9. Vehicle Analysis

The portfolio of the Vehicle Technologies Office's Analysis Subprogram broadly comprises data, modeling, and applied analysis. A subset of the portfolio is presented and reviewed at the VTO Annual Merit Review. The presentations or posters are available in the Annual Merit Review Database and described here in the Annual Merit Review outcome report.

The VTO works with its national laboratories to collect and analyze data on the transportation sector to help better understand the sector's needs and guide the Office s research investments. VTO publishes the Transportation Energy Data Book annually with Oak Ridge National Laboratory, which compiles information on petroleum consumption, vehicle use, environmental impacts, household vehicle characteristics, and fleet characteristics. It also collaborates with Oak Ridge to publish the Vehicle Technologies Market Report, which describes major trends in light and heavy-duty markets. VTO also publishes the Fact of the Week, a fact with an accompanying graph or chart, to draw attention to particularly useful statistics.

The Vehicle Technologies Office (V O) has supported the development of a number of software packages and online tools to model individual vehicles and the overall transportation system. Most of these tools are available for free or a nominal charge. Modeling tools that simulate entire vehicles and components allow researchers to create and test entire "virtual vehicles." Integration and validation tools help researchers test how multiple components interact.

With participation from the energy, electric utility, and automobile industries, VTO and the Fuel Cells Technology Office conducted a cradle-to-grave analysis activity that encompasses resource extraction (cradle), transformation of resources into fuels and vehicles, vehicle operation, and vehicle end-of-life disposal and recycling (grave). VTO also works with Argonne National Laboratory to publish performance reports under the Government Performance and Results Act (GPRA).

Subprogram Feedback

The U.S. Department of Energy (DOE) received feedback on the overall technical subprogram areas presented during the 2016 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 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 program area, including overall strategy, adequately covered?

Question 2: Is there an appropriate balance between near- mid- and long-term research and development?

Question 3: Were important issues and challenges identified?

Question 4: Are plans identified for addressing issues and challenges?

Question 5: Was progress clearly benchmarked against the previous year?

Question 6: Are the projects in this technology area addressing the broad problems and barriers that the Vehicle Technologies Office (VTO) is trying to solve?

Question 7: Does the program area appear to be focused, well-managed, and effective in addressing VTO's needs?

Question 8: What are the key strengths and weaknesses of the projects in this program area? Do any of the projects stand out on either end of the spectrum?

Question 9: Do these projects represent novel and/or innovative ways to approach these barriers as appropriate?

Question 10: Has the program area engaged appropriate partners?

Question 11: Is the program area collaborating with them effectively?

Question 12: Are there any gaps in the portfolio for this technology area?

Question 13: Are there topics that are not being adequately addressed?

Question 14: Are there other areas that this program area should consider funding to meet overall programmatic goals?

Question 15: Can you recommend new ways to approach the barriers addressed by this program area?

Question 16: Are there any other suggestions to improve the effectiveness of this program area?

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, et

Subprogram Overview Comments: Jake Ward (U.S. Department of Energy) - van999

Question 1: Was the program area, including overall strategy, adequately covered?

Reviewer 1:
The reviewer replied yes, the program's goal, objective, and strategy were all defined and/or covered, adding that funding and model/tool definition and integration were provided to demonstrate strategy execution

Reviewer 2:
The reviewer stated that the program area and strategy were well covered and linkages between the various components are clear, although the link between the new initiative in Systems and Modeling for Accelerated Research in Transportation (SMART) Mobility could be made more explicit.

Reviewer 3:
The reviewer said the program area was adequately covered. However, the reviewer specified areas to consider for improvement, namely, the objective can be read as vague and does not effectively speak to the relevance or usefulness of the program for various users of the output: government, industry, non-governmental organizations (NGOs). The reviewer also cautioned that "speaks for itself" is very subjective, and that it may be beneficial to reword this even if it is duller but measureable.

Reviewer 4:
The reviewer remarked that the linkage between the pyramid levels could have been made clearer with an example showing how information flows from one level to the next

Question 2: Is there an appropriate balance between near- mid- and long-term research and development?

Reviewer 1:
The reviewer stated that the balance seems appropriate.

Reviewer 2:
The reviewer expressed that efforts appear to be appropriately balanced.

Reviewer 3:
The reviewer remarked that this is subjective, but the work seems to be weaker in early applied (long-term) research, and that this seems to be the result of higher level strategic direction at DOE versus a decision issue at the program management level.

Reviewer 4:
The reviewer commented that it was not clear from the presentation that there were near-, mid-, and long-term research and development (R&D) goals, and that most of the "future work" seemed like near-term goals.

Question 3: Were important issues and challenges identified?

Reviewer 1:
The reviewer stated that the speaker clearly articulated the issues and challenges that the analysis program is addressing.

Reviewer 2:
The reviewer replied yes, elaborating that modeling and simulation improvements were presented and described including data updates, coding/software revisions, testing, calibration, integration, and review. It is an extensive set of analytical tools requiring a lot of care and maintenance. The reviewer suggested that there might be some opportunities for greater consolidated effort, but added that given the specificity of model function, integration with other tools, etc., desired analytical capability may preclude a scaling effort over multiple platforms.

Reviewer 3:
The reviewer remarked that there were not many issues and challenges identified, and that the presentation could have benefited from detailing the "why" or need for each of the highlights or accomplishments

Reviewer 4:
The reviewer stated that these were not addressed in the presentation.

Question 4: Are plans identified for addressing issues and challenges?

Reviewer 1:
The reviewer replied yes, core analytical model and tool program issues and successes were identified with plans provided for future activities.

Reviewer 2:
The reviewer stated that the speaker highlighted activities planned for the coming year and provided the motivation for the topical areas.

Reviewer 3:
The reviewer stated that these were not addressed in the presentation.

Reviewer 4:
The reviewer responded N/A and referenced prior comments.

Question 5: Was progress clearly benchmarked against the previous year?

Reviewer 1:
The reviewer replied yes to this question.

Reviewer 2:
The reviewer commented that the focus of the program has shifted somewhat from last year, especially with the addition of the SMART Mobility initiative, and that highlights of accomplishments indicated continued progress over the previous year in all major program areas.

Reviewer 3:
The reviewer observed that the prior year presentation was provided, which was helpful in benchmarking year-to-year progress, but that the 2016 slide deck did not have much benchmarking data.

Reviewer 4:
The reviewer stated that this was not addressed in the presentation.

Question 6: Are the projects in this technology area addressing the broad problems and barriers that the Vehicle Technologies Office (VTO) is trying to solve?

Reviewer 1:
The reviewer praised the projects in this program as providing foundational data, models, and analyses that provide insight into the value of transitioning to alternative vehicles and fuels supported by VTO. The reviewer applauded the program as solid and well-structured to provide context for the broad problems and barriers VTO is trying to address.

Reviewer 2:
The reviewer replied yes to this question.

Reviewer 3:
The reviewer stated that they seem to be closely aligned with VTO-identified problems and barriers

Reviewer 4:
The reviewer replied yes, but warned that there are some acute concerns and not all projects are as appropriate or as effective in addressing the broad problems and barriers. The reviewer also noted that some areas are better covered

by the projects in terms of multiple contributors, while others are more limited, and remarked that this remains a chronic challenge of the program. The reviewer also stated that acute feedback is provided for the individual presentations.

Question 7: Does the program area appear to be focused, well-managed, and effective in addressing VTO's needs?

Reviewer 1:
The reviewer described the program as well-organized and structured, adding that the suite of activities provides information, capabilities, and studies that highlight the potential and challenges of transitioning to alternative fuels and vehicles. The reviewer affirmed that program management seems strong, with clear linkages between the various complementary efforts, and that shifts in the program are responsive to VTO needs.

Reviewer 2:
The reviewer replied yes to this question.

Reviewer 3:
The reviewer said yes but, as stated above (in question 1), an example of information/data flows between the pyramid levels would help solidify the program area.

Reviewer 4:
The reviewer stated that the program is generally well managed and that the program manager has a confident vision. The reviewer remarked that it is difficult to discern where the root cause of shortcomings derives from: DOE leadership and direction, or program decision making. The reviewer concluded that it appears to be more the former.

Question 8: What are the key strengths and weaknesses of the projects in this program area? Do any of the projects stand out on either end of the spectrum?

Reviewer 1:
The reviewer stated that a key strength is the complementary structure and synergy across the project portfolio, and that all projects presented seem solid.

Reviewer 2:
The reviewer observed that there are a broad set of tools being used to analyze a broad set of issues, and remarked that many of these tools represent significant contribution to the analytical communit . The reviewer offered that there are redundancies in scope, but nuanced capability provides added insight on critical issues.

Reviewer 3:
The reviewer commented that a key strength seemed to be the engagement/collaboration with other federal laboratories, industry, academia, and area specific experts, while the perceived weakness was how all the information between the projects ties together.

Reviewer 4:
The reviewer judged that work performed on the Greenhouse gases, Regulated Emissions, and Energy use in Transportation (GREET) model stands out on the weak end along with the VTO program benefits analysis (see individual review). The reviewer stated that the Autonomie system simulation tool is stronger.

Question 9: Do these projects represent novel and/or innovative ways to approach these barriers as appropriate?

Reviewer 1:
The reviewer observed that many of the projects are longstanding ones within the portfolio and remarked that they provide continuity, capability, and information that the analysis community has come to rely upon. The reviewer added that the addition of new projects over the past few years has provided new and innovative modeling capabilities.

Reviewer 2:
The reviewer replied yes, adding that underlying assumptions should be clearly stated.

Reviewer 3:
The reviewer commented that it is hard to judge this based on the level of detail in this presentation.

Reviewer 4:
The reviewer said no, they do not, and added that Autonomie is one of the better executed projects by DOE's national laboratories this year.

Question 10: Has the program area engaged appropriate partners?

Reviewer 1:
The reviewer commented that the program area is engaged across multiple government, laboratory, university, and industry partners, and that these partnerships link to key organizations and thought leaders that provide relevant input and feedback, as well as consumers of the analysis and data.

Reviewer 2:
The reviewer replied yes to this question.

Reviewer 3:
The reviewer stated that it seems so, based on Slide 21.

Reviewer 4:
The reviewer remarked that this was not covered in the overview presentation but that the program manager explained how the different components of the program engage each other.

Question 11: Is the program area collaborating with them effectively?

Reviewer 1:
The reviewer affirmed that program management has clearly made a concerted e fort to engage a broad set of relevant stakeholders and partners, which informs the issues addressed and strengthens the resulting analysis products.

Reviewer 2:
The reviewer replied yes to this question.

Reviewer 3:
The reviewer was unable to determine.

Reviewer 4:
The reviewer stated that there is not sufficient information to answer this question

Question 12: Are there any gaps in the portfolio for this technology area?

Reviewer 1:
The reviewer replied no to this question.

Reviewer 2:
The reviewer stated none that come to mind.

Reviewer 3:
The reviewer answered that there are no obvious gaps at this time.

Reviewer 4:
The reviewer replied that, consistent with the comments provided above, there are two high-level weaknesses to consider: First, the greenhouse gas (GHG) emissions measurement is dependent on one model, which the reviewer cautioned greatly narrows the input and fails to recognize the critique and limitations established in the literature

or capture broader measurement techniques and perspectives that are hallmarks of good analysis. Second, all of the projects, and it appears that almost all of the funding, are supporting DOE laboratories. The reviewer offered that there was not a good rationale provided for why there is not more engagement with academia or other independent actors who bring different approaches, skills, and insights to the research (the reviewer said to see prior comment in this section as an example).

Question 13: Are there topics that are not being adequately addressed?

Reviewer 1:
The reviewer replied no to this question.

Reviewer 2:
The reviewer replied no to this question.

Reviewer 3:
The reviewer offered that including SMART Mobility is a much-needed enhancement to the program, and added that the program will need to create new capabilities to effectively address key challenges with new technologies that go beyond the powertrains and fuels that have been the focus of the program.

Reviewer 4:
The reviewer stated that GHG impacts/measurements are not being adequately addressed.

Question 14: Are there other areas that this program area should consider funding to meet overall programmatic goals?

Reviewer 1:
The reviewer replied no to this question.

Reviewer 2:
The reviewer replied no to this question.

Reviewer 3:
The reviewer suggested that further sensitivity studies to help identify and bound uncertainties in the modeling and analyses could provide further insight into the impact of technology, policy, and consumer choice.

Reviewer 4:
The reviewer suspected that some might suggest SMART mobility, which was added to the portfolio. The reviewer warned that while SMART mobility will affect energy utilization of the transportation system, this is a subject area that is likely better handled by DOT and others, as it is fundamentally a question of transportation system operation, regulation, and development/funding policy, even if VTO can generate an argument to show that energy is somehow tied in. The reviewer added that the material presented suggests large amounts of scope and mission creep despite the argument presented to the contrary, and that moving into this space needs to be very carefully considered.

Question 15: Can you recommend new ways to approach the barriers addressed by this program area?

Reviewer 1:
The reviewer replied no to this question.

Reviewer 2:
The reviewer stated not at this time.

Reviewer 3:
This reviewer's understanding is that the program has historically convened and also has planned workshops for stakeholder engagement, but observed that this was not covered in the presentation. The reviewer offered that

highlighting how this outreach is conducted and the lessons learned would provide even better context for the program focus areas.

Reviewer 4:

The reviewer remarked that this program continues to sustain funding for the same projects that tend to produce the same results from the same perspective. The reviewer offered that a simple new approach would be to allow or instruct the program manager to roll over the projects and bring in a new set of researchers and modelers/analysts to bring a different and complementary perspective to the work. The reviewer claimed that an exorbitant amount of money is being spent to produce fundamentally the same results (with the same limitations and embedded errors and uncertainty) that have persisted for years, and added that the return on investment (ROI) from a different perspective is probably going to be higher.

Question 16: Are there any other suggestions to improve the effectiveness of this program area?

Reviewer 1:

The reviewer replied no to this question.

Reviewer 2:

The reviewer replied no to this question.

Reviewer 3:

The reviewer stated that the reviews for GREET, Autonomie, and VISION/NEAT need to be separated, elaborating that while individual comments can be provided in technical sections, the ratings for each category do not apply to the individual projects. The reviewer pointed out that a stronger project receives a lower grade and the weak(er) projects are over-graded. The reviewer commented that this is a poor way to make project funding and continuation decisions and is a disservice to the higher performing individuals.

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 9-1 – Project Feedback

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Transportation Data Program: A Multi-Lab Coordinated Project	Davis, Stacy (ORNL)	9-10	3.08	3.42	3.50	3.00	3.29
ANL Vehicle Technologies Analysis Modeling Program	Wang, Michael (ANL)	9-14	3.25	3.17	3.58	3.25	3.25
VTO Program Benefits Analysis	Stephens, Tom (ANL)	9-18	2.50	2.67	2.75	3.00	2.68
Assessing Energy and Cost Impact of Advanced Technologies through Model Based Design	Rousseau, Aymeric (ANL)	9-22	3.58	3.67	3.67	3.50	3.63
Overall Average			3.10	3.23	3.38	3.19	3.21

Transportation Data Program: A Multi-Lab Coordinated Project: Stacy Davis (Oak Ridge National Laboratory) - van016

Presenter
Stacy Davis, Oak Ridge National Laboratory

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 said that all three projects seem well-designed, feasible, and integrated with other DOE efforts. Principal investigators (PIs) are trying to address technical barriers. The reviewer commented that for the TEDB, which informs the DOE and external models, the biggest barrier seems to continue to be inconsistency across the time series due to changes in data inputs. For the consumer survey on plug-in electric vehicles (PEVs), the most significant barrier seems to be the limitations of stated preference data (as opposed to revealed preference data). However, the reviewer remarked that the presenter aptly noted that some data are better than no data. The reviewer said that for questions assessing PEV awareness, a consumer survey is the right tool, and this will be a particularly valuable year-by-year data set. The presentation stated that the National Renewable Energy Laboratory (NREL) is also seeking opportunities to contextualize study results with external data sets, which seems useful. The reviewer remarked that for the electric drive E-Drive project, monthly PEV sales data are published on Argonne National Laboratory's (ANL) website. This is a valuable resource for researchers and stakeholders for tracking the early PEV market. If international sales data and U.S. regional breakdowns are also being regularly collected, the reviewer suggested making these public as well (on the same or linked ANL website) rather than just providing to VTO.

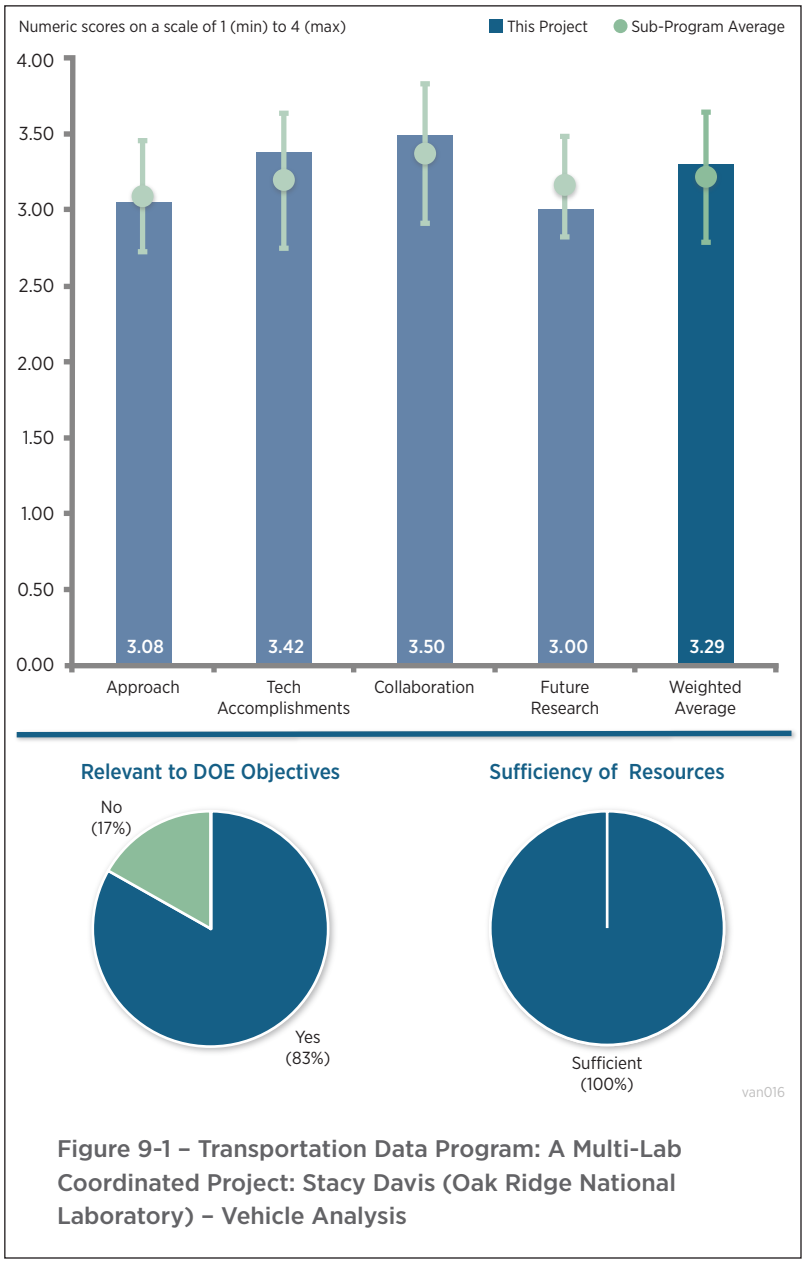

Figure 9-1 – Transportation Data Program: A Multi-Lab Coordinated Project: Stacy Davis (Oak Ridge National Laboratory) – Vehicle Analysis

Reviewer 2:
The reviewer said the project team has a strong approach that enables successful multi-lab coordination. The reviewer remarked that tasks and roles are clearly defined and that the focus on publicly accessible material enables transparency in the data reported.

Reviewer 3:
The reviewer stated that the approach is logical and provides foundational information relevant for a community of researchers. The team has had long-term engagement in the project and provided thoughtful attention to details that have come to be expected by the community of users. The reviewer said that the addition of E-Drive data are particularly relevant given the growing interest in vehicle electrification

Reviewer 4:
The reviewer said that the project appears to be designed to specifically address data, market and analytical needs of the VTO. The reviewer commented that the design, feasibility, and integration support the VTO programs and involve multiple stakeholders.

Reviewer 5:
The reviewer said the work is straightforward and satisfactory, and that there are no major issues or challenges. The reviewer found it unclear that preference analysis is very robust or better than competing alternatives, which is why it is not used versus other sources for the analysis that the reviewer saw being performed or utilized; however, the reviewer said it seems valuable as is to other users. The reviewer had some concern that the data are focused on only nine companies.

Reviewer 6:
The reviewer commented that the presentation lacked detail on how the data were collected. It was not clear how the data and information from this project are used by the other projects.

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 towards DOE goals.

Reviewer 1:
The reviewer noted that milestones have been met or are on track for all project components. The reviewer was particularly impressed by the outreach efforts for the TEDB and Vehicle Technologies Market Report: monthly website visits increased substantially from Fiscal Year (FY) 2015 to FY 2016 on both projects and topped 11,000 for TEDB. The reviewer observed that even granting that part of the increase for TEDB was a shift from hard copies to the web, the impressive usage numbers are indicative of the importance of this data to external researchers and transportation stakeholders. The reviewer noted that both the Consumer Benchmark Report and E-Drive project will provide important data to help understand and track early PEV adoption and identify challenges and barriers. The reviewer commented that the slides on the consumer survey state, "In an early adoption market, it is helpful to identify where further investigation is warranted." To that end, researchers might consider adding a few state- or region-specific questions in early adoption markets to explore how consumer views differ in these areas and to explore the impact of state incentives, visible public charging stations, or (if applicable) region-specific advertising and consumer education campaigns. If that is not possible, the reviewer suggested that an alternative may be to increase the total number of consumers surveyed such that the sample size is large enough to analyze responses both nationally and regionally. The reviewer recognized this is outside the current scope of the project and that while national benchmarking is very valuable on its own, regional data would be an additional, valuable resource.

Reviewer 2:
The reviewer remarked that the project continues to make steady progress and publish the market report, data book, and facts of the week. A significant increase in hits to the website for the TEDB indicates the value of this resource, and the reviewer suspected that this is attributed to the value of the data beyond the reduction in hard copy distribution mentioned during the presentation. The reviewer suggested that the team track what information is accessed to focus and prioritize which areas may either merit expansion or perhaps less frequent updates. It would also be helpful to understand more clearly how the data are used by the other parts of the VTO analysis portfolio.

Reviewer 3:
The reviewer stated that the team has shown good progress and is on track to meet all its milestones, and in some cases is even ahead of schedule. For instance, the market report was published early this year.

Reviewer 4:
The reviewer noted that this project has met defined accomplishments and progress toward meeting desired DOE goals.

Reviewer 5:
The reviewer commented, again, that the project was straightforward.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer commented that PIs are working with an impressive cross-section of government agencies, industry, and academia and have plans to expand outreach. The reviewer suggested the presenters might consider also reaching out to Idaho National Laboratory (INL). Early adopter data for PEV usage related to driving and charging could inform future questions on consumer surveys. The reviewer said that one of the slides on E-Drive mentioned the limitations of using the National Household Travel Survey data to model the behavior of PEV drivers and that perhaps INL data or other early adopter data sets could also be helpful here.

Reviewer 2:
The reviewer said that this multi-lab project shows strong coordination across the three partners—ORNL, NREL, and ANL. The team also has significant cross-sector collaboration involving industr , academia, and other government agencies, including DOT and EPA.

Reviewer 3:
The reviewer noted that the project team continues to collaborate with various providers and users of data. The project has clearly sought out feedback and has judiciously responded to input.

Reviewer 4:
The reviewer commented that there is a broad spectrum of stakeholder involvement including other government agencies, private sector, national laboratories, and academia.

Reviewer 5:
The reviewer said that the collaboration comes across as forced farming of the work in order to split the effort across the laboratories. The reviewer stated that the results are fine, but it is not clear how this is necessary or value added. The nature of the collaboration with the broader list was not explained.

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 remarked that the project has a sustained history of delivering a solid set of data for the community and clearly plans to continue on this path forward.

Reviewer 2:
The reviewer said that all projects have feasible plans for future work that are consistent with DOE goals. For the consumer survey, the reviewer suggested considering expanding the scope to allow regional evaluations in early adopter markets. For E-Drive, the reviewer suggested expanding outreach and making data sets publicly available, for example, by adding a global sales bar graph to ANL's monthly sales website.

Reviewer 3:
The reviewer stated that proposed future work is well planned with weekly, monthly, and annual milestones identified

Reviewer 4:
The reviewer commented that future plans should include identifying more recent data for inclusion in the presenters' reports. The reviewer strongly recommended that the presenters look into updating some data more

often than annually to make it available for use faster, as the presenter suggested could be a possibility. The reviewer stated that it would be interesting to see the team investigate why they found that in colder climates there is a reduced battery electric vehicle (BEV) share of the market. The reviewer commented that BEVs have been very successful in Scandinavia and questioned why they could not also be successful in the northern United States.

Reviewer 5:
The reviewer commented that proposed future work was not explained well, and that the slide was too high level.

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

Reviewer 1:
The reviewer stated that the projects provide valuable information to DOE, other policymakers, researchers, and the public on key transportation data. The National Benchmark Report will be particularly helpful in understanding how consumer awareness of PEVs changes or does not change over time, and it may also be helpful in assessing how certain incentives, infrastructure, and other factors impact that awareness. The reviewer said that this knowledge can be used to help reduce barriers to adoption. E-Drive sales data likewise provides important information for tracking and understanding early PEV market penetration.

Reviewer 2:
The reviewer remarked that the data collected by the team directly informs the VTO's Multi-Year Research, Development, and Demonstration (MYRD&D) Plan and is critical to ensuring relevance of program activities. The reviewer said that the data point from FY 2014 that stated there were 1,200 users of the reviewer book is a clear indicator of the relevance of the work.

Reviewer 3:
The reviewer said the project provides foundational data and important highlights that are used extensively by the modeling and analysis community.

Reviewer 4:
The reviewer expressed that the project supports data and analytic needs.

Reviewer 5:
The reviewer questioned who was using the data and how it was being used. The reviewer said it would be beneficial to add some content and provide examples of the data usage

Reviewer 6:
The reviewer stated that good data are foundational for good modeling.

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

Reviewer 1:
The reviewer said the resources seem sufficient for the current project milestones, but that if the scope of the projects expands, for example, by adding region-based consumer surveys, then additional funds may be needed.

Reviewer 2:
The reviewer stated that no gaps were identified that would warrant additional resources

ANL Vehicle Technologies Analysis Modeling Program: Michael Wang (Argonne National Laboratory) - van017

Presenter
Michael Wang, Argonne National Laboratory

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 said the project uses an excellent approach that enables comparison of differing technologies in a consistent way. There is clear integration of this effort with other VTO-funded analysis.

Reviewer 2:
The reviewer stated that there were strong technical achievements on all four models discussed and that plans for continued development seem well-designed and feasible. The reviewer expressed that there seemed to be particularly strong technical progress in Autonomie and the GREET model, for example, water consumption.

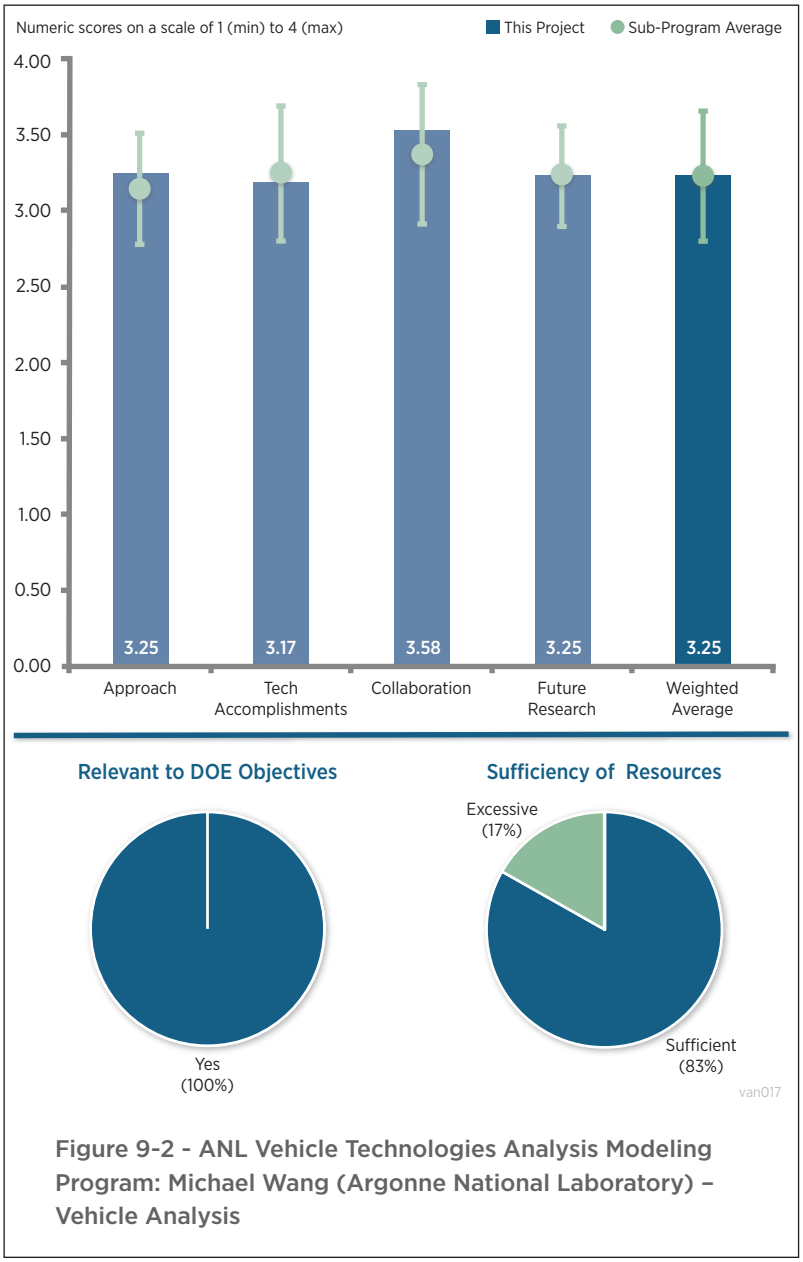

Figure 9-2 - ANL Vehicle Technologies Analysis Modeling Program: Michael Wang (Argonne National Laboratory) – Vehicle Analysis

The reviewer said the technical challenges seem highest for the household vehicle ownership model due to data limitations. The reviewer commented that it would have been helpful to see more detail on which datasets are being used for calibration and how different powertrain technologies are being handled; for example, a household's decision to buy a PEV. The reviewer understood this was difficult given how many topics needed to be covered in 20 minutes and suggested that in future merit reviews, it may be helpful for this to be a standalone topic. The models seem well-integrated with other DOE efforts.

Reviewer 3:
The reviewer commented that the suite of models developed under this project is useful for a broad user community. The continued model development, refinement, and use are important for supporting assessments made across the user base. The reviewer said the team seems to take a logical approach to balancing across gathering information, building the models, and performing analysis. The expansion of features, including access in the ".net" platform, is logical and reflects capabilities that are being increasingly demanded by the analysis communit .

Reviewer 4:
The reviewer commented that updates and integration of Autonomie, GREET, and VISION/ NEAT are well-developed and defined; howeve , vehicle market dynamics are not well-defined or developed. The reviewer questioned if this portion of the project will be the primary focus toward the end of the project's timeline, and the reviewer said that, if so, the presenter should be clear about that in the presentation.

Reviewer 5:
The reviewer said it would have been helpful if the presentation better addressed the first objective of overcoming inconsistent data, assumptions, and guidelines.

Reviewer 6:
The reviewer said the modeling approach is not the best choice or particularly well-suited for evaluating environmental sustainability. This, in part, derives from limitations on how the boundary and factors considered in GREET are determined. The reviewer stated that comparing across technologies, which inherently encompass systems that have different components and input flows, is very challenging. Howeve , GREET continues to present their results as having more usefulness and accuracy than is warranted for many of these applications, and that can be misinforming the decision-making process. The reviewer said the approach of Autonomie, however, is good.

The reviewer also said that the approach of VISION/NEAT, and the reliance on the exogenous inputs, limits its usefulness. It is unclear if there is a mechanism to ensure that the inputs are self-consistent. As such, the model functions more as a deterministic calculator for which the output may or not be realistic or relevant for informing decision making by DOE.

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 towards DOE goals.

Reviewer 1:
The reviewer said that both Autonomie and GREET are robust, well-vetted models, with an extensive list of technology pathways and fuel pathways that are widely used by outside stakeholders. The reviewer was particularly impressed by reported GREET updates and said that the development of regional platforms will be especially important for evaluating impacts of electric vehicles (EVs) due to wide variations in the grid. The reviewer was also glad to see the new video tutorial.

The reviewer said that the ability to model long-range scenarios (2050 or 2100) in VISION/NEAT seems limited by a lack of advanced technology powertrain options in the freight sector. The reviewer suggested that the presenter consider the addition of electrification; for example, plug-in hybrid electric vehicles (PHEV) or fuel cell vehicles (FCV), for medium-duty vehicles (MDVs) and heavy-duty vehicles (HDVs). While the reviewer recognized that data were limited and that many simplifying assumptions and caveats may need to be made, the reviewer said that projections to 2100 that do not allow for any freight electrification limit the models usefulness and may inadvertently imply that these are not viable technologies.

The reviewer also commented that for the household vehicle ownership model, it was not clear from the presentation what data are being used to calibrate PEV model components. The reviewer commented that the presenter might consider evaluating early adopter data on PEV usage from INL or other PEV-specific data sets as they become available given how different travel behavior and needs may be for owners of these vehicles relative to internal combustion engine (ICE) vehicles.

Reviewer 2:
The reviewer said that the publication of the cradle-to-grave report on June 1st was a significant accomplishment from four years of efforts. Integrating all of the modeling analysis and results is extremely valuable to the clean transportation community.

Reviewer 3:
The reviewer commented that the project continues to make good progress on developing capabilities that have become widely used by the academic, policy, and industry communities.

Reviewer 4:
The reviewer remarked that when evaluating fuel and vehicle emissions at a state level, electric power should reflect utility generation mix of consumption, not state production. VISION model calibration techniques should be clearly described and tested to indicate the impact calibration has on projected values.

Reviewer 5:
The reviewer said that the technical accomplishments vary. Inputs used to show results in GREET may be vetted by experts, but they are also refuted by experts. The reviewer said that the intransigence in which the researchers have failed to consider legitimate critique and the limits it implies on how the model should and should not be used continue to linger as problems. The reviewer commented, however, that the Autonomie results are valuable and well-received by the range of stakeholders.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that the project had excellent collaboration with other laboratories, researchers and original equipment manufacturers (OEMs). The reviewer commented that there was good coordination with the BETO WATER 2.0 model ensuring integration and consistency of assumptions.

Reviewer 2:
The reviewer said that the team obviously has a vast network of collaborators and partners that inform and shape the models and analyses. Sustained investment over multiple years has enabled this capability to flourish

Reviewer 3:
The reviewer commented that the PIs are working with appropriate government agencies, industry, and academia.

Reviewer 4:
The reviewer said that Autonomie should continue to collaborate with industry and others to continue to seek good empirical input and review.

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 said that the project had very well-defined milestones extending to F 2018 for Autonomie, GREET, and VISION/NEAT. There was less detail provided on plans for the household vehicle ownership model. The reviewer suggested that the presenter consider additional powertrain and technology options for MDVs and HDVs in VISION/NEAT.

Reviewer 2:
The reviewer said that the planned future work is relevant and valuable. The team should include the proposed updates to Autonomie, GREET, and VISION/NEAT as outlined in the presentation.

Reviewer 3:
The reviewer remarked that incorporating new components and powertrain technologies is a very logical expansion. The addition of quality assurance (QA) / quality control (QC), uncertainty analyses, and web processing tools also seems like it would be useful for the broader user community. The reviewer commented that water consumption accounting should consider all feasible technology options just as the GHG emissions considers all options in order to enable consistent comparisons. The reviewer also stated that the household vehicle ownership description was not clear and that more background is needed to understand how this is going to be used.

Reviewer 4:
The reviewer said that Autonomie was on point and likely to be accomplished. However, the reviewer commented that the GREET model continues to take a Band-Aid approach instead of addressing fundamental problems. The reviewer also said that the VISION/NEAT model was adequate.

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

Reviewer 1:
The reviewer remarked that the project is extremely relevant as it shows the impact of VTO technology developments and provides pathway analysis to show the sustainability and economic viability of current and future vehicle technology pathways.

Reviewer 2:
The reviewer said that the linking of the three tools seems to provide the DOE the capability to project benefits from VTO-funded R&D activities.

Reviewer 3:
The reviewer said that the suite of models in this project has become a standard set of tools used by the analysis community and is directly relevant to DOE objectives.

Reviewer 4:
The reviewer said that modeling is important for assessing the potential for advanced vehicle technologies to reduce petroleum and for identifying barriers to the adoption of these technologies.

Reviewer 5:
The reviewer opined that, overall, DOE petroleum displacement objectives are supported by this project, and noted better support from some parts than others. The reviewer expressed that providing misinformation, even if the answer is aligned with the objective, is probably more damaging than not providing information at all, but the reviewer said that is hard to measure with the yes or no question.

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 resources seem relevant to continue steady progress.

Reviewer 2:
The reviewer said that it is not clear how the large resources allocated to GREET are making it a fundamentally more useful tool or improving the usefulness enough to justify the investment. The reviewer also said that the resources for Autonomie are sufficient. The reviewer said that the three models covered in this project should be reviewed individually.

VTO Program Benefits Analysis: Tom Stephens (Argonne National Laboratory) - van018

Presenter
Tom Stephens, Argonne National Laboratory

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 stated that the approach to the work enables an unbiased comparison of the impact of the VTO investments. It is a very valuable way to show the impact of the VTO funding. The reviewer recommended that other offices adopt the same approach.

Reviewer 2:
The reviewer said that, in general, the project seems well-designed and the PI has feasible plans for making the analysis more robust, for example, by refining retail PEV costs, incorporating more cost components, and doing sensitivities around fuel prices. The reviewer commented that understanding which benefits are attributable to the VTO program, as opposed to other policies and market effects, remains a significant challenge. The reviewer suggested incorporating the light-duty GHG standards into the base case and doing additional sensitivities to account for other non-VTO potential drivers for technology improvements.

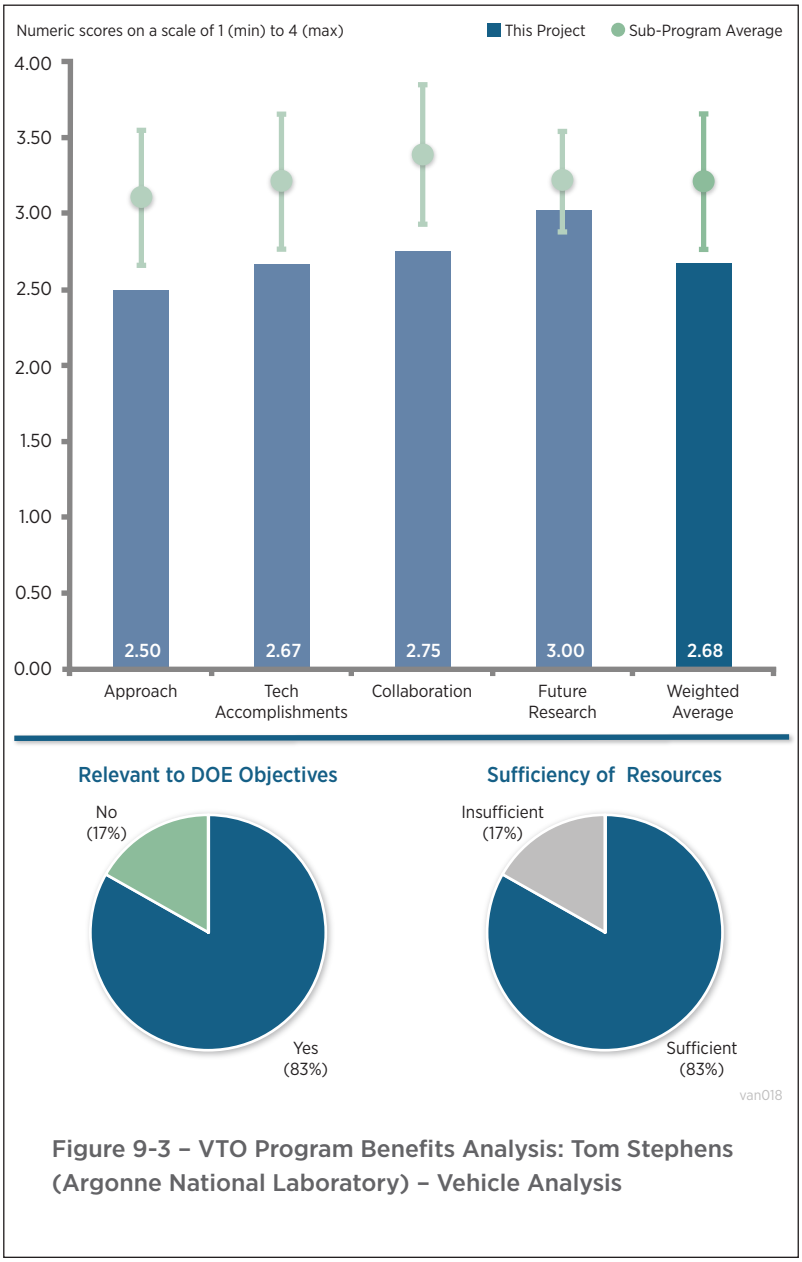

Figure 9-3 – VTO Program Benefits Analysis: Tom Stephens (Argonne National Laboratory) – Vehicle Analysis

The reviewer observed that there are four consumer choice models used to help address uncertainty in light-duty vehicle (LDV) sales share. While this seems like a good approach, the reviewer stated that it would have been helpful to know what technology penetration rates each model found. The reviewer said that if the results are similar, this could indicate that additional sensitivities need to be performed by altering the inputs to the consumer choice models; in other words, high adoption cases where tipping point for PEVs is reached, rather than just using different models.

Reviewer 3:
The reviewer said that the current analysis approach assigns all fossil energy improvements to VTO-funded R&D and ignores corporate average fuel economy (CAFE)/GHG standards through 2025. This seems to double count the benefits that are due to CAFE/GHG standards. The reviewer said that VTO benefits should be relative to CAFE

GHG standards (baseline) and show the improvement of fuel economy above and beyond CAFE/GHG or show how VTO-funded R&D lowers the cost of complying with CAFE/GHG standards.

Reviewer 4:

The reviewer said that the project goal and approach are very clearly focused on program evaluation. The reviewer commented that the researchers are careful in capturing the appropriate attributes of the program relative to the no program case. The presenters are providing a logical methodology for evaluating the environmental, cost, and petroleum consumption effects of the program.

Reviewer 5:

The reviewer stated that not enough work was completed, and that some are behind schedule. The reviewer said that this happens, but it speaks to the design and feasibility as outlined.

The reviewer said that the baseline is highly suspect and is predicated on an internal belief and understanding within the DOE of technology improvement, without considering private market, university, and other driven technology development. This black and white approach to technology development is problematic, particularly because a lot of DOE investments empirically demonstrated over several decades are duplicative and/or lag behind privately generated technology advancement. The reviewer also stated that the project lead indicated that the non-VTO case did not comply with CAFE standards, and this is functionally a non-starter for accepting the research as valid or useful.

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 towards DOE goals.

Reviewer 1:

The reviewer said that this is an ambitious project with significant potential to inform future policy by quantifying benefits of VTO technology performance goals. It can also help inform future advanced technology research by addressing challenges associated with such a complex modeling undertaking, for example, addressing discrepancies in assumptions and handling uncertainty across multiple models such as Autonomie, VISION, Advanced Vehicle Cost and Energy-Use Model (AVCEM), GREET, and the Plug-In Electric Vehicle Infrastructure model (PEVI).

The reviewer commented that good progress has been made. The reviewer was especially impressed by the integration of the agent-based charging infrastructure model with the Multi-Agent Transport Simulation (MATSim) framework. The reviewer suggested that multiple data sets, including both early PEV adopter data and more general household vehicle travel data, be used to calibrate the model and perform sensitivities around charging behavior.

Reviewer 2:

The reviewer stated that the project is consistent and has made steady progress. The presenters are focused on methodology and quantitative metrics for assessing program goals. The reviewer said that breaking down the levelized cost of driving for different components for a variety of powertrain technologies helps provide insight on where costs can be cut, both at the vehicle level and for the overall vehicle parc. The reviewer observed that the team has incorporated all of the LDV consumer choice models to get a sense of the uncertainty in the models as well as the uncertainty in the impact of the overall program. It would be worthwhile to explore what the underlying causes are for the differences in the models.

The reviewer commented that the infrastructure to grid interaction analysis is also a significant addition to the project. More information on the model, assumptions, and insight that the project team expects to learn should be made more explicit. The reviewer said that, similarly, information on the AVCEM model and expected insight should be more explicit.

Reviewer 3:

The reviewer said that the team has made significant progress and continues to update its analysis assumptions; however, some of the basis for the cost data are unclear. For example, the reviewer wonders what the hydrogen

(H_2) cost is in 2025 and what the basis is. The reviewer questioned if this is assuming a high volume market and what the delivery pressure is. The reviewer observed that this does not seem consistent with the latest records from the Fuel Cell Technologies Office (FC O), and that the same applies to the fuel cell cost.

Reviewer 4:

The reviewer commented that the baseline issue mentioned above makes it difficult to comment on the progress that has been made. The reviewer said that the retail cost markup research should be coordinated with DOT and EPA.

Reviewer 5:

The reviewer said that, overall, the project seems to be behind, but there are some positive outcomes. The project appears to have at least one foundational flaw that makes the output highly suspect. Regarding petroleum savings, the reviewer also stated that it is difficult to accept, given the approach concerns. On the topic of PE to grid interactions, the reviewer stated that it is hard to evaluate as work is still in progress. Finally, regarding AVCEM, the reviewer remarked that it is hard to evaluate as work is still in progress.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:

The reviewer said that collaboration with the other laboratories involved in the work is strong; however, the work would benefit from greater collaboration outside of the project team. Detailed peer review of the work, with more depth than can be achieved in a 20-minute AMR presentation, could provide valuable input. The reviewer commented that OEMs, fuel providers, and other technology offices should be involved in reviewing the cost estimates and assumptions.

Reviewer 2:

The reviewer commented that collaboration across the program partners is clear. This activity brings together the analysis portfolio team. The reviewer remarked that reviewing results with additional stakeholders could benefit this analysis.

Reviewer 3:

The reviewer stated that the PI is working with appropriate government agencies and academia. The reviewer suggested also reaching out to INL regarding early PEV adopter data, which could be used to help inform modeling components on consumer behavior and charging usage.

Reviewer 4:

The reviewer stated that based on the omission of CAFE/GHG standards, it does not seem that there is enough coordination with other agencies.

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 there were well-designed, feasible plans to make analysis more robust and incorporate more components. The reviewer suggested incorporating existing policies such as LDV GHG standards into the base case.

Reviewer 2:

The reviewer said that, overall, the updates proposed are good and will improve the analysis. The reviewer stated that it is not clear what the side cases are and how they will address the previous years' reviewer comment about the uncertainty around fuel prices.

Reviewer 3:
The reviewer commented that the proposed future work is logical. There is a long list of factors to address, but it is not clear how these will be prioritized and which have the potential to have most impact.

Reviewer 4:
The reviewer said that the proposed work focused more on completing expected work versus addressing post-work assessment that identifies new needs and weaknesses that were revealed. The reviewer remarked that a review of the feedback provided from the prior year indicates that the project is not aligned or has chosen not to address important recommendations.

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

Reviewer 1:
The reviewer expressed that this analysis directly provides insight into the impact of the VTO program and its objectives of petroleum displacement and GHG emissions.

Reviewer 2:
The reviewer expressed that the project will inform the DOE on which technologies and technology performance goals can have the biggest impact on petroleum reduction, GHGs, and other social benefits

Reviewer 3:
The reviewer remarked that the project helps to identify the areas in which the VTO can have the most impact.

Reviewer 4:
The reviewer said that understanding and comparing the cost to consumers and society is an important project.

Reviewer 5:
The reviewer said that the program benefits analysis e fort should explicitly state what assumptions are made regarding federal- and state-level vehicle emissions and fuel economy and fuel efficiency standards when evaluating the impacts of VTO-supported technologies. The reviewer remarked that not including federal and state minimum requirements could lead to considerable over-estimation of projected benefits

Reviewer 6:
The reviewer said that this is a difficult choice to select no, and perhaps the preferred response would be maybe. The reviewer expressed concern that the research is less informative and more focused on reaching an answer of yes, in effect, providing the sponsor with the answer they want. The reviewer commented that, phrased differently, the analysis shows that the VTO work could achieve the goals; however, it does not provide good insight into where the risks are for it falling short or where the key value of efforts is, and this appeared to be part of the project objective.

The reviewer stated that the results are meaningless if CAFE compliance and other market-driven improvements are not part of a baseline. Comments last year raised this concern, and this major flaw has persisted

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

Reviewer 1:
The reviewer said that to complete all the goals listed, the funding level seems low.

Reviewer 2:
The reviewer stated that the resources are sufficient; howeve , that is independent on if they are being used effectively. The resources should be enough to achieve the project requirements.

Assessing Energy and Cost Impact of Advanced Technologies through Model Based Design: Aymeric Rousseau (Argonne National Laboratory) - van023

Presenter
Aymeric Rousseau, Argonne National Laboratory

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 stated that the work is well-designed with clear milestones through FY 2018. The PI is addressing usability concerns identified by prior year reviewers and users through new plug and play features and improved workflow of Autonomie 2.0.

Reviewer 2:
The reviewer said that the project is very clear with a good approach. This is excellent work that is highly utilized by the industry. The reviewer remarked that the team had good responses to reviewer questions from last year. The approach taken to have two versions of Autonomie depending on the user, a simple version and an in-depth version, is excellent. The reviewer commented that it will improve greatly the use rate of the technology and the flexibility for advanced users

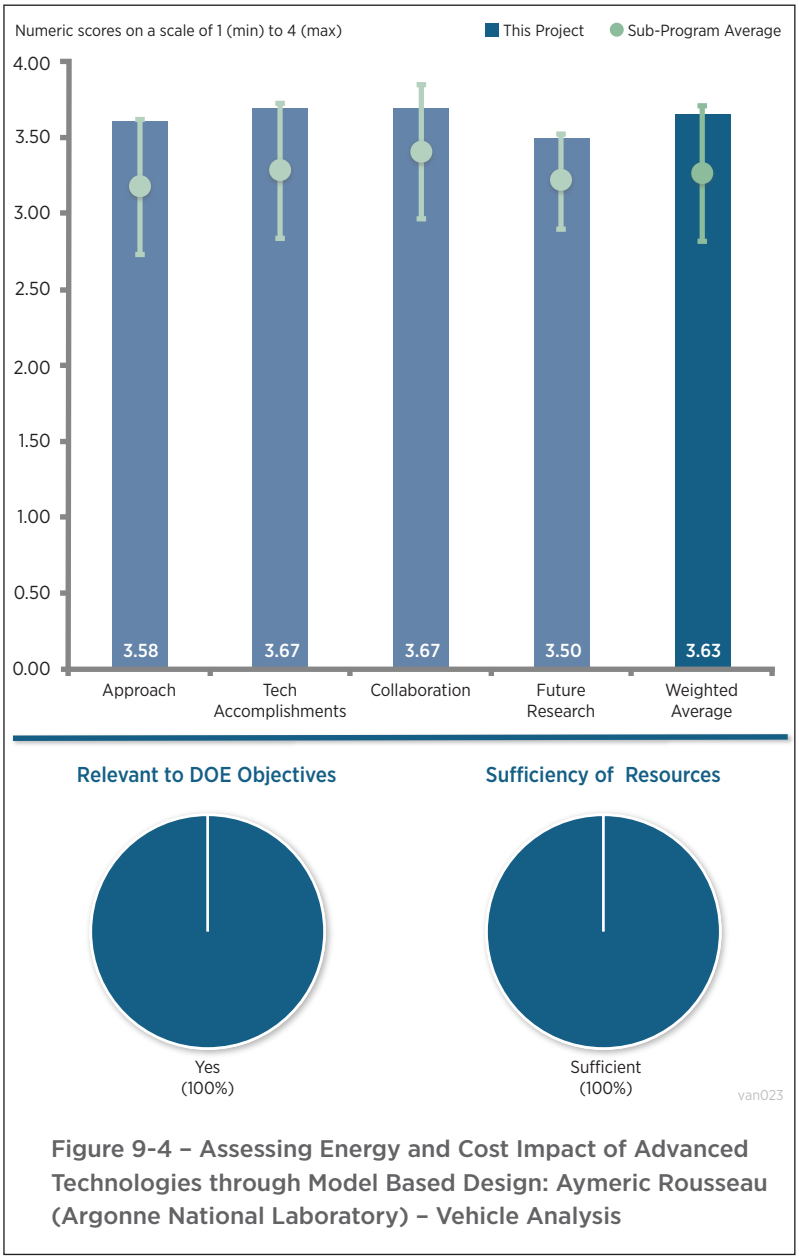

Figure 9-4 – Assessing Energy and Cost Impact of Advanced Technologies through Model Based Design: Aymeric Rousseau (Argonne National Laboratory) – Vehicle Analysis

Reviewer 3:
The reviewer said the feedback from the user community really seems to have improved the Autonomie tool.

Reviewer 4:
The reviewer said this capability has been developed over multiple years and has expanded its reach. Having full vehicle models for a wide range of powertrains is an important objective. The reviewer commented that making the tool available to a broad community is significant and that gathering community consensus to prioritize model inputs and assessments is a solid approach.

Reviewer 5:
The reviewer commented that the project was, analytically and scientificall , well-grounded and rigorous. Research and model improvements continue to add value and advance the state of the art.

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 towards DOE goals.

Reviewer 1:
The reviewer said that Autonomie provides robust system modeling capability of advanced technologies. There was significant technical progress including 100 new turn-key vehicles, new platform, and vehicle thermal validation. The reviewer was particularly impressed by the progress in building capacity related to smart mobility. The reviewer commented that, in particular, expanding modeling capabilities for autonomous vehicles and work on Autonomie EcoSystem are likely to be great assets to researchers and policymakers going forward.

Reviewer 2:
The reviewer said that the emphasis on validation is important and should continue. The accomplishments reflect a solid quality execution of research. The reviewer commented that accomplishments reflect a well thought-out process.

Reviewer 3:
The reviewer said the team has made excellent progress. This is highly valuable work that informs projects across VTO and FCTO and is also used for education in other agencies.

Reviewer 4:
The reviewer said that the team has focused on improving the usability of the tool. Adding application programming interface (APIs) and the ability to compare a wider set of simulations has enabled expanded assessments by the user community. The reviewer commented that the team has included an expanded set of turn-key vehicles to represent existing and future technologies. This, combined with the ability to look at individual component technologies, has allowed further exploration by the users. The reviewer remarked that the new workflow that enables the di ferent access by user versus developer needs can expand the accessibility of the models.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer observed that very strong collaborations are apparent with industry, academia, and other federal agencies. Also, the team shows good international collaboration. The reviewer remarked that the collaboration with the software developers is very valuable to the work as well.

Reviewer 2:
The reviewer said that the project seems to engage in extensive coordination with labs, OEMs, and other stakeholders on data inputs and vehicle testing.

Reviewer 3:
The reviewer observed that the team collaborates across the program as well, with a broad network of external companies, users, and researchers who provide insight into the technologies being evaluated.

Reviewer 4:
The reviewer said that the collaborations are important, well-linked directionally with Autonomie, and are valuable. However, it was not clear how they are all linked to each other.

Reviewer 5:
The reviewer stated that the interaction with industry and the user community seems vital for the further refinements of the tool

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 said that the future plans to continue to try to integrate traffic flow data into the model are ver interesting and are a good focus. The plans to also expand and integrate other analysis tools into the model make excellent use of investments already in place to expand upon the capabilities. The reviewer said the development of BMW's i3 extended range electric vehicle, the i3-EREV, is a very interesting case study bridging the BEV and fuel cell electric vehicle (FCEV) technologies.

Reviewer 2:
The reviewer said that detailed plans for future work seem well-designed and feasible.

Reviewer 3:
The reviewer remarked that, overall, the proposed future research is good and continues enhancements of the project. One significant new direction proposed is modeling of autonomous vehicles. Howeve , the reviewer said that there were few details provided on the approach the project team will take to go from vehicle level to system level analysis.

Reviewer 4:
The reviewer said that the project recognizes the importance of engaging industry and continuing to improve the acceptance by industry and others. The project deserves credit for honestly considering the critical feedback provided and having clear ideas on how to address them in concrete ways. The reviewer said there are some concerns with how the work will support smart mobility. It will be necessary to disaggregate individual vehicle performance improvements and total system improvements or systemic impacts imparted on an individual vehicle when energy consumption and efficiency are being measured. The reviewer commented that the discussion provided by the project lead is cognizant of this challenge, but may benefit from deeper clarification beyond th discussion that occurred during the review.

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

Reviewer 1:
The reviewer remarked that this work is extremely relevant, not only to the VTO objectives, but also to those of the sustainable transportation office providing a consistent platform across which to measure vehicle performance

Reviewer 2:
The reviewer stated that the project provides a unique capability that is a resource to a very extensive analysis community. It allows for vehicle-level assessments of fuel consumption and costs of various technologies that provide insight, and is also a foundational input to other models.

Reviewer 3:
The reviewer said that the Autonomie tool enables the evaluation of technologies that are currently not available for on-road or dynamometer testing.

Reviewer 4:
The reviewer commented that the work very clearly links to outputs in evaluating the impact of the individual technologies the VTO is working with.

Reviewer 5:
The reviewer said that providing system modeling capability of advanced technologies can support OEMs bringing vehicles to market and policymakers trying to understand and address barriers to adoption.

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

Reviewer 1:
The reviewer said the resources are sufficient but on the low side

Reviewer 2:

The reviewer said that the resources appear to be producing a high ROI. Future resources appear to be aligned with clear use and project improvement and work.

Acronyms and Abbreviations

AFDC	Alternative Fuels Data Center
AMR	Annual Merit Review
ANL	Argonne National Laboratory
API	Application programming interface
AVCEM	Advanced Vehicle Cost and Energy-Use Model
BEV	Battery electric vehicle
CAFE	Corporate average fuel economy
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EIA	Energy Information Administration
EPA	U.S. Environmental Protection Agency
EREV	Extended range electric vehicle
EV	Electric vehicle
FCEV	Fuel cell electric vehicle
FCTO	Fuel Cell Technologies Office
FCV	Fuel cell vehicle
FHWA	Federal Highway Administration
FY	Fiscal year
GHG	Greenhouse gas
GREET	Greenhouse gas, Regulated Emissions, and Energy use in Transportation
H_2	Hydrogen
HDV	Heavy-duty vehicle
ICE	Internal combustion engine
INL	Idaho National Laboratory
LDV	Light-duty vehicle
MATSim	Multi-Agent Transport Simulation
MDV	Medium-duty vehicle
MYRD&D	Multi-Year Research, Development, and Demonstration
NGO	Non-governmental organization
NREL	National Renewable Energy Laboratory

OEM	Original equipment manufacturer
ORNL	Oak Ridge National Laboratory
OTAQ	Office of Transportation and Air Quality
PEV	Plug-in electric vehicle
PEVI	Plug-in electric vehicle infrastructure
PHEV	Plug-in hybrid electric vehicle
PI	Principal investigator
QA	Quality assurance
QC	Quality control
R&D	Research and development
ROI	Return on investment
SMART	Systems and Modeling for Accelerated Research in Transportation
TEDB	Transportation Energy Data Book
VTO	Vehicle Technologies Offic