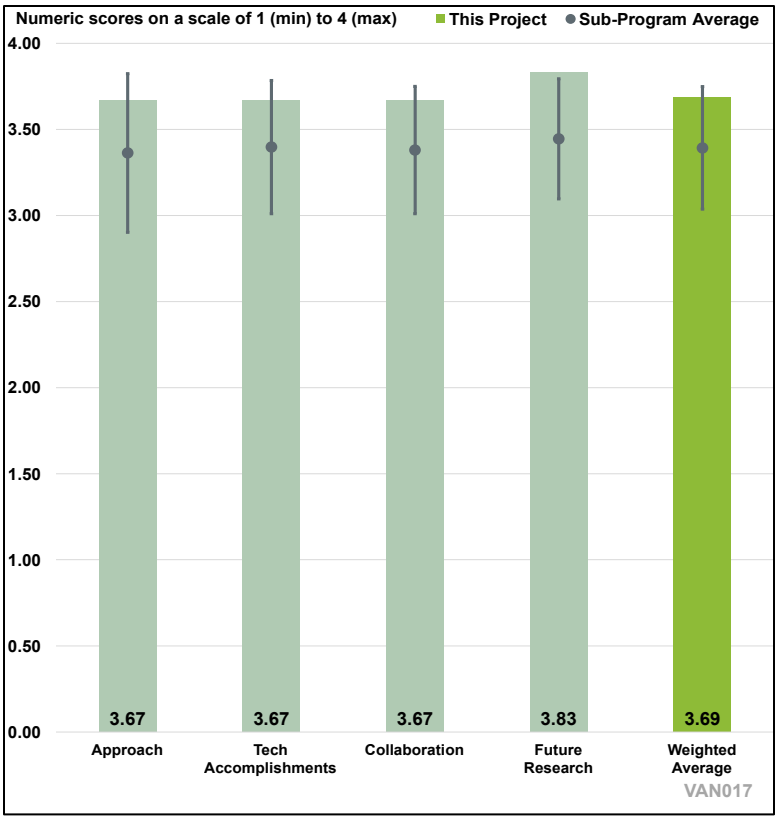

Figure 7-2. Presentation Number: VAN017 Presentation Title: ANL VTO Analysis Modeling Program Principal Investigator: Michael Wang, Argonne National Laboratory

Question 1: Please comment on the degree to which technical barriers are addressed. Is the project well designed, and is the timeline reasonably planned?

Reviewer 1

The reviewer stated that the first two barriers are very broad and all of the work presented, addresses them to some degree. There was not any discussion on whether the chosen pathways to whittle away at these barriers (Tasks 1-4) were selected due to their being priorities, or low-hanging fruit, or both. Regarding Task 1, the reviewer is not versed in different sources for "non-CO_2 GHG pollutants," but using EPA MOtor Vehicle Emission Simulator (MOVES) and literature review seems reasonable. The reviewer thought streamlining and automating data pipelines is always a win. For Task 2, the general approach seems reasonable to push Autonomie inputs through the Greenhouse gases, Regulated Emissions, and Energy use in Transportation (GREET) model to dump out greenhouse gases (GHGs). The reviewer thought Task 3 was a great idea and expanding the grid mix options and leaning on National Energy Modelling System (NEMS) outputs (Annual Energy Outlook [AEO]) is a good use of resources (openly available and heavily vetted). The reviewer also thought Task 4 was a good idea and had a good approach. The presentation needs to "connect the dots" a little better. For instance, it is unclear how "developing transparent models" helps to "overcome inconsistent data and methodologies." The presentation just states what GREET is and that emerging technology/mobility options will be added and does not talk about overcoming inconsistent data and methodologies (Slide 3).

Reviewer 2

One of the barriers that the project mentions that it is addressing is “overcoming inconsistent data, assumptions, and guidelines,” which does not seem like a “barrier” but rather a motivation for this work. The reviewer commented that it would have been nice to have seen an example of how GREET resolved an inconsistency. The project is like a machine now, adding new capabilities and automating tasks. The reviewer thought it would also have been nice to have described in more detail the “new methodology to automate annual updates of fuel economy.” There were a number of publication references, and the reviewer hopes one of those papers has more details. The reviewer also said it was nice to see a very practical exercise of using GREET to inform policy incentives (Task 4).

Reviewer 3

Dr. Wang and his research team have continuously and consistently overcome *so* many technical barriers throughout the decades-long development of GREET. Watching the evolution of GREET throughout the decades has been a real treat. Graduate students, future researchers, and young environmentalists cut their teeth on this model, starting in the mid-nineties, and many of these people are now career local, state, and national policymakers that make regular and important use of GREET. The current iteration of GREET is no different insofar as it successfully overcomes technical barriers, such as the incorporation of alternative electric power sector generation mixes and medium- and heavy-duty cradle-to-grave (C2G) analysis.

Question 2: Please comment on the technical progress that has been made compared to the project plan.

Reviewer 1

Regarding non-CO_2 GHG pollutants in Task 1, it is not clear to the reviewer what the old source was and how much of a change resulted from the update. Additionally, on the data automation methodology, no details were given, just pictures of spreadsheets. The reviewer commented it would be helpful to know what the old methodology was, what the new methodology is, and how much time it saves. For Task 2, the reviewer would have liked to have seen an uncertainty analysis. The reviewer said it would have been helpful to know how wide the assumptions were allowed to vary in the final results to account for uncertainties. After accounting for the uncertainties in a reasonable way, the reviewer would have liked to have known if the results were significant. For Task 3, there is a good spread of grid mixes, but the reviewer commented that the sensitivity could have been accomplished with far less; 4-5 cases would have covered the whole range with far less complexity. For Task 4, the model is useful for exploring different sensitivities.

Reviewer 2

The reviewer gave the project kudos as each task had significant accomplishments.

Reviewer 3

The task-specific objectives have been dealt with very successfully. The inclusion of the Bipartisan Infrastructure Law (BIL) and Inflation Reduction Act (IRA)-related incentives into the Heavy-Duty Battery Electric Vehicle Infrastructure Scenario Analysis Model (HEVISAM) is particularly noteworthy and relevant, as is the streamlining of data integration. The potential complexity and time-intensiveness of such data integration efforts is often not fully appreciated by many outside of the small circle of people directly involved in the process. Developing such a large and complex model that is internally consistent is hard work. The integration of other models from DOE and national laboratories, such as Autonomie, the Battery Performance and Cost (BatPaC) model, HEVISAM,

and EverBatt, etc., provides a robust, powerful, and defensible suite of modeling tools, the value of which (for regulators, at least) would be difficult to overstate. The expansion of electricity mix options to include additional AEO scenarios, regional fidelities, and decarbonization initiatives is relevant. The reviewer said it would be of great value to see this expansion include harmonization with EPA data and modeling efforts beyond the Emissions & Generation Resource Integrated Database (eGRID), such as EPA's Power Sector Modeling Platform using the Integrated Planning Model (IPM), used to support EPA's stationary and now, mobile source rulemakings.

Question 3: Please comment on the collaboration within the project team. Are there specific contributions made by industry, national laboratories, or other external entities? Are there areas where more collaboration is needed?

Reviewer 1

The reviewer commented that there seems like a good amount of collaboration: industry (U.S. DRIVE, Aluminum Association, and American Iron and Steel Institute), national laboratories (ANL, NREL, ORNL), and academia (University of Michigan). But it is unclear whether any of this was actual collaboration versus citation. Grid mixes from NREL were used, but the reviewer questions if the team worked with NREL or just downloaded the publicly available data/projections. The reviewer had the same concern with ORNL and U.S. DRIVE (embedded into Autonomie outputs).

Reviewer 2

The lab work is coordinated well, not just within ANL and other laboratories but also within multiple offices at DOE. This is commendable. However, since GREET uses some aspects of EPA's MOVES4 model, the reviewer said it was peculiar to see no engagement/collaboration with EPA.

Reviewer 3

The interactions with other VTO projects and models are readily apparent and is one of the greatest accomplishments of the GREET suite of tools. Collaboration and coordination appear strong, particularly with other national laboratories. The reviewer commented that it would have been useful to have a better understanding of these interactions with original equipment manufacturers (OEMs) and, particularly, energy companies.

Question 4: Please comment on the proposed future research. Has the project clearly defined a purpose for future work? To what extent will future work likely achieve its targets?

Reviewer 1

Non-CO_2 pollutants for hybrid electric vehicles (HEVs) and plug-in hybrid electric vehicles (PHEVs) needs more work. The review was not sure it is worth spending resources on expanding "new mobility options" in GREET as there is enough uncertainty to iron out in the modes currently covered by GREET.

Reviewer 2

Slide 19 does a good job of laying out future work. In particular, the impact of criteria pollutants is of increasing concern for communities as there is a more direct impact to human health. The reviewer suggested that expanding the future work to more broadly evaluate criteria pollutants be of greater priority.

Reviewer 3

The expansion of electricity mix options to include additional AEO scenarios, regional fidelities, and decarbonization initiatives is relevant and important. In that same vein, the reviewer said it would be of even greater value to see the expansion of GREET include harmonization not only with EPA's

eGRID, but to also expand GREET to include electricity mix options from EPA's Power Sector Modeling Platform using IPM, an economic dispatch model which is used to support EPA's stationary and now, mobile source rulemakings.

Question 5: Please comment on the relevance of the project. Does the project support the overall VTO subprogram objectives?

Reviewer 1

The project primarily supports the following objectives but lends support to the "foundation of data" objective as well: build, maintain, and exercise relevant analytical models; execute insightful integrated analyses that provide greater understanding of critical transportation energy problems.

Reviewer 2

The reviewer commented that the project is absolutely relevant.

Reviewer 3

GREET, in conjunction with Autonomie, BatPaC, HEVISAM, EverBatt, etc., clearly supports many VTO subprogram objectives. In addition to being DOE's flagship life cycle analysis (LCA) model, GREET may very well be the best example of a VTO project that cuts across multiple subprograms.

Question 6: Please provide comments on the resources of the project. Are the resources sufficient for the project to achieve the stated milestones in a timely fashion?

Reviewer 1

The resource allocation is sufficient to complete the task list along with the regular model maintenance and "cog-turning" that is required for such a large model.

Reviewer 2

The reviewer commented that there were sufficient resources.

Reviewer 3

Continued GREET development is critical for ongoing LCA research and policymaking purposes domestically and abroad. While the reviewer is aware that every dollar spent on GREET is one less dollar that DOE can spend on other valuable transportation-related projects, the reviewer highly encourages GREET's continued funding and development and looks forward to new releases. To this end, it is the reviewer's understanding that EPA is considering providing additional financial support to DOE to facilitate harmonization of GREET with EPA electric power sector dispatch modeling tools.

Presentation Number: VAN021
Presentation Title: Transportation Energy Evolution Modeling (TEEM) Program
Principal Investigator: Ruixiao Sun, Oak Ridge National Laboratory

Presenter

Ruixiao Sun, Oak Ridge National Laboratory

Reviewer Sample Size

A total of two reviewers evaluated this project.

Project Relevance and Resources

100% of reviewers felt that the project was relevant to current DOE objectives, 0% of reviewers felt that the project was not relevant, and 0% of reviewers did not indicate an answer. 50% of reviewers felt that the resources were sufficient, 50% of reviewers felt that the resources were insufficient, 0% of reviewers felt that the resources were excessive, and 0% of reviewers did not indicate an answer.

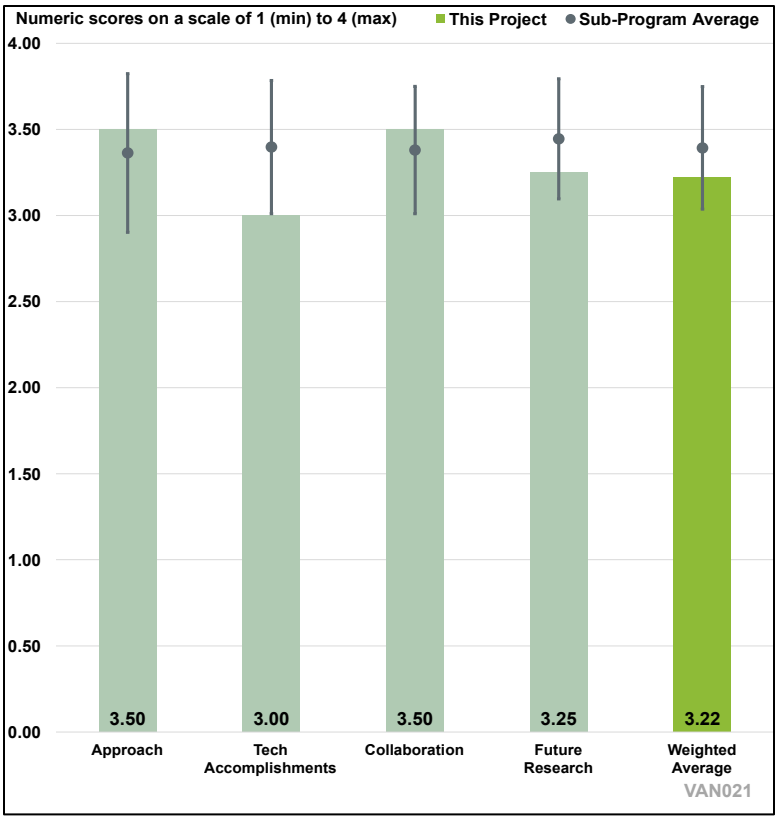

Figure 7-3. Presentation Number: VAN021 Presentation Title: Transportation Energy Evolution Modeling (TEEM) Program Principal Investigator: Ruixiao Sun, Oak Ridge National Laboratory

Question 1: Please comment on the degree to which technical barriers are addressed. Is the project well designed, and is the timeline reasonably planned?

Reviewer 1

The Market Acceptance of Advanced Automotive Technologies (MA3T) is an important model for VTO and a number of stakeholders. Keeping it up to date and rebuilding/re-estimating different components are both valuable to VTO. MA3T seems like a good option for implementing methodology to estimate the impact of IRA tax credits. Capturing more of the scrappage/survival behavior, beyond simple overall national averages, is vital to fully understanding the impacts of regulations. Implementing more detailed scrappage in MA3T will greatly improve the model's ability to estimate policy impacts.

Reviewer 2

The project is an interesting look across a range of scenario cases and seems to assume that electrification is the only path to net-zero emissions. Low-carbon liquid fuels should also be considered as a complement to electrification and represented by "+P1" or "+P2" cases where liquid fuels are lower in carbon intensity but higher in price.

Question 2: Please comment on the technical progress that has been made compared to the project plan.

Reviewer 1

The reviewer commented that the work on scrappage was fascinating (Greene/Leard) and was curious how the recent surge in insurance-totaled vehicles (due to increase cost-to-repair) might reverse some of this trend. The sales/stock results from Slides 8-9 could use a little more explanation. The reviewer said it was not clear what was meant by "Adv" or "Base" under battery and charging. Those assumptions (battery prices and charging infrastructure rollout) should have been explicitly noted in the presentation. The results themselves are also difficult to interpret. For instance, the reviewer questioned if the IRA added 5-10 million new vehicle sales per year in the late 2020s. The reviewer thought the change in total stock was odd as well. The reviewer questioned if the used vehicle market was not a zero-sum change., i.e., if it results in less scrappage overall rather than less battery electric vehicle (BEV) scrappage, and more internal combustion engine (ICE) scrappage. The reviewer thought it odd that the total stock grows much more in the higher BEV cases. The reviewer assumed travel demand is not changing, so all of these vehicles are being added to the fleet, and the total mileage per vehicle drops considerably (e.g., in BI+IRA1E there are over 50 million more vehicles on the road in 2050 versus Ref). The reviewer was not sure if these results were ready to be shown. Additionally, the International Council on Clean Transportation's (ICCT's) low IRA case assumes no BEVs qualify for the foreign entity of concern (FEOC) limitation, meaning, there should be no tax credit impact after 2025 (when critical mineral FEOC constraint comes into play—battery components FEOC constraint started in 2024). In other words, BI+IRA1 should not have a BEV ramp up into 2031.

Reviewer 2

The reviewer noted that there is still work to do on tuning the model and understood that the results shown were preliminary. The reviewer was also surprised by the variation in size of 2050 light-duty vehicle (LDV) stock over a range of scenarios (EIA's Annual Energy Outlook has 2050 stock at 294 million).

Question 3: Please comment on the collaboration within the project team. Are there specific contributions made by industry, national laboratories, or other external entities? Are there areas where more collaboration is needed?

Reviewer 1

MA3T, like any large model, requires a number of data inputs from a range of sources. The reviewer said it would have been helpful for the presentation to differentiate between these sources and active direct collaborations with other organizations, rather than bunching it all together.

Reviewer 2

The reviewer commented that there was collaboration across multiple teams.

Question 4: Please comment on the proposed future research. Has the project clearly defined a purpose for future work? To what extent will future work likely achieve its targets?

Reviewer 1

The future work aligns with the project goals (project ends in September 2024).

Reviewer 2

The reviewer questioned if there was value in aligning the model to new EPA GHG standards. The reviewer commented that it might be more interesting to run the model based on various incentives and assumptions and assess alignment with EPA compliance cases.

Question 5: Please comment on the relevance of the project. Does the project support the overall VTO subprogram objectives?

Reviewer 1

The reviewer said the project directly supports all three objectives.

Reviewer 2

The reviewer commented that the work is highly relevant and should prove useful in assessing policy measures.

Question 6: Please provide comments on the resources of the project. Are the resources sufficient for the project to achieve the stated milestones in a timely fashion?

Reviewer 1

Resources seem well-aligned with the expertise and effort required to complete the project.

Reviewer 2

The reviewer noted that this project may need more time and/or budget for thorough model development and scenario runs.

Presentation Number: VAN023
Presentation Title: Assessing Energy and Cost Impact of Advanced Vehicle Technologies
Principal Investigator: Ram Vijayagopal, Argonne National Laboratory

Presenter

Michel Alhajjar, Argonne National Laboratory

Reviewer Sample Size

A total of two reviewers evaluated this project.

Project Relevance and Resources

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

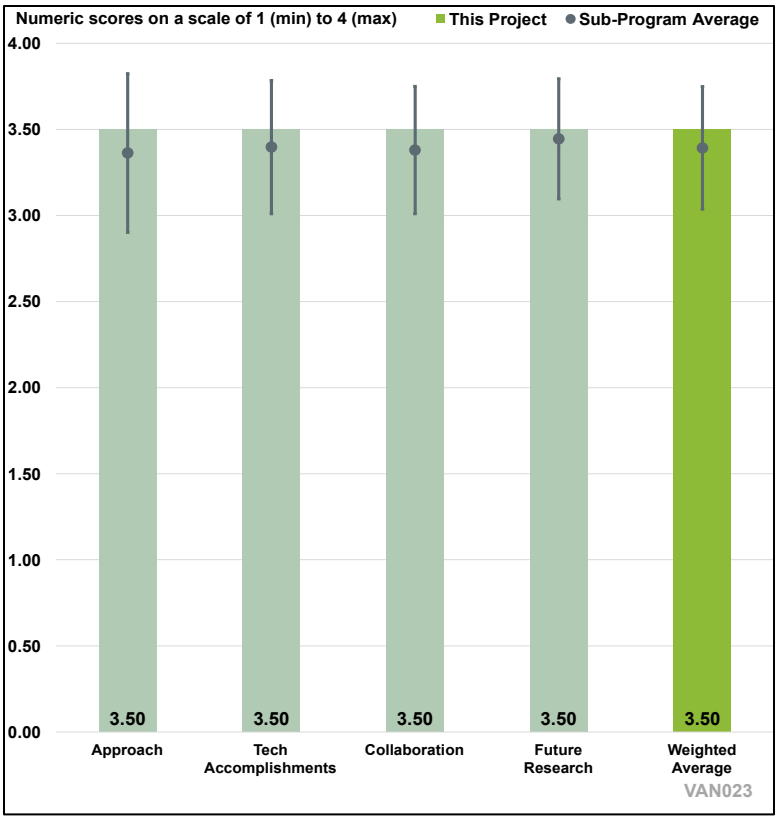

Figure 7-4. Presentation Number: VAN023 Presentation Title: Assessing Energy and Cost Impact of Advanced Vehicle Technologies Principal Investigator: Ram Vijayagopal, Argonne National Laboratory

Question 1: Please comment on the degree to which technical barriers are addressed. Is the project well designed, and is the timeline reasonably planned?

Reviewer 1

The approach to analyzing vehicle technologies is sound and well accepted by outside stakeholders.

Reviewer 2

The reviewer said the team is doing a good job at integrating a wide array of data sets and models.

Question 2: Please comment on the technical progress that has been made compared to the project plan.

Reviewer 1

Progress appears to have been on track through the period of performance. This was likely very challenging considering the need for ANL to support government-wide analyses over the past 2 years.

Reviewer 2

The reviewer commented that the project seems to be on track for timely completion.

Question 3: Please comment on the collaboration within the project team. Are there specific contributions made by industry, national laboratories, or other external entities? Are there areas where more collaboration is needed?

Reviewer 1

Work appears to be well coordinated with other national laboratories, with DOE, and with other federal agencies.

Reviewer 2

The team has responded to multiple stakeholders in expanding scope and capabilities over time.

Question 4: Please comment on the proposed future research. Has the project clearly defined a purpose for future work? To what extent will future work likely achieve its targets?

Reviewer 1

The reviewer would recommend that a greater variety of sources of cost data be incorporated, in particular, additional sources of component and vehicle teardown data.

Reviewer 2

The reviewer is looking forward to battery recycling database integration and the desktop version of TechScape.

Question 5: Please comment on the relevance of the project. Does the project support the overall VTO subprogram objectives?

Reviewer 1

Autonomie continues to be a key tool for evaluating VTO vehicle technology programs.

Reviewer 2

The project will be useful as a starting point for newer electric vehicle adopters in assessing costs and capabilities.

Question 6: Please provide comments on the resources of the project. Are the resources sufficient for the project to achieve the stated milestones in a timely fashion?

Reviewer 1

The reviewer stated that no indication was provided that funding was insufficient for near-term and future goals.

Reviewer 2

The reviewer commented that the project seems on track to complete planned work within the project timeframe.

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 three reviewers evaluated this project.

Project Relevance and Resources

100% of reviewers felt that the project was relevant to current DOE objectives, 0% of reviewers felt that the project was not relevant, and 0% of reviewers did not indicate an answer. 67% of reviewers felt that the resources were sufficient, 33% of reviewers felt that the resources were insufficient, 0% of reviewers felt that the resources were excessive, and 0% of reviewers did not indicate an answer.

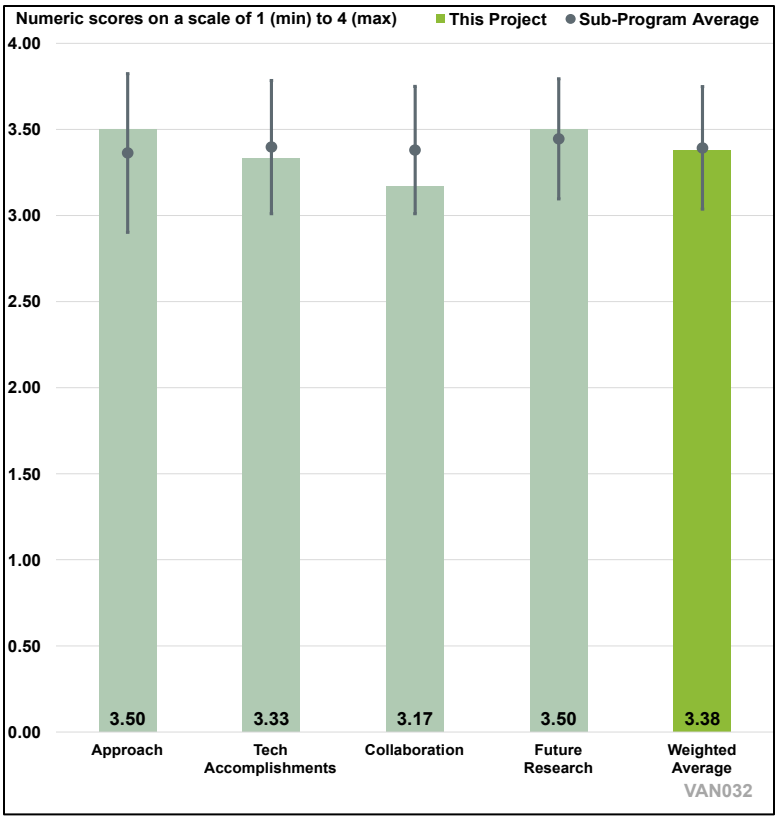

Figure 7-5. Presentation Number: VAN032 Presentation Title: Tracking the Evolution of Electric Vehicles and New Mobility Technology Principal Investigator: Joann Zhou, Argonne National Laboratory

Question 1: Please comment on the degree to which technical barriers are addressed. Is the project well designed, and is the timeline reasonably planned?

Reviewer 1

The reviewer said the work approach is good, although there were some weaknesses due to data limitations (Experian stock data is quite different from S&P/Polk, and Ward's sales data does not align perfectly into EPA car/light truck categories). There are ways to solve the data issues, but they are either too expensive for this project (Polk) or are not publicly available (EPA official production numbers by car/light truck and nameplate). Additionally, the approach should be to develop estimates with uncertainties, rather than single values. This is particularly relevant for the counterfactuals required to estimate GHG reduction, gasoline consumption reduction, and fuel cost savings.

Reviewer 2

Information on markets (e.g., vehicle registrations) and commodity flows is well presented and highly useful. Results on fuel cost savings and total cost of ownership seem somewhat at odds with other analyses. Rather than general claims in this area, the reviewer said it might be useful to select several "tracking model pairs" consisting of a new electric vehicle (EV) vs. new ICE vehicle or new HEV and compare the 5-year ownership cost while detailing general and regional assumptions. HEV options, particularly in cases where gasoline prices are high, may compete more favorably than the

baseline ICE vehicle and make a stronger showing against the EV option. The reviewer said it would have been nice to see annotations where/when disruptions in data trends are observed. For example, the reviewer questioned if there were changes in policy or issues in supply. The reviewer also questioned if these were short-term blips or the first signs of fundamental shifts in the market.

Reviewer 3

The battery manufacturing and planned battery plant investment research is of tremendous national and international value and was heavily cited by EPA in its recent light-, medium-, and heavy-duty rulemakings. The battery manufacturing and battery plant investment research are very important and, depending upon DOE's available funding, may even have been strong enough to stand on its own (that is, independent of the research on EV market trends and usage of mobility technology as a function of household income). This latter research on EV market trends and usage of mobility technology as a function of household income is more basic and still developing and the reviewer is confident that it will have increasing importance in the future.

Question 2: Please comment on the technical progress that has been made compared to the project plan.

Reviewer 1

The team has produced several great pieces of analysis. Recent sales trends, including both the number of units as well as sales-weighted attributes, are very important for VTO to understand the U.S. LDV market as it evolves. The manufacturing and battery production flows (Slide 9) are particularly helpful as other modelers attempt to estimate the potential eligibility for the IRA clean vehicle credits (CVC). The gasoline displacement analysis needs to include caveats and uncertainties if published and should present ranges and not single values due to the enormous uncertainty of the counterfactual fuel economy and vehicle miles traveled (VMT). BEV VMT is around 15% lower than that of non-BEVs, not because of the powertrain but because they are luxury vehicles; and luxury vehicles are driven less miles than mass-market vehicles. More importantly, though, the analysis assumes a counterfactual case that likely does not meet Corporate Average Fuel Economy (CAFE) or EPA GHG. ICE vehicles in a no-BEV world would be much more efficient to comply with CAFE. Local fuel use and GHG emission reductions should have included HEVs, which are clearly the preferred manufacturer non-plug-in vehicle (PEV) compliance option, and an option that consumers have widespread access to across most size classes. The same goes for the "public-facing EV fact page," HEVs should be included in the total cost of ownership (TCO) calculations.

Reviewer 2

The reviewer would have liked to have seen more rigor and detail on the total cost of ownership analysis.

Reviewer 3

The technical accomplishments associated with the battery manufacturing and planned battery plant investment research are great and fill an important gap in our understanding and the reviewer encourages the funding of this work. The technical accomplishments of the non-battery-related research are also significant and will take additional time and funding to fully bear fruit. However, this work remains important and the reviewer encourages its support.

Question 3: Please comment on the collaboration within the project team. Are there specific contributions made by industry, national laboratories, or other external entities? Are there areas where more collaboration is needed?

Reviewer 1

The reviewer stated that there does not appear to be much direct collaboration on project work aside from working with regional agencies on mobility usage data. Other laboratories, academia, and industry (and government agencies) are all thinking about these market dynamics and would likely have a lot to contribute (whether via review of ANL work and assumptions or directly developing analyses with ANL).

Reviewer 2

The reviewer stated that the collaboration with NREL and ORNL seems about right, as is the outreach with regional agencies, Clean Cities, and the City of Chicago. The reviewer suggested reaching out to EPA's Transportation and Climate Division (TCD), in the Office of Transportation and Air Quality (OTAQ), with regards to the EV market trends and usage of mobility technology as a function of household income as this work lines-up nicely with their portfolio. Regarding the battery-specific research, the reviewer suggests reaching out to EPA's Assessment and Standards Division (ASD), also in OTAQ.

Reviewer 3

The reviewer did not have any specific comments.

Question 4: Please comment on the proposed future research. Has the project clearly defined a purpose for future work? To what extent will future work likely achieve its targets?

Reviewer 1

The reviewer said maintaining publication of current reports and analyses is good. The supply chain component is valuable, and it would be helpful for ANL to maintain a live database (even just an Excel file updated monthly) to account for the inevitable new announcements and delays over the coming years. The reviewer does not think this warrants another project with more funding, just posting the already regularly internally updated spreadsheet as a resource. This reviewer referenced prior comments for a few ideas on future work. Future work could include a more detailed assessment of the counterfactuals for the gasoline consumption and emissions reduction analyses. The reviewer also recommends adding HEVs to all "BEV v. ICE" analyses (emissions, TCO), because consumers are not operating in an ICE vehicle vs. BEV dichotomy.

Reviewer 2

In looking at regional emissions impacts, the reviewer thought it might be useful to also consider consumer choices around clean electricity. Even where electric power grids are still coal-heavy, EV buyers have options around clean electricity procurement ranging from home solar to utility-sponsored programs to renewable energy credit (REC) purchases. The reviewer expects that where consumer choice of an EV is motivated, at least in part by the desire to reduce GHG emissions, there will also be actions taken on clean electricity. The reviewer commented that it would be interesting to know if data supports this (i.e., are EVs serving to accelerate the growth of clean energy in the power grid).

Reviewer 3

The reviewer stated that continuing to document battery manufacturing and planned battery plant investments will be of great importance into the future and the reviewer urges DOE to continue funding such research. Likewise, the reviewer urges DOE to consider funding more basic research,

such as the non-battery-related aspects of this project. The reviewer suspects that these aspects will likely have increased importance in the future. This is one downside of collecting basic statistics on newer, not-well-established projects, like those presented here. An early finding that high-income households in Chicago are more likely to use high-tech gizmos, such as transportation network companies (TNCs), e-bike, and e-scooter services, it is not particularly surprising or illuminating. However, a finding (in a hypothetical future) that low- and medium-income households in Chicago are starting to adopt the use of TNCs, e-bike, and e-scooter services would be of great relevance, for it would suggest the mainstreaming of vehicle electrification. And before such a historic transition can be divined from the data, much historical data will need to be gathered.

Question 5: Please comment on the relevance of the project. Does the project support the overall VTO subprogram objectives?

Reviewer 1

This project supports both of the following VTO Analysis objectives: create and maintain a strong foundation of data; and execute insightful integrated analyses that provide greater understanding of critical transportation energy problems.

Reviewer 2

The reviewer did not have any specific comments.

Reviewer 3

The battery-specific research presented herein clearly supports the objectives of several important VTO subprograms, such as Analysis, Batteries, Electrification, Materials, etc. This research is very relevant and of great immediate value. Aspects of the non-battery-specific research (e.g., transportation electrification as a function of household income) are also important, but perhaps in the longer term. The reviewer questions if it would be beneficial for some sort of closer alignment of these aspects of the presented research with the Energy Efficient Mobility Systems subprogram.

Question 6: Please provide comments on the resources of the project. Are the resources sufficient for the project to achieve the stated milestones in a timely fashion?

Reviewer 1

The reviewer commented that resources were sufficient to achieve the stated milestones.

Reviewer 2

Funding for the battery-only portions of this project (battery manufacturing and planned battery plant investments) is well, well-worth the $250,000 spent on it in fiscal year (FY) 2023 and all of the rest of the research, the remaining six or so accomplishments, only serve to make this research a better deal for the U.S. taxpayer. (Put more crudely, it could be said that the battery-only research “pays” for or justifies the remaining research). And while the data gathered for this nascent non-battery research may not yet be earthshaking, there will come a time when it will be, and it is vital that this transition be well-documented so that the associated lessons can be learned. The reviewer suggests increasing the funding for this research so that it can continue and, ideally, suggests increasing the funding so that these researchers can purchase other vital automotive datasets to augment the existing Wards Auto and Experian Automotive data.

Reviewer 3

The reviewer did not have any specific comments.

Presentation Number: VAN045
Presentation Title: Analysis of Electric Heavy-Duty Driving and Infrastructure Requirements Within A Regional Area
Principal Investigator: Marcus Alexander, EPRI

Presenter

Marcus Alexander, EPRI

Reviewer Sample Size

A total of two reviewers evaluated this project.

Project Relevance and Resources

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

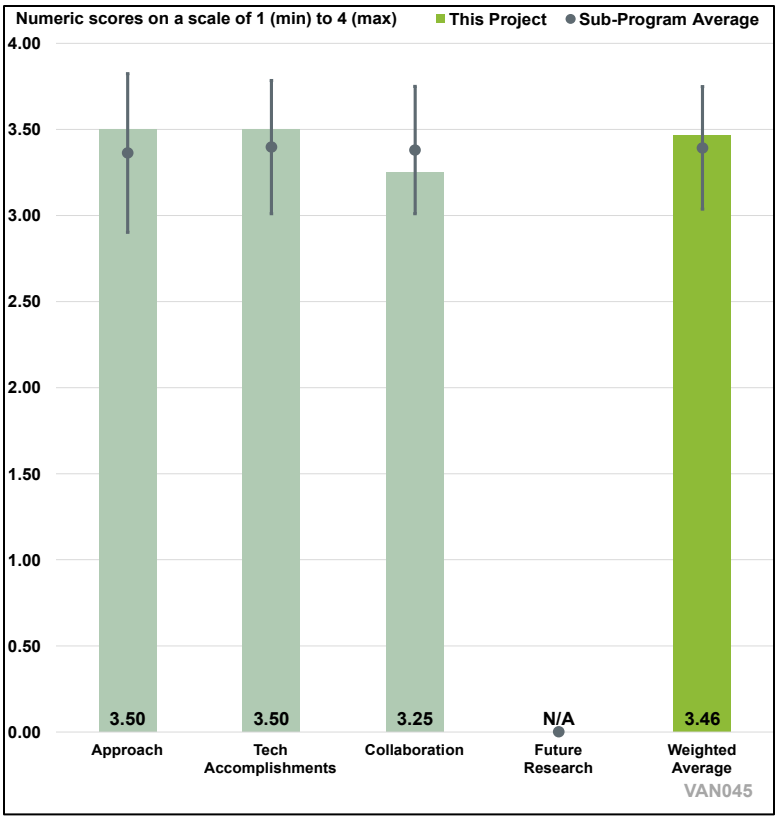

Figure 7-6. Presentation Number: VAN045 Presentation Title: Analysis of Electric Heavy-Duty Driving and Infrastructure Requirements Within A Regional Area Principal Investigator: Marcus Alexander, EPRI

Question 1: Please comment on the degree to which technical barriers are addressed. Is the project well designed, and is the timeline reasonably planned?

Reviewer 1

The approach is somewhat similar to the broader DOE Transportation Electrification Impact Study (TEIS) and the results appear to be complementary to that study.

Reviewer 2

The project team's expertise aided the project approach, which leveraged existing data, tools, and models. The overall approach to evaluate high-power charging for truck fleets is a broad area, but the focus on specific examples was good. The project was able to pull broad insights and location-specific insights on constraints/options to minimize grid upgrades to serve the load. The overall approach to model truck fleets that would/may use the charging sites was good to determine the need. Using that data with utility data/insights to understand location-specific options and costs was good.

Question 2: Please comment on the technical progress that has been made compared to the project plan.

Reviewer 1

The project appears to have been completed on time and on budget.

Reviewer 2

The project developed charging load profiles for known (depot)/anticipated (truck stop) trucks and used real-world utility data to understand current usage/limitations and determined installation cost estimates to meet the new power demand. The evaluation and comparison of several cost minimization approaches for local distribution grid upgrades was good and showed how they each can solve the challenge, but at sometimes large cost differences.

Question 3: Please comment on the collaboration within the project team. Are there specific contributions made by industry, national laboratories, or other external entities? Are there areas where more collaboration is needed?

Reviewer 1

The scope of the distribution-level analysis appears to have been fairly limited. The reviewer would have liked to have seen more utilities involved representing a larger geographic area and demographic/geographic diversity.

Reviewer 2

The project team structure with the Electric Power Research Institute (EPRI) as lead and performing utility modeling, NREL focused on core competency vehicle modeling, and utilities providing real-world data was a very good team and usage of team qualifications.

Question 4: Please comment on the proposed future research. Has the project clearly defined a purpose for future work? To what extent will future work likely achieve its targets?

Reviewer 1

The project has ended. The reviewer would recommend to DOE that they limit AMR to projects with ongoing research so that the reviews can still impact the progress of a particular project.

Reviewer 2

The project is over, but EPRI mentioned their current EVs2Scale2030 project.

Question 5: Please comment on the relevance of the project. Does the project support the overall VTO subprogram objectives?

Reviewer 1

This is obviously very relevant due to the potential distribution-level impacts of heavy-duty (HD) direct current fast charging (DCFC).

Reviewer 2

The project is a clear fit for vehicle and systems analysis to better understand the real-world operation of vehicles and grid, develop cost estimates, and mitigation approaches with results comparison is a clear industry need (utilities, commercial/municipal fleets, and truck stop operators)

Question 6: Please provide comments on the resources of the project. Are the resources sufficient for the project to achieve the stated milestones in a timely fashion?

Reviewer 1

The reviewer said no indication was provided that funding was insufficient.

Reviewer 2

The reviewer commented that funding was sufficient for a 3.5-year modeling project that included national laboratory resources.

Presentation Number: VAN047
Presentation Title: Integrated Modeling and Technoeconomic Assessment of Electric Vehicle Community Charging Hubs
Principal Investigator: Eleftheria Kontou, University of Illinois

Presenter

Ruolin Zhang, University of Illinois

Reviewer Sample Size

A total of three reviewers evaluated this project.

Project Relevance and Resources

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

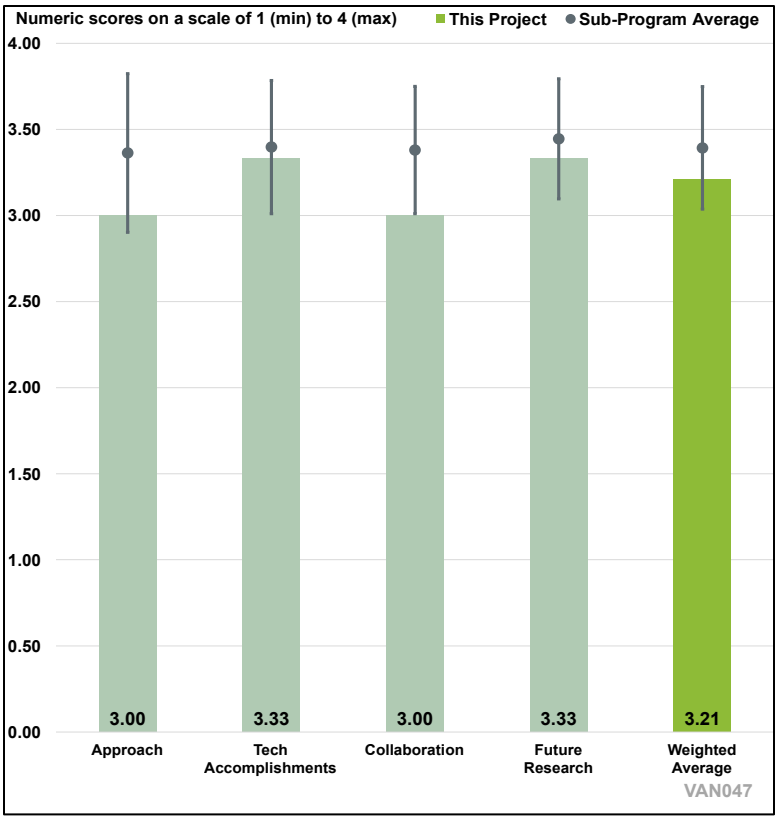

Figure 7-7. Presentation Number: VAN047 Presentation Title: Integrated Modeling and Technoeconomic Assessment of Electric Vehicle Community Charging Hubs Principal Investigator: Eleftheria Kontou, University of Illinois

Question 1: Please comment on the degree to which technical barriers are addressed. Is the project well designed, and is the timeline reasonably planned?

Reviewer 1

The project takes an interesting approach to explore an economical deployment of chargers at multi-unit dwellings (MUDs). The general approach is adequate with a reasonable timeline. However, the reviewer questioned the usage of charging station data but not vehicle data from EVWATTS to develop the logit model for the driver's decision of charging location.

Reviewer 2

The reviewer would have liked to see more emphasis on overall economics. It is not clear what the assumed costs for parking and/or charging that make investments attractive were. It was also not clear if there are significant stress points from a tenant/user/system operator perspective.

Reviewer 3

Technical barriers are well-described and addressed via multiple agents (parker, garage owner, EV owner vs. ICE vehicle owner). The challenges presented by misallocation of parking spots are discussed up-front. Approach, inputs, variables, and methods are identified and described clearly. The timeline extension (a year, i.e., 50% of the originally scheduled project duration) seems significant but understood re: COVID-19 impacts. Some of the challenges with interconnection and make-ready costs might be important to include with the techno-economic assessment, i.e., how

tools like those developed as part of this research can assist with forecasting nearer-term payback periods (thereby encouraging development of more charging facilities and make EV adoption an easier choice for consumers).

Question 2: Please comment on the technical progress that has been made compared to the project plan.

Reviewer 1

The project seems to make good progress toward its completion, and results are clearly presented with its technical contribution.

Reviewer 2

The project may need some form of pilot operation to validate that this really works for all stakeholders.

Reviewer 3

The exploration of the different factors motivating drivers/parkers was well-structured, isolated, and parameterized to achieve key insights. Comparison of several different approaches was well-formatted to unpack the impacts of the research, via charts on optimization, utilization, matchings, and revenue. There are clear advances to be made in terms of spatial visualization of impacts; there were a bit more challenging to comprehend, and a graphic user interface (GUI), as described in the outstanding deliverables, will greatly improve that issue.

Question 3: Please comment on the collaboration within the project team. Are there specific contributions made by industry, national laboratories, or other external entities? Are there areas where more collaboration is needed?

Reviewer 1

The project seems to form a strong collaboration between national laboratories and transportation agencies. However, the review stated that it can be improved by having inputs from MUD property owners and housing agencies about implementation factors/constraints to be considered.

Reviewer 2

The reviewer suggested reaching out to several charging network providers and MUD property managers for active engagement.

Reviewer 3

Community engagement as a key deliverable seems to be an important takeaway. Developing relationships with end users will produce important insights for future work. The scope of collaboration with the Alliance for Clean Transportation and the Illinois DOT is not clear.

Question 4: Please comment on the proposed future research. Has the project clearly defined a purpose for future work? To what extent will future work likely achieve its targets?

Reviewer 1

The proposed future work is clearly defined and appropriate for concluding the project, which will allow the project to achieve its targets.

Reviewer 2

The reviewer suggested trial and validation before proceeding with further analysis cases (e.g., curbside charging).

Reviewer 3

Looking into other non-household electric vehicle supply equipment (EVSE) applications seems to be a clear next step. Understanding the economics in greater detail, as well as the jurisdictional nuances of curbside charging facilities (who builds them, where, by what authority, through what funding and payback mechanisms, etc.) will be essential. Just because a location appears to be suitable does not necessarily mean that a charging facility can/will be built, given cost and payback structures that vary by jurisdiction.

Question 5: Please comment on the relevance of the project. Does the project support the overall VTO subprogram objectives?

Reviewer 1

This project is relevant and supportive of VTO subprogram objectives. MUD charging is an important challenge to address to allow the US to achieve its transportation electrification goal.

Reviewer 2

The question of MUD EV charging is highly relevant and will become important by the end of the decade as EV stock ramps up.

Reviewer 3

This research supports a key mechanic for transportation electrification. While many drivers will leverage home charging facilities, those cannot be taken for granted in a future with significantly higher degrees of transportation electrification. Further, en-route charging (away from where a vehicle is primarily domiciled) can not only benefit customers but may also create benefits for utilities by incentivizing more flexible charging, given that those en-route chargers present additional opportunities for charging that may not otherwise be available to drivers. Essentially, utilities and customers will have additional, flexible options for charging with more ports deployed in more places, all of which will benefit from some level of incentives to increase utilization. There is also an important equity component, whereby public charging experiences need to be dramatically more efficient and higher quality to facilitate more straightforward transportation electrification experiences for consumers, regardless of whether they own property on which they can charge their vehicle.

Question 6: Please provide comments on the resources of the project. Are the resources sufficient for the project to achieve the stated milestones in a timely fashion?

Reviewer 1

The reviewer commented that the resources for this project are sufficient and appropriate for achieving milestones in a timely fashion.

Reviewer 2

The reviewer said there were sufficient resources for the initial analysis phase but would like to see more work on economics (levelized cost of charging and business models) as well as pilot demonstrations as future steps.

Reviewer 3

Resources were not described at length, either in the read-ahead, or the presentation itself, so making a judgement call here is challenging. It appears that adding staff/advisors from utilities, or with additional electric utility-facing experience, may create additional value for this project, in terms of understanding more practically how parking spot electrification is planned, funded, and accomplished. Integrating concepts like rate design, interconnection, return on investment/payback

periods, and load forecasting/diversity may serve to paint a clearer picture about the potential benefits offered by integrating this research into parking systems.

Presentation Number: VAN059
Presentation Title: Deploying Charging Infrastructure to Catalyze Market Adoption of Electric Vehicles and Improve Mobility Health and Economic Outcomes in Disadvantaged Communities
Principal Investigator: Corey Harper, Carnegie Mellon University

Presenter

Corey Harper, Carnegie Mellon University

Reviewer Sample Size

A total of three reviewers evaluated this project.

Project Relevance and Resources

100% of reviewers felt that the project was relevant to current DOE objectives, 0% of reviewers felt that the project was not relevant, and 0% of reviewers did not indicate an answer. 67% of reviewers felt that the resources were sufficient, 0% of reviewers felt that the resources were insufficient, 33% of reviewers felt that the resources were excessive, and 0% of reviewers did not indicate an answer.

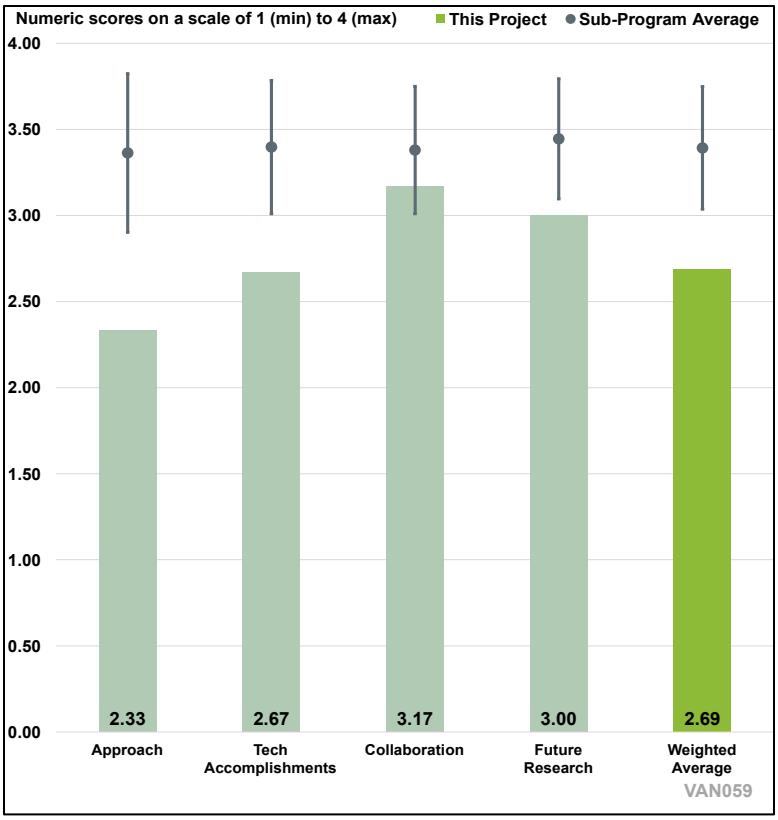

Figure 7-8. Presentation Number: VAN059 Presentation Title: Deploying Charging Infrastructure to Catalyze Market Adoption of Electric Vehicles and Improve Mobility Health and Economic Outcomes in Disadvantaged Communities Principal Investigator: Corey Harper, Carnegie Mellon University

Question 1: Please comment on the degree to which technical barriers are addressed. Is the project well designed, and is the timeline reasonably planned?

Reviewer 1

It is unclear to the reviewer how this project may address its goals, especially when the model does not seem to consider the cost of deployment and cost of EV ownership. The timeline is reasonable.

Reviewer 2

The project seems to have several very different focuses that the reviewer does not think will work. The focus on improving EV adoption in low-income/minority population is good, but seems the primary reasons are known to be more of vehicle cost and new vs. used in many cases, rather than available EVSE being the limitation. The project goals (Slide 6) are very specific like this was an implementation project, not equity modeling focused. The reviewer does not see how the (upcoming) distribution grid analysis will help answer the main questions. The reviewer thought it seemed unnecessarily too detailed for this work.

Reviewer 3

The project has a very good initial question and good integration of a number of models.

Question 2: Please comment on the technical progress that has been made compared to the project plan.

Reviewer 1

Considering the short time period of execution, the project is still at an early exploration stage, and the progress so far is satisfactory.

Reviewer 2

The reviewer acknowledged that the project started recently and has only spent 10% of the budget. Initial modeling work is underway and incorporates factors for low income and minority populations to determine location and proximity to current and future potential modelled EVSE. The Kuse factor needing to be forced to 205 (extremely high) seemed to indicate the underlying assumptions/algorithm needs to be refined.

Reviewer 3

The review commented there had been reasonable progress for only a half-year of work.

Question 3: Please comment on the collaboration within the project team. Are there specific contributions made by industry, national laboratories, or other external entities? Are there areas where more collaboration is needed?

Reviewer 1

The project seems to have a good team with university, national laboratories, and local agencies. The reviewer said it would be good to see how local agencies and communities contribute to the project, especially on how to accommodate mobility needs of communities with different demographic and geographic conditions/limitations.

Reviewer 2

The team and roles were described, but the current work was all Carnegie Mellon University (CMU) so team coordination was not highlighted since the project is not yet at the stage where NREL and UVM will be active in the project.

Reviewer 3

The reviewer commented that the project had good collaboration.

Question 4: Please comment on the proposed future research. Has the project clearly defined a purpose for future work? To what extent will future work likely achieve its targets?

Reviewer 1

The immediate future work seems to be a reasonable next step based on current progress, but it is unclear to the reviewer how this project may address its goals with proposed future work. For example, while charging infrastructure plays a crucial role in EV adoption, total cost of ownership remains the dominate reason especially for the disadvantaged communities that are more sensitive to cost. However, it is not clear to the reviewer how cost is being considered in the future project scope.

Reviewer 2

The reviewer stated that the next step of the usage modeling was described, but specific roles and work for NREL and UVM were not described.

Reviewer 3

The reviewer was concerned with how generalizable/scalable the results would be outside of Pittsburgh (the study area).

Question 5: Please comment on the relevance of the project. Does the project support the overall VTO subprogram objectives?

Reviewer 1

The project is relevant to VTO objectives and supports them.

Reviewer 2

The reviewer said the project is relevant but needs to be more focused to address a targeted relevant question and not try to do too much in one project. The reviewer also said this project should reevaluate the relevance for some of the work (e.g., distribution network analysis).

Reviewer 3

The reviewer commented that the project is highly relevant.

Question 6: Please provide comments on the resources of the project. Are the resources sufficient for the project to achieve the stated milestones in a timely fashion?

Reviewer 1

The review stated that the resources were appropriate for the project to meet milestones in a timely fashion.

Reviewer 2

The reviewer commented that the resources of the project were sufficient.

Reviewer 3

The reviewer said the resources were sufficient, but likely excessive if/when the project scope evaluation is complete, e.g., distribution analysis and determining how to meet specific metrics (e.g., increase EV adoption in disadvantaged communities [DACs], decreased travel cost/time, decrease grid upgrade costs, determining how many EVSE are needed in a specific area).

Presentation Number: VAN060
Presentation Title: Quantifying New and Used Plug-in Electric Vehicle Market Dynamics in Disadvantaged Communities
Principal Investigator: John Helveston, George Washington University

Presenter

John Helveston, George Washington University

Reviewer Sample Size

A total of three reviewers evaluated this project.

Project Relevance and Resources

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

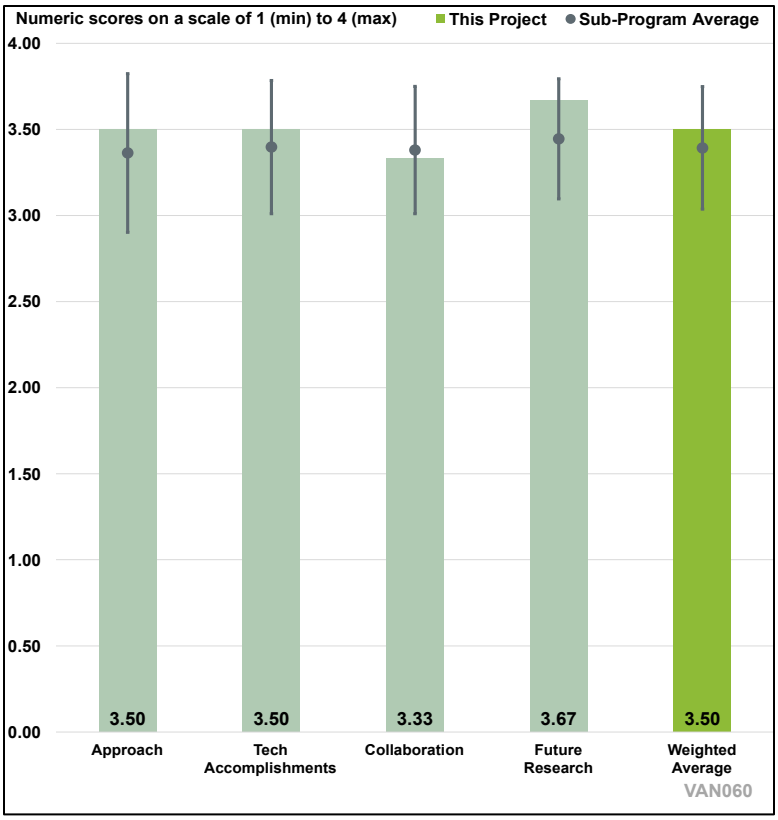

Figure 7-9. Presentation Number: VAN060 Presentation Title: Quantifying New and Used Plug-in Electric Vehicle Market Dynamics in Disadvantaged Communities Principal Investigator: John Helveston, George Washington University

Question 1: Please comment on the degree to which technical barriers are addressed. Is the project well designed, and is the timeline reasonably planned?

Reviewer 1

This project has a good structure to understand PEV market dynamics and study consumer preference in DACs, and the timeline is reasonably planned. One suggestion for Thrust 1 is to consider how the insight may be used to evaluate total cost of ownership for new and used electric vehicle buyers, and how cost parity may vary between the new and used car market.

Reviewer 2

The reviewer said the approach was interesting and innovative.

Reviewer 3

The study is well designed and will address the barriers listed for exploration. The timeline for the project is reasonable and achievable. The study will help identify some interesting observations about how to make EV ownership more equitable by understanding some of the root causes. The reviewer said it is an important topic, was glad to see it funded, and was looking forward to the project results.

Question 2: Please comment on the technical progress that has been made compared to the project plan.

Reviewer 1

The project shows good progress toward the project plan. While the dataset used in the study has its challenges and certainly not perfect, it allows informative and insightful analysis to been done. The idea of using social media platforms for the survey is interesting, but potential data quality issues and sampling bias should be addressed.

Reviewer 2

The reviewer commented that the initial results were intriguing.

Reviewer 3

The project started a few months ago and it seems to be progressing well. The George Washington University team and NREL partnership seems to be working well. The reviewer said it is a relatively low dollar project but an important project. Equity is important and hopefully the results will help develop better policies.

Question 3: Please comment on the collaboration within the project team. Are there specific contributions made by industry, national laboratories, or other external entities? Are there areas where more collaboration is needed?

Reviewer 1

The collaboration with the national lab and the plan to integrate its tools seem reasonable, however, how it will be implemented is unclear to the reviewer. The reviewer commented that it may be beneficial to collaborate with disadvantaged communities to get some qualitative feedback rather than purely relying on quantitative survey data.

Reviewer 2

The reviewer said the project was a good example of academia/university collaboration.

Reviewer 3

The project is still in the early stages and the collaboration/coordination seems to be going well. The reviewer stated it would have been beneficial to have some local community groups and neighborhood associations as partners or identified in the work streams.

Question 4: Please comment on the proposed future research. Has the project clearly defined a purpose for future work? To what extent will future work likely achieve its targets?

Reviewer 1

Future work is defined and it is appropriate for achieving project goals. Potential future scope could include modeling the total cost of ownership for new and used EV owners, and how cost parity may vary between the new and used EV market.

Reviewer 2

The project is likely to develop insights for the research community and VTO.

Reviewer 3

The project has well-defined future work and seems achievable. Based on the current performance and achievements, the likelihood of achieving results/deliverables is very high. The reviewer is looking forward to hearing more about it in the next AMR.

Question 5: Please comment on the relevance of the project. Does the project support the overall VTO subprogram objectives?

Reviewer 1

This project is highly relevant to VTO subprogram objectives and is addressing an important question about affordability and EV adoption in the disadvantage community.

Reviewer 2

The reviewer said the project is highly relevant.

Reviewer 3

Equity is a very important part of policy development. This study will point to some results that will help with better delivery of policies for DACs. DACs stand to benefit a lot from adoption of EVs and it is important to understand how to increase EV uptake in DACs.

Question 6: Please provide comments on the resources of the project. Are the resources sufficient for the project to achieve the stated milestones in a timely fashion?

Reviewer 1

Resources are appropriate for the scope of this project and its timeline and milestones.

Reviewer 2

The reviewer commented that there were sufficient resources for an analytical project.

Reviewer 3

The reviewer said hopefully, the future work that will be needed after this study is completed will be funded. This is an important topic and should be supported.

Presentation Number: VAN061
Presentation Title: Transportation Electrification Impact Study
Principal Investigator: Eric Wood, National Renewable Energy Laboratory

Presenter

Eric Wood/ Bin Wang, National Renewable Energy Laboratory and Lawrence Berkeley National Laboratory

Reviewer Sample Size

A total of four reviewers evaluated this project.

Project Relevance and Resources

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

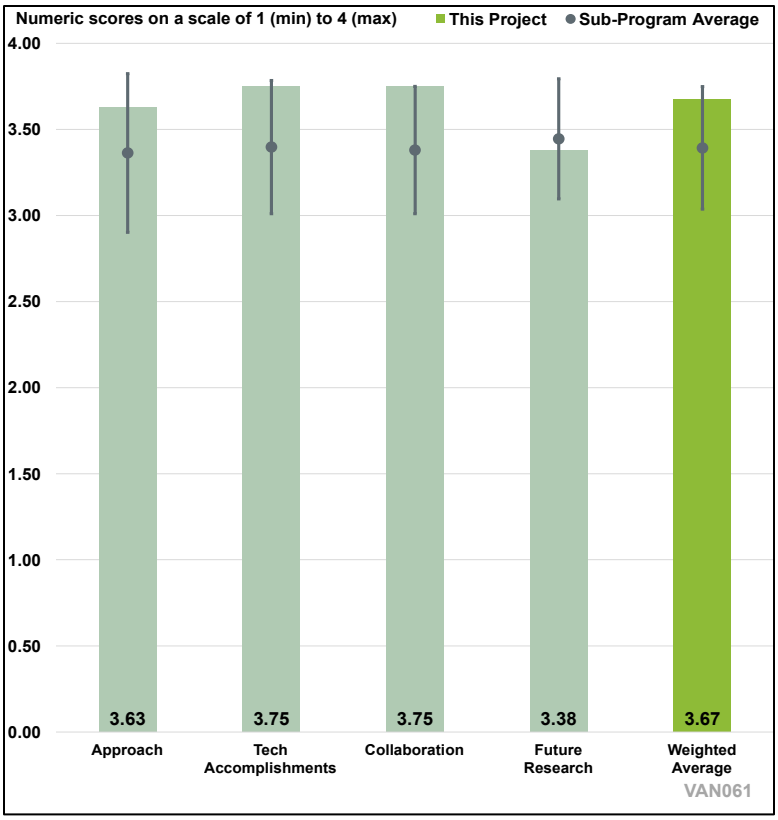

Figure 7-10. Presentation Number: VAN061 Presentation Title: Transportation Electrification Impact Study Principal Investigator: Eric Wood, National Renewable Energy Laboratory

Question 1: Please comment on the degree to which technical barriers are addressed. Is the project well designed, and is the timeline reasonably planned?

Reviewer 1

This is a unique project in terms of timeline, a “sprint.” The team developed a reasonable approach, merging several suites of pre-developed models from NREL (EVI-X modeling suite), LBNL (HEVI-LOAD), and Kevala (grid-side) to try and get a better feel for the scale and impact of EV charging infrastructure installation and operation in a “high-EV” future. Limiting the scope to incremental rather than absolute limits the overall value of the work. The reviewer said it would have been more valuable to determine the feasibility and cost to achieve EPA’s assumed No Action BEV adoption pathway (from an infrastructure perspective). But the approach provides exactly what was needed for EPA’s policymaking purposes, which was the goal. The LDV approach was also narrowed sufficiently to ensure all tasks could be completed (two analysis years, predetermined EV adoption scenarios, specific geographies, relatively simple “managed vs. unmanaged” scenarios). Heavy-duty is a different animal altogether, but the team designed a logical approach to estimate charging infrastructure impacts and costs in the allocated timeline.

Reviewer 2
Work was well executed given the condensed timing. The reviewer was not sure comparing infrastructure capital investment ($12 billion) to net benefits ($33 billion) was entirely relevant. The reviewer assumed that infrastructure costs, or at least a portion of those costs, are already reflected in the net benefits calculation in the form of electricity pricing. If the extent of infrastructure capital investment leads to near-term jumps in electricity prices, then that would be worth addressing as a separate summary topic.

Reviewer 3
The reviewer commented that this was a very ambitious project with a clear focus on determining the potential estimated distribution cost increase from a proposed EPA rulemaking that would increase PEVs. The project focused only on the incremental PEVs. The reviewer said there was a good and logical teaming approach to leverage qualifications and developed models (all partners) to do the work. Several modeling steps were needed to move from projected sales (by county) to electric demand, to determine available capacity, new capacity required, and cost estimate of distribution system upgrades to support the policy case. The project evaluated different options/aspects including managed charging as ways to efficiently use existing infrastructure/minimize new infrastructure needs. The modeling included travel demand which is especially useful for supporting freight movement. The principal investigators mentioned hydrogen fueling infrastructure, but it was not focused on a very big problem, but a logical approach and teaming.

Reviewer 4
The reviewer said the project is well designed, in particular being able to reallocate resources for a "sprint."

Question 2: Please comment on the technical progress that has been made compared to the project plan.

Reviewer 1
The team appears set to complete all milestones on time and has already completed the "sprint" segment (in the finalized EPA regulation). The findings are fascinating and will be valuable for those maintaining and updating integrated energy models that need to better represent PEV charging infrastructure. The reviewer commented that there should be more focus on the uncertainties. The number of knobs and levers that were set based on expert judgement need to be explicitly stated, and ideally the team should make everything openly available so that the results can be reproduced by other researchers.

Reviewer 2
The reviewer said the full report should be made public.

Reviewer 3
The project performed modeling of county level zero emission vehicle (ZEV) projections (all counties it seems), also determining state and national ZEV averages that inform the later distribution needs analysis/costing, which is impressive. The project looked at ZEV sales/stock and power/energy demand projected at county, state, and national levels. The modeling results confirm the highly local impacts on grid demand and distribution system capacity/needs. Kevala's work quantified the peak load and total energy increases resulting from the proposed EPA action. The work also modeled the positive impact of managed charging (fleet and home). The results also showed a relatively small increase in kilowatt-hours and kilowatts. The reviewer also said the distribution system improvement needs analysis regarding charging stations, infrastructure components, and cost for

unmanaged/managed was great and highlights the overall investment scale and potential savings from managed charging.

Reviewer 4

The reviewer said a multi-state charging infrastructure cost assessment was a significant achievement.

Question 3: Please comment on the collaboration within the project team. Are there specific contributions made by industry, national laboratories, or other external entities? Are there areas where more collaboration is needed?

Reviewer 1

This was clearly a highly collaborative effort. Data and findings were passed between multiple national laboratories (NREL/LBNL), government agencies (DOE/EPA), and industry (Kevala).

Reviewer 2

The reviewer stated there was good coordination across multiple teams, especially in spanning light-duty and medium- and heavy-duty, and also working with power distribution experts.

Reviewer 3

The team included the needed relevant qualifications and staff. The coordination and collaboration between the different laboratories (NREL as lead, LBNL) and Kevala seemed to be well-designed and worked well. The role and coordination of others listed as partners (EPA, California Energy Commission, Joint Office of Energy and Transportation, etc.) was not well-described but the reviewer expects they served as industry advisors which is appropriate for including the required perspectives, understandings, and corrections when needed.

Reviewer 4

The reviewer said there was good collaboration between NREL, LBNL, EPA, DOE, and the private sector.

Question 4: Please comment on the proposed future research. Has the project clearly defined a purpose for future work? To what extent will future work likely achieve its targets?

Reviewer 1

The reviewer said the future research all seems like it would be valuable, with the purpose generally being “improve understanding of PEV impacts on the grid.”

Reviewer 2

The reviewer commented that it was important to include the evolution of grid mix before drilling down into more detailed analysis. Recommended actions, for example, on where and when to charge EVs, should comprehend the decoupling of the grid from fossil fuels. This may change the picture considerably and will likely complicate the analysis, but it is important to look beyond the current grid which is still 60% fossil-based and not aligned with the current administration’s 2030 and 2050 GHG emissions reduction targets.

Reviewer 3

The planned future work for this project is appropriate and near-term work focus is on important topics to understand how distribution infrastructure hardware manufacturing ramp up needed to support the near-term needs.

Reviewer 4

The reviewer stated to continue the good work.

Question 5: Please comment on the relevance of the project. Does the project support the overall VTO subprogram objectives?

Reviewer 1

The reviewer said this project firmly supports all VTO Analysis objectives: data, analysis, and modeling.

Reviewer 2

The reviewer stated the project was highly relevant, especially in terms of grid readiness and the benefits of managed charging.

Reviewer 3

The project has a clear and direct relevance to understanding the projected PEV population and grid charging demands and in determining what grid investments are needed to support the successful PEV deployment.

Reviewer 4

The reviewer commented that the project is highly relevant.

Question 6: Please provide comments on the resources of the project. Are the resources sufficient for the project to achieve the stated milestones in a timely fashion?

Reviewer 1

The resources have proven to be sufficient (the project is basically complete).

Reviewer 2

The project report is complete.

Reviewer 3

The budget is very high for a modeling/simulation project, but there was a lot of work being done concurrently which requires a lot of staffing. One hour to describe a project of this scale and pace was not enough, so the review suspects there were a lot of project elements that were not described. The funding level is likely accurate.

Reviewer 4

The reviewer said resources were sufficient.

Acronyms and Abbreviations – VAN

Abbreviation	Definition
AEO	Annual Energy Outlook
AMR	Annual Merit Review
ANL	Argonne National Laboratory
API	Application programming interface
ASD	EPA's Assessment and Standards Division
BatPaC	Battery Performance and Cost Model
BEV	Battery electric vehicle
BIL	Bipartisan Infrastructure Law
C2G	Cradle-to-grave
CAFE	Corporate Average Fuel Economy
CMU	Carnegie Mellon University
CO_2	Carbon dioxide
CVC	Clean vehicle credits
DAC	Disadvantaged community
DCFC	Direct current fast charging
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
eGRID	Emissions & Generation Resource Integrated Database
EIA	U.S. Energy Information Administration
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
EV	Electric vehicle
EVSE	Electric vehicle supply equipment
FEOC	Foreign entity of concern

Abbreviation	Definition
FOTW	Fact of the Week
FY	Fiscal year
GHG	Greenhouse gas
GREET	Greenhouse gases, Regulated Emissions, and Energy use in Transportation model
GUI	Graphic user interface
HD	Heavy-duty
HEV	Hybrid electric vehicle
HEVISAM	Heavy-Duty Battery Electric Vehicle Infrastructure Scenario Analysis Model
ICCT	International Council on Clean Transportation
ICE	Internal combustion engine
IPM	EPA's Integrated Planning Model
IRA	Inflation Reduction Act
LBNL	Lawrence Berkeley National Laboratory
LCA	Life cycle analysis
LDV	Light-duty vehicle
MA3T	Market Acceptance of Advanced Automotive Technologies
MOVES	EPA's MOtor Vehicle Emission Simulator
MUD	Multi-unit dwelling
NEMS	National Energy Modelling System
NREL	National Renewable Energy Laboratory
OEM	Original equipment manufacturer
ORNL	Oak Ridge National Laboratory
OTAQ	EPA's Office of Transportation and Air Quality
PEV	Plug-in electric vehicle

Abbreviation	Definition
PHEV	Plug-in hybrid electric vehicle
REC	Renewable energy credit
TCD	EPA's Transportation and Climate Division
TCO	Total cost of ownership
TEDB	Transportation Energy Data Book
TEEM	Transportation Energy Evolution Modeling
TEIS	U.S. Department of Energy's Transportation Electrification Impact Study
TNC	Transportation network company
US DRIVE	U.S. Driving Research and Innovation for Vehicle efficiency and Energy sustainability
USG	U.S. government
UVM	University of Vermont
VAN	U.S. Department of Energy's VTO Analysis (VAN) subprogram
VIUS	Vehicle Inventory and Use Survey
VMT	Vehicle miles traveled
VTO	Vehicle Technologies Office
ZEV	Zero emission vehicle