9. Vehicle Analysis

The Vehicle Analysis (VAN) subprogram provides testing and analysis relevant to the Vehicle Technologies Office (VTO). The subprogram mission is to plan, execute, and communicate technology, societal, economic, and interdisciplinary analyses for the U.S. Department of Energy (DOE), the Office of Energy Efficiency and Renewable Energy (EERE), VTO, and external stakeholders. Overarching activities within this subprogram serve to develop and deploy vehicle technologies that reduce the use of petroleum while maintaining performance, power, and comfort, and help people access and use efficient, clean vehicles that meet their transportation needs. VAN subprogram activities include the following.

- Model, test, and validate vehicle components within virtual systems before they are used in actual vehicles.
- Conduct statistical research on energy use and transportation with National Laboratories and other federal agencies.
- Provide software tools to industry for vehicle simulation, technology evaluation, economic modeling, and transportation emissions measurement.

The VAN subprogram envisions providing a robust transportation energy analysis by focusing on five research areas:

- Macroeconomic Accounting: Using models and tools such as VISION +, the VAN subprogram is currently updating baseline scenarios to match historical and AEO-projected future data; expanding the tool set to novel analysis modes (e.g., off-highway); and designing and executing integrated, coherent, macroeconomic analysis scenarios that examine and estimate VTO technology research and development (R&D) benefits.
- Market Penetration and Consumer Behavior: Using models and tools such as Market Assessment of Advanced Automotive Technologies (MA3T), Automotive Deployment Options Projection Tool (ADOPT), VCM, SEDS, and TRUCK, the VAN subprogram is coordinating four vehicle choice models (VCMs) for suite operation using common input; refining range-anxiety research for incorporation into models; and estimating market penetration scenarios for input to various analyses.
- Emissions and Environmental Modeling: Using models and tools such as the Greenhouse Gas, Regulated Emissions, and Energy Use in Transportation (GREET) model, the VAN subprogram is currently providing input to and publishing a DOE well-to-wheel (WTW) official Program Record; researching and incorporating facility/infrastructure cycle data; and developing "GREET.net" further—a user-friendly software platform.
- Vehicle Modeling: Using models and tools such as Autonomie, FASTSim, and HTEB, the VAN subprogram is currently calculating vehicle cost-performance pair meta-data, establishing VTO inputs for official EERE Low-Carbon Scenarios, and facilitating a DOE Levelized Cost of Driving (LCD) Official Program Record.
- Technology and Market Data: Using models and tools such as TEDB, xEVdata, and the SRA database, the VAN subprogram published the Transportation Energy Data Book (31st Edition), tracks and publishes xEV sales domestically and aboard, and is developing a database to test the economic effects on vehicle sales.

The long-term VAN subprogram R&D strategy in each of the five various areas of research is:

- Macroeconomic Accounting: author and publish benefit metrics and methodology, and to prepare and execute iterative analytical updates as VTO goals, targets, and milestones are updated.
- Market Penetration and Consumer Behavior: cross-validate VCMs via suite operation; incorporate two additional vehicle choice models for a more robust market penetration "triangulation"; expand VCM dialogue by engaging with experts beyond the DOE community; and to compare and refine the models accordingly.
- Emissions and Environmental Modeling: continue the expansion of GREET.net user-friendly graphical user interface (GUI); research and refine "back-end" infrastructure and facility data; and to formally begin a vehicle-fuel pathway water footprint modeling.
- Vehicle Modeling: continue development of user-friendly vehicle characteristics GUI and diagnostic metrics; author and publish results and methodology documentation; and to leverage vehicle characteristic meta-data into a family of spin-off publications.

- Simulation and Technology Market Data: continue updating and disseminating data sources regularly; expand market knowledge with third-party data; and to distill and publish robust economic effects affecting and related to vehicle sales.

Subprogram Feedback

DOE welcomed optional feedback on the overall technical subprogram areas presented during the 2013 Annual Merit Review (AMR). Each subprogram technical session was introduced with a presentation that provided an overview of subprogram goals and recent progress, followed by a series of detailed topic area project presentations.

The reviewers for a given subprogram area who volunteered to provide subprogram overview comments responded to a series of specific questions regarding the breadth, depth, and appropriateness of that DOE VTO subprogram's activities. The subprogram overview questions are listed below, and it should be noted that no scoring metrics were applied. These questions were used for all VTO subprogram overviews.

Question 1: Was the subprogram area adequately covered? Were important issues and challenges identified? Was progress clearly presented in comparison to the previous year?

Question 2: Are plans identified for addressing issues and challenges? Are there gaps in the project portfolio?

Question 3: Does the subprogram area appear to be focused, well-managed, and effective in addressing the DOE Vehicle Technologies Office's needs?

Question 4: Other Comments.

Responses to the subprogram overview questions are summarized in the following pages. Individual reviewer comments for each question are identified under the heading Reviewer 1, Reviewer 2, etc. Note that reviewer comments may be ordered differently; for example, for each specific subprogram overview presentation, the reviewer identified as Reviewer 1 in the first question may not be Reviewer 1 in the second question, etc., as reviewer responses were optional.

Subprogram Overview Comments: Jacob Ward (U.S. Department of Energy) – van000

Question 1: Was the sub-program area adequately covered? Were important issues and challenges identified? Was progress clearly presented in comparison to the previous year?

Reviewer 1:

The reviewer indicated yes, and added that the analysis projects were critical to determining where to allocate R&D funding.

Reviewer 2:

The reviewer reported that the area was well covered, and added that progress was clearly presented in comparison to the previous year.

Question 2: Are plans identified for addressing issues and challenges? Are there gaps in the project portfolio?

Reviewer 1:

The reviewer confirmed that the plans were identified well. This reviewer added that there was no real discussion of gaps in the project portfolio, but that it was hard to cover all of the areas in 15 minutes. This reviewer added that perhaps there were not any gaps as this was a relatively mature program area.

Reviewer 2:

The reviewer noted that there was a heavy emphasis on vehicle choice modeling. This reviewer suggested that it might be useful to add some emphasis on collaborations that would evaluate data from the current alternative-vehicle demonstration projects (and American Recovery and Reinvestment Act [ARRA] projects) as well as CA projects.

Question 3: Does the sub-program area appear to be focused, well-managed, and effective in addressing the DOE Vehicle Technologies Program's needs?

Reviewer 1:

The reviewer felt that yes, this was a mature, clearly focused area and appeared to be well managed.

Reviewer 2:

The reviewer asserted that this was an important component of the VTO.

Question 4: Other Comments

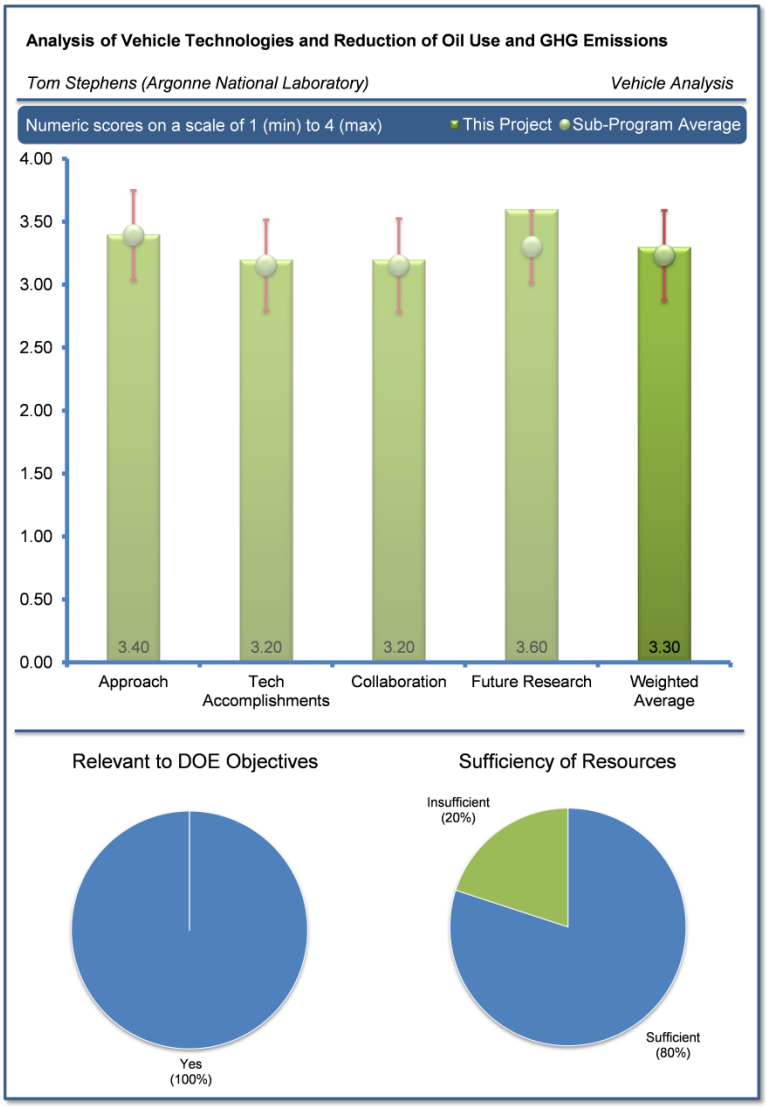
No comments were received in response to this question.

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, as well as numeric scoring responses *(on a scale of 1 to 4)*. 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 summary table presenting the average numeric score for each question for each project is presented below.

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Analysis of Vehicle Technologies and Reduction of Oil Use and GHG Emissions	Tom Stephens (Argonne National Laboratory)	9-5	3.40	3.20	3.20	3.60	3.30
WTW Analysis of Vehicle/Fuel Systems and GREET Development	Michael Wang (Argonne National Laboratory)	9-8	4.00	3.50	3.50	3.50	3.63
Consumer Vehicle Technology Data	Mark Singer (National Renewable Energy Laboratory)	9-11	3.00	2.50	2.50	2.83	2.67
Analytical Modeling Linking the FASTSim and ADOPT Software Tools	Aaron Brooker (National Renewable Energy Laboratory)	9-15	3.33	3.33	3.33	3.33	3.33
Updating and Enhancing the MA3T Vehicle Choice Model	Zhenhong Lin (Oak Ridge National Laboratory)	9-18	3.25	3.25	3.25	3.25	3.25
Overall Average			3.40	3.16	3.16	3.30	3.24

Analysis of Vehicle Technologies and Reduction of Oil Use and GHG Emissions: Tom Stephens (Argonne National Laboratory) – van001



Reviewer Sample Size

A total of five reviewers evaluated this project.

Question 1: Approach to performing the work – the degree to which technical barriers are addressed, the project is well-designed, feasible, and integrated with other efforts.

Reviewer 1:

The reviewer stated that the focus was excellent because it provides analysis needed by other efforts. The reviewer felt that one of the primary focuses was the identification of technical barriers; these barriers were identified well. The reviewer indicated that important new potential barriers that need to be addressed have been identified, and that new work was being done on the reaction of manufacturers and what it took to get them to build new vehicles. The reviewer also described the focus on the transition from early adopters to mainstream customers as excellent.

Reviewer 2:

The reviewer felt that one other potential aspect to investigate is how the deployment of individual technologies impacts and interacts with the deployment of other technologies. The reviewer noted that understanding how the capital and resource constraints of original equipment manufacturers (OEMs) impact the simultaneous deployment of technologies within a timeframe could provide understanding of the penetration of advanced vehicle technologies, especially as a response to Corporate Average Fuel Economy (CAFE) and greenhouse gas (GHG) standards.

Reviewer 3:

The reviewer commented that the use of data sources and methods based on multiple strategies regarding technology penetration, investment strategies, and industry resources provided multiple avenues to evaluate investor decision behavior.

Reviewer 4:

The reviewer felt that this project is an important component of the analysis needed to understand the issues facing technologies that could play a role in reducing both the nation's dependence on oil and its GHG emissions from transportation sources. The reviewer noted that incorporating more analysis on assessing the transition costs, barriers, and potential policy solutions would make the analysis more useful in informing policy makers.

Question 2: Technical accomplishments and progress toward overall project and DOE goals – the degree to which progress has been made, measured against performance indicators and demonstrated progress toward DOE goals.

Reviewer 1:
The reviewer observed a template for vehicle technology deployment timing that incorporates the following: potential for delays for the transition to mass markets; and remaining uncertainty identified as recent developments in computer simulation and design, rapid prototyping, modular platforms, and other ways of fast-tracking deployment. The project also examined alternative ways of replicating due diligence on deployment investments through cash flow and decision tree analysis.

Reviewer 2:
The reviewer felt that it was difficult to evaluate the progress towards objectives because future scenarios are, by definition, uncertain. The reviewer noted that the work is important because it identifies potential barriers that are often overlooked in analyses. The reviewer also described the use of historical technology penetration data to help understand the barriers and timelines to new technology penetration as good, and that the use of cash flow analysis and decision tree analysis are good tools to identify investor decision points. The reviewer felt that there should be more work done quantifying and monetizing non-cost barriers of advanced technology vehicles by customer segments instead of merely identifying them and ranking them overall.

Reviewer 3:
The reviewer felt that the technology deployment template was a useful tool and a good accomplishment; however, the reviewer noted that adding to the tool's value going forward will rely on the ability to evaluate the impact of the remaining uncertainties identified, including modular platforms and rapid prototyping.

Reviewer 4:
The reviewer felt that more analysis on the transition cost and barrier would make the project more useful.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer noted that, though the direction of the project supports other projects, the work was done relatively independently.

Reviewer 2:
The reviewer reported the following collaboration and coordination: W. McManus (Oakland University); A. Brown and L, Vimmerstedt (National Renewable Energy Laboratory [NREL]); John German (International Council on Clean Transportation [ICCT]); Z. Lin (Oak Ridge National Laboratory [ORNL]); A. Birky (TA Engineering, Inc.); A. Brooker (NREL); and A. Vyas (Argonne National Laboratory [ANL]).

Reviewer 3:
The reviewer indicated that collaborating with automakers and suppliers could be helpful.

Reviewer 4:
The reviewer stated that future project work could incorporate previous work on transitions costs performed by ORNL during the development of the Hydrogen Transition (HyTrans) model.

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.

Reviewer 1:
The reviewer noted that the project correctly identified some key remaining uncertainties including the impacts of computer simulations, rapid prototyping, and modular platforms. The reviewer felt that the focus on development pathways was excellent.

Reviewer 2:
The reviewer indicated that the focus of the proposed future work hits the points with the biggest impact.

Reviewer 3:
The reviewer listed the following items when responding to this question: deployment pathways; global sales trends; improve and integrate models; and improve interagency collaboration.

Reviewer 4:
The reviewer felt that it would be valuable if similar methodologies could be employed to capture risks associated with fuel infrastructure development and how the presence or lack of fueling infrastructure could impact the risk assessment for auto producers.

Reviewer 5:
The reviewer thought that future work should incorporate more analysis on assessing the transition costs and barriers and potential policies solutions because that type of analysis would be useful for policy makers.

Question 5: Does this project support the overall DOE objectives of petroleum displacement? Why or why not?

Reviewer 1:
The reviewer noted that the project is an important component of the analysis needed to understand the issues facing technologies that could play a role in reducing both the Nation's dependence on oil and its GHG emissions from transportation.

Reviewer 2:
The reviewer felt that understanding what drives or inhibits the deployment of advanced technologies will help DOE better evaluate what technologies deserve funding and additional research. The reviewer also felt that the research will also help DOE determine how funding can break down some of the barriers to widespread deployment of advanced technologies.

Reviewer 3:
The reviewer indicated that the barriers addressed by this project were routinely ignored by many analyses, which makes the results useless. The reviewer also stated that, despite the inherent uncertainties in assessing future scenarios, it is essential to identify potential barriers and inject as much realism as possible in order for technology analyses to have any validity.

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

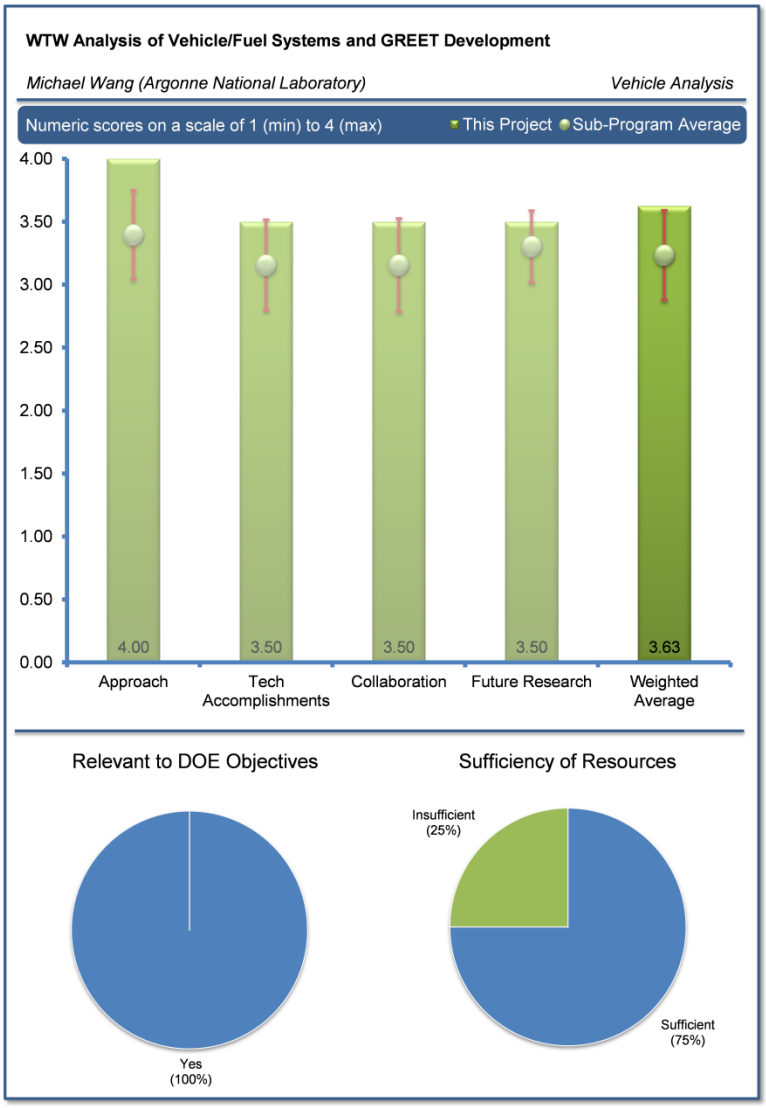
Reviewer 1:
The reviewer felt that the resource levels seemed to be appropriate.

Reviewer 2:
The reviewer described the work as important, but difficult to quantify. Further, this reviewer felt that the current resources were appropriate.

Reviewer 3:
The reviewer felt that more resources could be devoted to analysis of the transition costs and barriers of advanced vehicle and fuel technologies.

Reviewer 4:
The reviewer noted that no information was given.

WTW Analysis of Vehicle/Fuel Systems and GREET Development: Michael Wang (Argonne National Laboratory) – van002



Reviewer Sample Size

A total of four reviewers evaluated this project.

Question 1: Approach to performing the work – the degree to which technical barriers are addressed, the project is well-designed, feasible, and integrated with other efforts.

Reviewer 1:

The reviewer commented that the approach for the project was excellent. The reviewer felt that this was an outstanding tool, and indicated that it was used in several regulatory environments including California's Air Resources Board (ARB) for low-carbon fuel standard (LFCS) and at the U.S. Environmental Protection Agency (EPA).

Reviewer 2:

The reviewer felt that the work seems to be taking the right approach by considering the evolution of technologies over time, considering the effects of regulation, and building a consistent platform to compare life-cycle analyses (LCAs) for different technologies.

Reviewer 3:

The reviewer indicated that the success of the GREET project is a model that should be used to demonstrate the value and importance of government funded analysis of technology research and development. The reviewer noted that continued development and enhancement of the GREET model is very important to maintaining its relevance in the state of the art of LCAs.

Question 2: Technical accomplishments and progress toward overall project and DOE goals – the degree to which progress has been made, measured against performance indicators and demonstrated progress toward DOE goals.

Reviewer 1:

The reviewer commented that the presentation indicated that the project had made very good progress towards its goal of building an adaptable, expandable and transparent platform. The reviewer additionally felt that, given the current and anticipated proliferation of plug-in hybrid electric vehicles (PHEVs), the progress on PHEV performance and fuel-cycle simulation is very timely and important. The reviewer noted that the expansion of electricity generation modeling by region in order to allow for a more accurate evaluation of PHEV vehicles is of particular importance.

Reviewer 2:

The reviewer indicated that the GREET model accomplishments were excellent; however, the reviewer mused that more resources could be devoted to the incorporation or enhancement of indirect factors such as land use and economic factors. The reviewer noted that the inclusion of indirect factors could potentially change lifecycle GHG of technologies significantly.

Reviewer 3:
The reviewer felt that the list of research proposals was relevant and that the work evaluating oil sands and other upstream crude oil sources was timely. The reviewer noted that more differentiation between upstream petroleum types in the research would have improved the results.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The project leaders reached out to the fuel producers, automakers, and suppliers, which the reviewer felt were the right sources to contact. In addition, the reviewer noted that the literature reviews and incorporation of Autonomie simulation results were very appropriate.

Reviewer 2:
The reviewer stated that additional stakeholder input and collaboration would be useful.

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.

Reviewer 1:
The reviewer commented that the proposed future work seemed very appropriate and that the focus on lightweighting materials for CAFE purposes will be very important.

Reviewer 2:
The reviewer indicated that the GREET model's accomplishments were excellent; however, more resources could be devoted to the incorporation or enhancement of indirect factors (e.g., land use and economic factors) that could potentially change lifecycle GHG of technologies significantly.

Reviewer 3:
The reviewer stated that the incorporation of short-lived GHG and water was timely. The reviewer felt that more work on oil sands, other conventional petroleum sources, and incorporating methane leakage in the distribution system would be useful.

The reviewer also noted that very little mention was made of how the stochastic elements of GREET were constructed, how they interacted, or how they could be improved; this related directly to the consequential versus attributional methodology of LCA. Further, this reviewer affirmed that any change in one component of the LCA chain should impact the others. The reviewer did indicate that the study of this feedback was complicated and may be beyond the scope of this model.

Question 5: Does this project support the overall DOE objectives of petroleum displacement? Why or why not?

Reviewer 1:
The reviewer felt that the project was very relevant. Having a common platform to evaluate and compare LCAs will be a critical tool in developing strategies to reduce petroleum use given the transition to so many new vehicle technologies and the proliferation of alternative fuels and sources.

Reviewer 2:
The reviewer reiterated that the success of the GREET project is a model that should be used to demonstrate the value and importance of government funded analysis of technology research and development. Continued development and enhancement of the GREET model is very important to maintaining its relevance in the state of the art of LCAs.

Reviewer 3:

The reviewer stated that GREET calculates both GHG emissions and energy consumption. The reviewer felt that both GREET and GHG are valuable in the evaluation of the merits of DOE programs.

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

Reviewer 1:

The reviewer felt that the project was appropriately funded and staffed.

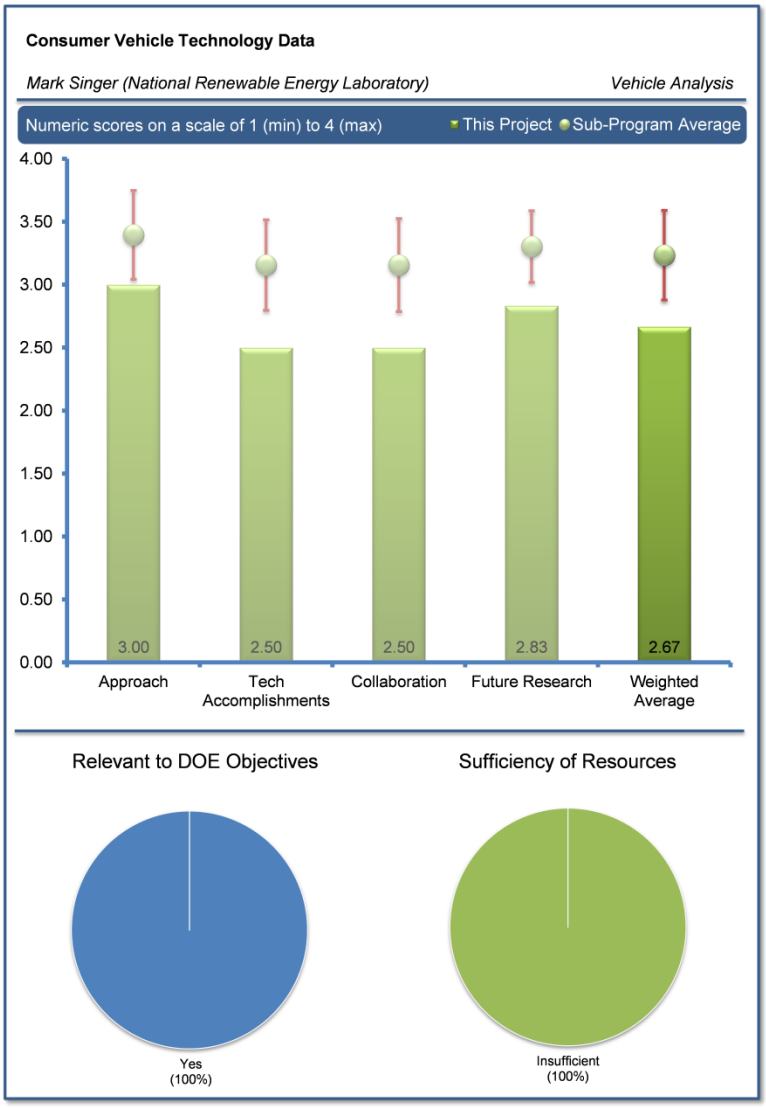
Reviewer 2:

The reviewer indicated that the funding level looked reasonable for this type of project.

Reviewer 3:

The reviewer felt that the success of the model's use by government, academia, and industry justified increasing the resources put toward analysis, updating, and enhancing the GREET model.

Consumer Vehicle Technology Data: Mark Singer (National Renewable Energy Laboratory) – van003



Reviewer Sample Size

A total of six reviewers evaluated this project.

Question 1: Approach to performing the work – the degree to which technical barriers are addressed, the project is well-designed, feasible, and integrated with other efforts.

Reviewer 1:

The reviewer indicated that gathering data on consumer purchases was highly valuable, especially if trends can be tracked over time. The reviewer felt that the survey could be more useful if it also asked customers about recent purchase decisions; however, given the $25,000 budget, the approach was great.

Reviewer 2:

The reviewer felt that understanding consumer preference and willingness to pay for vehicle attributes is critical to understanding the potential impact advanced technologies and regulation will have on new vehicle purchase decisions. Measuring shifts in the value or perceived importance of vehicle descriptors like safety, quality, dependability, and efficiency as vehicle attributes change over time will be critical to successful deployments.

Reviewer 3:

The reviewer noted that, from the project description, it appeared that the VTO has not recently funded collection of data on consumer preferences for vehicle models and technology choice. The reviewer felt that, while it appeared that this type of information collection could be useful in the development of vehicle choice models and other VTO analytical exercises, additional resources should be devoted ensuring that the relevant information is collected. The reviewer indicated that the project may benefit by incorporating information collected by University of California, Davis researchers on consumer preferences and what data and questions are important for future surveys.

Reviewer 4:

The reviewer stated that the approach seemed to be generally effective, but obtaining more recent survey results needed to be a focus because obtaining a better understanding of survey responses to observed consumer behaviors is critical for decision/policy makers.

Reviewer 5:

The reviewer noted that the approach was to develop VTO expertise in historical survey trends, develop VTO expertise in the relationship of survey responses, and to respond to VTO researcher requests to administer survey efforts. The reviewer indicated that no response was given to questions regarding why survey results from December 2005 through January 2013 have yet to be published.

Reviewer 6:
The reviewer observed no consistent set of questions or trend analysis, and that the presentation showed survey responses from as long ago as 2006.

Question 2: Technical accomplishments and progress toward overall project and DOE goals – the degree to which progress has been made, measured against performance indicators and demonstrated progress toward DOE goals.

Reviewer 1:
The reviewer indicated that the project seemed to be making good progress. The observation that consumers required a large difference in fuel economy to affect behavior was a key finding. Additionally, the reviewer felt that another key finding was that consumers desired a payback period of 1-1.5 years.

Reviewer 2:
The reviewer noted that this type of information collection could be useful, but accomplishments have been hindered due to lack of funding. The reviewer recommended that VTO should increase funding of its surveying efforts if resources are available.

Reviewer 3:
The reviewer observed the following survey results: consumer settings define the potential market; market perceptions of how consumer views relate to observed behavior; consumer sentiments towards specific technologies; change in consumer views over time; and consumers' willingness to pay for improved fuel economy.

Reviewer 4:
The reviewer noted that the trends over time were useful; however, the fact that the results had not been published in eight years was disturbing. The reviewer felt that asking about what customers were intending to do yielded highly biased results, indicating that this was well known phenomenon. The reviewer suggested that asking customers about factors that influenced their purchase of a new vehicle in the past six months would be more accurate and provide more useful information.

Reviewer 5:
The reviewer felt that some of the survey data was too out of date to be useful; also the reviewer indicated that a trend analysis would be necessary to make the data very useful.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer indicated that there was extensive evidence of collaboration and coordination with other research entities. This reviewer noted VTO research efforts conducted by ORNL, ANL, and NREL scientists, coordination with DOE vehicle deployment efforts, and the Opinion Research Corporation.

Reviewer 2:
The reviewer remarked that the responsiveness to individual requests for information was good; however, the reviewer felt that coordination with other research institutions could be improved. It was noted that numerous academic and private organizations perform this type of research.

Reviewer 3:
The reviewer indicated that increased funding could help improve collaboration and coordination.

Reviewer 4:
The reviewer stated that, given the lack of available data, collaboration and potential cost sharing opportunities should be explored to further develop data collection and analysis in this area.

Reviewer 5:
The reviewer felt that collaborating with other polling entities and research organization outside of DOE could help.

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.

Reviewer 1:
The reviewer noted that the project contained a well thought out plan to maintain and develop new data while expanding expertise to develop new and enhanced future studies. The activities specifically referenced by the reviewer included developing a coordinated consumer views effort drawing from the experience of historical efforts to enhance future studies and continued administration of new survey efforts and the maintenance of data from prior efforts.

Reviewer 2:
The reviewer commented that, considering the significant changes in fuel prices and consumer attitudes towards new vehicle powertrains and technologies from the timeframe when many of the surveys were completed (i.e., 2006 through 2008), the focus on new survey efforts is vital. The reviewer indicated that partnering with new institutions is a good focus, and stated that new survey efforts and partnering with new institutions really seemed to be the right focus areas.

Reviewer 3:
The reviewer stated that it appears that this program has not been a priority for DOE and interest waned in the past. The reviewer suggested that DOE either make the program a priority or discontinue it. The reviewer expressed hope that future plans will be followed through.

Reviewer 4:
The reviewer suggested that participants on this project should reach out to other organizations to elicit suggestions for survey frames and consumer opinion, and other areas that need further examination.

Reviewer 5:
The reviewer ranked this area as fair not poor, suggesting that additional funding would help future research.

Question 5: Does this project support the overall DOE objectives of petroleum displacement? Why or why not?

Reviewer 1:
The reviewer noted that the ability of new technologies to reduce petroleum use is dependent on consumer acceptance so understanding consumer demands and behaviors is very important.

Reviewer 2:
The reviewer commented that the study appears completely relevant to DOE objectives of petroleum displacement through analysis of historical trends and projections to the future.

Reviewer 3:
The reviewer indicated that information on changes in consumer sentiment can be useful to help inform DOE on future work, especially if trends can be established over a long period of time. Given the historical data gathered in this area, it would be useful to continue this work. The reviewer stated that asking consumers about factors influencing recent purchase decisions would be even more valuable. This question is far more accurate than asking consumers about future considerations. In addition, this data is not available from any public source, so it would be very valuable.

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

Reviewer 1:
The reviewer stated that the program should be maintained and the results published and communicated, which likely takes more than $25,000 per year. The reviewer also suggested that another survey should be implemented that targets recent vehicle purchasers and asks them about the factors influencing their recent purchase decision.

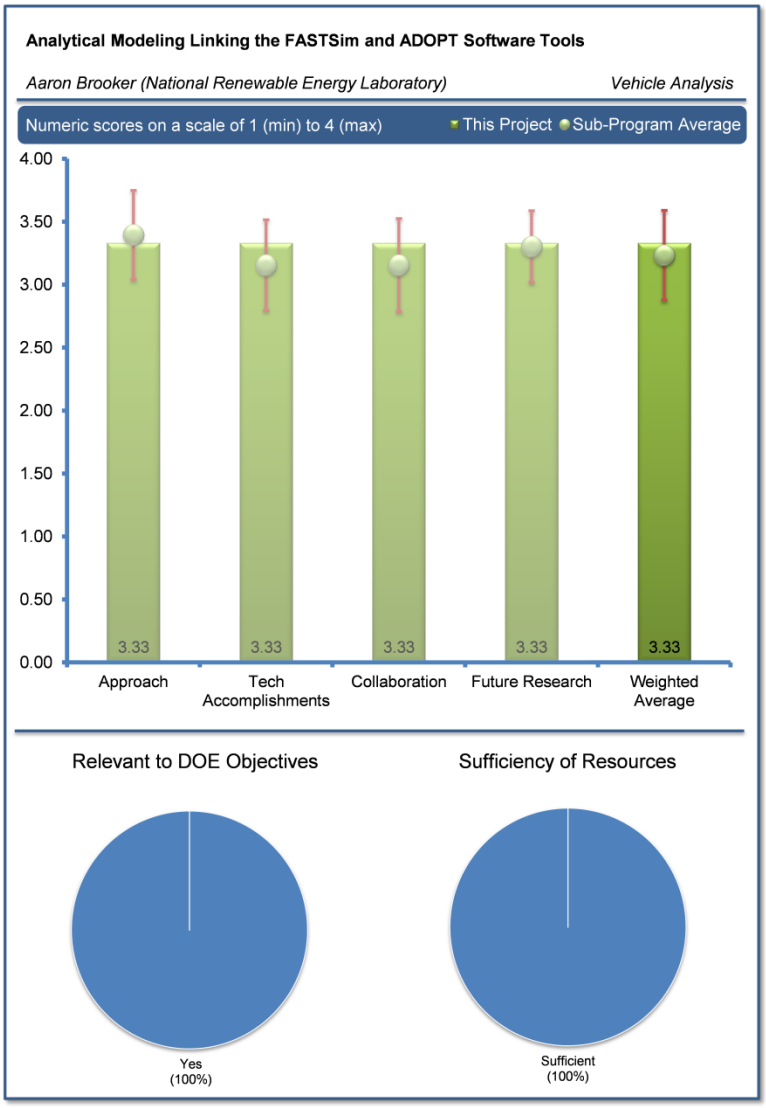
Reviewer 2:
The reviewer indicated that it appears that this effort does not possess sufficient resources and support to promote the results of their research efforts, otherwise material developed as far back as 2006 would have been published by now.

Reviewer 3:
The reviewer commented that, given the outdated nature of many of the survey results, it seemed that additional funding would be required.

Reviewer 4:
The reviewer stated that, at current funding levels, only minimal effort can be employed to address project goals.

Reviewer 5:
The reviewer indicated that this work is underfunded to successfully meet its goals. It needs either more funding to create a robust consumer survey component or the funding should be shifted to other projects.

Analytical Modeling Linking the FASTSim and ADOPT Software Tools: Aaron Brooker (National Renewable Energy Laboratory) – van004



Reviewer Sample Size

A total of six reviewers evaluated this project.

Question 1: Approach to performing the work – the degree to which technical barriers are addressed, the project is well-designed, feasible, and integrated with other efforts.

Reviewer 1:

The reviewer indicated that the project appears to be on schedule and has successfully integrated the two models into one usable simulation.

Reviewer 2:

The reviewer commented about the well thought-out approach and scope of research effort, specifically noting vehicle powertrain and consumer choice modeling. This reviewer noted the following unique aspects: consumer preference changes based on income; income level changes over time and number of sales; extensive validation; and competition of advanced vehicles with entire existing fleet. The reviewer also referenced the comparison of consumer preferences to cost-effectiveness.

Reviewer 3:

The reviewer indicated that the approach seems to have a logical progression and that the consideration of mass compounding is important and that it seems the consumer preference is solely based on income levels and does not consider other factors.

Reviewer 4:

The reviewer stated that modeling impacts of technology improvements on consumer choice and sales is a great goal, but that it is not entirely clear if all the required inputs to properly model effects have been considered.

Reviewer 5:

The reviewer noted that, while the presentation provided a good overview of the project's work, there needed to be more information about ADOPT, vehicle choice model, and the parameters and assumptions underlying it.

Question 2: Technical accomplishments and progress toward overall project and DOE goals – the degree to which progress has been made, measured against performance indicators and demonstrated progress toward DOE goals.

Reviewer 1:

The reviewer stated that there was lots of progress, but that the project seems to be assuming that existing data and validations can be extended to new technology types. Also, consumer preferences may not be properly incorporated into the model.

Reviewer 2:
The reviewer stated that while it looks like significant progress has been made in linking the Future Automotive Systems Technology Simulator (FASTSim) and ADOPT models it is not clear that these are the appropriate models for analyzing vehicle lightweighting. Lightweighting is a function of manufacturer's preference relative to other technologies in achieving fleet fuel economy or GHG reductions targets as opposed to a consumer preference.

Reviewer 3:
The reviewer commented that the run time reduction was impressive and provides significant advantages for future investigations. Additionally, expanding the number of represented vehicles and having the capability to evolve vehicles is beneficial to adding realism.

The reviewer felt that it seemed superfluous to add all of the current models to a simulation that extends to 2050, since all of the current types will be replaced in the future. Additionally, it was not explained how new models are introduced and impact of fuel prices and other exogenous factors.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer commented that the collaboration with industry, government, academia and data providers seemed to be a good mix.

Reviewer 2:
The reviewer noted that feedback was received from industry and government. Industry partners included Chrysler, Ford, and General Motors (GM). Government partners included ANL, the Energy Information Agency (EIA), and ORNL. Data was provided by PA Consulting Group, Polk and SRA International (Sentech). The reviewer also noted extensive documentation for collaboration and coordination with other institutions.

Reviewer 3:
The reviewer noted coordination with industry and other groups.

Reviewer 4:
The reviewer felt that the project had excellent data sources, but that the reviewer did not see much collaboration with other modelers or organizations.

Reviewer 5:
The reviewer felt that, while currently the level of collaboration was good, this was a very interesting approach to examining the impact of income on consumer behavior and how shifts in income could impact vehicle purchase/production in the future. The reviewer felt that additional effort should be made or funded to solicit comment and feedback on this modeling effort.

Reviewer 6:
The reviewer commented that while it looked like the FASTSim and ADOPT models have coordinated with industry and government, it was unclear how the FASTSim, ADOPT and the MA3T models relate to one another.

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.

Reviewer 1:
The reviewer stated that the proposed improvements were appropriate and included some of the major areas of concern.

Reviewer 2:

The reviewer commented that the proposed future work seemed to be appropriate. Incorporating other factors to consumer choice would be helpful and looking at a saturation point for consumers' desire on acceleration performance could be useful. The reviewer felt that the effect of CAFE will be important.

Reviewer 3:

The reviewer noted several fiscal year (FY) 2013 goals, including: improve confidence in projections by running ADOPT through historical periods and comparing the model to actual sales and vehicle changes, evolve capabilities into compressed natural gas (CNG) vehicles by adding a CNG engine map. Another goal was to add the ability to optimize powertrains for consumer choices into FASTSim from ADOPT, enhance flexibility to consider more technology improvement options, and to improve user friendliness and post online. The noted potential FY 2014 work included: linking vehicle miles traveled to fuel cost and efficiency, expanding vehicle evolution to tallow vehicles to change in class size, adding CAFE effects, adding penalties that captures battery electric vehicles' slow recharge time and low range, completing a framework to run in parallel with other models for comparison, applying to key technology target areas such as batteries, fuel cells, and CNG, and estimating sensitivity to external factors such as fuel prices, income projections, and refueling station availability.

Reviewer 4:

The reviewer felt that, given the variation in consumer preference by income level, it would be interesting to explore this further by including or examining the preference terms for a greater number of vehicle attributes. The reviewer also recommended funding or examining price sensitivities on unit sales (elasticity) by income group.

Reviewer 5:

The reviewer indicated that there was a need to compare projections with other models; not just validation with historical data.

Question 5: Does this project support the overall DOE objectives of petroleum displacement? Why or why not?

Reviewer 1:

The reviewer commented that it was important to be able to estimate the impacts of technology progress on future product sales and fuel, and GHG reductions. However, the reviewer felt that this was definitely a garbage in, garbage out scenario; the inputs are key to the accuracy of the output. It is important for ADOPT to carefully coordinate with efforts elsewhere in DOE to evaluate potential barriers to advanced technologies.

Reviewer 2:

The reviewer indicated that incorporating consumer choices is required when evaluating the impact of new technologies on petroleum reduction.

Reviewer 3:

The reviewer stated that DOE needs a suite of tools for evaluating vehicle technologies from the producers and consumers perspective; development of the FASTSim and ADOPT models along with other models such as the MA3T are resources that DOE should further develop.

Reviewer 4:

The reviewer commented that analysis of penetration is important in guiding technology decisions in the VTO.

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

Reviewer 1:

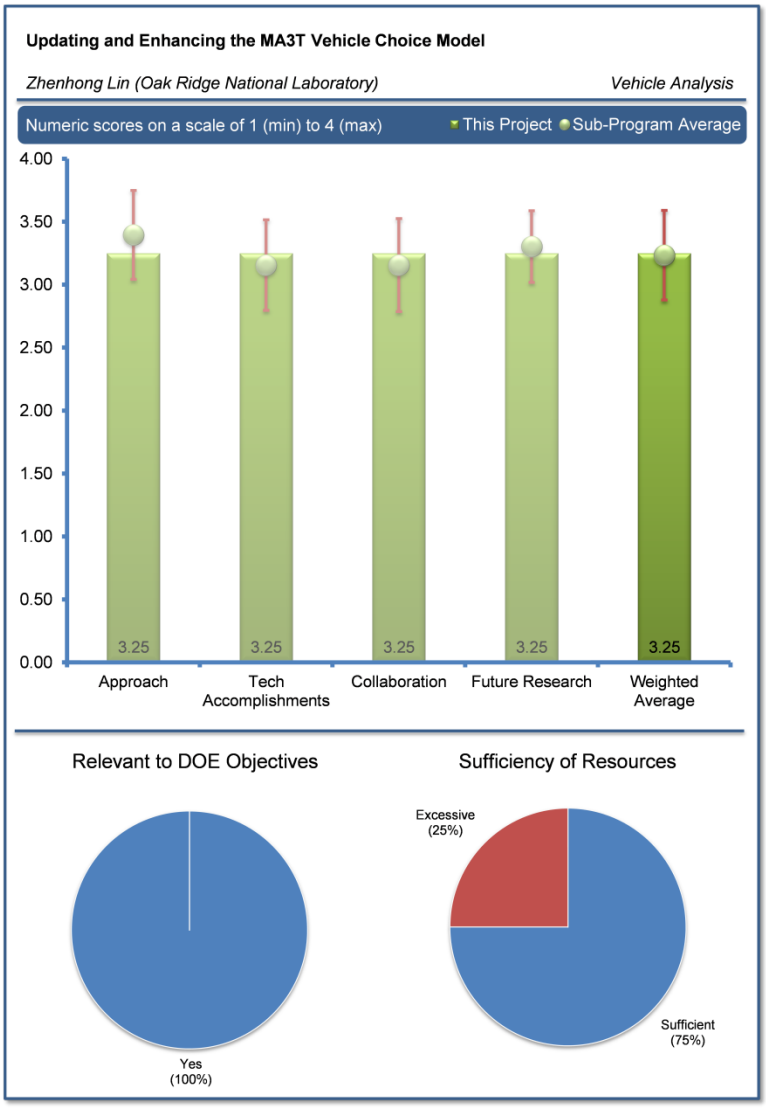
The reviewer stated that this project was sufficiently funded given the current objectives, but thought that this project could benefit from additional funding.

Reviewer 2:
The reviewer indicated that, given the quality of the results of this research, resources should be adequate.

Reviewer 3:
The reviewer felt that the resources seemed appropriate for the work.

Reviewer 4:
The reviewer noted that the resources seemed to properly reflect the priority and amount of work needed.

Updating and Enhancing the MA3T Vehicle Choice Model: Zhenhong Lin (Oak Ridge National Laboratory) – van005



Reviewer Sample Size

A total of four reviewers evaluated this project.

Question 1: Approach to performing the work – the degree to which technical barriers are addressed, the project is well-designed, feasible, and integrated with other efforts.

Reviewer 1:

The reviewer commented that it was a complicated but important model. The concept showed dedication to making the model accurate and overcoming barriers.

Reviewer 2:

The reviewer stated that, from the information in the presentation, the approach seems appropriate.

Reviewer 3:

The reviewer noted that the presentation slides were cluttered and difficult to understand. The reviewer felt that the material is obviously cogent to the research effort but it was not presented in an understandable fashion.

Question 2: Technical accomplishments and progress toward overall project and DOE goals – the degree to which progress has been made, measured against performance indicators and demonstrated progress toward DOE goals.

Reviewer 1:

The reviewer indicated that the automation calibration and runtime reduction seemed to be important accomplishments. Additionally, the validation results seemed to be promising.

Reviewer 2:

The reviewer felt that there were lots of functional improvements the last year, but not a lot of improvements to the inputs for the high cost of the project ($770,000).

Reviewer 3:

The reviewer commented that the accomplishments were presented in a disjointed, haphazard manner and was difficult to understand. Also, the material presented as accomplishments seemed repetitive of earlier studies.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:

The reviewer noted that there was a high level of coordination, both within and outside DOE.

Reviewer 2:
The reviewer commented that the collaboration efforts seemed to be appropriate.

Reviewer 3:
The reviewer commented that the list of research partners and coordination efforts for present and future research was impressive, noting preparing input data and processing model results with Jonathan Ford and Karen Sikes (SRA International, Inc.), vehicle attribute data and application of MA3T in analyses with Tom Stephens and Aymeric Rousseau (ANL), scenario setup and infrastructure analysis with Jing Dong (Iowa State University), and electricity carbon intensity with Laura Martin (DOE/EIA).

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.

Reviewer 1:
The reviewer commented that the proposed future work on consumer behavior, industry behavior, technology innovation and uncertainties seemed to cover all the bases.

Reviewer 2:
The reviewer indicated that the future work is properly focused, but not very ambitious when compared to cost of the project. In addition, the reviewer added that it should have more focus on consumer barriers to advanced technology vehicles.

Reviewer 3:
The reviewer commented that it needs to better understand consumer behavior, industry behavior, technology innovation, and associated uncertainties. The reviewer was unsure whether this has already been addressed in previous studies in a more understandable fashion. The reviewer did note that an impressive list of future initiatives are presented for the remainder of 2013 and 2014 but that it appeared to be a duplication of efforts related to previous presentations.

Question 5: Does this project support the overall DOE objectives of petroleum displacement? Why or why not?

Reviewer 1:
The reviewer felt that it addresses numerous aspects of alternative fuel usage and alternative fuel vehicle choice.

Reviewer 2:
The reviewer noted that, as stated in some of the other reviews, consumer choices are vital to understanding the impact of new technologies on petroleum reductions.

Reviewer 3:
The reviewer indicated that it was important to have models to turn technology improvements into market share increases, and fuel reductions, and carbon dioxide (CO_2) reductions. The reviewer was not clear on how this project differed from the project VAN004. The reviewer felt that there was a lot of redundancy between these two projects, especially in the consumer choice module.

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

Reviewer 1:
The reviewer indicated that the resources seemed to be sufficient.

Reviewer 2:
The reviewer indicated that information regarding resources available to the project were not sufficient enough to offer a comment on the sufficiency of resources.

Reviewer 3:

The reviewer indicated that $770,000 for some operational improvements and relatively minor improvements to the inputs seemed to be excessive.

Acronyms and Abbreviations

Acronym	Definition
ADOPT	Automotive Deployment Options Projection Tool
ANL	Argonne National Laboratory
ARB	Air Resources Board
AMR	Annual Merit Review
ARRA	American Recovery and Reinvestment Act
CAFE	Corporate Average Fuel Economy
CNG	Compressed Natural Gas
CO_2	Carbon Dioxide
DOE	U.S. Department of Energy
EERE	Office of Energy Efficiency and Renewable Energy
EIA	Energy Information Administration
EPA	U.S. Environmental Protection Agency
FASTSim	Future Automotive Systems Technology Simulator
FY	Fiscal Year
GHG	Greenhouse Gas
GM	General Motors
GREET	Greenhouse Gas, Regulated Emissions, and Energy Use in Transportation
GUI	Graphical User Interface
HyTrans	Hydrogen Transition
ICCT	International Council on Clean Transportation
LCA	Life-Cycle Analysis
LCFS	Low Carbon Fuel Standard
LCD	Levelized Cost of Driving
MA3T	Market Assessment of Advanced Automotive Technologies
NREL	National Renewable Energy Laboratory
OEM	Original Equipment Manufacturer
ORNL	Oak Ridge National Laboratory
PHEV	Plug-In Hybrid Electric Vehicles
R&D	Research and Development
VAN	Vehicle Analysis
VCM	Vehicle Choice Model
VTO	Vehicle Technologies Office
WTW	Well-to-Wheels