1. Hybrid and Vehicle Systems Technologies

Hybrid and vehicle systems research provides an overarching vehicle systems perspective to the technology research and development (R&D) activities of the U.S. Department of Energy's (DOE's) vehicle research programs, and identifies major opportunities for improving vehicle efficiencies. The effort evaluates and validates the integration of technologies, provides component and vehicle benchmarking, develops and validates heavy hybrid propulsion technologies, and develops technologies to reduce the parasitic losses from heavy vehicle systems. Analytic and empirical tools are used to model and simulate potential vehicle systems, validate component performance in a systems context, benchmark emerging technology, and validate computer models. Extensive collaboration with the technology development activities is required for success. The results of hybrid and vehicle systems activities are used to estimate the national benefits and impacts of DOE-sponsored technology development, and successfully transfer developed technology to industry.

In August 2009, the Department announced the selection of ten projects totaling $425 million for development, deployment, and validation of hybrid vehicles, and deployment of charging stations across the nation. American Reinvestment and Recovery Act (ARRA)-funded transportation electrification activities will aid in the deployment of technologies that help to reduce petroleum consumption. Activities include deployment of 18,000 public and private charging stations in major metropolitan areas across the country, and deployment of truck stop electrification infrastructure at 50 sites across interstate corridors. Additional deployment activities include development, validation, and deployment of light- and medium-duty electric drive vehicles.

During this merit review, each reviewer was asked to answer a series of questions using multiple-choice responses (and with explanatory comments when requested), as well as using numeric scores *(on a scale of 1 to 4)*. In the following pages, reviewer responses to each question for each project are summarized, the multiple choice and numeric score questions are presented in graph form, and the explanatory text responses are summarized for each question. The summary table below lists the average numeric score for each question and for each of the projects.

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
‡ Electric Drive Vehicle Demonstration and Vehicle Infrastructure Evaluation	Don Karner (Electric Transportation Engineering Corp.)	1-5	3.40	3.60	3.60	3.60	3.55
‡ Advancing Transportation Through Vehicle Electrification - PHEV	Abdullah Bazzi (Chrysler LLC)	1-8	3.25	3.50	3.50	2.75	3.34
‡ Advanced Vehicle Electrification	Darren Gosbee (Navistar, Inc.)	1-10	2.50	2.67	2.67	2.67	2.63
‡ Interstate Grid Electrification Improvement Project	Jon Gustafson (Cascade Sierra Solutions)	1-13	3.14	2.86	2.86	2.29	2.86
‡ Advanced Vehicle Electrification and Transportation Sector Electrification	Greg Cesiel (General Motors)	1-17	4.00	3.33	3.33	3.33	3.50
‡ Smith Electric Vehicles: Advanced Vehicle Electrification + Transportation Sector Electrification	Robin Mackie (Smith Electric Vehicles)	1-20	3.25	3.00	3.00	3.25	3.09
‡ Electric Drive Vehicle Infrastructure Deployment	Kumar Gogineni (Coulomb)	1-22	3.50	3.50	3.50	3.00	3.44
‡ Class 8 Truck Freight Efficiency Improvement Project	Derek Rotz (Daimler Trucks North America LLC)	1-23	3.71	3.71	3.71	3.29	3.66
‡ Technology and System Level Demonstration of Highly Efficient and Clean, Diesel Powered Class 8 Trucks	Scott Newhouse (Peterbilt)	1-26	3.00	3.43	3.43	3.43	3.32

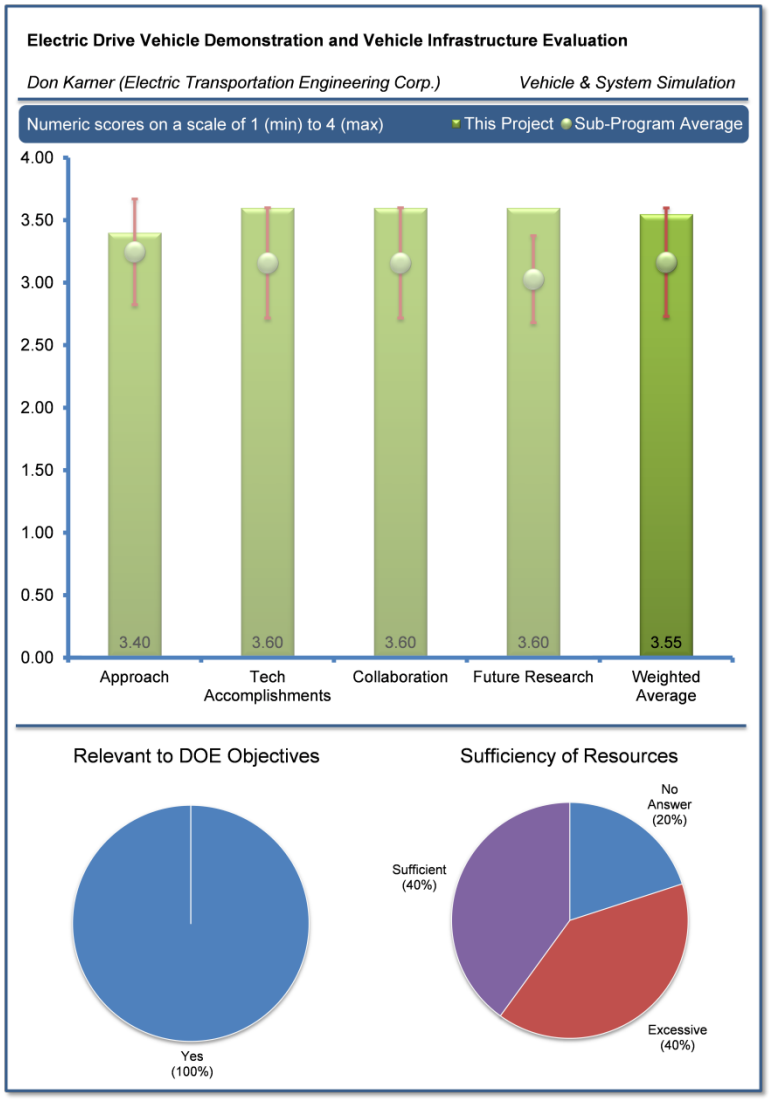
Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Medium- and Heavy-Duty Vehicle Field Evaluations	Kevin Walkowicz (National Renewable Energy Laboratory)	1-30	3.67	3.33	3.33	3.33	3.42
DOE/DOD Parasitic Energy Loss Collaboration	George Fenske (Argonne National Laboratory)	1-32	3.50	3.25	3.25	2.75	3.25
DOE's Effort to Reduce Truck Aerodynamic Drag through Joint Experiments and Computations	Kambiz Salari (Lawrence Livermore National Laboratory)	1-35	4.00	3.75	3.75	3.50	3.78
† PHEV Engine Control and Energy Management Strategy	Paul Chambon (Oak Ridge National Laboratory)	1-38	2.75	3.00	3.00	2.25	2.84
Plug-In Hybrid (PHEV) Vehicle Technology Advancement and Demonstration	Greg Cesiel (General Motors)	1-40	2.50	2.00	2.00	2.25	2.16
Ford Plug-In Project: Bringing PHEVs to Market	Julie D'Annunzio (Ford Motor Company)	1-42	3.75	3.75	3.75	3.25	3.69
Idaho National Laboratory Testing of Advanced Technology Vehicles	Jim Francfort (Idaho National Laboratory)	1-44	3.33	3.33	3.33	2.67	3.25
Advanced Vehicle Testing Activity & Evaluation	Don Karner (ECOtality North America)	1-46	3.67	3.33	3.33	3.33	3.42
Advanced Technology Vehicle Lab Benchmarking - Level 1	Henning Lohse-Busch (Argonne National Laboratory)	1-48	3.75	4.00	4.00	3.50	3.88
Advanced Technology Vehicle Lab Benchmarking - Level 2 (in-depth)	Erik Rask (Argonne National Laboratory)	1-50	4.00	3.50	3.50	3.50	3.63
Electric Drive and Advanced Battery and Components Testbed (EDAB)	Barney Carlson (Idaho National Laboratory)	1-52	3.20	3.00	3.00	2.80	3.03
Advanced LD Engine Systems and Emissions Control Modeling and Analysis	Stuart Daw (Oak Ridge National Laboratory)	1-54	3.25	3.25	3.25	3.25	3.25
Medium- and Heavy-Duty Electric Drive Vehicle Simulation and Analysis	Jeffrey Gonder (National Renewable Energy Laboratory)	1-56	3.50	3.50	3.50	3.00	3.44
LDV HVAC Model Development and Validation	Jason Lustbader (National Renewable Energy Laboratory)	1-58	3.00	3.00	3.00	3.00	3.00
Integrated Vehicle Thermal Management - Combining Fluid Loops in Electric Drive Vehicles	John Rugh (National Renewable Energy Laboratory)	1-60	3.33	3.00	3.00	3.17	3.10
Codes and Standards to Support Vehicle Electrification	Ted Bohn (Argonne National Laboratory)	1-63	3.60	3.80	3.80	3.20	3.68
† Testing and Validation of Vehicle to Grid Communication Standards	Krishnan Gowri (Pacific Northwest National Laboratory)	1-66	3.33	3.00	3.00	3.00	3.08
Development of High Power Density Driveline for Vehicles	Oyelayo Ajayi (Argonne National Laboratory)	1-68	2.40	2.20	2.20	2.60	2.30
Wireless Plug-in Electric Vehicle (PEV) Charging	John Miller (Oak Ridge National Laboratory)	1-72	3.33	3.17	3.17	3.60	3.26
Advancing Plug In Hybrid Technology and Flex Fuel Application on a Chrysler Mini-Van PHEV DOE Funded Project	Abdullah Bazzi (Chrysler LLC)	1-74	3.75	3.75	3.75	3.25	3.69
SuperTruck - Development and Demonstration of a Fuel-Efficient Class 8 Tractor & Trailer	Dennis Jadin (Navistar International Corp.)	1-76	3.83	3.67	3.67	3.67	3.71
Evaluation and Adaptation of 5-Cycle Fuel Economy Testing and Calculations for HEVs and PHEVs	Henning Lohse-Busch (Argonne National Laboratory)	1-79	2.75	3.25	3.25	2.50	3.03

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Grid Interaction Tech Team, and International Smart Grid Collaboration	Keith Hardy (Argonne National Laboratory)	1-82	3.80	3.80	3.80	3.20	3.73
Optimal Energy Management of a PHEV Using Trip Information	Dominic Karbowski (Argonne National Laboratory)	1-85	2.86	2.86	2.86	2.71	2.84
Impact of Battery Management on Fuel Efficiency Validity	Eric Rask (Argonne National Laboratory)	1-89	3.20	3.40	3.40	3.00	3.30
Electric Drive Vehicle Level Control Development Under Various Thermal Conditions	Namdoo Kim (Argonne National Laboratory)	1-91	2.67	2.83	2.83	2.67	2.77
Hydraulic HEV Fuel Consumption Potential	Aymeric Rousseau (Argonne National Laboratory)	1-94	3.33	2.67	2.67	2.67	2.83
The Meritor Dual Mode Hybrid Powertrain CRADA	Andreas Malikopoulos (Oak Ridge National Laboratory)	1-96	3.00	2.67	2.67	3.33	2.83
New York City Taxi Electric Vehicle Project	PT Jones (Oak Ridge National Laboratory)	1-98	3.20	3.80	3.80	3.20	3.58
Vehicle Mass and Fuel Efficiency Impact Testing	Jim Francfort (Idaho National Laboratory)	1-101	2.75	2.75	2.75	3.00	2.78
CoolCab Test and Evaluation and CoolCalc HVAC Tool Development	Jason Lustbader (National Renewable Energy Laboratory)	1-103	3.50	3.25	3.25	3.25	3.31
Mitigation of Vehicle Fast Charge Grid Impacts with Renewables and Energy Storage	Tony Markel (National Renewable Energy Laboratory)	1-105	2.67	3.00	3.00	2.67	2.88
Fuel Consumption and Cost Benefits of DOE Vehicle Technologies Program	Neeraj Shidore (Argonne National Laboratory)	1-107	3.00	3.20	3.20	3.00	3.13
Fuel Displacement & Cost Potential of CNG, LNG, and LPG Vehicles	Jason Kwon (Argonne National Laboratory)	1-109	2.33	2.50	2.50	2.67	2.48
PACCAR CRADA: Experimental Investigation in Coolant Boiling in a Half-Heated Circular Tube	Wen Yu (Argonne National Laboratory)	1-112	3.75	3.25	3.25	3.75	3.44
Integrated External Aerodynamic and Underhood Thermal Analysis for Heavy Vehicles	Tanju Sofu (Argonne National Laboratory)	1-115	3.00	2.00	2.00	3.00	2.38
A Complete Vehicle Approach to the SuperTruck Challenge	Pascal Amar (Volvo Trucks)	1-117	3.17	3.50	3.50	3.17	3.38
Improving Vehicle Fuel Efficiency Through Tire Design, Materials, and Reduced Weight	Jay Kim (Cooper Tire)	1-119	3.20	3.00	3.00	3.20	3.08
Materials Approach to Fuel Efficient Tires	Timothy Okel (PPG)	1-121	3.20	2.60	2.60	2.80	2.78
System for Automatically Maintaining Pressure in a Commercial Truck Tire	Robert Benedict (Goodyear)	1-123	3.40	2.80	2.80	3.00	2.98
Next Generation Environmentally Friendly Driving Feedback Systems Research and Development	Matthew Barth (University of California at Riverside)	1-125	3.50	3.33	3.33	3.17	3.35
Look-ahead Driver Feedback and Powertrain Management	Zwick Tang (Eaton)	1-127	3.17	3.33	3.33	2.83	3.23
† Improved Cold Temperature Thermal Modeling and Strategy Development	Forest Jehlik (Argonne National Laboratory)	1-129	3.33	2.67	2.67	3.00	2.88
† Advanced HD Engine Systems and Emissions Control Modeling and Analysis	Stuart Daw (Oak Ridge National Laboratory)	1-131	2.50	2.75	2.75	2.75	2.69

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
† Electric Drive Vehicle Climate Control Load Reduction	John Rugh (National Renewable Energy Laboratory)	1-133	3.00	3.33	3.33	3.00	3.21
† Defining Real World Drive Cycles to Support APRF Technology Evaluations	Erik Rask (Argonne National Laboratory)	1-135	2.67	3.00	3.00	2.67	2.88
† Autonomous Intelligent Electric Vehicles	Andreas Malikopoulos (Oak Ridge National Laboratory)	1-137	3.33	3.00	3.00	3.00	3.08
ANSI Electric Vehicle Standards Roadmap	Jim McCabe (American National Standards Institute (ANSI))	1-139	3.67	3.33	3.33	3.00	3.38
Overall Average			3.25	3.16	3.16	3.03	3.17

† denotes poster presentations
‡ denotes ARRA funded projects

Electric Drive Vehicle Demonstration and Vehicle Infrastructure Evaluation: Don Karner (Electric Transportation Engineering Corp.) – arravt066



Reviewer Sample Size

This project was reviewed by five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

All five panelists emphatically agreed that the project supports the Department of Energy (DOE) objectives. One panelist asserted installation and evaluation of electric vehicle (EV) charging stations is a key first step to increasing the rollout of EVs. A second panelist wrote that charging infrastructure is certainly relevant to electric vehicles and the petroleum displacement benefit they can deliver. The third panelist indicated the large rollout of electric vehicle supply equipment (EVSE) and data collection to optimize future utilization is highly relevant. A fourth panelist simply stated the installation of electric vehicle charging infrastructure supports the deployment of electric vehicles which directly replace petroleum usage with electricity for transportation. The last panelist reiterated that this project has major relevance to DOE's petroleum displacement objectives. Furthermore, the development and deployment of cost-effective electric and hybrid-electric vehicles is a critical strategic initiative that supports the overarching goal of reduced petroleum usage in the United States. The panelist asserted that while design and production of such vehicles is obviously one critical aspect, an equally important one is providing the infrastructure that will improve the viability and customer acceptance of electric vehicles. A sound support infrastructure is pivotal to promoting a significant increase in electric vehicle sales going forward. This panelist identified that the project seeks to understand and quantify the charging infrastructure requirements for electric vehicles, and includes several key activities to achieve that objective, namely development of an electric charging grid in selected areas of the country that will be the basis of the study; support of electric vehicle deployments in these areas; data collection to understand significant patterns for vehicle charging; use of collected data to refine vision for infrastructure requirements; identification and resolution of barriers to larger scale deployment, including utility and legal requirements that will govern future infrastructure development; and recommendations for larger scale infrastructure deployment.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Overall the panelists assured that the approach was good. One panelist complimented the efforts, noting the project team seemed to understand well the tasks, barriers, and objectives and has good focus on documenting and improving the deployment of charging stations, learning to understand critical areas. Another panelist stressed the benefits of the project scale. While the overall scale of the project being so wide seems to be a challenge in and of itself, having data from such diverse locations will be of significant value as the market develops and having the different project partners in order to get local stakeholders involved and supportive

was also a good approach stated this panelist. For this reviewer, given that one of the objectives of this project was to identify barriers, this approach is effective because many of the barriers are being identified and solutions are being defined. A third panelist called the technical approach logical and effective. This panelist shared key steps of the approach. First, facilitate deployment of 8,000+ vehicles in selected sectors. Second, deploy infrastructure in sectors, including evaluation of options for charging stations. To accomplish this, extensive work was required to select charging equipment, work through barriers including local regulations, American Disability Act (ADA) requirements, signage requirements, and energy costs. Third, collect data to establish charging patterns, driving habits, etc. This information will be subsequently utilized to develop specific recommendations for infrastructure deployment on a large scale. Idaho National Laboratory (INL) is receiving the data and preparing monthly report outs. Finally, explore smart grid integration to develop potential complete systems solutions for vehicle charging that will minimize energy cost. Another panelist remarked the lack of EVs available to market reduced the amount of data and penetration of systems indicating that it was most likely a result of optimistic market penetration assumptions. The last panelist confirmed the overall approach and integration with other stakeholders (local regulators, installers, utilities, vehicle manufacturers/dealers, etc.) was good and that gleaning information about non-network charging events from the INL data was also good. This panelist suggested additional data (such as the second-by-second speed traces between charging events) from willing participants could have been accomplished by offering one equipment discount to participants only willing to provide charging data and a higher discount to those willing to provide additional data. Another suggestion this panelist listed was that greater attention be paid to the demographics of participants and comparison of their travel patterns with the population at large to interpret the results and understanding how far they can be extrapolated.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Most panelists expressed that while progress was good, it was slow for various reasons. The first reviewer observed that the project team appeared to be aggressive in its approach to making progress, while the second reviewer acknowledged that progress was slow due to rollout of EVs to market. A third reviewer asserted much progress has been made to identify barriers, a stated objective, and some solutions were noted. This reviewer also commented that the overall size and scale of the project appeared to have hampered early progress which provides a valuable lesson learned on just how difficult it is to deploy infrastructure on a mass scale. The panelist asserted the lessons learned are in-themselves of value and should be considered a technical accomplishment. The evaluator noted the overall electricity usage was given and could have been correlated to a petroleum savings. Another respondent opined good progress was made on EVSE installation, data collection and dealing with regulatory issues. Additionally the project has set up a solid back bone system for collecting data from the chargers. This respondent stated the mapping application looked helpful for participants to locate a charger, but could be improved by including the location of other public chargers and specifying which chargers will give free or discounted electricity for participation in the study. The reviewer also considered progress toward the ARRA goal of job creation, noting the presentation mentioned greater than 100 new personnel and 38 certified installation contractors, but the total number of jobs created from DOE's investment in the project was not clear. The last panelist stressed the program generally followed the carefully thought out plan with the most significant issue that has delayed the program to date being the slower rate of vehicle deployment. The panelist declared this issue to be beyond the ability of this team to resolve, but stated it has somewhat affected the overall progress, and limited the amount of data collected to date. This reviewer further indicated that nevertheless, good progress has been made in terms of vehicle deployment, planning and installation of EVSE equipment, evaluation and resolution of technical and regulatory issues governing EVSE installations, and development of a network to capture vehicle data. The panelist commented that much of the vehicle and infrastructure deployment is complete and that the program will now focus on data collection and analysis. The respondent reiterated that a key deliverable from the project is development of specific detailed recommendations (based on data collected) for future infrastructure deployments.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Reviewers agreed that a good mix of stakeholders and extensive collaboration and coordination were evident in this project. One reviewer asserted it was no small task to coordinate and achieve buy-in from all key stakeholders and without this multi-point coordination; the project could not have succeeded. This panelist remarked that success on this project was highly dependent on successful collaboration with a variety of entities, including original equipment manufacturers (OEM) [General Motors

Corporation (GM)] and Nissan, whose electric vehicles made up the test fleet), utilities (approval of rates and insight into most economical charging times), state and local authorities (for approval of installations and also confirmation of ADA requirements being met), Underwriters Laboratories (UL) (for independent testing of the chargers), and finally vehicle users (data collection and home charger installations). Another reviewer acknowledged that the mix of stakeholders would provide good project data in the large scale deployment of infrastructure that will be good for lessons learned from region to region going forward. This reviewer expressed having UL on the team is a definite benefit. A third reviewer commented that collaborations included working with local regulators, private companies, utilities, trained installers (to install chargers), working with dealers and individual consumers (to involve participants), working with INL (to collect/analyze data), but did not recall the roles of Oak Ridge National Laboratory (ORNL) and two universities that were also listed. One reviewer indicated that there appears to be some common objectives and perhaps even some redundant activities between this project and another presentation (arravt071) and a lack of coordination/communication between the projects. The panelist expressed this as a potential opportunity for both projects to compare notes on approach, results achieved to date, and possible synergy that could be exploited between the two programs. The reviewer also indicated, per discussion at the 2012 Annual Merit Review, that results and conclusions from both programs will be compared and analyzed by DOE, who will look for common themes, conclusions, recommendations, etc.

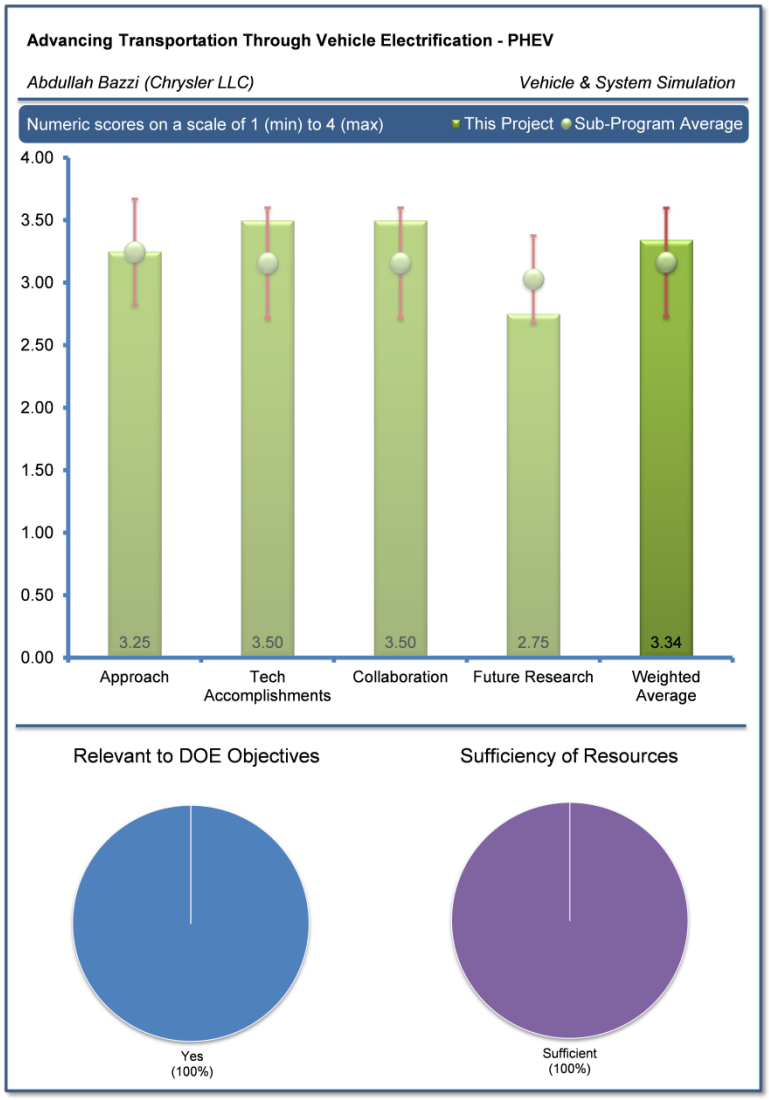
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The majority of the reviewers agreed future research as proposed would be beneficial. One reviewer indicated that the project's focus on documenting and understanding issues associated with charging installations gave the team a good understanding of future work requirements. The second reviewer recognized that the articulated plans for future data analysis and identification of lessons learned should be of significant value and the energy usage and lessons learned data from the diverse locations will be of value in its aggregate to support future market transformation efforts. This reviewer further suggested that close attention be paid to how driver energy usage changes in regions where significant fast chargers are installed. The third reviewer said it appeared that the results of this project can provide many answers that will accelerate acceptance of electric and hybrid vehicles although the project is reported to be approximately at the halfway point. This person noted a key output of the data is to evaluate electricity demand for vehicle charging vs. available capacity at utilities. The respondent indicated that guidelines for when to charge, or development of strategies for automatically charging only when overall grid demand is low, are some of the concepts being explored. This reviewer commented that with the vehicle and infrastructure deployments reaching completion, emphasis now shifts to data collection and analysis. The respondent remarked that results will be used to generate a detailed set of recommendations for future infrastructure deployments, vehicle charging strategies, and development of business models for the EVSE charging infrastructure. A fourth reviewer stated that little detail was given on how the future work would help to overcome the challenge of making the business case for non-home charger installation. This reviewer also articulated planned future activities include observing user response to introduction of EVSE access fees, partnering with utilities to evaluate demand response, and summarizing lessons learned.

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

The reaction to this question was mixed. The first two reviewers said that the resources were sufficient. One stated that it appears that human resources and funding were adequate. This reviewer noted that over 100 new personnel had been hired to manage and implement the program. The respondent indicated that at $219 million, the project budget would seem to be well suited to support key program objectives. This individual also re-stated that one of the most significant impediments was the slower than anticipated deployment of electric vehicles, which has limited the amount of data collected so far. Because the program runs until September 2013, this reviewer asserted that there should be sufficient time and vehicle miles to gather data that will yield meaningful conclusions. Two other reviewers concluded that the resources were excessive. One person acknowledged that this is difficult to judge from a 20-minute presentation, however the scope of this activity seems greater than the Coulomb ARRA project, but perhaps not nearly 10 times greater as the budget would suggest. Another reviewer suggested that infrastructure could easily outpace the market for EVs.

Advancing Transportation Through Vehicle Electrification – PHEV: Abdullah Bazzi (Chrysler LLC) – arravt067



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Three panelists agreed the project has the potential to reduce petroleum use. One panelist asserted that the effort significantly improves fuel economy during road operation and the supplemental energy when vehicle is stopped eliminates the need for idle. The second panelist remarked the project develops an advanced electric vehicle that uses grid power to provide 20 miles of driving range. The same reviewer noted that the project's capability goal to provide auxiliary power from battery storage (energy stored from the grid) has the potential to reduce petroleum use by portable generators. Another panelist commented that utilization of grid power for pickup trucks certainly would displace a considerable quantity of petroleum, but the researchers did not provide a baseline fuel economy for the vehicle so that this could be demonstrated.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

The reviewers' comments on the approach were mixed. One reviewer stated the technical aspects of vehicle design and testing were all fine and praised the data collection and analysis part of the project that will enable accurate assessment of the types of uses and locations that make the most sense for plug-in hybrid-electric vehicles (PHEV) pickup trucks. Another reviewer recounted that the summary indicated that only 20 fleet vehicles were deployed in 2011 but the work plan indicated that more than 200 should have been deployed, thus their plan and results diverge significantly. The reviewer however noted that the reality of their approach seems superior to their earlier plans.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Overall the experts concluded that the work was on track. One expert affirmed the project has demonstrated an over-achievement in reaching fuel economy improvement for the vehicle. Another expert acknowledged less difficult barriers here than for less futuristic projects.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The evaluators have differing opinions on the level of collaboration. One evaluator recognized the project has involved a number of partners for evaluation and different use cases. Another evaluator stated that a large preponderance of the demonstration partners seem to be utilities. This person noted it would be interesting to add other types of users – lumber yards, general contractors, and individuals who use pickup trucks.

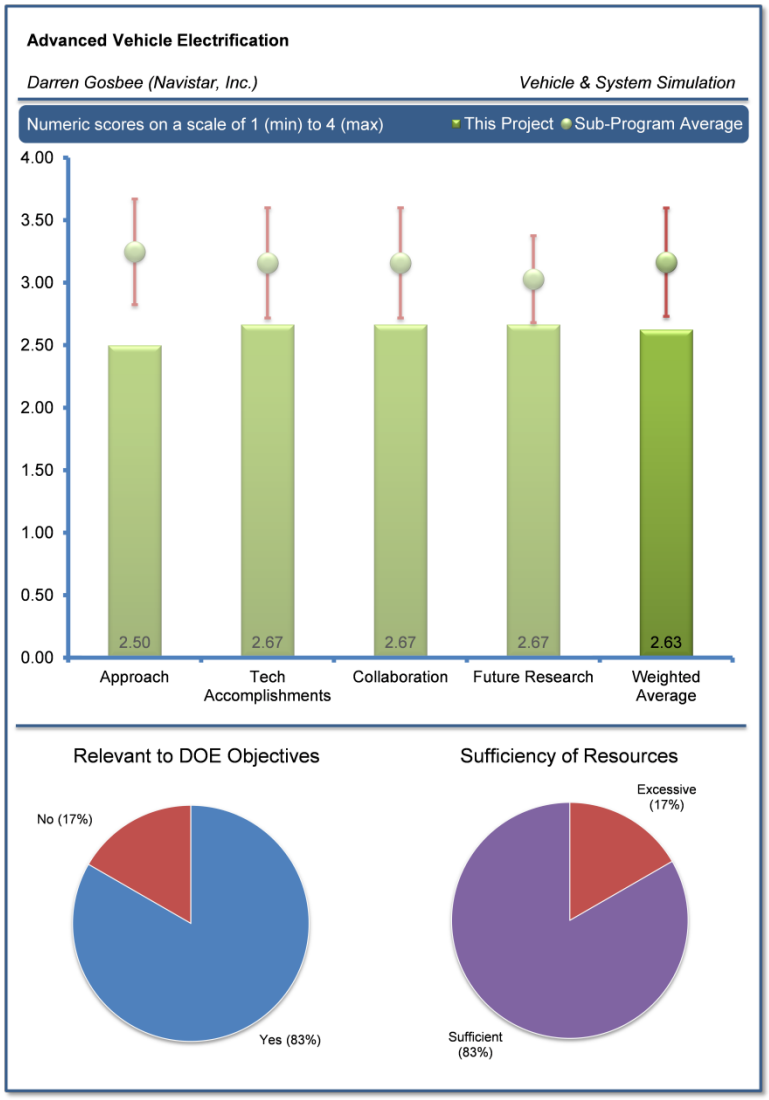
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One panelist commented that the project looks like it will continue to proceed as planned and that the original plan must have been acceptable to give the project that much money. Another panelist commented that the progression of the research steps makes sense and the reality of limited deployment numbers seems to make more sense than the large numbers shown in the plan. This panelist suggested that the future research plan should focus on validating and evolving advances on a small number of vehicles followed by a stair step increase in deployed vehicles that demonstrate the evolving technology improvements. The panelist stated this will help the project to conserve resources and focus on making technology improvements that will improve the chances of success for the operation of the larger numbers of fleet deployments. A third panelist expressed that a technology demonstration will end up influencing product decisions and investments in company's capabilities in these technological areas. The last panelist articulated that the presentation did not speak to the application of lessons learnt and how these may or may not be applied. This panelist suggested smart grid may be a worthwhile initiative.

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

All reviewers expressed that resources were sufficient for the project. One reviewer asserted that reasonable levels were established for resource needs. Another reviewer commented the project seems to have more than any other and it looks like it is at least enough.

Advanced Vehicle Electrification: Darren Gosbee (Navistar, Inc.) – arravt069



Reviewer Sample Size

This project was reviewed by six reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Most reviewers concurred that the project had the ability to displace some petroleum use. One panelist stated the project has the potential to allow grid power to displace energy from petroleum for medium-duty (MD) vehicles. Another panelist asserted that it reduces fuel (oil) consumption through use of battery-electric propulsion power exclusively. A third panelist opined that electrification of medium-duty commercial trucks will certainly help displace petroleum use, though the displacement potential of limited-range all-electric vehicles (AEVs) will be limited by the relatively low driving miles of the conventionally-powered trucks that they replace. For this reason, the panelist continues, the ability to avoid pollutant emissions in dense urban areas may need to be an additional rationale considered. Another panelist commented that obviously replacing petroleum-fueled vehicles with EVs saves petroleum. But whether the amount is significant or not depends on what type vehicles and how they are used; however, the only clue is the purported saving of 1,250 gallons per year, the panelist indicated. This person considered that MD trucks are a low volume/ miles application with limited savings potential. Further, the panelist mentioned if it is light-duty (LD) vehicles, it could be much better but the slides were confusing on that score. The final panelist articulated that the original premise of the project appears to have altered. This panelist stated that originally the project was focused on the deployment of the Modec/eStar vehicle, however the focus now appears to have been transferred to the development of a Generation 2 (GEN2) platform based on an existing stripped chassis format. The panelist noted that although not expressly stated it appears the production of the eStar is being halted.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Most reviewers agreed that the approach was addressed at a high level. One expert stated that the project demonstrated excellent learning on utilizing an existing platform and developing for markets as markets mature. Another expert asserted that this was a high level presentation and not much detail was shared. A third expert recounted that the approach included efforts to transfer/adapt technology from a foreign platform to the U.S. market, and to subsequently develop a next generation vehicle. The expert continues that the apparent limitations of the foreign platform suggest that GEN2 development activities should have been moved earlier in the five-year project plan. This expert states that little also appears in the approach on data collection/utilization, which seems like a missed opportunity. Another expert shared a similar sentiment, expressing that the approach does not reflect sufficient risk mitigation strategies at decision points. This expert commented that the presentation of the work plan is low resolution and the high level results presented indicate a significant need for risk mitigation strategies. The fifth expert articulated

that the project goals appear to have altered. The final expert found it very difficult to evaluate this project because so little technical detail and so few numbers are included. This expert explained that their ratings will be lower because information is missing and the reviewer cannot rate non-information as high as information. The work may all be excellent, but the reviewer could not tell that from the presentation. This person would have liked to see a lot more detail on what the project team expects to learn from the data collection, which it is the most valuable part of the project.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first evaluator stated the project seems to have accomplished what it set out to do in a reasonably competent manner. The second evaluator remarked the project demonstrated adaptability to market forces, ensuring progress toward greater acceptance. A third evaluator commented that the lack of market acceptance indicates that overcoming barriers has been slow. Another evaluator articulated that the listed accomplishments include platform, battery and charger improvements to the Generation 1 vehicle and progress on assembling the development team and designing the GEN2 vehicle. This evaluator however noted that a number of the accomplishments seem to be carried over from the 2011 presentation, so it is unclear how much has been achieved since then. The evaluator asserted little technical detail was provided in the presentation. The last evaluator remarked that technically the production of eStar has been established and significant technical barriers overcome; however a comprehensive misunderstanding of customer requirements has led to a wholesale change in the project trajectory. This evaluator expressed concern about how was the voice of the customer was managed in context of the technical development and what has been learnt that will prevent the same mistakes happening again with the GEN2 development.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One panelist acknowledged that the project team has developed industry relationships at all levels through being a founding member of electric vehicle organization. Another panelist mentioned the project listed collaborators including National Renewable Energy Laboratory (NREL) for data collection, supplier partners and customers. This panelist however also stated that few details are provided and these collaborations have no doubt been limited by the limited number of vehicles delivered to date. A third panelist would expect any truck project to have on board somebody who worried about tires, etc. The panelist stated this collaboration seemed a bit thin however considered that maybe there is more than this rather generic presentation mentioned. The final panelist asserted that no collaboration has been established with universities or other skills-based learning organizations, and no collaborations have been established with other DOE funded projects.

Question 5: Has the project 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?

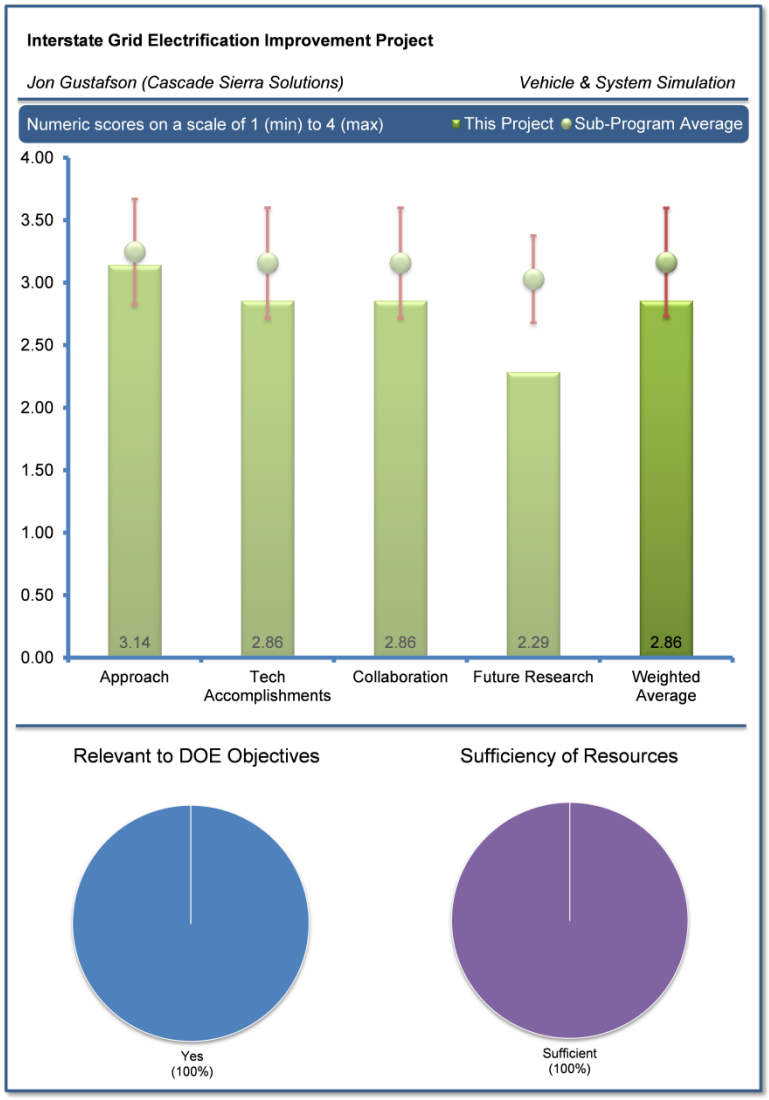
One commenter expressed that future tasks follow plan as set out originally. Another affirmed that focus was on future products and key technical barriers in gearbox development. A third commenter said the main focus of future work was to be development and continued cost improvement of the GEN2 product. This reviewer asserted this seems prudent given the limited success of the Generation 1 vehicle thus far. Additionally the reviewer commented that the proposal to pursue General Services Administration (GSA) certification seems like a good approach to boost sales. This reviewer also alerted that little was said about how and if the 950 vehicle deployment target would still be met before the end of the project. The fourth reviewer informed that there is a scarcity of evidence and detail that the planned work will overcome the barriers. The final reviewer expressed concern about how the future research would lead to improved adoption of the product or overcome the barriers that exist for the adoption of the eStar or other platforms that will be developed from the core technology.

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

Five reviewers stated the funds were sufficient. One reviewer asserted there is large number of vehicles to be deployed, justifying the high cost. Another reviewer admitted it was a little difficult to judge. The reviewer noted the project was listed as 44% complete, but less than 20% of the planned DOE funds have been used. The reviewer pondered that perhaps the total budget is being reduced from the original plan of $39 million from DOE plus $39 million from Navistar. If that was the case the reviewer expressed this might be reasonable given the relatively slow pace of vehicle deliveries thus far. One reviewer expressed the funds

were excessive. The reviewer articulated that the lack of evidence of a structured plan to overcome the barriers and the stated progress of goal achievement suggest that the resource allocation timeline may need to be restructured significantly.

Interstate Grid Electrification Improvement Project: Jon Gustafson (Cascade Sierra Solutions) – arravt070



Reviewer Sample Size

This project was reviewed by seven reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Most experts agreed that the project would reduce petroleum use. The first expert said the goal was to save eight million gallons of petroleum per year. The second expert expressed that fuel consumption during idle is one of the key problems and that the program can help reduce the fuel consumption if the goal can be achieved. Another expert recognized that successful implementation of this project will enable thousands of truckers to remain comfortable when they sleep in their cabs, without burning any petroleum. A fourth expert asserted truck idle reduction through electrification is a direct replacement of petroleum with electricity in maintaining cab conditioning and refrigeration on trailer refrigeration units (TRUs). Another expert acknowledged that through truck stop electrification, over the road truck idle fuel usage can be substantially reduced. This expert remarked the target of eight million gallons annually by 2014 sounded aggressive, but to truly assess, there is a need to understand the percentage uptake of available operators to this technology to know if this is an acceptable target. The final expert commented that even though this project on truck stop electrification (via shore power) will reduce idling and thus displace petroleum, it should have been incumbent upon the author to show in the presentation how much petroleum would be displaced and how much emissions avoided on a per truck basis, and second, how much of the ARRA and DOE Vehicle Technologies Program (VTP) goals that this particular project hopes to achieve. This expert had an additional comment about the title of the presentation being somewhat misleading in that the expert thought it was about the transmission of electricity through the power grid across state lines and for clarification. The same reviewer further stated that the author should have clarified by using interstate highway.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

The first reviewer remarked that it was a good approach to work on developing infrastructure and rebates for onboard idle reduction equipment, as well as good objective to deploy by end of 2012 and then initiate monitoring, with a final year of analysis. Additionally this person expressed it was a good approach to use seven different onboard idle reduction technologies. A second reviewer stated working on electrification with both the trucks and the truck stops is a good approach, as the presenter identified it as working on both the supply and demand sides. The reviewer affirmed this effectively tries to address the chicken or the egg barrier that exists in most transportation electrification endeavors. Further, this reviewer articulated that likewise concentrating on dedicated champions to use and support the technologies is a good approach since these individuals have a vested interest in making the technology and market transformation a success. In this reviewer's opinion, past experience at siting electrification

projects where property owners do not support the technology has shown how it can become quickly abandoned and used as a justification to label a project a failure. The reviewer emphatically agreed that concentrating on champions that will support the technology provides the best value to transform the market and provide a better return on public funding. Another reviewer commented that one reason why electrified parking spaces have enjoyed limited success has been the lack of adequate coverage along major trucking routes. Therefore, this reviewer asserts, drivers needed to have on-board equipment to ensure they could stay comfortable overnight. The reviewer then concludes that one reason why simple plug-in technology was underutilized is that only trucks with electrical equipment on-board could use them and thus by creating a network of coverage on truck routes and also creating a user base, this project aims to provide both the chicken and the egg simultaneously. The reviewer also remarked that data collected will allow us to determine what works and what does not, and why. The fourth reviewer expressed that the truck stop electrification and rebates/incentives assists the availability aspect, however getting the trucks to have the enabling technologies may be the more important barrier. This reviewer questions what opportunity is there to identify high idle operators and provide needed information to them, and gather from them to properly build out network to meet their needs – thus having largest idle reduction impact. Additionally, the reviewer stated that site location is critical and truckers with investment in idle reduction technologies need to utilize this equipment at every stop.

The final reviewer questioned the motivation and strategy to idle reduction, and felt that it appeared the author was more interested in an approach that flaunts numbers. The reviewer added that if DOE wants idle reduction to work, it needs to nudge this author into putting the resources (truck stop electrification by providing shore power) at the most effective locations. Based on the reviewer's expertise, the reviewer stated that the most effective locations for reducing idling, and thus, displacing petroleum use, is at truck stops where the truckers have to make a rest stop because their hours of service have run out. The reviewer noted that the author did not seem to understand that the U.S. Department of Transportation (DOT) has rules for how long a truck driver can be on the road. For reference the reviewer stated that rest stops usually require a long period of rest – eight hours, thus, eight hours of idling can be avoided. Instead of maximizing the total amount of idle reduction, the author sought to maximize the number of truck stops to be electrified even if the trucker is at the truck stop for only five minutes. The reviewer suggested that the author should have been required to submit a plan of what truck stops should be electrified for review and approval before being allowed to proceed. Another point this reviewer made is that there is nothing in the project that touches on the issue of standardizing shore power and accommodating different levels of shore power. The reviewer acknowledged that the question had to be asked before the issue was recognized. Additionally, the reviewer remarked that without some standardization or knowledge of the frequency of the different types of shore power connections and power for hotel loads on a truck, this project will not succeed. Another point made by this reviewer is that there is nothing in the project about collecting financial data from the truckers or the truck stops. Based on truck safety projects associated with on-board collision avoidance systems, the reviewer strongly emphasized that truckers will not buy such a system (e.g., lane departure warning system) no matter how much data you have on how effective the system is in preventing a crash unless you can demonstrate a short-term return on investment with real-world data from other truckers. The similar situation applies to truck stop owner/operators. If the author does not collect and analyze such data, this reviewer asserted that there is no chance of this project succeeding on a self-sustaining basis – no one can ever be convinced that truck stop electrification via shore power is a worthwhile investment. The final point this reviewer makes is that there is nothing in the project about collecting data on the actual amount of idle reduction. This reviewer would like to know without collecting such data, how one measures this particular project's success. The reviewer inquired whether the measure of success is the number of truck stops electrified with shorepower, or is it the total amount of idle reduction, and hence, the total amount of petroleum displaced.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first reviewer asserted that the accomplishments seem reasonable for the amount of time spent to-date. This reviewer expressed that the trucking industry has seen several competing concepts go by the wayside so recruiting participants in this program would be tough, thus, getting the participant identified and getting 3,500 trucks identified is good progress. Another reviewer remarked that the project appears to be progressing at a sufficient pace, all 50 sites are either completed or under construction, and 3,500 of 5,000 trucks are selected. The third reviewer expressed sites are up and running, and equipment is on trucks, however now the reviewer wants to see the data. A fourth reviewer indicated that this is a good program to provide the grid

connection, however not significantly technically advanced. This reviewer suggested that as the project tracks the usage and estimates fuel use in future years the project team should investigate ways to improve use of facilities. The next reviewer articulated it was not clear how the trucks with the equipment that can utilize the grid were coordinated with this program. The reviewer expressed that it is all about the installation of the grid stations. The sixth reviewer asserted not much progress (5%) to date and there was much to do to meet deadlines. The last reviewer noted there are only two objectives given for this project: electrification (via shore power) at 50 truck stops along interstate highways, and processing of 20% rebates on battery-operated and/or shore power idle reduction equipment on 5,000 trucks. The project commenced May 2011 and will end in May 2014. By this reviewer's estimation the project should be one-third of the way through the three-year project period, while Slide 2 noted that the project is 60% complete and the slide titled Project Status notes that only nine sites are complete with 31 under construction. This reviewer also recalled there is no mention of any rebates having been processed. In this reviewer's opinion, there is no way that the project can be 60% completed and for there to have been 60% completion, 31 sites would have had to be completed (instead of being under construction). The reviewer asserts that the information provided is misleading (or contradictory) about progress and the author should have provided a schedule of milestones.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The first evaluator affirmed the industrial partners are especially strong on the equipment manufacturer side and the quad chart suggests truck stop and truck manufacturer partners as well, but these do not show on the partner logo slide. The second evaluator proclaimed that the partnering chart showing all the different entities building hardware and getting the industry associations to support this project was outstanding. Furthermore, the evaluator articulated the industry has come a long in a short period of time and it was good to see a majority of the supply side companies there. This evaluator noticed there was not a list of some of the specific trucking companies that are participating in the program. In this evaluator's estimation to see some major carriers such as Swift, Schneider involved in the program would have brought this project up to outstanding. The third evaluator confirmed there was good collaboration with industry and universities per the slide that lists prospective alliances; however, it is not clear how many of these alliances came to fruition. Another evaluator stated tracking usage of the project partners is important, but the progress in build the improvements and gathering use partners appears to be on track. One evaluator indicated this area requires more information, and specifically, how the collaboration works with other partners. The evaluator expressed that listing all partners without some details would not help too much. The last evaluator declared no attempt was made to partner with any state DOTs or State highway agencies and no explanation was given as to why state DOTs or State highway agencies were excluded. The evaluator noted that on the other hand, there was a plethora of private partners, but it is difficult to tell which ones are truck stop owner/operators.

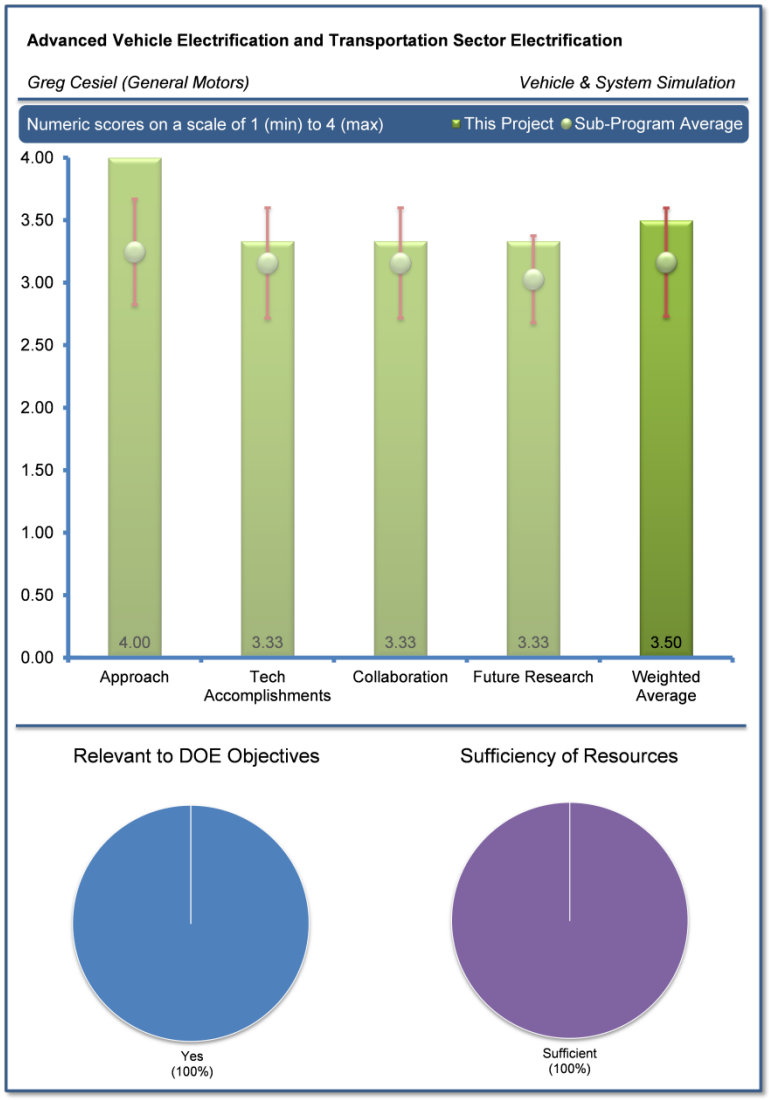
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first panelist strongly articulated the project is right on track with the excellent plan that won them the award. Another panelist stated the objective of monitoring and collecting data for one year and analyzing and acting on the results for a second year is good; however, the panelist noted the details are not known. A third panelist expressed the aspect with regards to truck stop electrification is critical since past use of improved sites had infrequent use. This panelist remarked that going forward learning how to increase use through both through truck side and site side improvements will be critical to success. The next panelist did not recall seeing a chart on future research. This panelist indicated that the presenter articulated a future analysis of the usage data but this would have been good to see in a chart, and could have answered a question another panelist brought up regarding peak energy usage. This panelist expressed that having an analysis plan to guide this project would have been beneficial and showing some additional market transformation planning would have also been welcome. The fifth panelist also articulated no future research was mentioned. This panelist postulated that it seems that the project just needs to install the station and ask the trucks to use the facilities. The last panelist asserted that without changing the approach as noted in Section 2, Approach, it is not possible to see how this project can advance.

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

All seven panelists agreed that resources for the project are sufficient. One panelist said the project seemed to be on track schedule wise and the presenter did not indicate that there were any funding or scope issues, which tends to show good scoping of the project versus having to adjust scope as the project goes along. Another panelist articulated that it appears funding level is appropriate, but there are no details for funding breakdowns. The last panelist commented this is a pretty tight budget given that the researchers are trying to achieve a successful demonstration with $22 million from DOE for economical deployment of a system similar to one that failed commercially and lost well over $300 million. The panelist affirmed that this was a pretty neat trick that might work because the project was thought through intelligently.

Advanced Vehicle Electrification and Transportation Sector Electrification: Greg Cesiel (General Motors) – arravt071



Reviewer Sample Size

This project was reviewed by three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first expert asserted that this project is highly significant to national efforts to reduce dependency on petroleum. Further the development and deployment of cost-effective electric- and hybrid-electric vehicles is a critical strategic initiative that supports the overarching goal of reduced petroleum usage in the United States. The expert continued that this initiative has two critical but equally important work streams: design, development, and production of electric and hybrid vehicles; and establishing a charging infrastructure that will make usage of such vehicles easier while improving the overall viability of vehicle electrification. The expert shared that the development of the Chevrolet Volt was conducted largely at private expense, and is not within the scope of this program but rather this project is focused on deployment of these vehicles in several geographical locations, creation of a charging infrastructure/microcosm (both privately owned and public access), and data acquisition of the vehicle to better understand usage patterns, duty cycles, and charging schedules. The expert indicated the resulting data analysis will help the OEM refine/improve the vehicle, better define the specific needs of a charging infrastructure, and provide insight as to how these vehicles can be operated most efficiently. Another expert stated it was a large-scale demonstration of a series-electric hybrid vehicle and that it was too bad it could not have been even bigger.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

The first reviewer expressed the project appears well organized and focused on the primary objective. The next reviewer similarly stated the approach was fundamentally sound. Additionally the reviewer indicated the basic elements of the project were: launching the Chevrolet Volt and subsequent deployment to several key markets that will serve as the basis for the study; utilizing the capabilities of GM's OnStar system to gather data and send to INL for consolidation, analysis, and report out; working with utilities and vehicle owners to facilitate installation of charging stations, which addresses one of the two main barriers identified; and a final report, including analysis of all data collected and specific recommendations for vehicle re-design opportunities, future battery requirements/ enhancements, and infrastructure requirements once electric vehicle penetration increases. The reviewer added that since this project involved only one vehicle type (Chevrolet Volt), it must be understood that conclusions drawn regarding driving habits and charging needs are specific to this type of "range extender" electric vehicle. Further the reviewer suggested that if other vehicles had been included in the program (Nissan Leaf), there may be some different conclusions drawn.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The project evaluator expressed that in general, good progress has been made, and project seems to be on track to achieve most objectives by the completion of the program in 2013. This person identified the following technical accomplishments: key vehicle components and subcomponents validated (assuming this was completed as part of the original vehicle launch, and not as part of this program); all Federal Motor Vehicle Safety Standards (FMVSS) and compliance testing completed (again, assuming this was accomplished prior to production launch of the vehicle); connectivity with smartphones developed, allowing 24/7 access; and efficiency gages and green leaf screens developed to provide driver with feedback concerning operating efficiency. The evaluator also noted completions not specifically listed under technical accomplishments but achieved so far are: electric charging stations being installed by utilities (for public charging venues) and by vehicle owners; and data collection beginning in the Fall of 2010, being sent to INL for summary and analysis, and issuing of monthly reports.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer indicated that GM's partners/collaborators for this program are: DOE and the Electric Power Research Institute (EPRI), which is seeking involvement of other utilities and also providing information that will be helpful in setting up other technology demonstrations (fast charging, smart charging and battery to grid); nine utilities in various parts of the country, primarily dealing with installation of charging stations; INL, which is receiving data and creating monthly summaries of vehicle usage and charging; and North Carolina State University that is evaluating charging infrastructure requirements and issues for a parking lot/parking garage. The reviewer indicated that there appears to be some common objectives and perhaps even some redundant activities between this project and another presentation (ARRAVT066) and a lack of coordination/communication between the projects. The panelist expressed this as a potential opportunity for both projects would be to compare notes on approach, results achieved to date, and possible synergy that could be exploited between the two programs. The reviewer also indicated, per discussion at the 2012 Annual Merit Review, that results and conclusions from both programs will be compared and analyzed by DOE, who will look for common themes, conclusions, recommendations, etc. Another reviewer commented that it would have been interesting to learn more of how GM is coordinating with the other projects developing charging infrastructure, two of which list GM as a partner.

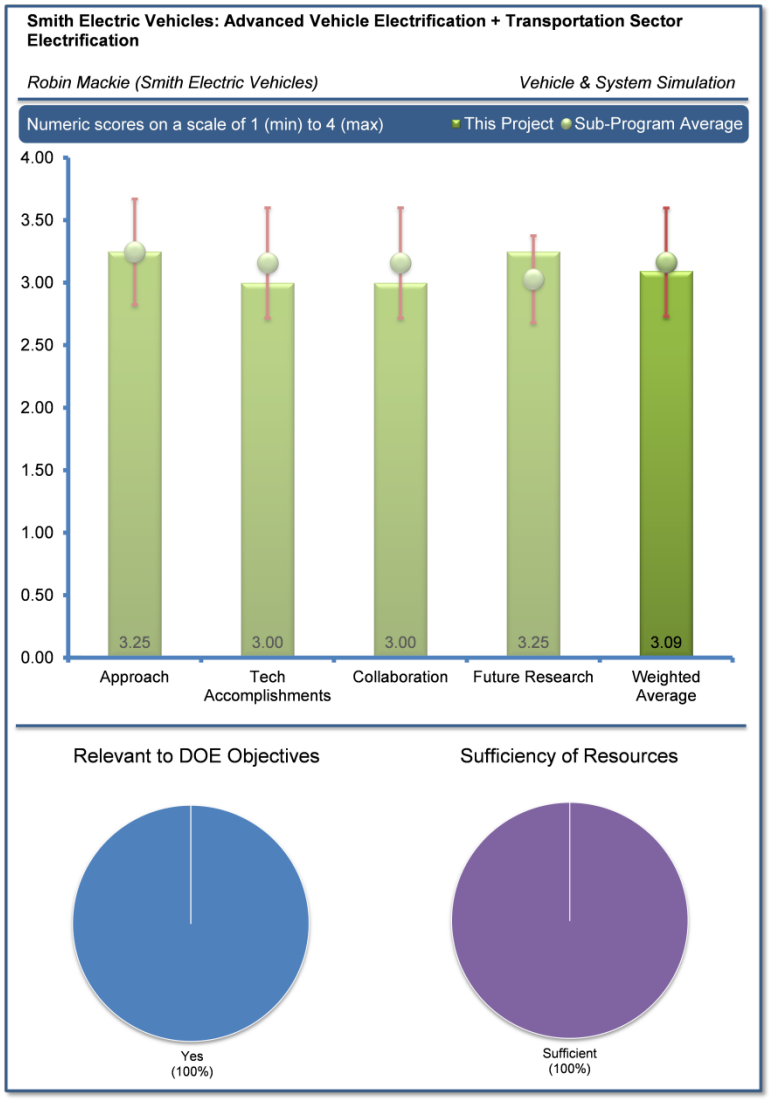
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first expert stated the future plans include: continuation of data collection through the third quarter of 2013; additional charging station installations; continued investigation of fast charging, smart charging, and secondary use of batteries (grid storage, etc.); and assumed, but not specifically stated, is a final report that will draw conclusions on vehicle duty cycles, driving habits, charging schedules, and findings on special projects (fast and smart charging, secondary battery use). The expert commented that there is not as much substance in this report out as desired. To support this opinion the expert shared questions that were not addressed. Specifically, the reviewer would like to know how many more charging stations will be installed. The reviewer would like to know whether other areas will be selected for participation and data collection. Finally, the reviewer inquired about how many total Chevrolet Volts will ultimately be included in the data collection program. While this last question may be dependent upon future Chevrolet Volt sales, the expert expressed it would seem that there should be some type of target quantity. The expert found the special projects particularly interesting, but it is a little unclear whether or not this project team has the lead in the activities. The reviewer asserted that the use of OnStar to communicate with grid and determine the best time for charging should result in smoothing out power demand requirements and also help the vehicle owner save money. This person assumed that GM is taking the lead on this. Additionally the expert indicated that fast charging development initiatives seem to be ongoing independent of this project, but GM and the rest of the team are providing input on vehicle integration and standardization. Another reviewer did not catch whether the fast-charging piece was a part of this project or something presented as incidental, nice-to-know. Further, given that the Chevrolet Volt is a series hybrid with an internal combustion engine, this person was not clear on how the fast charging station fits prominently into this work, unless GM will be introducing a battery electric-vehicle (BEV), but noted that was not mentioned.

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

All panelists agreed resources were sufficient for this project. One panelist noted that there is no indication of projected shortfalls in either category and assumed that both funding and human resources are adequate for completion of project, although the spending to date was not provided. This panelist expressed the only question mark may be whether enough vehicles will be deployed to obtain the desired sample size for the data collection and analysis as this was not specifically addressed in the presentation.

Smith Electric Vehicles: Advanced Vehicle Electrification + Transportation Sector Electrification: Robin Mackie (Smith Electric Vehicles) – arravt072



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first evaluator indicated that medium-duty vehicle development is directly applicable to displacing petroleum fueled vehicles. The next evaluator agreed electrification of medium-duty commercial trucks will certainly help displace petroleum use, though the displacement potential of limited-range all-electric vehicles (AEV) will be limited by the relatively low driving miles of the conventionally-powered trucks that they replace. For this reason, the evaluator stated the ability to avoid pollutant emissions in dense urban areas may need to be an additional rationale considered. The last reviewer expressed some reservations that the total distance driven by each of these trucks is only 30 miles per day, so the savings are at least an order of magnitude smaller per truck than for the Class 8 projects. While there is some petroleum displacement, this reviewer stated the real justification for MD electrification is air pollution and noise in cities which are not addressed. Additionally, the reviewer had an issue with the carbon calculation, which looks like it has a factor of ten lost (or else something was not well labeled).

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer stated that the small company was demonstrating very effective use of its limited resources to support this deployment program. Another panelist stated the project approach included leveraging United Kingdom (UK) development experience, which is a good strategy to quickly start U.S. customer deliveries. The panelist recounted that AEV buyers are slated to receive 92% of the ARRA grant funds in exchange for providing data on the vehicles' operation. This person noted the payment amounts to about one-third the cost of the vehicle, which seems like an effective way to increase sales. Additionally, the panelist commented that corresponding benefits include greater opportunity for learning from the product delivery and customer use experience, and the creation of associated jobs. This panelist asserted that the balance of the ARRA funds appear allocated to vehicle modification/certifications required by U.S. customers and regulators, as well as to development of the next generation components/systems. The panelist indicated it was good to see Smith's approach includes providing about three-fourth of the support for these activities out of its own cost-share funds. The third panelist articulated that the two main parts of this project are vehicle deployment and development of a very cool system for collecting and analyzing data and that this data will be particularly useful for identifying the most productive types of uses for such vehicles. This panelist further stated, the biggest barrier that Smith faces is battery cost, which is not in their arena thus the researchers must either wait and hope that battery prices will drop, or

possibly consider using cheaper batteries, like nickel metal hydride (NiMH), for applications where additional mass is not a major drawback. The last panelist commented the system itself seems well-designed and sound. However that mileage of the vehicles is low and therefore it does not make much economic sense for the market with regards to electrification.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Most reviewers expressed satisfaction with the technical accomplishments. The first reviewer articulated it was good to see that the project is well on its way to not only meeting but exceeding its vehicle deployment target. This reviewer expressed that the large amount of data collected, over 1.8 million miles of driving, will benefit customers as well as other DOE projects. Further, this person remarked positive progress seems to have been made in development of the next generation drive and battery pack, as well as in improved understanding of how to better meet customer needs (such as by offering multiple battery sizes). The reviewer stated that one opportunity for improvement would be to more clearly chart out the eventual business case for customers as grant funds and other purchase incentives start phasing out. Another reviewer asserted that Smith is doing a fine job of getting the vehicles on the road and collecting data to assess performance. While performance improvements are not discussed in detail, this reviewer commented performance improvements also seem to be going well. The last reviewer affirmed there was good progress to deploy and study vehicles but significant challenges still exist with cost and range.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The first panelist stated major collaboration is with vehicle customers. The panelist shared that some issues exist and that potential improvement is possible in vehicle turnover to operators to achieve optimal vehicle performance. The second panelist remarked that collaboration seems good with NREL, and several university collaborators that were listed in the presentation, though time constraints limited the amount of details that could be provided on those efforts. The last panelist expressed that little information was provided, but the collaborations seemed adequate.

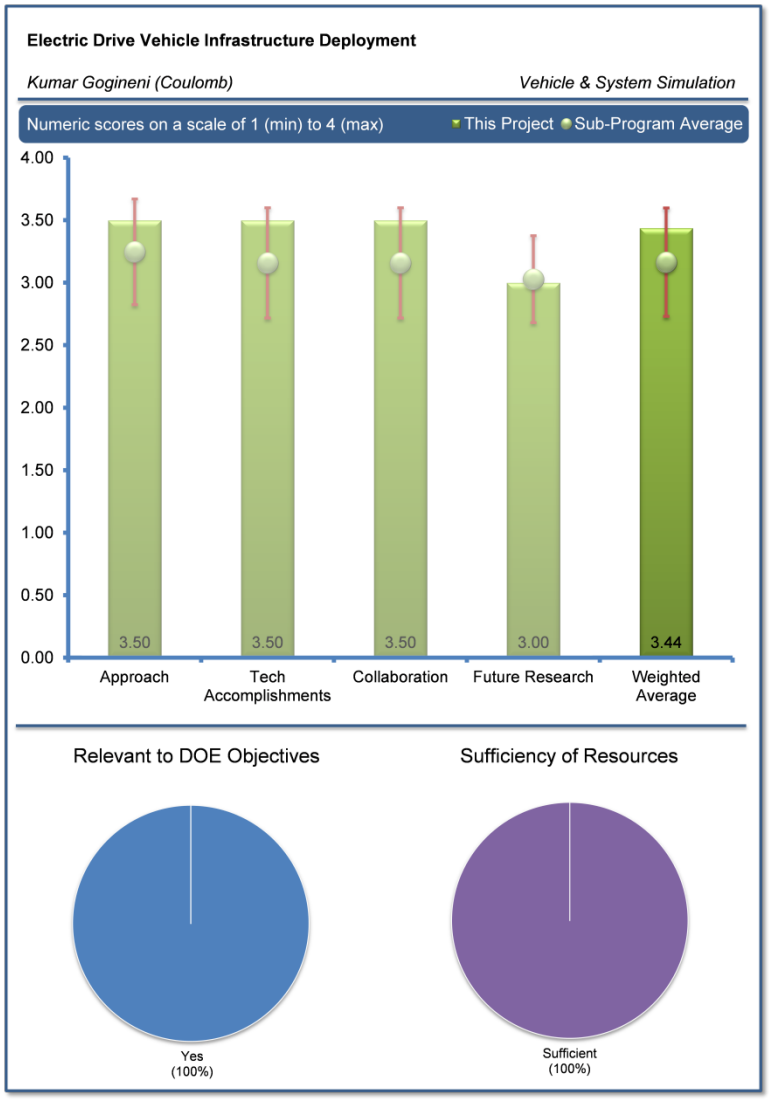
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first evaluator stated that continued deployment and study of operation is planned. Additionally this evaluator expressed a focus should be placed on lessons learned from data. The next evaluator indicated that very little detail is provided although the project seems to be following the proposed path nicely and the researchers will keep doing as planned. The last commenter articulated that the future work plans include data transfer improvements for the monitored vehicles, implementation of prognostic problem detection from the data, and further development/launch of the improved battery and drive systems. Given the vehicle deployment success thus far, this reviewer shared that perhaps the ARRA funding could be stretched further by reducing the per-vehicle payment for data collection. The reviewer indicated that improvements to the Generation II vehicle design may start reducing the amount needed for this payment (which effectively serves as a buy-down incentive) and could in turn increase the total number of vehicles deployed through the project (by spreading the funds over an even greater number of trucks).

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

All panelists agreed that resources for this project were sufficient. The first panelist expressed that while a small organization, Smith USA has done a good job of resourcing the project and covering all aspects of a vehicle rollout. The next panelist asserted that Smith's significant cost-sharing seems like it is helping the funds go farther than they would otherwise. This panelist remarked that it is also good that cost savings has enabled expansion of the vehicle deployment target. Perhaps reducing or beginning to phase out the data collection/purchase incentive payment could help expand the deployment even further. The last panelist noted that the fact that vehicle buyers need such large incentives verifies the small savings potential due to low miles driven and that the basic economic case for electrifying such trucks is weak.

Electric Drive Vehicle Infrastructure Deployment: Kumar Gogineni (Coulomb) – arravt073



Reviewer Sample Size

This project was reviewed by two reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One panelist articulated that understanding the installation of EV charging stations and their acceptance has enormous potential impacts for how EVs can be introduced.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One panelist stated that the overall approach and the project appear sound and on track although this person found the presenter difficult to understand because the presenter spoke very quickly. With only a PowerPoint and the presenter's voice to go by, the panelist indicated it made assessing the project more difficult.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One panelist affirmed that installations are almost complete and the project appears to be well on schedule.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One panelist asserted the coordination appears extensive, especially within the private sector.

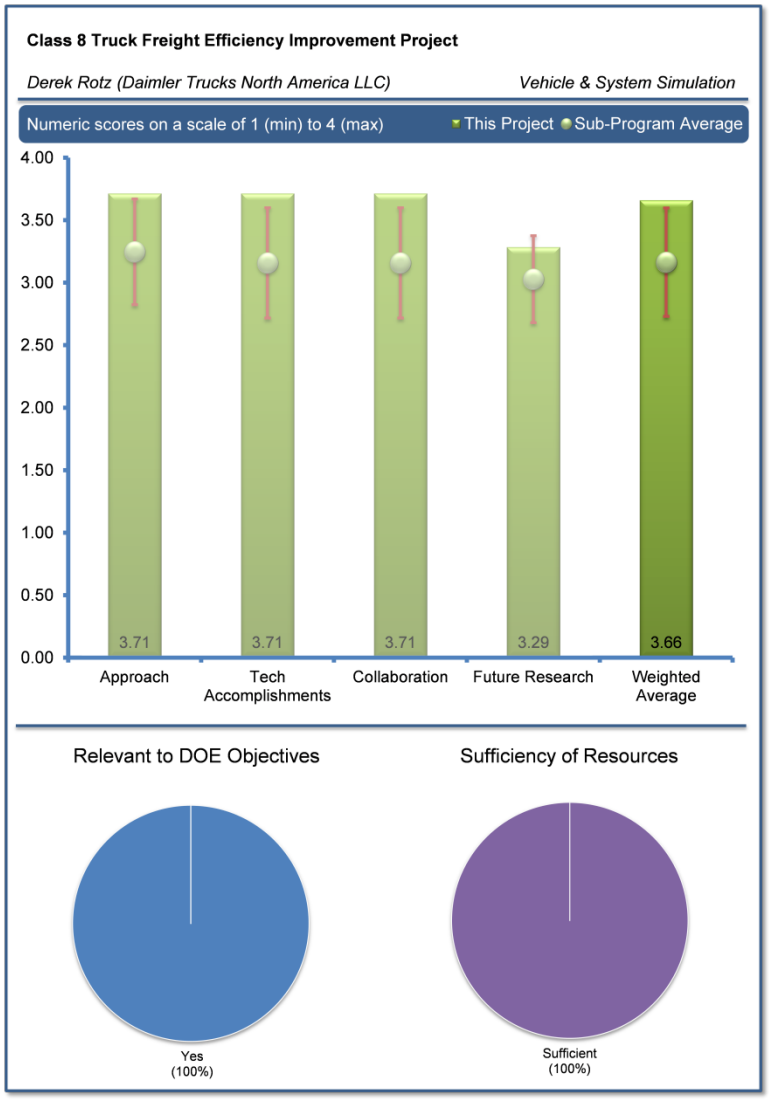
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

No comments were received in this section.

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

Both reviewers agreed the resources for this project were sufficient.

Class 8 Truck Freight Efficiency Improvement Project: Derek Rotz (Daimler Trucks North America LLC) – arravt080



Reviewer Sample Size

This project was reviewed by seven reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Many reviewers believe that the SuperTruck project is very important due to its main objective of petroleum displacement in Class 8 trucks. One person stated that the project objectives are key enablers to energy efficient highway transportation. Another mentioned that SuperTruck is very relevant due to the large amount of fuel consumed by over-the-road (OTR) trucks and Daimler is the market share leader in this segment. Another evaluator pointed out that this project is relevant as it will develop technology options for the largest commercial fleet segment in the United States and that the project analyzes many options for reducing fuel consumption in this fleet. This person added that as with all of the SuperTruck projects, the project goal is a 50% reduction in fuel use for on-road heavy-duty (HD) trucks. Another reviewer believed this would make a big dent in petroleum use. This person added that the SuperTruck program is a bold initiative to accelerate the development of new technologies that can have a major impact on fuel consumption. The next reviewer added that the program calls for development of a Class 8 vehicle that delivers a 50% improvement in freight efficiency (expressed in terms of ton-miles per gallon). It is further stipulated that the engine must deliver a 20% improvement, and equal or exceed 50% brake thermal efficiency. The next evaluator said that this project, one of four being conducted under the SuperTruck program, very clearly aligns with and supports the DOE initiative for reduced petroleum dependence. The last reviewer felt that in order to achieve such dramatic improvements, revolutionary, rather than evolutionary changes will be required. This person added that this program provides significant funding for OEMs to explore, down-select, and develop the technologies that can deliver such dramatic improvements.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One evaluator stated that Daimler is taking a complete system approach to this challenge and are using the available funding and resources to investigate some significant, challenging areas of big truck design. The best example that this expert found was Daimler's investigation into distributed cooling systems for aerodynamic opportunity. Another commentator thought it was interesting that the focus is on frame rails, sandwich structures, transmission shifting, and oil formulations/control. Many of the reviewers liked several elements of this project because they address significant problems in a low-cost way. For instance, one reviewer stated that one such element is the eco-driving feedback and that another is the analysis of time-of-day differences. This reviewer also added that the level of hybridization seems to be appropriately low for long-haul, so that a large battery is not required, avoiding significant mass and cost penalties; and that having a small battery means that something else is needed for

hotel load at night, hence the solid oxide fuel cell auxiliary power unit (SOFC APU). This reviewer continued that it remains to be seen whether it is better than a diesel and that they would like to see integration of the APU to avoid component duplication. This person also added that the plug-in capability for the APU would be desirable. The next expert to respond stated that the technology roadmap and analysis conducted to identify the pathways for vehicle and engine efficiency gains. Aerodynamic improvement, power-train and drive-train efficiency improvement, light-weighting, energy management, parasitic loss reduction and hybridization were all identified as technical approach. This person continued that the experimental tests were conducted on tinker trucks to quantify the gain from each of the proposed technologies and that this was overall a good approach. The reviewer also felt that the issue of total vehicle gain when all the technologies are integrated should be addressed. One commentator stated that Daimler Trucks North America (DTNA) has taken a very logical, methodical approach to creating a SuperTruck. This person observed that Phase 1 of their program explored a wide variety of technologies that could contribute substantially to improved efficiency. This reviewer believed that most of this activity was analytical in nature, with some limited confirmation testing to evaluate and eventually down-select the most promising technologies and that the objective was to trim down the list of technologies to be further evaluated. The same commentator observed that in Phase 2, a shortened list of technologies is subjected to testing to validate the Phase 1 analysis. This person added that to facilitate this effort, two mule vehicles were built and dedicated testing on specific components and systems were conducted. The reviewer added that significant aerodynamic testing has been done with scale models to zero in on the optimum tractor trailer shape and configuration. The reviewer also noted that the strength of Phase 2 testing and analysis, final designs will be generated for the SuperTruck in Phase 3, accompanied by more extensive analysis to fine tune the designs. Continuing to the next phase the reviewer noted Phase 4 is the procurement and build phase for the final SuperTruck. The individual components and systems will be tested to reconfirm anticipated improvements, affirmed the expert. In Phase 5, the completed SuperTruck will be subjected to extensive testing to confirm the freight efficiency improvement. Separately the engine will be dynamometer tested to confirm the improvement in brake thermal efficiency. According to another commentator, a freight efficiency budget has been generated to document how much freight efficiency improvement is anticipated for each component or subsystem (aerodynamics, powertrain, light-weighting, energy management, parasitic loss reduction, and hybridization). The team has wisely built in more total savings than required, so that any shortfalls in projected performance in one component or subsystem are potentially compensated for in other areas,. Most reviewers felt that it does cover all necessary technologies to achieve the goal. However, one reviewer pointed out the barriers addressed so far are the tradeoff between aerodynamic efficiency and cooling requirements; the design, development of safe and efficient high voltage distribution; and the balance between cost, weight, and efficiency. One expert remarked that there was good analysis of light-weighting costs versus stiffness issues; however, this person stated that the sizing components was good but could add more detail on how battery sizing was completed.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

All of the reviewers felt that the project seems on track and is progressing. One reviewer noticed that all of the preliminary concept development and design are well underway, and modeling and analysis supports these efforts. Another reviewer stated that the initial tests of individual components on tinker trucks are in progress in which significant improvements have already been identified. The Phase 1 analysis and modeling portion has largely been completed, continued the reviewer. Two mule vehicles have been built for testing and evaluation of individual components and systems. The next reviewer observed that extensive analysis and testing has been conducted on aerodynamic shape; thermal management of the engine and hybrid system; light-weighting analysis of major structural components; integration and optimization of the powertrain/drivetrain; reduction of parasitic losses (power steering, air compressor); energy management, including predictive torque and anti-idling; and hybridization. The same reviewer believed that these efforts will help to quantify what each major design change can deliver in terms of efficiency improvement, so there should be few surprises during the latter stages of the program. The reviewer concluded with the feeling that the project appears to be right on schedule. The next commentator observed that, in terms of meeting freight efficiency targets, the DTNA set a goal of 25% improvement for Phase 2 activity. This reviewer said that DTNA appears to have achieved approximately 37% based on testing and analysis conducted to date, significantly exceeding their intermediate goal. The next reviewer felt that Daimler is progressing with major concept decisions using analytical tools and tinker trucks. They are engaging suppliers and their resources in Germany in a very efficient and strong way. The next commentator to respond agreed that the tests are underway or planned as scheduled and that the overall project is on schedule. The person added that the analysis completed for

some of the individual technologies tested and the gains quantified. The last reviewer liked that this project was incorporating driver behavior. This person added that the accomplishment at this stage was only in the component level, which makes it hard to make judgments.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The first commenter expressed that the DTNA SuperTruck program has a full complement of partners and collaborators from the following areas: energy management, hybridization, aerodynamics and cooling, light-weighting, powertrain and parasitic losses, and fleet advisors and test fleets. This reviewer pointed out that there are no fewer than 25 partners/collaborators engaged in this program, a few internal to Daimler, but mostly external resources (suppliers, fleet customers, DOE, National Labs). There appears to be strong expertise in each of the key areas noted. The next commenter felt that it seemed like the project actively worked with all of their partners. Another reviewer stated that the extensive collaboration and partnership with the key technology players in each of the approaches being pursued is needed and is present. Involvement of fleet owners is excellent idea, added the same reviewer. The reviewer added that all of the major areas of truck design, construction, and testing seem to be covered. Another reviewer suggested doing measurements of heat load during idling at night, when most idling actually occurs, in order to get a more realistic idea of performance. The last reviewer believed that the project should elaborate on requirements versus project goals (i.e., how did requirements drive activities). Overall, most of the reviewers felt this project showed very good decision making. For instance, their discussion of integrating electric turbo compounding if the bench tests prove that it offers a good payback, stated one reviewer. Only one reviewer showed concern in that their team is so internally-focused that they may miss a few opportunities outside of the Daimler family.

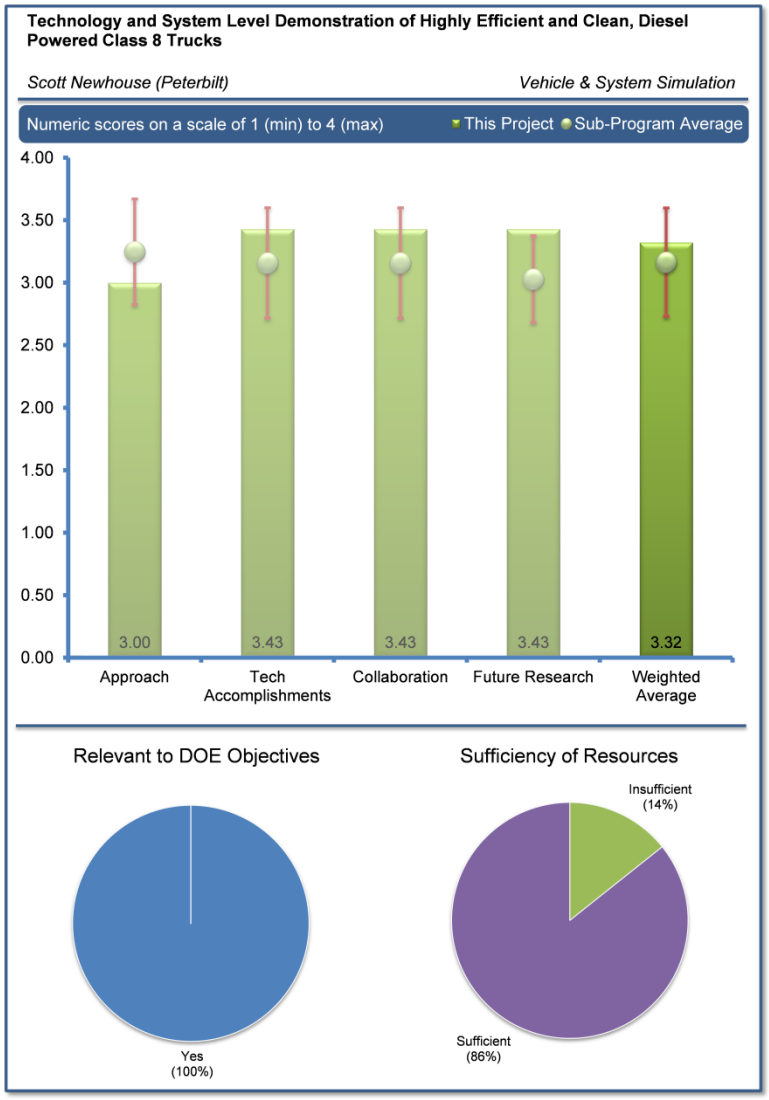
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer to respond felt that the project was on schedule, and that more system level testing is ongoing and/or planned. However, the plan did not address system integration and optimization testing. Another reviewer said the researchers have a strong plan for future work. The next reviewer stated that future activity will proceed consistent with the detailed multi-phase plan described. The reviewer described next steps: continuation of system level testing; completion of full scale cab model for aerodynamic evaluation; build up preliminary SuperTruck chassis for System integration (complex controls for hybrid, powertrain, waste heat recovery, and predictive torque management); and the completion of integrated tractor/trailer configuration for light-weighting and aerodynamic optimization. One reviewer felt that the project will continue down their current productive path, but the details in the presentation are a bit sketchy. This reviewer would have like to have seen more about the integration, since so many elements are being tested one at a time. A different reviewer expressed concern when the presenter did not mention how hybrid work is integrated with the future work, and how it can help to improve the vehicle efficiency in typical vehicle cycle. The final reviewer remarked this is another one of the SuperTruck projects that this reviewer is non-plussed with.

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

Seven reviewers felt that the project resources were sufficient. The first reviewer said the project is well funded at $79 million. Another reviewer stated that the team seems to have done a good job on planning the tasks to match the funding available. The next person to comment believed that the resources seemed capable and were sufficient to complete goals. A different reviewer stated that the project is well positioned to finish on time, and to achieve the performance objectives identified. Another reviewer said that, based on the broad-based design and testing activities on multiple fronts, it is obvious that there is a substantial human resource commitment to this program. The contribution of 25 partners ensures that technical assistance is readily available to deal with a broad range of new component and system designs. The final reviewer really expected to see some solid results.

Technology and System Level Demonstration of Highly Efficient and Clean, Diesel Powered Class 8 Trucks: Scott Newhouse (Peterbilt) – arravt081



Reviewer Sample Size

This project was reviewed by seven reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first commentator stated that project objectives set by the SuperTruck program are consistent with DOE objectives. The project also addressed the issue of job creation, which was the main objective of the ARRA program. Another reviewer believed that this project, one of four being conducted under the SuperTruck program, very clearly aligns with and supports the DOE initiative for reduced petroleum dependence. A different reviewer liked that this included the emissions portion as well. The reviewer stated that this has typically been overlooked in past DOE Vehicle Technology Reviews. Another reviewer stated that as for all of the SuperTruck projects, the overall goal of 50% reduction in fuel use supports the objective of petroleum displacement perfectly. The next reviewer stated that in order to achieve such dramatic improvements, revolutionary, rather than evolutionary changes will be required. This program provides significant funding for OEMs to explore, down-select, and develop the technologies that can deliver such dramatic improvements. Another commentator believed that the project objectives are key enablers to energy efficient highway transportation. The following commenter observed that per requirements set forth in the Funding Opportunity Announcement (FOA), the engine must deliver a 20% improvement and equal or exceed 50% brake thermal efficiency. The SuperTruck program is a bold initiative to accelerate the development of new technologies that can have a major impact on fuel consumption. The reviewer said the program calls for development of a Class 8 vehicle that delivers a 50% improvement in freight efficiency (expressed in terms of ton-miles per gallon) and that the Cummins-Peterbilt team will also target a 68% improvement in freight efficiency over a 24-hour duty cycle (overnight hoteling included). The last reviewer expressed that Peterbilt and its sister PACCAR OEM, Kenworth, has significant market share in this sector of the HD Truck industry.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer expressed that the project seems well-designed and is on schedule to meeting its milestones. This person noted that the team did the logical thing and validated individual components on a mule truck before putting everything together. The reviewer was unclear as to what modeling was done first beyond the aerodynamics computational fluid dynamics (CFD) calculations. This reviewer also wondered why a fuel cell APU, and whether duplicate components for hotel load could have been avoided. The same reviewer further indicated a desire to hear about features like the route management that reduce fuel use without significant cost or weight. Another reviewer stated that the project considered many technology enhancements and

approaches to achieve the technical goals of aerodynamics, engine, transmission, axles, tire, route management, weight reduction, and idle management. This person observed that the project uses current truck configurations as engineering mules for testing. This, the reviewer opined, will certainly ease final product acceptance by fleet owners and customers. The next reviewer observed that the team is using the following multi-phase approach to develop the SuperTruck: Objective 1 (Phase 1), which involves engine demonstration of 50% brake thermal efficiency; Objective 2a (Phase 2), which involves vehicle drive cycle demonstration of 50% improvement in freight efficiency; Objective 2b (Phase 3), which involves vehicle drive cycle demonstration of 68% improvement in freight efficiency over a 24-hour duty cycle; and Objective 3 (Phase 4), which involves engine demonstration of 55% brake thermal efficiency. The specifics of the approaches for each objective were not shared in great detail for the program, noted this reviewer, but it appeared that a combination of analysis and component/subsystem level testing was conducted. This reviewer said that it would have been helpful to the reviewers to better understand the list of technologies or products that were originally considered. The same reviewer pointed out that it is commendable that the freight efficiency targets are believed to have been achieved or exceeded at this point, based on analysis and component/subsystem testing. This reviewer continued that, to date, two of the five identified program barriers have been addressed (i.e., under-hood cooling with waste heat recovery and required vehicle and engine weight reduction). This person added that there is good detail presented showing where the weight reduction is being achieved. A different reviewer explained that with the technology settling down in emissions, this is getting easier; however, the project team will need to keep up-to-speed on the development of catalysts for emissions. Another reviewer was concerned about the due diligence of the project team's work. This person questioned the robustness of the project team's work in aerodynamics, anti-idling, and tires/wheels because very few details were shared. The same reviewer stated that the project team's partner, Cummins, seemed well situated on the project; however, from a vehicle standpoint, the reviewer did not see evidence of a good, deep, quality approach to the 50% challenge. This person added that although it was possible that the details were available, just not provided, this reviewer could not make a determination without seeing similar information to the other three SuperTruck companies. The next reviewer stated that the presentation could have elaborated more on the technical integration issues and other areas besides aerodynamics. This person added that the presentation did not discuss plans for weight reduction, transmission/axle, or tire effects on the project goals. The same reviewer further noted that the project should address integration concerns or challenges that will affect new technology success (i.e., potential compromises with the aerodynamics approach caused by cooling). The last commenter described the freight efficiency improvement over a 24-hour duty cycle as overly optimistic.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first reviewer remarked to keep going. Another reviewer stated that the project is on track and had achieved and/or exceeded their goal in tests with the technologies successfully packaged into 587 trucks. This person added that the project demonstrated efficiency gains through weight reduction, aerodynamic drag reduction, with some room for improvements. The analysis showed normal shaped vehicles as good as futuristic looking vehicles, added the reviewer. Another reviewer wondered whether the skirts and boat-tails will be durable and also acceptable to customers. For production models, it may be appropriate to back up on the last few increments of the coefficient of drag (C_d), stated the reviewer. This person stated that these things cause a severe weight penalty and advised not to forget that a lighter truck can haul more tons. The next respondent to comment listed the major accomplishments that were identified in the presentation: defined path to achieving required efficiencies for both the engine and the vehicle (52% improvement projected against a target of 50%. This could result in a shortfall if one or more of the candidate technologies do not deliver as anticipated); an approach for aerodynamic improvement was identified through CFD modeling and components were fabricated for initial testing; Cummins performed initial evaluations of waste heat recovery system (other engine related developments are being reported out in a separate session); performed initial testing of advanced transmission; and performed assessment of auxiliary power unit. The reviewer observed that more progress noted in the presentation included: completed packaging of technologies without significant tear up to the vehicle or wheelbase extension; identified attractive weight savings for both the tractor and trailer that is expected to provide a 3% improvement in freight efficiency (specific data was provided showing the projected weight savings for major components and subsystems); and numerous CFD analyses were conducted on Demo 1 and Demo 2, with Demo 1 configurations exceeding the 14% target, however the Demo 2 fell slightly short of the 24% goal. This reviewer felt that the conclusions drawn from this evaluation were a little surprising. The reviewer added that, unlike the other three SuperTruck programs, this team has opted to stay with what is essentially a production cab design. The

conclusions from the CFD analysis indicate that only very minor improvements would be achieved by a more radical redesign, which runs counter to conclusions reached in the other SuperTruck projects. The next reviewer stated that the project was meeting the goals with minor supporting documentation; tradeoffs such as cost and weight were not shared. The reviewer added that the goals and details versus obtained results (or plans to get results) could be discussed in more detail. It is unclear if major milestones had been obtained and if efficiency goals are on track, expressed the reviewer. The last reviewer mentioned that Slide 16 requires clarification on why the advanced concept vehicles only show very little improvement on C_d, even with different trailers (side skirt and tail). Use of this sample is misleading, added the commentator.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer said this team covers all the bases, from engine and drivetrain experts to trailer manufacturers to APU suppliers and end users and that the team appears to be getting the job done together. The second reviewer said that the list of participants and collaborators on the project are the industry leaders in their area. A third reviewer stated that with Cummins serving as the contract lead, there are a total of 14 partners and collaborators active on the project (including Peterbilt). The second reviewer continued saying that expertise in the following components/systems/and technologies is readily available: cooling, transmissions, brakes and suspension, axles, tires, wheels, APUs, heating, ventilation and air-conditioning (HVAC), global positioning system and dash display, CFD, trailer design and manufacture. Cummins has the lead on engine improvements and related systems (waste heat recovery) while Peterbilt has the lead on vehicle design and integrations added another commenter. It is unknown whether Cummins or Peterbilt are engaging any of the national labs for technology development or testing. Another reviewer said that the researchers appear to have much less engagement by suppliers and DOE labs; however, they seem to have reasonable fleet input. The final reviewer thought the project seems to involve many partners, but this reviewer is not sure in what level it is.

Question 5: Has the project 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?

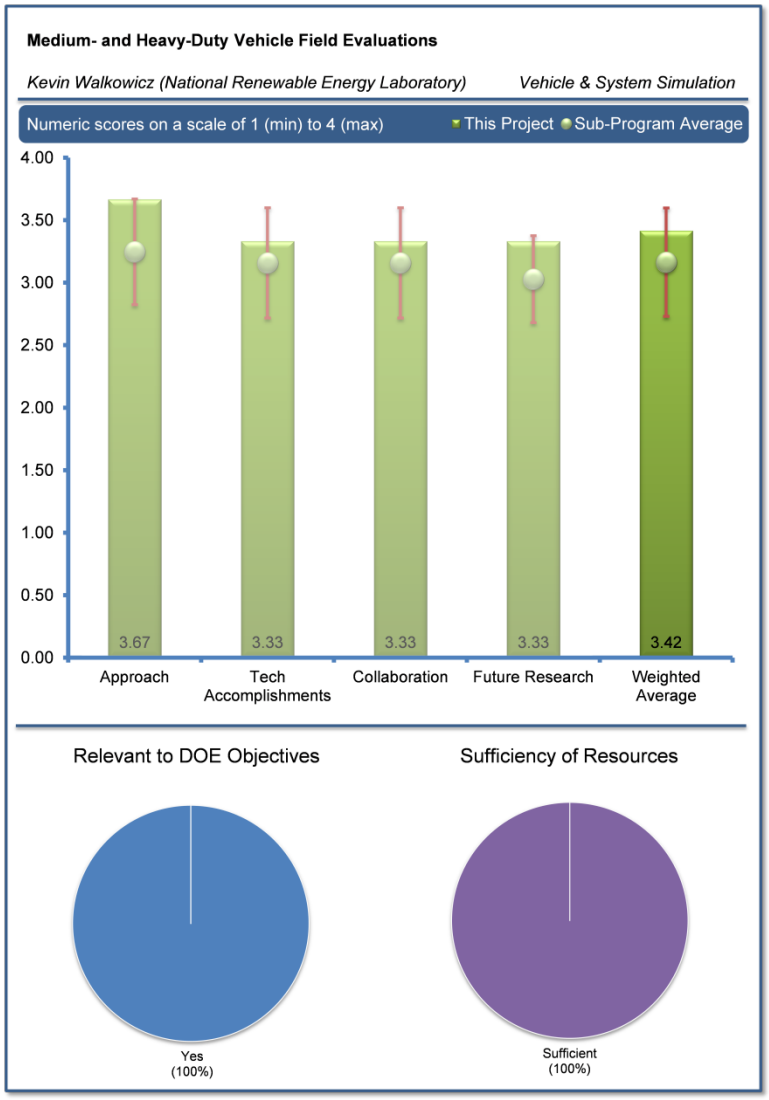
The first reviewer felt that it seemed like all the future work was focused toward the program objectives. The second reviewer commented that the project plans to test optimized engine and advanced transmission systems to increase the gain further. There is plan to build and test a demonstration vehicle in which the various technologies are incorporated. The reviewer found that the technology implementation and marketing after the program is over is commendable. Another commentator observed that the future work as defined in the presentation for the next 12 months is as follows: engine calibration and optimization, vehicle testing of advanced transmission, testing of tractor/trailer aerodynamic solution, build and test SuperTruck Vehicle 1, design freeze of Vehicle 2, and the initial calibration of the GEN2 auxiliary power unit. This commentator continued saying that three program barriers are considered open issues, and will be evaluated on the demonstrator truck: effects of reduced engine speed on drivetrain components and potential vibration issues, trailer aerodynamic devices that meet operational requirements, and vehicle and powertrain communication speed. This commentator said it is unclear whether or not contingency plans are in place to address these open issues should the lead approaches prove ineffective. The next reviewer stated that the proof of a successful program will be the truck's performance once completely integrated and tested in year four. As with the other teams, a coherent work plan was formulated up front, and the team appears to be following it on schedule, which means that the future work is appropriately formulated, to the extent that one can tell from such an abbreviated presentation. Another reviewer added that better elaboration on Slides 19 and 23 would be helpful for reviewers to understand details on what will exactly happen and when it will happen. The last reviewer to comment thought this project needs to continue being explored, especially as catalyst technology improves. The reviewer continued saying this would be helpful to extend to other fuels, while bring mindful of how alternative fuels affect emission. This reviewer also noted that they would like to see emissions explored as it relates to compressed natural gas (CNG)/ liquefied natural gas (LNG)-fueled vehicles.

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

One expert felt that there were insufficient resources and that given the lack of detail presented, this reviewer questioned whether there are sufficient resources working on this project. Six of the seven reviewers felt that the project resources were sufficient. One reviewer stated that the program appears to be adequately funded, at approximately $79 million. The 14 partners suggest that the project has access to technical expertise in a number of critical areas. The pace of this project has been

swift, and there are no indications that the project will not be completed on time, added the reviewer. This reviewer felt that there was no clear indication that contingency plans or parallel paths exist in case the lead approaches for technologies do not deliver anticipated savings. This person continued stating that such plans may exist, but were not shared as part of the presentation. If these plans do not exist there could be an unusually high demand for resources late in the program as the team works to overcome potential shortfalls in performance. Another commenter said that the project team has figured out what they wanted to do, and are doing it on schedule and on budget. The final reviewer stated that this project took on a hard piece of modeling work.

Medium and Heavy-Duty Vehicle Field Evaluations: Kevin Walkowicz (National Renewable Energy Laboratory) – vss001



Reviewer Sample Size

This project was reviewed by three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first reviewer believed that this project is the single most comprehensive investigation of the performance characteristics of plug-in electric MD/HD trucks. The potential relevance to public and private fleets is tremendous, added the commenter. Another reviewer stated that this project seems to be doing a good job of collecting real-world data on how new technology hybrid-electric vehicles (HEV) are performing in the field. This person added that the data will be useful to the industry and to government in understanding if the technology is really worth investing in. The last reviewer felt that there is a need for understanding whether the hybrid technologies reduce fuel consumption and are user friendly.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer stated that there is an appropriate selection of partners and a good parcel of data from each truck. The reviewer added that publication of the data is helpful for the general market, and expressed hope that other projects capture some of the other non-production technologies and the possible fuel economy impacts. Another commenter observed a very good approach and noted that the data was collected and analyzed well. This person especially liked the comparison to the conventional that is made here in the MD/HD project. The same reviewer remarked that utilizing the chassis test to help provide more insight seemed good. This reviewer highlighted that the example of forcing a route switch between the HEVs and conventional shows that the project is staying on top of the data and trying to get representative data. The same reviewer expressed uncertainty as to whether there is a clear end in sight for this project, and questioned when it would be known that a new technology is close enough to another that you already logged that it does not need to be logged. This reviewer remarked that this was not clear in the material. The next commentator stated that the project is well-formulated from a technical standpoint. One critique indicated by this commenter is that there is fairly limited emphasis on addressing significant deviations from vehicle performance specifications. This person commented that the team reports an efficiency of 1.6 kWh/mile for the Smith EV, though according to specifications, that vehicle is supposed to achieve 0.8 kWh/mile. Without any effort to investigate the causes or potential remedies for this deviation, explained this reviewer, the results would likely eliminate this vehicle as a viable option for most applications. This project will find itself quickly irrelevant if nobody will use the vehicles it is testing, opined the reviewer. It was understood by this reviewer that these are preliminary results, but stressed that a more proactive approach to interpreting results and identifying problems and remediations is crucial.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first reviewer to respond felt that the project appeared to be moving along well and was eager to see more data. Another reviewer believed that the project achieved good results for the comparison between the conventional and hybrid trucks. This person agreed that the uptime, fuel economy, and maintenance cost were all factors that would help fleets decide on whether to implement hybrid technology. The next reviewer to respond felt that the progress was hard to judge; however, the project seems to be progressing well with a lot of good data collected, added the commenter. The reviewer suggested that it would be nice to have clear targets to look back on during the next year to see how well the targets were set. One example that the reviewer stated would help was the specific number of miles logged per month. Data or logged miles per dollar spent would help compare this project to others that might be doing the same thing in the future. This reviewer believed that it would be helpful to publish an understanding of why the dynamometer results differed from field results for fuel efficiency. This would help the fleets pick the right routes for their vehicles. This person also felt that it would be helpful to understand and publish why the actual range of the Smith is different from the predicted range.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer felt that the project had a good list of fleet and system provider partners. Another believed that there was a good collaboration between the partners in order to get access to different vehicles. The last reviewer to respond stated that the complexity of negotiating multiple stakeholders to deliver and gather data from multiple vehicles is tremendous. This person also believed that the team had done an admirable job simply getting vehicles into fleets for use. This reviewer mentioned the awareness of this project and its results in the federal fleet was poor and was even worse among private fleets. This activity has the potential to make an immediate real-world impact, added the reviewer. The reviewer continued saying that the lack of performance data prevents fleet managers from adopting these vehicles and believes that the results from this study fill this critical gap. The reviewer mentioned the federal fleet in particular because the DOE can help by directly informing and influencing federal fleet procurement decisions by raising awareness of this project. The outreach efforts for this program look like any other research project, but a more aggressive effort is called for. The reviewer concluded that this project needs a more ambitious and better-constructed outreach plan.

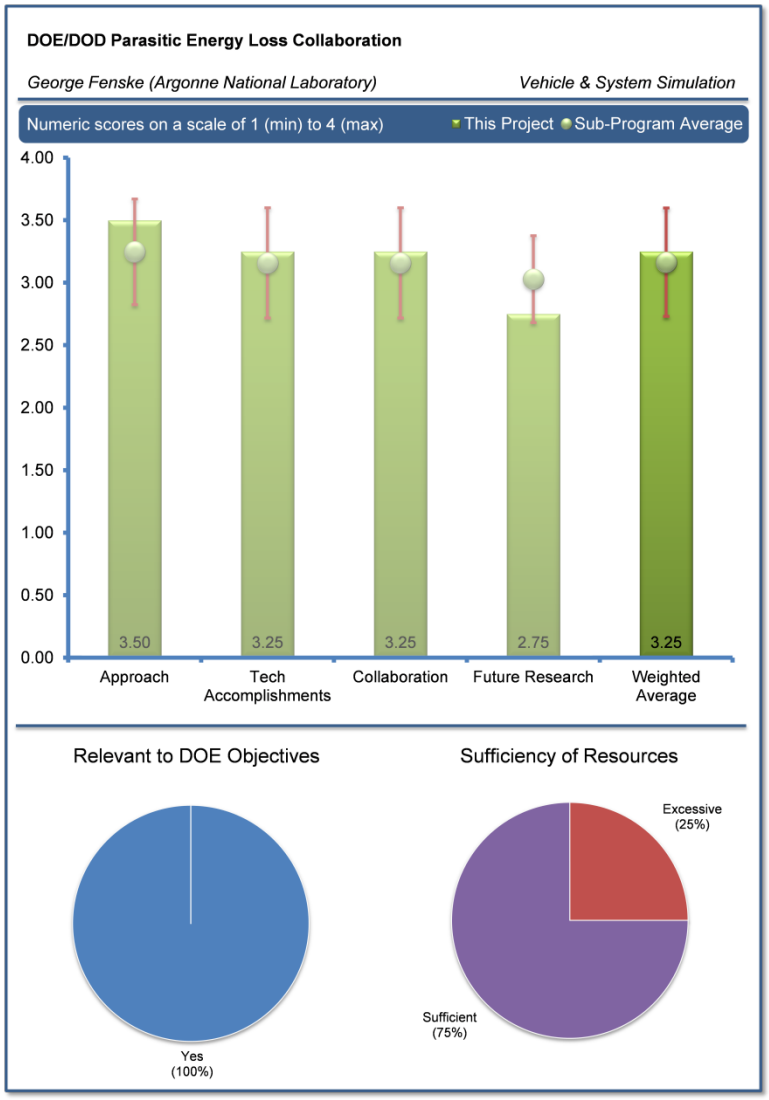
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer believed that the Parker hydraulic hybrid drivetrain (HHD) system was a good system. And that it is necessary in order to understand if the fuel savings will pay off the cost of system. The next commenter stated that the development of the fleet database seems especially worthwhile. Although general route creation has been done before, it would be nice to have drive cycle routes readily available that are independent of the vehicle size, added the reviewer. The commenter suggested that speed targets and stop times should be included; instead of just the measured speed profiles that end up being dependent on the vehicle, driver, and controls used in the tests. The last reviewer stated that on the top two bullet points on the future work slide are more continuations of existing work than anything new. The reviewer added that a better outreach plan is necessary since the FleetDNA database is insufficient in maximizing the impact of this program. The reviewer also believed that it would be good to see a distinction between the other ongoing and similar battery efforts.

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

All three reviewers to respond felt that the project resources were sufficient in order to achieve the project milestones in a timely fashion. The first commentator felt that the project had sufficient resources in order to meet its technical objectives. The next reviewer suggested that a measure of data per dollars spent should be available.

DOE/DOD Parasitic Energy Loss Collaboration: George Fenske (Argonne National Laboratory) – vss005



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One observer reported the stated objective of the program is to reduce fuel consumption. Another observer noted that it was important to be able to measure the impact on fuel economy of advanced tribological concepts, and that this work allows designers and operators to know the cost benefit of using advanced lubricants. The next panel member saw a clear link of friction reduction to fuel savings, and indicated that linkage with the Department of Defense (DOD) is a promising approach to save tax payer dollars and achieve similar fuel savings objectives. The final reviewer stated that powertrain parasitic friction is well understood to have a significant negative impact on fuel consumption in ground vehicles, and pointed out that the results of a quick spin down test performed recently on a heavy-duty diesel engine underscore this (i.e., the drag torque was calculated as approximately 10% of the rated engine torque at normal operating speeds). This reviewer expressed that development and extension of a comprehensive, unbiased, and relatively accurate database should offer a high degree of utility. The reviewer also noted that the title of the project should have been revised to eliminate ambiguity. This reviewer explained that the parasitic losses addressed here are focused on the engine, which should have been explicitly included in the title. The reviewer conceded, however, that engine friction is the largest parasitic friction component in a typical powertrain, so the broad title is technically applicable. The same reviewer concluded that this research is relevant to DOE objectives across a broad range of the mature ground vehicle industry, being focused on internal combustion engines.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer considered friction to be a sensitive and nonlinear physical phenomenon that will require the strong blend of empirical analysis planned here. This reviewer agreed that mapping results across a full matrix of normalized load and speed will insure a broad range of applicability. The same reviewer further commented that this seems like a good compromise because additional combinations can be tested efficiently with the given test setup, and it is just a matter of obtaining extra material samples and some extra time on a dedicated test rig. The reviewer concluded by stating that the coupling of tribology-related durability and reliability characteristics should further improve the utility of the data, and the inclusion of sophisticated crank-throw dynamics analysis to determine impact on the friction mean effective pressure should improve the availability of the data to engine practitioners. Another observer reported that the Principal Investigators (PI) understand the barriers, that the U.S. Military will benefit from this work, and that the new lookup table and model will be a valuable tool for engine designers. The next panel

member liked that the approach will combine with DOD goals, and liked that the testing of available commercial solutions and experimental solutions proposed by industrial partners. This panel member suggested that the researchers work on newer experimental approaches, such as laser engraving and micro embossing in evaluating engineered surfaces. The panel member questioned if there was too much reliance on only testing things that the industrial partners are pulling. This panelist acknowledged that this is a tricky balance, as some of the experimental techniques may never become commercially feasible. However, acknowledged this reviewer, someone needs to do the basic research. The final reviewer indicated that this project adds very little to the current state of the art of engine tribology, and that this effort duplicates research and development that have been well covered over the last several decades. This reviewer pointed out that Ricardo codes being acquired and utilized have been used by the engine community for decades, and these users include GM, Ford, Caterpillar, Cummins, Detroit Diesel, and more. Many of these codes have been validated, continued this reviewer, who further found the work barely complements to the current Massachusetts Institute of Technology (MIT) consortium work and prior work by many. Examples identified by this reviewer include work documented by the following: MIT (i.e., Professors Nam Suh, Ernest Rabinowicz, Victor Wong, Dave Dawson, etc., from the 1970s to date); Japan (i.e., Professor Shoichi Furuhama); University of Michigan (i.e., Professor Dom Patterson); Penn State University (i.e., Elmer Klaus, Larry Duda, Joe Perez, etc.); Wayne State University (i.e., Professor Naeim Henein); Georgia Tech (i.e., Ward Winer, et. al); Midwest Research Institute (i.e., Paul Sutor); National Institute of Standards and Technology (NIST) (i.e., Steve Suh); ORNL (i.e., Charlie Yust); and Argonne National Laboratory (ANL) (Drs. F. Jones and M. Kaminiski in the 1980s and 1990s). The same reviewer remarked that these examples make the point that a literature search would produce the majority of the expected results and outcomes of this project, and revealed that many of these results have used the same tools (simulation and experimental) or similar tools to arrive at validated, high fidelity results. This reviewer concluded that this project is reinventing the wheel.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One reviewer evaluated this project to be on target and on schedule. Another reviewer offered that it was progressing nicely toward goals and that the work is of the highest, world-class quality and well recognized as valuable by the industry. The next observer saw that good progress seems to have been made, overall. This observer indicated that it seemed the Cooperative Research and Development Agreement (CRADA) was added after the fact, and wished that the presenter had explained better the specific benefits the CRADA brings in this case. The observer further wondered if the objective related to a common DOE/DOD strategy was to generate common solutions or to apply a common methodology to generate such solutions. The observer stated that if the first was meant, there was little mention of successful common solutions or the potential of such. If the second was meant, continued this reviewer, good progress has been made. In any case, this reviewer recommended that this ambiguity be clarified. The final panelist reported that TACOM and DOE (ECUT and later on vehicle programs) have sponsored similar programs, and recommended that the researchers check these databases to discover what accomplishments and progress may be claimed here.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer indicated the project exhibited an excellent level of collaboration. This reviewer found it difficult to fully judge as some of the OEM names are confidential. The reviewer further hoped that the CRADA with Ricardo would be signed quickly and would not lead to delays. This reviewer noted that collaboration with universities or small companies would be a plus, but that they may fit better in other DOE programs or projects. The reviewer further saw that collaboration with DOD brought new technical challenges and operating requirements, and indicated this work would likely shed new insight and further advance work on commercial vehicles as new challenges often lead to new innovations. The reviewer liked this approach, and concluded that, if successful here, it might be extended (e.g., by looking at friction problems in solutions in jet engines and applying back to heavy trucks). Another observer indicated that overall collaboration was good, but most collaborators were not full participants. This observer pointed out that the collaborator associated with the CRADA poses a potential concern in that information from this research that would otherwise be directly available may be controlled and metered to industry only at a relatively high expense. The observer found this especially concerning in light of other interested government agencies like the DOD, and recommended careful consideration of this potential conflict. The next panelist saw good collaboration, but suggested that Air Force Research Laboratory (AFRL) be added because they are also working in this area. This panelist recognized that ANL has the expertise in this area, suggested that the PI should publish the work at the Society of Automotive Engineers (SAE), and suggested including

life cycle cost analysis. The final reviewer did not understand the absence of automotive and engine companies, and speculated that the rationale is that the automotive and engine companies are ahead in this research area, some of whom are ahead by a wide margin. The final reviewer conceded that these companies may consider some of the company know-how as a competitive advantage and questioned the role for DOE.

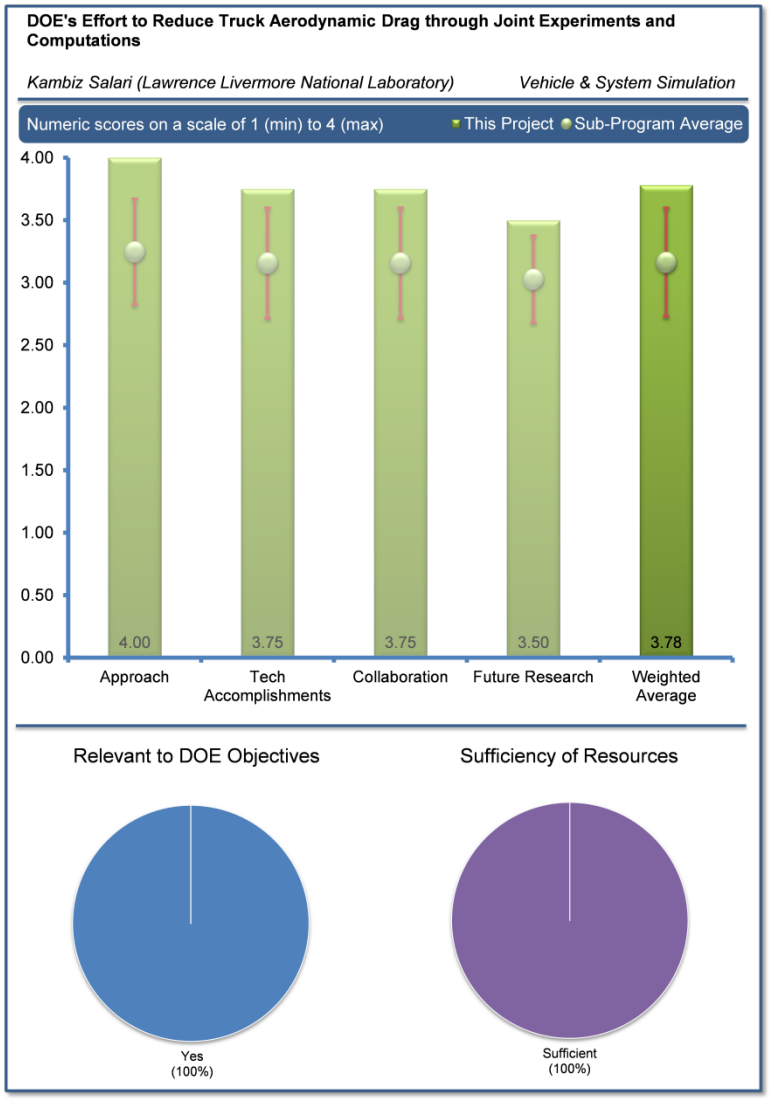
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One panel member found that this research builds nicely on previous work at both ANL and elsewhere. This panel member would have liked to see future work connected to universities and higher risk, higher reward solutions, but accepted that this should be after the current work is well advanced. The panel member indicated that it would be interesting to see what comes out of the relationship beginning with the MIT consortium. Another reviewer observed that most of the planned activity had not been executed yet, and therefore found that this section was not especially relevant. This reviewer pointed out that the engine validation in Phase 3 does not seem to be firmed up yet. The same reviewer suggested that it may be of value to include different types of internal combustion engines of interest for this phase, such as natural gas, gasoline, and diesel. The next observer stated that ANL is the leader in this area, and that while Dr. Choi, who is no longer with ANL, is the founder of nanofluids, ANL still has the experts in this field. This observer emphasized that this is important work. The final reviewer commented that there was no need to duplicate prior work by others.

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

Three reviewers rated resources as sufficient, and another reviewer opined that resources were excessive. One indicated that the resources appeared to be relatively lean but sufficient, and observed a good example of cost-effective research. This reviewer added that the friction testing appeared to be relatively low overhead and specimen material cost is likely covered substantially by the collaborators. Another reviewer agreed that this is a good use of funds, and that the project is certainly not overfunded.

DOE's Effort to Reduce Truck Aerodynamic Drag through Joint Experiments and Computations: Kambiz Salari (Lawrence Livermore National Laboratory) – vss006



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first reviewer commented clear link to fuel savings. This program over many years has been a larger contributor to fuel savings delivered to commercial vehicles on the road. According to another reviewer, this project is demonstrating potential to significantly impact the DOE objectives quickly and cost-effectively. Using the figures provided, aerodynamic treatments may result in a 12% reduction in fuel consumption equating to 3.2 billion gallons or $13 billion of diesel fuel across the entire fleet. If 3% of the fleet adopts these treatments as is estimated in 2012 alone, it is equivalent to nearly 100 million gallons or $400 million of diesel fuel right off the bat. This reviewer noted that trailer skirts are being sighted on the interstates in increasing numbers. Wide-based single tires are also penetrating the market already. This research will help spur adoption rates by providing unbiased high fidelity data to prospective fleets. The third reviewer noted that trailers are an area of low hanging fruit for fuel reducing technologies. Adoption rates of the various technologies are very low primarily driven by a low business case return if the fleets have very high trailer to tractor ratios, causing low average miles per trailer. According to this reviewer, this kind of project has significant relevance because it will get good information out there. For the fourth reviewer, aerodynamics represents one of the largest energy losses on the vehicle. It is also one of the lowest-cost means of improving efficiencies and stands the best chance for commercialization and widespread deployment. Focusing research to reduce aerodynamic drag losses is one of the most effective means towards the goal of displacing petroleum.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

The first reviewer to respond stated that this project is very balanced and well managed. This person observed that the testing began in wind tunnels, moved to tracks, and eventually developed two real fleets. This person also thought that choosing Navistar as the main program manager brought solid aerodynamic and project management expertise to the project. This project is very well done, added the reviewer. The next reviewer mentioned that with the combination of modeling, wind tunnel testing, and controlled field tests, the fleet tests provided really powerful results. The project's willingness to keep pushing the work to new areas such as the tanker and regional vehicle market to promote more fuel saving opportunities is impressive to keep bring more and more fuel savings opportunities to markets. Another reviewer noted that the review presentation was excellent overall. This person believes that the presentation's summary and visuals will help with information dissemination. The reviewer also felt that the cost and payback estimates were lacking and should have been included in the presentation. This reviewer stated that the approach taken to

pre-filter solutions based on commercial feasibility would insure quick adoption in the marketplace. This person added that it will help address the issue of added operation and maintenance costs from aerodynamic treatments and will enable the existing supply base to provide innovative and effective solutions. The use of the full scale wind tunnel on large trucks, though expensive, is a nice use of the facility for the commercial arena. This person mentioned that track testing is also expensive but is vital to provide the unbiased, high fidelity data needed to spur adoption of the technologies by pragmatic fleet owners running on thin margins. This reviewer also felt that the inclusion of wide-based single tires in this research seemed strange since aerodynamics and rolling resistance are largely independent. The reviewer mentioned that it seemed like the present emphasis on the project was only on aerodynamic optimization. The final reviewer observed that the focus on trailer aerodynamics addresses the technical barriers of aerodynamic drag. This person felt that the trailer aerodynamics is only part of the equation and that the research should also focus on the tractor aerodynamics. This person believed that there is an opportunity that still remains to be addressed to treat the tractor and trailer as a single aerodynamic system. The CFD simulation on gap seals did not appear on to be a workable solution that addresses matters such as trailer swing/articulation and back-of-cab access, added the reviewer. This person stated that they would also like to see physical mockup work on gap seals on the vehicle in the future.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first commenter was impressed years ago when they saw large truck OEMs adopting this technology. This reviewer was even more impressed to see that the fleets were now purchasing aftermarket devices from smaller companies to add to their vehicles. This reviewer concluded that while it is hard to make a one-to-one link, it is clear this program has had a large impact in delivering solutions to everyday commercial use. The second commentator stated that they had seen this project presented at a number of truck forums over the past few years and had been impressed with their approach and technical accomplishments. This person remembers seeing the project at American Trucking Assocation Technology Maintenance Council in February, where videos portrayed truck drivers at two different fleets who were sharing their perspectives on how the various trailer technologies affected their operations. This reviewer complimented that the project has had impressive accomplishments in an area that has big opportunities. Another reviewer observed progress being made during the previous year where the buildup and testing of a trailer aerodynamic system collected real-world experience in order to validate the expected savings. This person continued, stating that the collected dataset on Slide 16 indicated the conducted test did not appear to be rigorous. The reviewer observed that vehicle speeds and driving distance varied and that there was no record of ambient conditions. Due to the lack of information, the reviewer believed that the fuel economy values made it difficult to draw meaningful conclusions. The final reviewer felt that it was unclear how much of the plan was currently completed (as a percentage) and what the planned project completion date was. All of the technical accomplishments are self-evident by the fact that and increasing number of trailer skirts and wide-based single tires are being sighted on the interstates. There is ample evidence of actionable data to date.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The first viewer to respond stated that this project was technically excellent and showed strong collaboration and the ability to work with companies of all types and sizes. Another commenter said that there was a good use of resources such as Lawrence Livermore National Laboratory, fleets, and technology suppliers. The next responder to comment felt that the program seemed to have a good composition of partners relevant to the program including trailer, trailer aero, truck OEMs and fleets. Michelin's involvement in an aerodynamics program, however, seemed confusing, added the reviewer. The last commentator stated that this research is a good example of strong, broad-based industry collaboration. This person added that the level and quality of communication regarding this research is outstanding and the effects are self-evident by the relatively quick rate of adoption in a value conscious industry.

Question 5: Has the project 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?

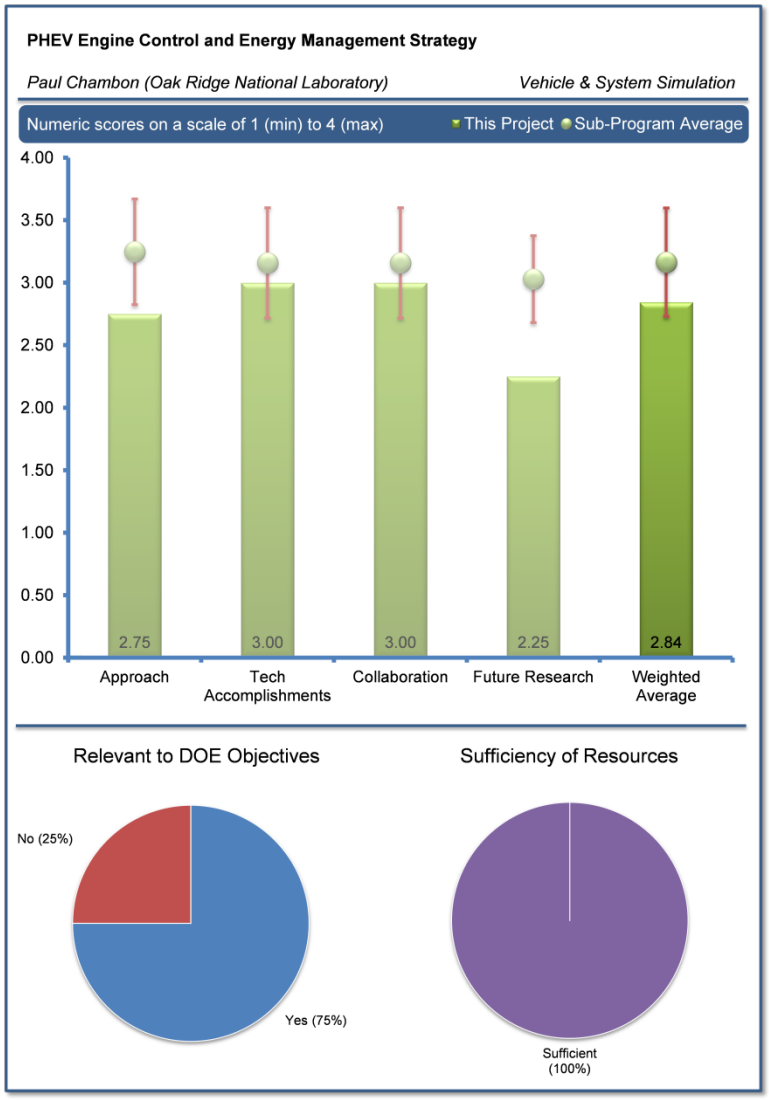
Reviewers had positive feedback on proposed future research. The first reviewer is looking forward to seeing what this team will attack next since they seem to consistently come up with new projects to complete. A different reviewer stated that transitioning to tankers seemed like a reasonable next step, given the significant opportunities to reduce aerodynamic drag. This person added that

they would also like to see work done on the tractor, since it is also a significant contributor to aerodynamic drag. The third reviewer stated that dry van trailers had the highest tractor to trailer ratios since they are used as stationary inventory storage. This person felt that lowering the miles driven will show a potential for fuel savings. Future work can be in tankers and flatbeds, where the tractor and trailer tend to stay connected giving the trailer more miles, added the reviewer. This reviewer stated that this project should be extended if funding is available. This person believed that the work completed could also help support the Environmental Protection Agency (EPA) and National Highway Traffic Safety Administration (NHTSA) with future greenhouse gas (GHG) regulations that will include trailers. The final reviewer felt that focusing on tankers seemed like a good next step, especially since the tractor/trailer ratio of tankers is nearly 1:1. The reviewer stated that this means the equivalent cost of the added aerodynamic treatments to the trailer will only be a third of that of a typical on-highway application with a tractor/trailer ratio of 1:3. Special consideration should be given to refrigerated trailers which also have a tractor/trailer ratio closer to unity, added the commenter.

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

All four reviewers to respond felt that the project resources were sufficient. The first reviewer to respond stated that a lot of work had been accomplished for a budget of $500,000. This person felt that the outcomes delivered appeared to be proportionate to the resources provided. Another commenter mentioned that this project seemed to be balanced and appropriate. A third reviewer said the resources appeared to be sufficient given the broad range of collaborative support and facilities. This person added that this is not an inexpensive program but the payback has been well demonstrated. Foreseeably, this research could extend for some time and continue to add value (although oddly a planned end date was not provided). This person felt that this project will experience diminishing returns and future resource levels should be commensurate with this. The final reviewer said that the funds are adequate but not excessive. This person added that this group delivers results and should be kept funded even if other opportunities must be cut by shrinking budgets.

PHEV Engine Control and Energy Management Strategy: Paul Chambon (Oak Ridge National Laboratory) – vss013



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One commenter observed that this project is investigating initial strategies to mitigate criteria pollutants associated with cold starts, which are expected to be more frequent with plug-in hybrid-electric vehicles. Another investigator believes that by addressing this issue this project supports the proliferation of PHEVs which support petroleum displacement. The next commentator stated that HEV cold start issues had been addressed by OEMs, and that they would be taken care of adequately in PHEV by these same OEMs. By all forecasts, the penetration of PHEV in the future or near future would be small; therefore, the potential of using them for petroleum displacement would be minimal. The last reviewer stated that the cold start emissions are the leading challenge facing a successful commercialization of PHEVs. This person believes that the task of working to coordinate engine and hybrid vehicle control strategies in tandem will minimize cold start emissions and optimize fuel economy.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer said that the approach taken is quite robust, given the limitations of one vehicle and one powertrain being tested. Another reviewer stated that the approach is reasonable utilizing engine-in-the-loop coupled with a simulated vehicle environment. The basic engine is characterized and control strategies are implemented through an open source prototype engine controller. The reviewer continued, stating that the existing modeling capabilities through Autonomie are leveraged and hybrid vehicle and engine control strategies as a system are assessed by utilizing results from the ANL-ORNL simulation study. This person believed that the focus is to coordinate both engine and vehicle control strategies as a system to minimize PHEV cold start emissions while optimizing fuel economy. Another commenter stated that the project did not have the equipment fast enough to study transient hydrocarbon emissions. This person questioned if the equipment could be rented or borrowed from someone. The last reviewer to respond stated that this small project addresses a specific issue and will provide insight into specific strategies to solve cold start emissions as well as improve vehicle modeling in Autonomie.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One reviewer felt that good progress had been made once an industrial partner stepped up. The next reviewer to respond stated that the technical accomplishments and quantification of results for the project had limited. This person felt that this was due primarily

to the difficulty in acquiring a production controller from the industry. Most technical accomplishments have been related to set up and commissioning of the system (both hardware and simulation), though initial testing results are starting to filter in, continued the reviewer. A good example, given by this person, was the implementation of a stratified crank and how it has shown demonstrable improvements in cold start hydrocarbon emissions. This reviewer continued stating that simulation work had been completed to determine optimal vehicle control strategies and that the vehicle system control and engine control strategies still need to be coordinated. Overall, this person believed that it is difficult to determine the success of current technical accomplishments given the paucity of data since there appears to be a fair amount work still to be done to achieve completion by the end of Fiscal Year (FY) 2012. Another reviewer expected more progress to date for the overall budget and duration that this project described. This person observed that the project team had rallied late, by installing the engine on a better dynamometer system that could support hardware in loop testing of the complete hybrid powertrain, especially with the technical support from their new partner, Bosch, for the engine controls access. The last commentator to respond felt that this project was finished sluggishly.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer stated that as of FY 2012, it looked like the external partners were fully engaged in the project. Another reviewer felt that the level of collaboration seemed appropriate given the scope of the project. This person, as well as the next reviewer, believed that it would be beneficial to see more coordination with the OEMs as to direction of the task and possible post FY 2012 activities. The last reviewer felt that the project is purely a learning exercise if the project does not get better support from OEMs.

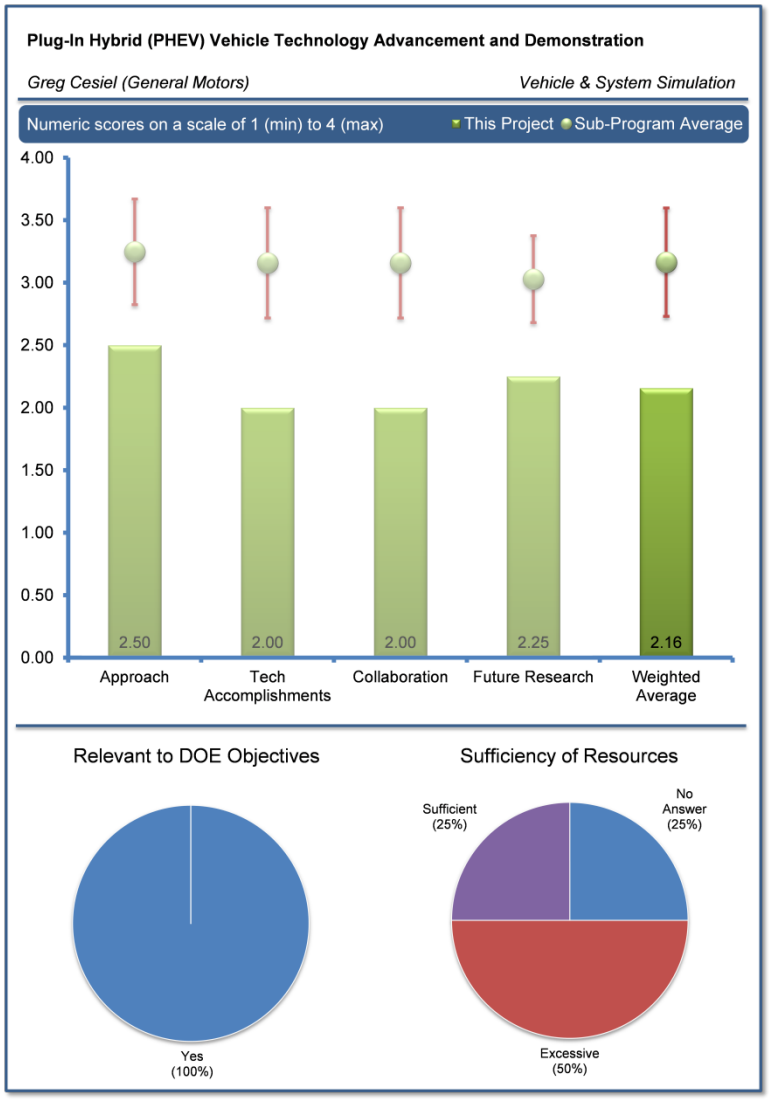
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer to respond felt that the proposed future work was appropriate as this task is scheduled to conclude at the end of FY 2012. This reviewer mentioned that the proposed post FY 2012 activities should be carefully vetted with the industry. Another commenter felt that the future plans should build on the results achieved. This person expressed that the impact on overall fuel consumption of the new cold start strategy should be examined, as well as the integration with control system strategies. The next commentator stated that this project had ended and that no significant insight was offered. The last reviewer to respond noticed that the project ends in FY 2012. This person said that it was not clear whether hydrocarbon traps are the most fruitful area of study given the progress made on expediting warm up and maintaining catalyst temperatures.

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

All four reviewers to respond felt that the project resources were sufficient. One commenter stated that the resources appeared adequate to accomplish the milestones. Another believed that the current project team and resources seemed sufficient to complete the task. The last reviewer felt that the resources were sufficient, but not well spent.

Plug-in Hybrid (PHEV) Vehicle Technology Advancement and Demonstration Activity: Greg Cesiel (General Motors) – vss018



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer stated that because hybrid vehicles will no doubt use less petroleum-based fuel, the project will reduce use of petroleum-based fuel. Another panelist noted that PHEV development clearly supports DOE objectives for petroleum reduction. The last panel member remarked that PHEVs are one of the best ways of reducing fuel consumption, which should fit the overall DOE program goal.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One person indicated that the whole approach in general was good, and the key possible technical barriers were identified. Another observer noted that testing and development plan appears to be sound, although very little detail and results were presented to substantiate this. The next reviewer stated that no data or figures support the approaches, and observed only vague wordings or statements. The final panelist noted that the presented objectives of the program appear to be a moving target. This panelist suggested the reader compare Slide 3 of the 2011 presentation to that of the 2012 presentation.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One reviewer indicated that the GM presentation was a weather report, with no substantive technical material presentation. Because there was nothing to show, this reviewer could not evaluate the project, and declined to provide any further scoring. Another panelist concluded that because little or no actual data and results were presented, it was impossible to truly assess progress on the project. This panelist reported that the presenter said the project is on track and has achieved its goals, but offered no proof. The next observer did not find it clear in the presentation that technical targets have been met. This observer agreed that no substantive results or data were presented to support technical accomplishments. The observer pointed out that charge infrastructure was presented as a barrier, but no action was present in this project to address that barrier. This observer concluded that either the barrier should be removed, or technical scope should be added to the project to address such barrier. The final reviewer could not quantify the program progress without any numbers and figures. This reviewer was surprised at the lack of detail presented and was disappointed that the PI was unable to make the presentation.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One panelist reported that two project partners were identified in the presentation, but that details of the role and the extent of the collaborations were missing. Another person said that little collaboration was apparent, and that no results were presented for peer review. The last reviewer noted the project sounded like it had all partners involved, but had no results with data and figures to support it.

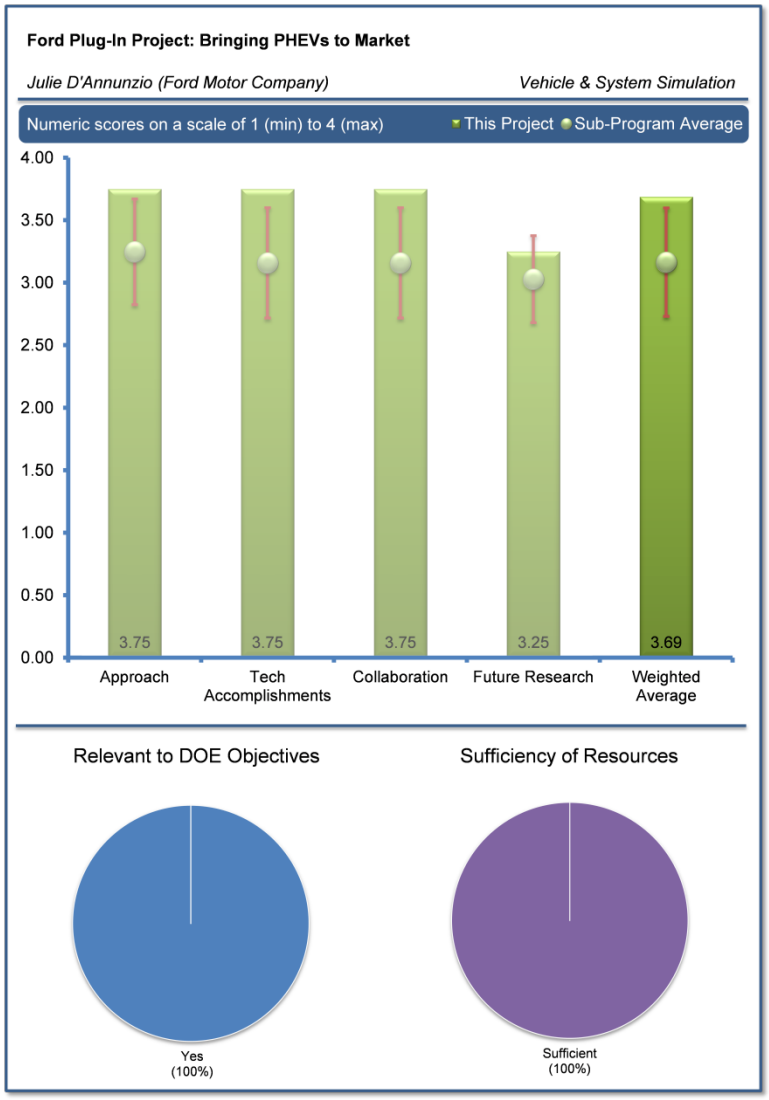
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One person noted the program to be well conceived and future work well planned, and expressed hope that detailed results will be forthcoming. Another person relayed that although the program is winding down, no details were provided on what is next. The last panelist said that too little information was available from the presentation to make any comments.

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

One reviewer observed sufficient resources, while two other reviewers found resources to be excessive. The first reviewer noted that GM resources for vehicle development and testing were excellent and appeared to have been applied to the program appropriately. The second reviewer agreed that given what was presented, it was impossible to judge resources. The final reviewer stated that without reporting tangible progress, the resources can be viewed as excessive.

Ford Plug-In Project: Bringing PHEVs to Market: Julie D'Annunzio (Ford Motor Company) – vss019



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer stated that the displacement of gasoline miles with electric miles clearly supports the reduction of petroleum use since passenger vehicles are considered a big market. Another commentator stated that grid connected electric vehicles have potential to displace a significant amount of petroleum usage in U.S. transportation sector, especially in the light-duty sport utility vehicle market.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

The first commentator affirmed that customer focused development is key to long-term success of commercializing these advanced technologies. Another commenter stated that this project seemed to have been a relatively early, low-budget (pre-ARRA) project with the "let's just try it" mentality. The person added that, as early experience came in, the designs and expectations were modified to make the vehicles work better.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One reviewer noted that, in addition to vehicle performance accomplishments, the team discovered something key to the actual utility of the plug-in hybrid vehicle in the real-world: people just do not bother to plug in. This is interesting and important, but may be correlated with the vehicles not being for personal (or family business) use. According to this reviewer, different types of users might behave very differently, so this needs to be examined. The last reviewer that responded noted that the technical progress is evidenced by planned introduction of a production vehicle that uses the technology advancements from this project.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The first reviewer stated that there is evidence of strong collaboration with potential customers and validation partners. Another commentator responded by saying that the collection of utility partners is quite impressive, but additional types of users would give a much more balanced view of PHEV (and user) performance in the real-world.

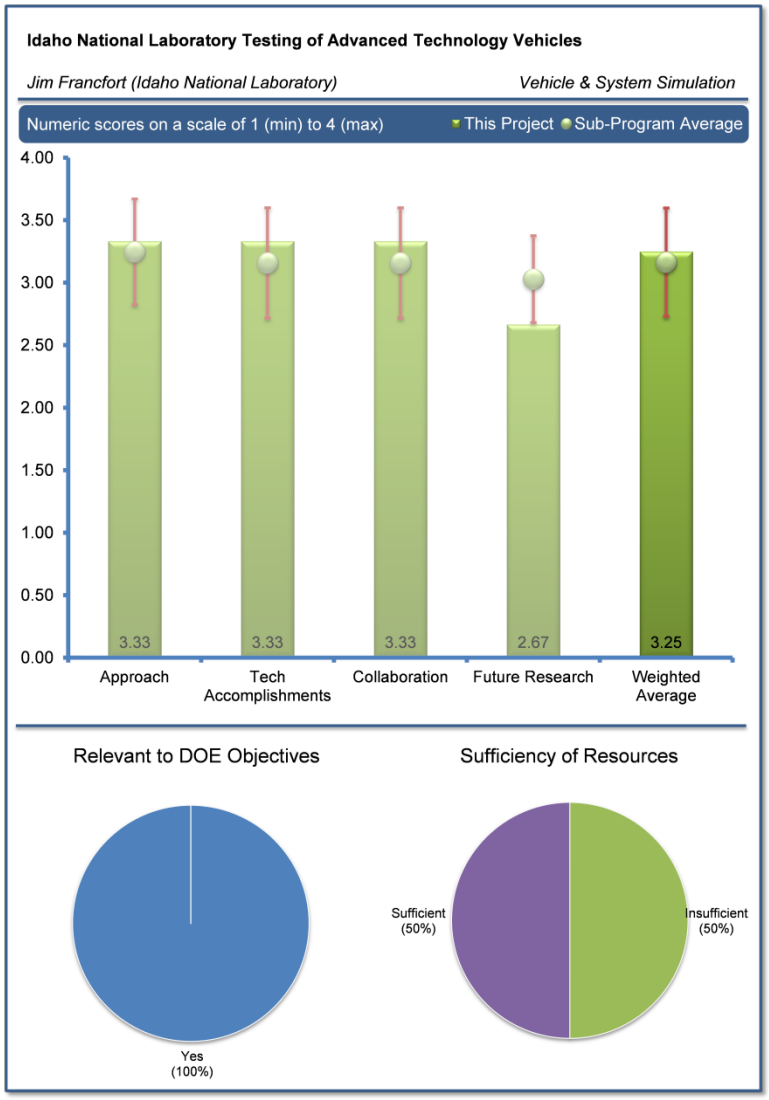
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One reviewer stated that the future work indicates focus on harvesting potential for customer realization of fielded technology benefits as well as documentation of fleet performance; these are enablers for future sales of this technology in the market place. Another reviewer stated that future work would include a continuation and completion of tasks already underway. Not thrilling or innovative, just solid, added the reviewer.

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

All four reviewers felt that the project resources were sufficient. One reviewer stated that this project looked cheap after seeing many of the ARRA projects.

Idaho National Laboratory Testing of Advanced Technology Vehicles: Jim Francfort (Idaho National Laboratory) – vss021



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One commentator stated that this project covers a broad range of technologies with real-world miles. Another investigator stated that this project clearly supports DOE's objectives by providing a well-constructed testing regimen for plug-in electric vehicles and EVSE that is not occurring elsewhere. The last commenter to respond stated that this project performs real-world assessments of high fuel economy (energy efficient) vehicles and determines which vehicle powertrain arrangements/features use the least energy in real-world driving conditions. The results are honest assessments of each technology and completely independent of the OEMs selling the vehicle, added the reviewer.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One responder stated that this project appears to be well-designed to gather copious amounts of useful data. Another reviewer said that although the broad range was good so far, both best and most likely to succeed technologies need to be identified. The last reviewer to respond stated that the efforts to address the cost barrier are not clearly explained or identified. This person stated that the main barrier is likely vehicle cost to the consumer despite the project's low-cost vehicle testing product. The reviewer continued by saying that it should be more clearly described how the assessment of vehicles reduces their overall cost, especially if a production vehicle is being tested.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One reviewer said that the progress in overcoming the cost barrier was not clearly identified in the presentation. According to the second reviewer, a significant amount of testing has been performed in many different areas. It was unclear in the presentation how each of the accomplishments relates back to the objectives/barriers. According to this reviewer, the presenters should do a better job of clarifying this. It seems like there are a lot of different projects occurring, but nothing is tying them together (back of the objectives). This reviewer recommends that accomplishments should quantify how much of each objective was satisfied; total progress toward goals is not clear currently. The last reviewer to respond stated that it was unclear how the end state of vehicle testing is defined in this project. Based on the information provided, there are 30+ million miles of data collected with thousands more vehicles on the road providing data; potentially generating 100+ million miles of data. This person was unsure on how many millions of miles worth of data it would take before a conclusion that electric drive vehicles worked or did not work. This reviewer

added that the volume of data produced by this project seems to contradict the public perception that electric vehicles are a new and unproven technology, yet EVs continue to be treated as a mystery. The reviewer concluded by stating that something is missing in this project that is preventing the scores of data collected to be translated into concrete, actionable analyses.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One evaluator stated that there is excellent work coordinating with manufacturers, councils and public groups occurring in this project. Another reviewer felt that it seemed like the partners are working together well, and that data is being communicated between them through the reports being generated. This person stated that it was not clear what and how much vehicle manufacturers are learning from the testing at INL that can help them improve their products. While testing for the DOE to verify OEM claims is important, this may limit the impact of INL testing on removing barriers related to improving the next generation of vehicles, stated the reviewer. The last reviewer stated that while the team's success in leveraging matching resources and forging industry partnerships is admirable, the communication within the federal government's fleet management community is lacking. This reviewer believed that a stronger outreach program is called for. DOE has the ability to influence the federal fleet more directly than private entities or individual consumers, yet, most fleet managers appear oblivious to the presence of these data, remarked the reviewer.

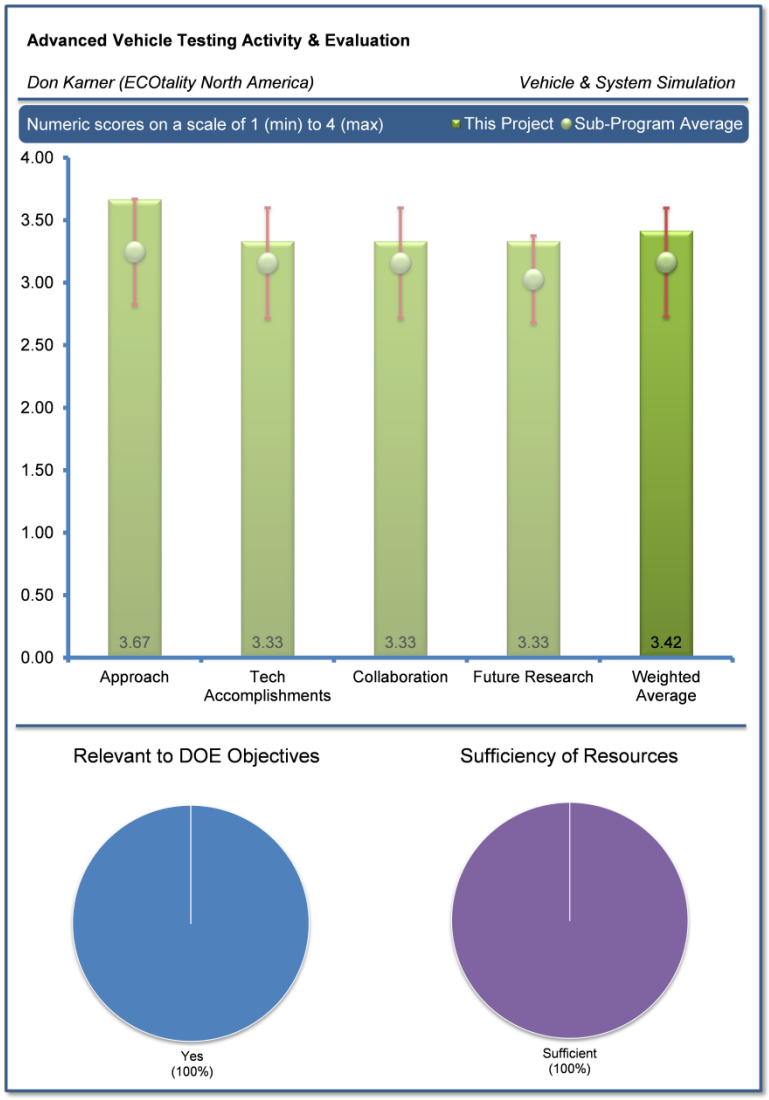
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One reviewer observed that the project was emphasizing conductive EVSE and wireless charging. Another reviewer stated that work will continue in many areas, but was not clear whether the proposed work would help meet the objectives stated. The future work was very general sounding and more specific information should be provided, added the reviewer. The last commentator to respond felt that, with the exception of wireless charging, the proposed future work does not suggest any new lines of activity that might advance new technologies or better inform consumers regarding current technologies. This person added that the data produced by this project are tremendously valuable, but the project risks stagnation if there is not a more cohesive and, frankly, ambitious vision for the future. Simply testing new models of vehicles does little to address the underlying problem that consumers are generally hesitant to adopt electric vehicles. This reviewer noted that producing summary reports is great, but the reviewer would like to know who is using those data to solve problems. This team reports that the Dodge Ram PHEVs are averaging about 19 mpg. Chrysler has indicated that the vehicles are supposed to get roughly 35 miles per gallon. This reviewer believes, unless there is a misunderstanding in interpreting the data, there is a pretty huge discrepancy between these results. Yet, according to this reviewer, rather than dig deeper into why that discrepancy exists, the team proposes to test additional vehicle models. The reviewer concluded by stating that if 30+ million miles of data are insufficient to address these issues, it is unclear what another 100+ million miles will provide.

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

Two reviewers found that funding is insufficient. One reviewer said that this project could use additional resources to perform a deeper analysis of the data it has already collected and expand its outreach efforts. Two reviewers found that funding is sufficient. A reviewer stated that project funding could increase if specific goals are expanded. Another reviewer felt that the resources appeared to be sufficient for vehicle/component testing. The equipment and testing procedures for advanced powertrains is evolving rapidly, so INL should work to meet or exceed the capabilities of OEMs.

Advanced Vehicle Testing & Evaluation: Don Karner (ECOtality North America) – vss029



Reviewer Sample Size

This project was reviewed by three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer stated that Antelope Valley Transit Authority is very important in order to speed the development of EVs for personal transportation. A second commenter felt that data collection and open publication on real-world performance of electrified vehicles will help researchers and infrastructure providers understand the societal impact. The independent evaluations of the various architectures and makers will help consumers make informed choices, thereby strengthening the market. The last reviewer stated that this is a key infrastructure contract for DOE to evaluate the actual field performance of multiple vehicle technologies.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer stated that the project and operations appear to be well organized and tracked. The reviewer continued saying that the approach appears successful in conducting the required testing on behalf of DOE. Another commenter stated that the team has long experience in this field and is committed to staying current in this rapidly changing space and that the technical barriers seem surmountable by the research team. The next respondent stated that this program is mature and has been refined over the years to be sharply focused on providing consistent unbiased data to DOE and the industry. Now that several EVs are in the mainstream market, this program could serve additional duty as a consumer information program. The reported results would need to be repackaged and presented in a more consumer like fashion, added the reviewer. The expert continued to mention that one of the public's concerns is the life of the battery pack. By using this program as outreach, perhaps more consumers would be persuaded to purchase EVs.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One reviewer stated that the data collection is conducted on plan and on schedule with on-going quality checks. Another respondent felt that the program appeared to maintain the balance of testing production vehicles and enough new pre-production technology to keep it at the leading edge. This reviewer continued saying that this is a large program that stays in front of the technology helping to pull it into the mainstream while weeding out the lesser solutions. The final reviewer stated that the project appears on track for all relevant measures. This reviewer added that this project is service-oriented rather than development of new technology.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One respondent felt that the collaboration with INL was effective and essential. It is thus beneficial to maintain a long-term relationship, expressed this reviewer. Another reviewer stated that the collaboration with technology developers, vehicle manufacturers, and fleets is strong and seemingly productive. The next reviewer stated that it was not obvious if there was an additional opportunity to look for best practices in vehicle testing from the private sector (reaching beyond basic contract terms). This reviewer would encourage the project to collaborate on efficient test methods with OEMs that have done this kind of field testing for years. If this collaboration happens with the private sector (i.e., outside the National Lab partners), it is not obvious from the presentation, added the reviewer.

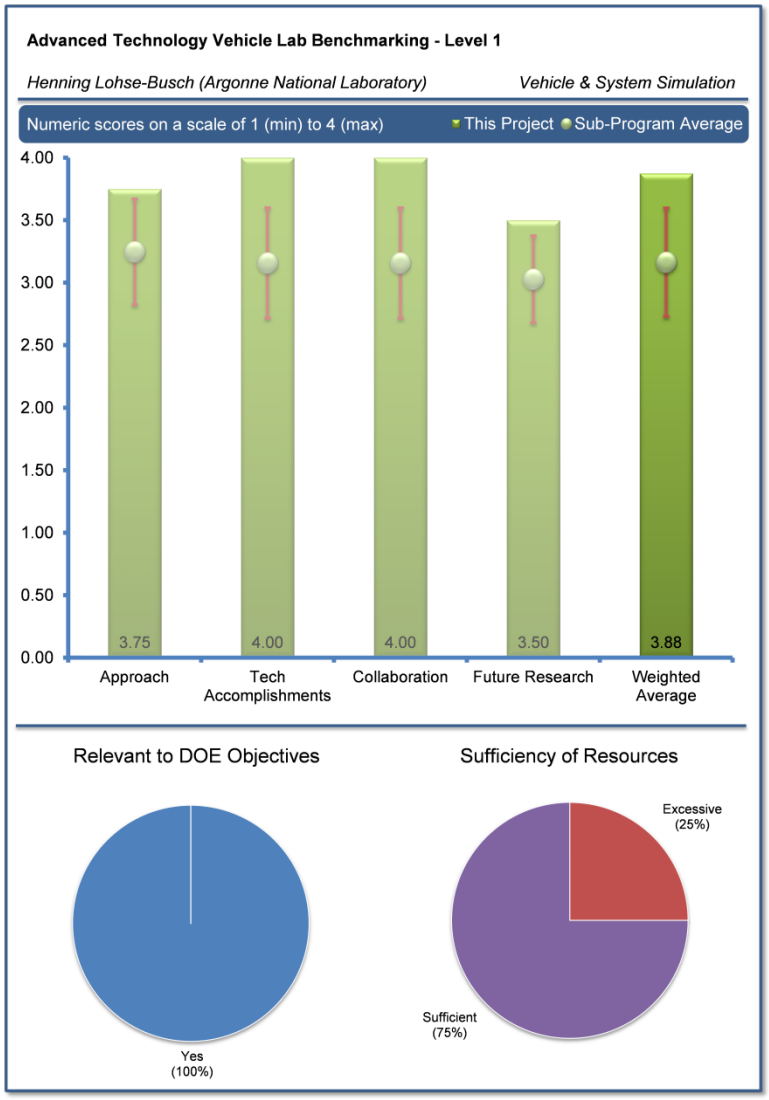
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One responder stated that based on previous performance they do not anticipate any difficulty with future projects of a similar nature. Another reviewer said that continuous upkeep of test procedures is evident. The commentator continued, stating that future research is guided by DOE technology selections. The last reviewer stated that despite being early into the new contract, there are no known disconnects related to resources versus performance expectations of the project.

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

All three reviewers to respond felt that the project resources were sufficient. The first reviewer commented that the resources necessary to conduct this testing appear sufficient. Given the nature of the work and the history of the program the cost estimating process should be mostly academic. Another reviewer felt that the resources appeared to match the need to execute as vehicles are available to test. The use of private fleets for mileage accumulation seems appropriate and well-executed. The last commenter to respond agreed in saying that the projects are executed on schedule.

Advanced Technology Vehicle Lab Benchmarking - Level 1: Henning Lohse-Busch (Argonne National Laboratory) – vss030



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first commenter felt that advanced technology vehicle testing is important to benchmark the state-of-the-art for powertrain systems and components. This independent evaluation of technology facilitates confidence in the technology and provides a basis in which to establish technical targets for the next generation of advanced vehicles. The reviewer continued by saying that testing acts as an enabler to accelerate technology development (feeding results back to industry) and commercial implementation. The next reviewer believed that benchmarking is critical in order to give DOE a reference for future project decisions and evaluations on technology performance and relevance. The final reviewer agreed and said that by benchmarking the leading EV technology, petroleum displacement is supported by speeding the development of effective and practical EVs.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

The first reviewer commented that the project's approach has been perfected over the years and the ideas for improvement are revealed along the way as new testing challenges emerge. The second reviewer remarked solid approach refined over years of experience. According to the third reviewer, this task is well-established and mature having been in existence since 1998. The reviewer added that most of the earlier challenges have long since been worked out and resolved. A proficient testing approach customizable to specific vehicles has been established. The commentator continued to state that a continuous improvement in testing procedures has been achieved and standards test plans including instrumentation and drive cycles. Test facilities and instrumentation have been steadily built up over the years and largely completed with the recent commission of five-cycle testing and hot (solar) and cold testing capability. A well-defined sequential process has been established between ANL, other DOE labs, and U.S. Driving Research and Innovation for Vehicle efficiency and Energy sustainability (U.S. DRIVE) to identify, select, and evaluate advanced technology vehicles. It is not likely there are any significant glitches in the approach or process at this stage; however, there may be smaller opportunities to further enhance overall operating efficiency which should be continuously explored and implemented. The last commenter felt that there was an excessive amount of detail on few vehicles that were likely to miss incremental improvements in technology.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first commenter stated that benchmarking of lower cost HEV technology was completed and provided characterization of other leading EV topologies. The second reviewer stated that given the level of funding for this task in FY 2011 ($850,000) and FY 2012 ($600,000), technical accomplishments and progress appear adequate. The Hyundai Sonata P2 (parallel) HEV has been benchmark tested, the Nissan Leaf efficiency (including systems)/range at hot/cold temperatures has been established, and J1711 concepts validated on the Chevrolet Volt, added the same reviewer. A significant number or publications and presentations have been generated. The third reviewer said that this Level 1 benchmarking has had a refined process over many years of experience. The person added that it accomplishes its mission and that the challenge now is to adapt to new capabilities of lab facility (e.g., hot/cold conditions). The final reviewer felt that the goals were too narrow, despite the good progress being made against them.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The first reviewer stated that collaboration and coordination is well established for this task with SAE (domestically and internationally), U.S. DRIVE and OEMs, other DOE labs, as well as internally with ANL modeling and simulation. The level of collaboration and coordination is good for this effort; nonetheless efforts should always be active to consider broadening collaboration as necessary. The second reviewer believed that ANL collaboration and coordination is critical due to the position they occupy in the process. They are in the center of the activity coordinating with every direct EV stakeholder. Another reviewer said that it appeared that the project communicated well about the collaboration that is ongoing in the industry related to this benchmarking activity. The reviewer continued to add that this project particularly emphasizes the involvement of public/private interests. The final reviewer pointed out that the data was open to wide range of industry as well as academic and government entities.

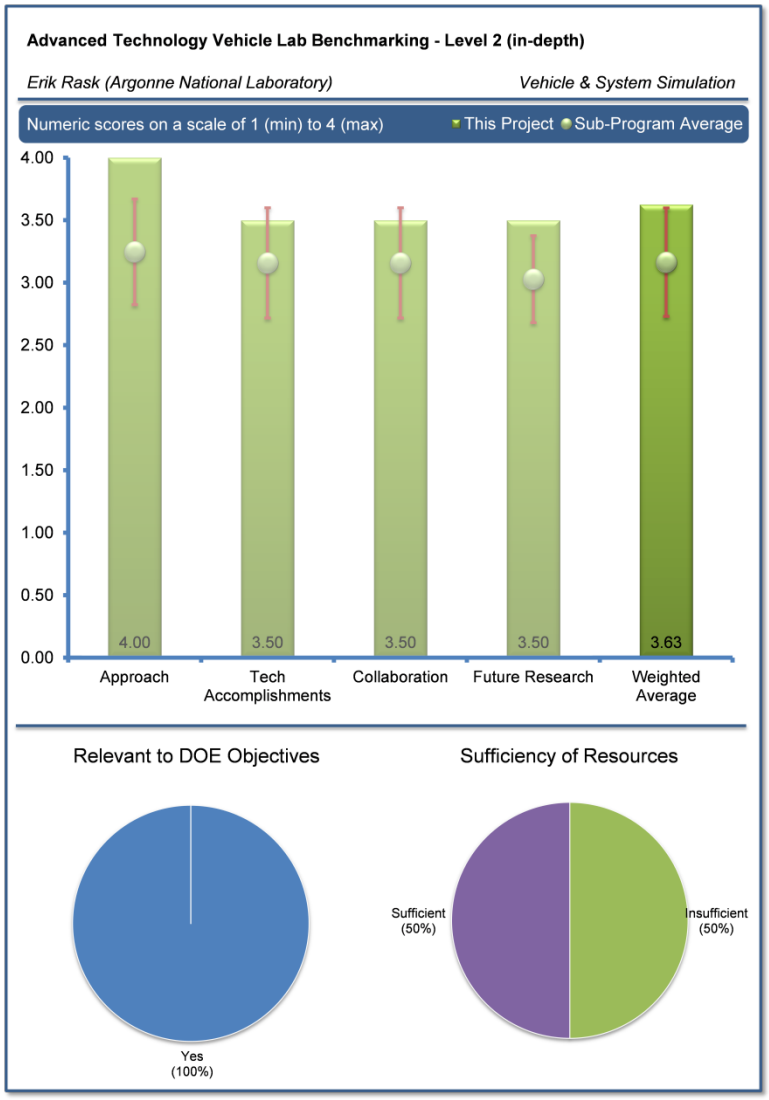
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer stated that future research is right on target with the current hurdles EVs face, i.e., operating at extreme temperatures without a significant loss of range and efficiency. The reviewer agreed that overcoming this barrier is necessary for widespread EV proliferation. The next re4viewer stated that as a data collection/dissemination service project, ongoing work is tied to selection of vehicles for test and timely performance of same. This person described that the future work is more of the same and seems appropriate. The final commenter mentioned that proposed future testing activities are based on outcomes of DOE/INL/ANL/ECOtality summit meeting. This person continued saying that only vehicles that have unique technical features or upgrades are considered for testing. The reviewer described that many OEMs are now adding novel warm-up hardware and controls and the new PHEVs/ battery electric-vehicles are coming out from OEMs.

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

Three of the four reviewers to respond felt that the project resources were sufficient. One of the reviewers said the modest budget appears to be sufficient for the level of work planned for execution. Another reviewer stated that current throughput was probably matched with funding level. This reviewer acknowledged that with more OEM offerings arriving on the market globally (with unique architectures/component sets) DOE should consider biasing more funding to this activity. The final reviewer stated that this task is adequately funded. This reviewer noted that steady efforts should be made to further improve efficiencies and lower testing/evaluation costs if at all possible. Per this reviewer, this is a good time to do this as facility upgrades are now completed, in operation, and utilization processes under way. The final expert to comment observed that a lot of money was used to test eight vehicles, most of which already have publicly available data.

Advanced Technology Vehicle Lab Benchmarking - Level 2 (in-depth): Eric Rask (Argonne National Laboratory) – vss031



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer felt that this project had a good objective. One of the commentators agreed that benchmarking is critical in order to give DOE a reference for future project decisions and evaluations on technology performance and relevance. Another reviewer stated that ANL Level 2 benchmarking is at the leading edge of EV technology and showcases what is possible for today through detailed data, speeding the adoption of new EV ideas and advanced non-EV vehicles. The final reviewer stated that advanced technology vehicle testing is important to benchmark the state-of-the-art for powertrain systems and components. This reviewer continued saying that this independent evaluation of technology facilitates confidence in the technology and provides a basis in which to establish technical targets for the next generation of advanced vehicles. This reviewer also believed that this testing/evaluation acts as an enabler to accelerate technology development (feeding results back to industry) and commercial implementation.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer said that this project is excellent work and appears to be well organized to accomplish the intended detailed (component and systems levels) performance data. The reviewer concluded that this is a good natural extension from Level 1 benchmarking effort. According to the second reviewer, the Level 2 benchmarking and the vehicle selections keep the focus on practical petroleum displacement. By selecting non-U.S. market vehicles new ideas can be introduced into the U.S. product development process. Propulsion design and control remains both art and science. Concluded this reviewer, this is excellent work. Another reviewer found that the Advanced Technology Vehicle Lab Benchmarking – Level 2 is the in-depth invasive instrumentation/testing used for detailed analysis of power flows, components, duty cycles etc. for a small subset of vehicles of particular interest to DOE and OEMs. Only vehicles with specific uniqueness of their technologies and thought to be on the cutting edge of advancements are selected for Level 2 testing. According to this reviewer, this task is well established and mature with most of the testing/instrumentation challenges having been previously worked out and resolved. A proficient testing approach has been established with a continuous improvement in testing procedures, and test plans including instrumentation and drive cycles. Test facilities and instrumentation have been steadily built up over the years and largely completed with the recent commission of five-cycle testing and hot (solar) and cold testing capability. This reviewer concluded by stating that it is not likely there are any significant glitches in the approach or process at this stage given its maturity; however, there may be opportunities

to enhance overall operating efficiency which should be continuously explored and implemented. The final reviewer observed that the project provides data not available from other sources and that can be used to guide future work.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The reviewers generally felt that the information provided was comprehensive and showed useful data and formatting. One commenter stated that the project appeared to be on track. This person continued to say that given the level of funding for this task in FY 2011 ($850,000) and FY 2012 ($200,000), technical accomplishments and progress are good. Another reviewer continued saying that this task has conducted detailed analysis of the Hyundai Sonata including electric machine evaluation and cold start strategies. Another reviewer acknowledged that the Chevrolet Volt's unique charge sustaining operation and overall operating strategy have been examined while the Volkswagen TSI has been extensively benchmarked including its use of a reduced engine size, boosting, and a low-loss transmission. The last reviewer mentioned that with the temperature control of the dynamometer test chamber, Level 2 testing can achieve a new level of significance for DOE and the industry.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One commenter stated that there is a broad range of industry and other groups involved in this project. Another reviewer felt that collaboration and coordination is well established for this task with SAE for standards activities (domestically and internationally), U.S. DRIVE and OEMs, other DOE labs, as well as internally with ANL modeling and simulation. The same reviewer felt that the level of collaboration and coordination is good for this effort; nonetheless efforts should always be active to consider broadening collaboration as necessary. The third commenter mentioned that the network of other institutions is obvious and extensive. This person said that, similar to a 2011 comment, the presentation could include a block (process) diagram for how the collaborative community chooses the vehicles for tests (not just why they were ultimately chosen). This person felt that the block diagrams emphasize on how the voices of the collaborators are integrated for selection. The final commentator suggested that due to their position in the test process, ANL must collaborate and coordinate with the main industry and government stakeholders.

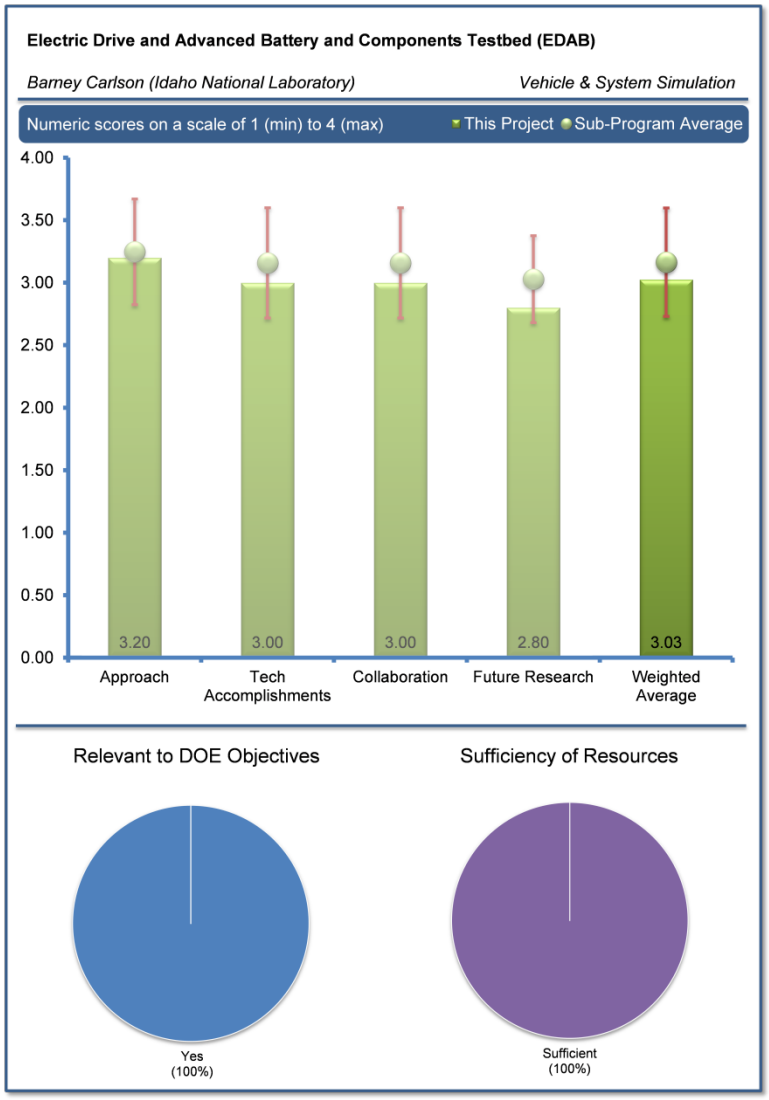
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One reviewer mentioned that the Peugeot 3008 HYbrid4 will be evaluated given its unique vehicle configuration as a diesel hybrid with a stop-start system. This person noticed that this system allows for many different and unique operating modes. Given limited resources in FY 2012, this reviewer feels that the Peugeot seems like a good choice. The second reviewer believed that the testing of the Peugeot will likely reveal new concepts for propulsion design and control that yet to be employed in the U.S. industry. This reviewer believed that this will help the U.S. industry remain relevant and perhaps spawn new ideas yet to be tried anywhere. Another commentator stated that as a data collection/dissemination service project, ongoing work is tied to a selection of vehicles for testing. Future work is more of the same and seems appropriate, added the commentator. The final reviewer remarked that only one vehicle limits the scope.

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

Two of the reviewers to respond felt that the project resources were sufficient. Two experts thought the project’s resources were insufficient. According to one reviewer, this task will probably need to be more sufficiently funded in the future given the range of new vehicle entrants both across electric drive and advanced conventional technologies. Steady efforts should be made to further improve operating efficiencies and lower testing/evaluation costs if at all possible. According to this reviewer, this is a good time to do this as facility upgrades are now completed, in operation, and utilization processes under way. Unfortunately, the cost of Level 2 benchmarking can severely limit the number of evaluations in any given year. A second reviewer remarked well worth the cost to provide meaningful evaluation of competing technologies. A third reviewer remarked that resources appear to be sufficient to test most of the leading designs at a rate at which they emerge in the marketplace, and the final reviewer agrees the rate of vehicles (currently a pace of three per year) is probably matched to funding/resource level. According to this reviewer, with more OEM offerings arriving on the market globally (with unique architectures/component sets), DOE should consider biasing more funding to this activity.

Electric Drive and Advanced Battery and Components Testbed (EDAB): Barney Carlson (Idaho National Laboratory) – vss033



Reviewer Sample Size

This project was reviewed by five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One respondent stated that this project provides a consistent controlled method for evaluating different energy storage systems for plug-in electric vehicles. Another respondent stated that the test bed allows for pre-production vehicle battery testing in a vehicle environment. The next reviewer said that battery technology is the single most important barrier to widespread EV adoption. Another commentator mentioned that evaluating new batteries for HEVs will hopefully reduce petroleum use.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

According to the first reviewer, the ability to evaluate battery packs in a real-world environment without building a car could save a great deal of time and expense. The second reviewer found that this project has a clear technical objective and appears to have executed a sound strategy to meet its technical objectives. The third reviewer concluded that the project is well-designed and well-executed. The team has made great progress towards building a functional system that can emulate various vehicle conditions through the series driveline. This reviewer's main concern with the proposed approach was that it is unclear what the benefit is of on-vehicle testing compared to lab testing. The presenters noted that there may be some interactions between the battery and other components of the vehicle that may be difficult to identify when emulating the road conditions in the lab. This is a valid point; however, to this reviewer it was difficult to see how this hurdle is overcome by emulating the known behaviors of the vehicle on a moving platform. The interactions between the components will only be visible when the actual components are used. This reviewer suggested that an interesting approach may be to refocus the project to better understand the interactions between the components and include these interactions in lab testing or even in testing standards development rather than building additional mule vehicles. The final reviewer was just not sure there is a great argument for doing this work in a vehicle. The reviewer understood that being out on the road allows ambient condition variability and real shock loads, but also that the shock loads are those for a pickup truck not the target vehicle and not production mounting. It seemed to this reviewer that if project implementers are going to make a pickup truck act like a Nissan Leaf then implementers can make a test cell act like a Nissan Leaf and run it 24 hours a day with test cell quality instrumentation and data logging and introduce the driving variation that implementers would like to understand in a controlled test environment.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first reviewer believed that the team has made significant progress toward meeting the project objectives. The second investigator stated that progress seemed to be good towards the plan and milestones. The investigator said that the calibration of controls to match baseline vehicle looked quite good. The third commentator felt that it is unfortunate that the initial battery to be tested comes from a company that just went bankrupt. The reviewer added, that aside, it would be helpful to have a clearly articulated strategy for selecting different energy storage systems for testing. The reviewer believed that this would help clarify the research objectives and better define the relevance of the results. The final reviewer expressed that the project needs a little more proof of correlation to in-vehicle use.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

A respondent noted that the project team appears to have formed the core collaborations necessary to execute this project. Another reviewer stated that collaboration with ORNL, AVL and ECOtality is sufficient, and has led to the fast progress of the project. The next commenter stated that it seems like appropriate collaboration is happening. The reviewer added that Oak Ridge came through on the controls and AVL with the vehicle dynamometer system. The last commentator mentioned that the role of collaborators seemed limited to the stage of project they are involved in and not enough industry/trade involvement was occurring.

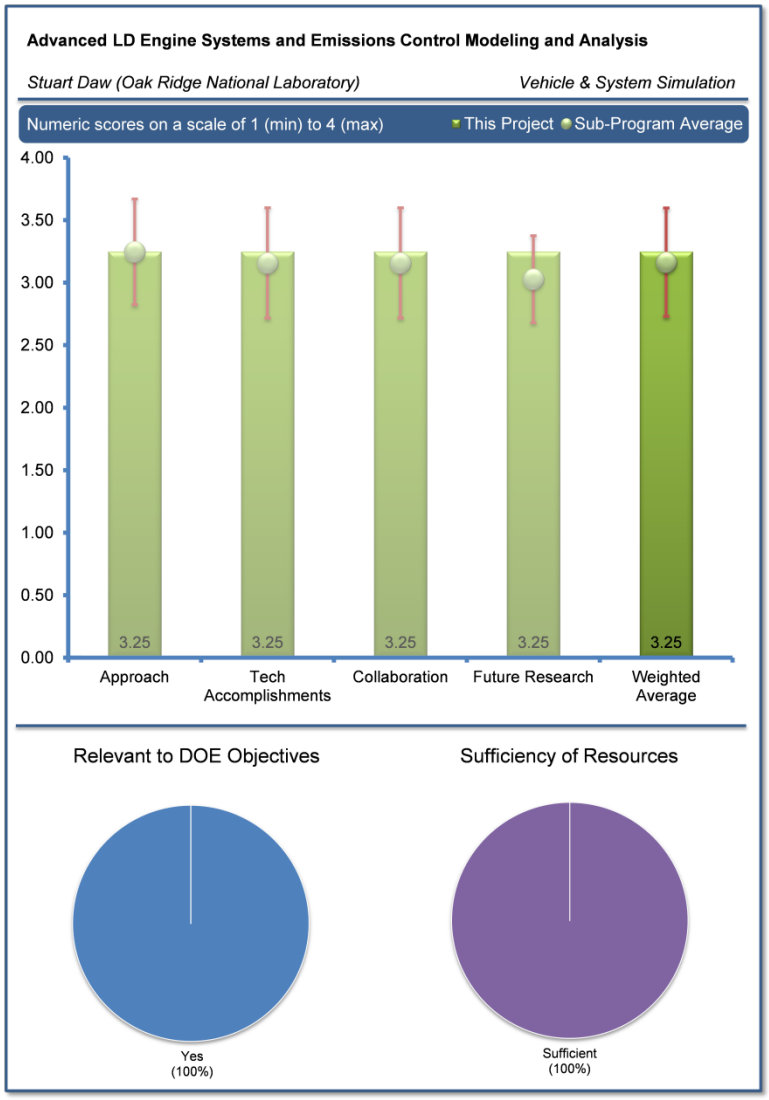
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One of the reviewers observed that the goal seemed very limited but is commensurate with funding. The next reviewer noticed that the plan was built on past progress and generally addressed overcoming barriers. Another respondent pointed out that the team states that they will test different energy storage systems, but it does not describe how or why each system will be selected for testing. One of the reviewers mentioned it seems like a lot of work to test a component without its accompanying production intent system around it, so new components are getting tested with current knowledge controls and other system components. The same reviewer inquired whether these could be included in a retrofit of the production vehicle. The reviewer believed that a new battery could be integrated with the current Nissan Leaf.

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

All five reviewers to respond felt that the project resources were sufficient. A reviewer agreed that the team has effectively executed the project to this point, so it appears that existing resources are sufficient. A second reviewer said resources are sufficient to achieve the stated milestones in a timely fashion. Another reviewer would recommend more funding and broader goal (multiple units and involvement of industry). The final investigator said that it is hard to judge, but with all of the hardware in place and the controls and dynamometer work, it seems like the FY 2012 budget can go down from FY 2011.

Advanced LD Engine Systems and Emissions Control Modeling and Analysis: Stuart Daw (Oak Ridge National Laboratory) – vss041



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer pointed out that improving the fuel economy on Class 8 Trucks would reduce overall petroleum usage in the U.S. This reviewer also exclaimed that SuperTruck is a key program. Another panelist reported that the project is set up well to increase the efficiency of the internal combustion engine component of hybrid powertrains. The next person indicated that these advanced technology engines would have a good chance to get into HEVs in the near future, and that their fuel savings would be significant especially if non-petroleum fuel is used. The final reviewer considered this project to be relevant to the development of system optimization tools for efficient development of future powertrain systems. This reviewer, however, questioned how all of the many disparate elements shown in the presentation will eventually come together to meaningfully simulate systems in the real-world.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One observer indicated that this approach was a breath of fresh air, as it brings new eyes to look at this issue. However, this observer was disappointed that the conclusions arrived at were not new, and wondered if this project could keep pace with the industry. Another reviewer relayed that the approach is coordinated to a number of other projects, and is addressing some of the model gaps in new, emerging technologies. This reviewer opined that as presented, the project seemed to be a bit random in how these gaps were being chosen for study. The same reviewer recommended that future project presentations be introduced with a definition of the objectives and the paths to achieve the objectives, as this is a broad area of potential study that can get very random in nature if not executed around a planned set of outcomes. The final panelist asked how the researchers obtained the engine maps.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One panel member stated that the project is only six months old and needs to progress further to assess long-term progress, but that short-term looks quite good. Another reviewer agreed that the progress is reasonable so far. The next observer remarked that this was good, but needed to be better. The last panelist observed that test conditions justified the work on the conventional Ford Fusion that was mentioned, even though this detracted from a project whose focus is hybrids. This reviewer stated that the

presentation raised the question of whether the project had too much conventional engine work, although it could have been the presentation more than the work itself, which was harder to assess.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer stated that most of the collaborations are within DOE groups, and suggested that improvement could be made with more industry input and collaborations, whose input for ultimate application of the work would be useful. Another reviewer pointed out that real engine maps from OEMs or the best engines would not become available in the near future. This reviewer further recommended that the reviewers consider using some less-than-perfect engine maps and other data to construct the project team's model, improve it after iterations, and let OEMs run the model to obtain some results. The same reviewer pointed out that this may yield surprising results.

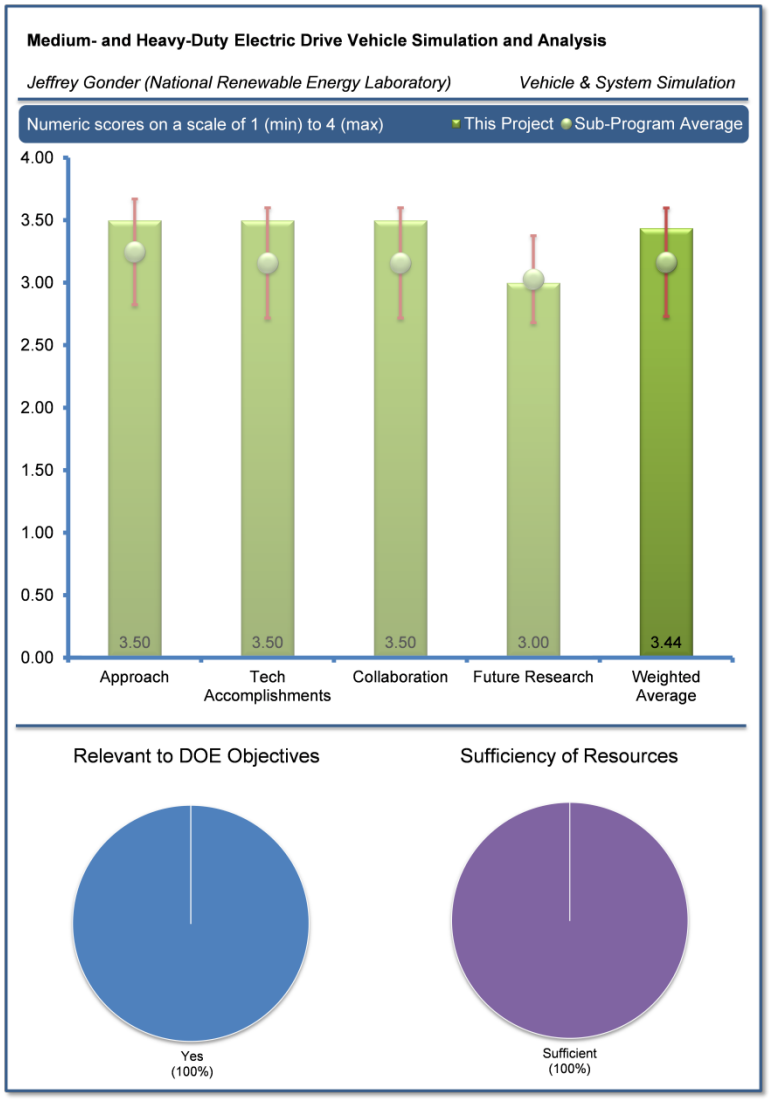
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One panelist opined that this program needs to be pushed further; to start pushing the envelope like Navistar. This panelist stated there was not much new in terms of conclusions. The next reviewer would have liked to see industry needs investigated and defined, as well as a plan on how these may be addressed to assure use of this work. Another reviewer noted the proposed future research was acceptable.

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

All respondents found the resources to be sufficient.

Medium- and Heavy-Duty Electric Drive Vehicle Simulation and Analysis: Jeffrey Gonder (National Renewable Energy Laboratory) – vss043



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One expert stated that this project studies circumstances where PHEVs or HEVs are best for users and the consequences on petroleum displacement. A second reviewer added that well-to-wheel efficiency of medium-duty delivery trucks and heavy-duty trucks can, of course, be significantly improved with the addition of electric drive. The same reviewer was unsure if this could allow us to reduce the total cost of ownership. This person added that if the battery costs dropped significantly, and petroleum prices rose sharply, there would probably be no need to justify investing in electric drive vehicles, but until then, this study provides valuable information. According to the third reviewer, the outcome of the project will be to help determine the optimal sizing on a PHEV drivetrain for fastest payback time. This, in turn, could help the adoption of PHEVs for MD applications. The final commentator noted that any data that can be supplied to potential customers on the applicability and costs associated with the products and their payback on particular applications and routes is a good thing. Picking the battery pack for potential replacement as a variable as well was a good thought. Battery cost replacement will be a worry and of concern to many potential buyers. Common urban drive cycles will need to be combined with range requirements, by the customer, to determine best battery pack sizing.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

The first reviewer stated that the project was well-designed and well-executed. A second expert stated that the team is sharply focused on addressing the technical barriers. The problem is multi-dimensional but the team was able to consider all of the major parameters in enough detail to give confidence in the results. The reviewer added that through various partnerships, the team will validate the modeling approach on actual production vehicles. Another reviewer noticed that the project provides plenty of evidence (in terms of total cost of ownership and in terms of validity of the simulation methodologies that were used to arrive at these conclusions) to support the adoption of electric vehicles for MD and (to a lesser extent) HD fleets. One of the technical barriers that was listed was risk aversion. One person suggested that perhaps more could be done to bring in results of other DOE funded projects that show the low levels of risk involved in the adoption of these technologies. This reviewer suggested perhaps the battery testing at INL, showing the battery state after 160,000 + miles of use. The last commenter simply stated that the study seems to have picked relevant drive cycles for the potential of the EVs versus the baseline diesel vehicle.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The team has made excellent progress towards the objectives stated one expert. The reviewer stated that the researchers have identified cost-effectiveness crossover criteria as a key metric/outcome of the study – a metric that will be of great interest to the community. Another commentator remarked that the technical accomplishments were good, and added that the project seemed to have selected the appropriate variables to try and model and analyze; that is, battery size, drive cycle, and then verifying and correlating data with that already existing. Another expert expressed that the adoption of PHEV is still dependent on government incentives. The final evaluator observed that the direction of the project appears to have taken a slightly different turn from the previous year, perhaps because of the change in the PI for the project, but otherwise significant progress has been made.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One expert believed that there was a good mix of commercial and government partners, and a second reviewer also observed a good combination of partners' results/resources and the team's own work. Another person stated that the collaboration with other institutions is outstanding. The team has partnered with component and vehicle manufacturers in order to validate their cost and parametric models. The team has also brought in the substantial work already done at the labs, for example, on battery degradation. The final reviewer referenced comments made in question two concerning how the direction of the project has changed since the previous year.

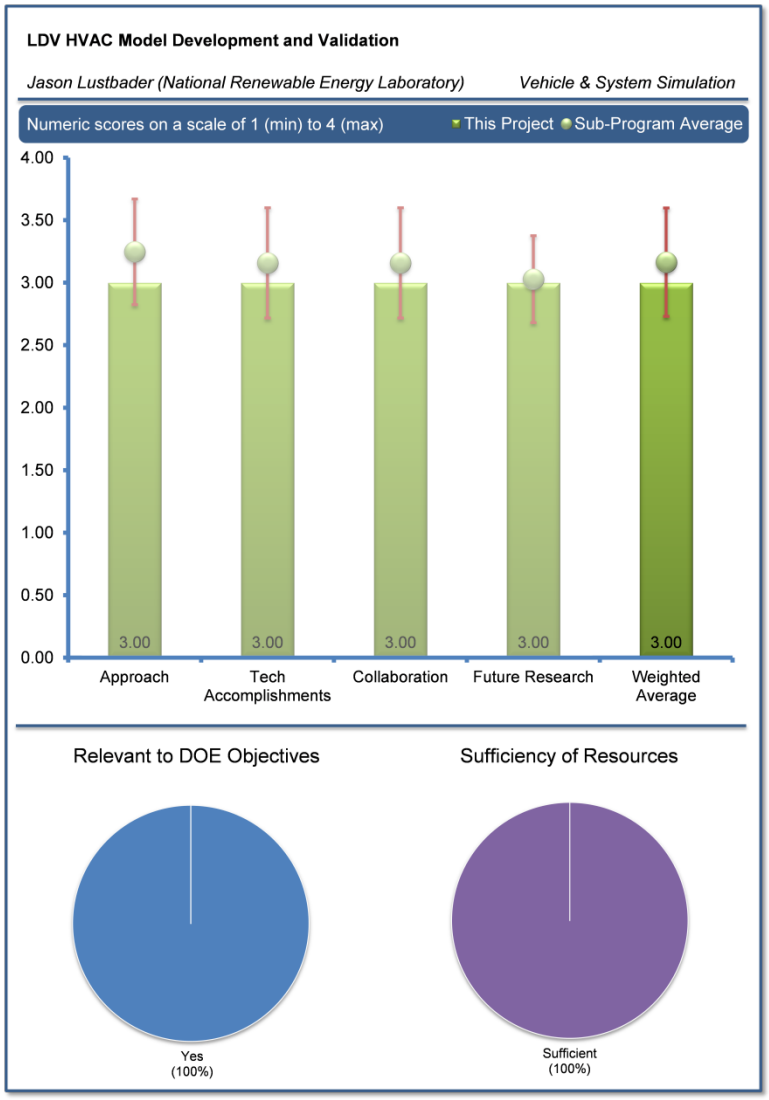
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer noted that the future plan is very good. Making the models available to the public would encourage more interest in the technology, both from the industry perspective so that they can run their own models, and from the educational perspective. Another expert suggested that it is good that the project is considering adding grade to drive cycles for future work. However, all the analyses are restricted to just three drive cycles (the Heavy Duty Urban Dynamometer Driving Schedule , Hybrid Truck Users Forum Class 4 Parcel Delivery Driving Schedule, and the Orange County Bus Cycle) and wondered if it makes more sense to use many more drive cycles - several hundred if possible, to get a better idea of the spread that one would expect to see in the results. The reviewer felt that as long as this is done using simulation with a validated model, it should not be very expensive. Another reviewer suggested that the researchers consider limiting the scope of the research and this project to just MD vocations. The reviewer added that HD drive cycles are different enough from MD to potentially have significantly different results and paybacks. The last commentator stated that future research addresses problems identified in the current research and includes more plausible and important alternatives. The reviewer concluded by stating that the proposed future research lacks focus and the presenter seems uncommitted.

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

All reviewers who responded felt that the project resources were sufficient. One expert commented the well-defined study matches resource with necessary efforts. Another stated that there is not a lot of time left for the completion of the project, and a significant change in resources at this point is not warranted. The final evaluator noticed that there was no slide addressing the resources consumed or required to complete the project.

LDV HVAC Model Development and Validation: Jason Lustbader (National Renewable Energy Laboratory) – vss045



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer expressed how this is important work with a highly qualified team that has been working in this area for some time. The reviewer added that air-conditioning (A/C) loads account for more than 5% of the fuel used annually for light-duty vehicles. A second expert stated that the A/C has large impact on fuel economy of vehicles and by modeling A/C the effects of proposed improvements can be calculated before they are implemented. The final commentator found that in general, yes the project supports DOE objectives, and remarked that having good models will help engineers do better system design and optimization for the complex vehicle systems that will help reduce petroleum use.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

The first reviewer concluded that it is a good approach overall to model the components in the system. It is also good that the model has been correlated to physical results. The reviewer understands that other software packages will not plug into Simulink but the Simulink model results could be compared with other accepted software for A/C that do not plug into Simulink. The second reviewer found that having an open source thermal model that is validated is very useful to designers and users of the technology. Other people have thermal models but their models cannot link fuel consumption to HVAC loads. With EVs this work is even more important. Another reviewer remarked this is good, but that it is not rocket science either. For this reviewer, what would be interesting is whether our expectations in the United States much greater for A/C than that, say in Europe. This reviewer wondered whether our comfort expectations are making us spend more fuel. The final reviewer thinks that the project is not clearly stating why a new tool is needed to be created from scratch. Commercial tools can do this modeling. Per this reviewer, when asked about benchmarking commercial tools, the presenter gave an answer that sounded like commercial tools could not do the things this model does. This reviewer's understanding is that tools like GTSuite can do A/C system modeling with physics-based heat exchangers and transients. This reviewer acknowledges that a commercial tool is not freely available in terms of zero licensing cost. This reviewer commented that when DOE spends money to develop a tool that might already exist commercially, it needs to be clear on the objective. If another tool already exists that does something similar, it would be a good effort to compare the new tool to the benchmark to ensure accuracy. However, the reviewer found that for the model desired, the technical approach seems good. Lumping pipes to one per pass sounds like a good tradeoff of detail for execution speed. This reviewer noted that keeping it

fully transient capable sounds like the right thing in order to be useful for drive cycles and transient controls evaluation and development.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first commenter stated that this was a realistic research plan with timeline and goals. Another reviewer thought there was good progress towards goals made. This reviewer added that it looks like the electric A/C model is slightly behind schedule. Model validation was done for condenser and evaporator and evaporator heat transfer coefficient was corrected. It seemed to this reviewer that some key pieces, like mapping of the components, have yet to be decided on for funding. This reviewer was not sure why this scope was not part of the original two years of funding for the project; or, if the scope was included and the timeline has slipped. The final reviewer said that if it can be assumed that a model needed to be developed from scratch, then it looks like good progress on creating the model. This person felt that the condenser heat transfer looks to match well. In this reviewer's experience with two-phase flow system, a 6% evaporator heat transfer match seems a little high. The reviewer concluded by acknowledging that some plans to improve this match were discussed.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One expert stated that collaboration seemed appropriate and that test data results from Visteon seemed appropriate. Another person mentioned that the project team is publishing their work in SAE and suggests the team expands their publications to American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) papers as well. This reviewer pointed out that the ASHRAE Handbook covers HVAC design for vehicles. The next commentator noticed that it was not mentioned in the slide for latest work if collaboration is still being done with Volvo. The reviewer stated that if it was not, the reviewer would be very interested in the results.

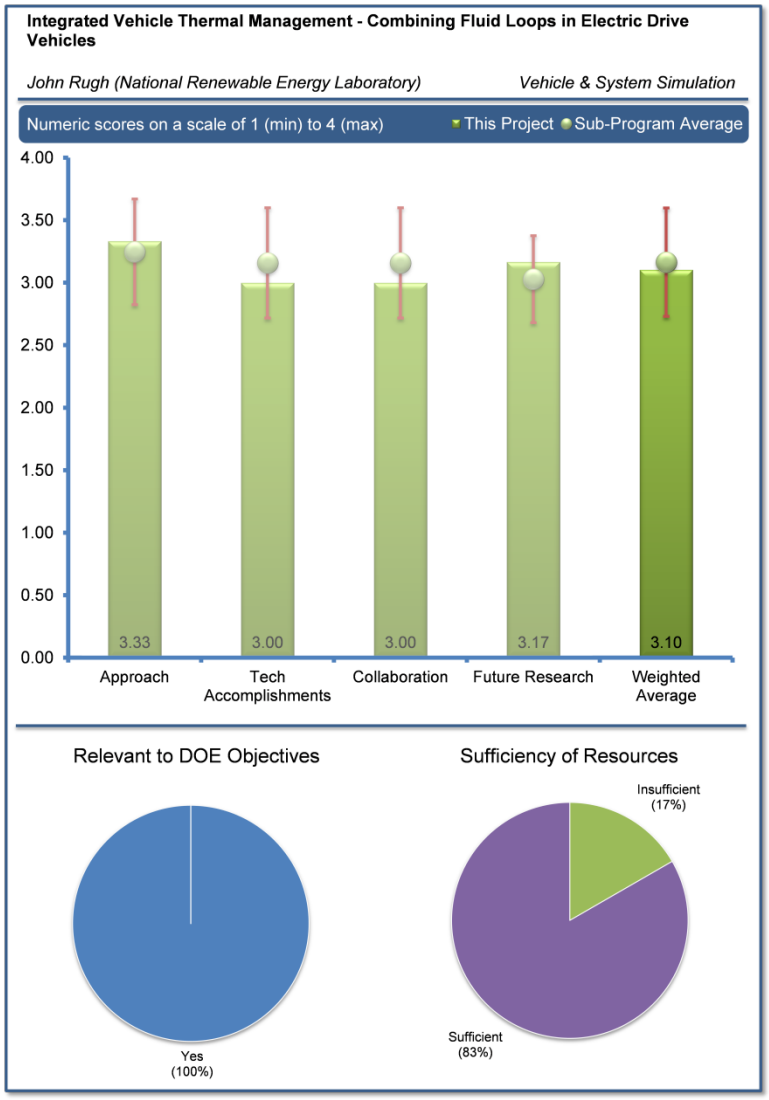
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One expert suggested including ASHRAE Standard 55 (which includes indoor air quality) in model. Another person suggested referencing prior comments on expectations for A/C in the United States versus, for instance, Europe. The reviewer inquired if our self-cooling expectations and need for creature comfort is costing the United States more money in petroleum dollars. A third reviewer believed that some the goals will not be realized if funding is not obtained for 2013. The final reviewer would like to know why it looks like the model will be released in FY 2012, but the user's guide will not be available until FY 2013. This person added that it seems like the user's guide would be needed when the model is released.

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

All four reviewers to respond felt that the project resources were sufficient. One expert stated that funding is sufficient but additional projects should be considered. The reviewer noted that the present goal is a thermal model that is linked to fuel consumption. The reviewer suggested expanding this goal to include actual truck routes with global positioning system, traffic and road conditions (incline) in this model in future years. A user needs to know how much money they will save. This reviewer noted that life cycle cost should also be included. However, this reviewer emphasizes that these suggestions do NOT take away the opinion that this is excellent work.

Integrated Vehicle Thermal Management - Combining Fluid Loops in Electric Drive Vehicles: John Rugh (National Renewable Energy Laboratory) – vss046



Reviewer Sample Size

This project was reviewed by six reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One of the reviewers indicated that thermal management is key to increasing electric vehicle usage. The reviewer observed that the project is a collaboration between Energy Storage Systems (ESS) and Advanced Power Electronics and Electric Motors (APEEM) with a goal to reduce the number of components, and thereby reducing the cost of the vehicles. The reviewer said that improved thermal management will increase a vehicle's reliability and is an excellent example of different divisions working together to solve an important common problem. The same reviewer also mentioned that the success of EVs depend on the reliability of electronic components. The reviewer pointed out that high temperatures reduce an electronic component's service life. Therefore, as the reviewer explained, the tools from the project will make EVs more reliable and accepted into the marketplace. These comments were partially reiterated by two other reviewers. One reviewer indicated that combining cooling systems in electric drive vehicles may reduce costs, lower weight, and improve performance, which can facilitate consumer acceptance and increase use thereby reducing petroleum consumption. The other reviewer highlighted the need to integrate and reduce the number of systems on a vehicle to cool the various components as this reduces vehicle weight and cost. However, the reviewer indicated that only vehicle-level OEMs are typically concerned with this. The reviewer suggested that this information can assist them in scoping targets for component suppliers and industry standards. Another reviewer said that a part of the responsibility is to develop a vehicle-level energy management software, and in that context, the reviewer was aware of the extent to which OEMs are willing to go in order to achieve relatively small efficiency gains. The same reviewer, representative of OEMs, expects measurable benefits in fuel consumption by managing waste thermal energy intelligently, and indicated this project addresses that aspect, at least in part. A different reviewer commented that it is important to look at a system approach to EV efficiency rather than looking at each component or vehicle performance after the design is complete.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Most of the reviewers had positive comments. One reviewer noted that performing the system level models is a good first step. The reviewer said that continuing to refine and incorporate more data as you go forward is a must. The reviewer continued to say that the bench test and finally vehicle level OEM involvement seems like the correct approach going forward. Another reviewer explained that the project is working with OEM partners and has the potential to introduce new thermal management systems that

are more efficient and cost less. The same reviewer also observed that the team is experienced and well qualified. These comments were also supported by a third reviewer who remarked it was a good approach to validate model, bench test and then expand to vehicle design. A different reviewer detailed that this task starts with thermal one-dimensional (1-D) modeling of APEEM, energy storage, engine, transmission, and passenger compartment thermal management systems. The reviewer noted that modeling is used to identify, select, and analyze promising combined thermal management concepts. The same reviewer continued to say that a number of existing models are leveraged and enhanced. The reviewer then indicated that subsequently, bench top testing will be used to verify modeling results. The reviewer pointed out that the goal is to enable the use of combined cooling loops with electric vehicles to drive down costs and weight. Overall, the reviewer asserted that the project seems to have a reasonable approach, but that it would be good to know whether it has been vetted and received positively by industry. The remaining reviewer suggested that risk aversion as a barrier to implementation of combined cooling loops should be considered. This reviewer noted that while the items listed under Barriers may all be barriers to acceptance of electric drive vehicles (EDVs), they are not barriers to acceptance of combined cooling systems in EDVs.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Mixed reviews were received from several reviewers. One reviewer indicated that this is a four year project, that the design tools are on schedule, and that the plan includes testing in actual vehicles. The reviewer also said that the team has a new CRADA with Ford. Overall, this reviewer noted that the project had an excellent research plan with realistic goals, tasks and timeline. Another reviewer summarized that a number of modeling simulations have been conducted for the energy storage system, cabin, electric motor, inverter, and overall heating / cooling system, and further explained that various drive cycles including aggressive hot and cold have been analyzed including cold and hot soaks. The reviewer noted that the results seem to indicate the possible feasibility of the approach, although temperatures approach design guidelines for power electric machines, which could potentially lead to uncomfortable cabin temperatures while the battery cells are being cooled to desired temperatures. A different reviewer indicated that baselining each of the systems is done on a similar thermal range so that results can be measured comparatively. However, the reviewer noted that no system will remain static, so there will continue to be variables going forward as improvements are made on any one system, which in turn will have vehicle-level ramifications. Similarly, if there are constraints made on a particular system, say regulations to restrict motor output, this will have vehicle level implications as well. Another reviewer indicated that the model seems okay but so far seems to be looking at limits and tradeoffs one at a time. The reviewer further highlighted the need for more ability to provide guidance for what needs to improve to provide optimum. More specific comments were provided by another reviewer indicating that one of the benefits of effective thermal management is being able to raise the operating temperature of the engine quickly, especially during the cold FTP cycle. The reviewer noted that this is expected to provide significant fuel economy benefits and suggested that it would be worthwhile to include this aspect in the project benefits. The same reviewer also said that the drive cycles that are listed in the presentation include US06, Davis Dam, and Bemidji, to cover a range of applications. From the reviewer's perspective, Death Valley and Las Vegas in summer are far more severe hot cycles. While the presentation provides a reference for a thermal model of a permanent magnet motor, the reviewer did not have a chance to read it, and said that it was not clear what level of detail is included in the electric motor model. According to the reviewer, it is critical to limit the peak temperature of the motor, and using a lumped model representation may not provide adequate resolution to capture the peak temperature. Lastly, the reviewer acknowledged taking a brief look at FASTSim, but had not had the chance to see it more extensively. Therefore, the reviewer questioned whether it is sufficiently accurate for purposes of this project, i.e., whether its accuracy of prediction of waste heat generation over some cycle suffices for the calculations that have been made.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Two reviewers provided positive comments. One reviewer indicated that it is good that OEMs are being included. The reviewer observed some overlap between this project and VSS070 (Electric Drive Vehicle Level Control Development Under Various Thermal Conditions) and suggested that perhaps some of the thermal model development methodologies could be shared to achieve synergy. The other reviewer noted that collaborations for this task are very good including a vehicular HVAC manufacturer, OEMs, vendor for Kuli software and engineering support, and three VTP program offices (i.e., Systems, Energy Storage, and APEEM) all providing task cost-share. The reviewer also noted that a CRADA is the approval process with a Detroit OEM. Another reviewer acknowledged that the team is working with a software company and OEMs. A different reviewer pointed

out the project needs more direct contributions and involvement from major subsystem suppliers and an OEM. The reviewer explained that system component suppliers are motivated to optimize their own system from a weight and cost perspective, while the OEM is motivated to optimize all systems across the vehicles. The reviewer then explained that there are tradeoffs involved there that only the OEM can evaluate from an overall vehicle perspective. As such, the reviewer notes that experiences with sub system suppliers will give better insight into the process involved in setting subsystem specifications and targets.

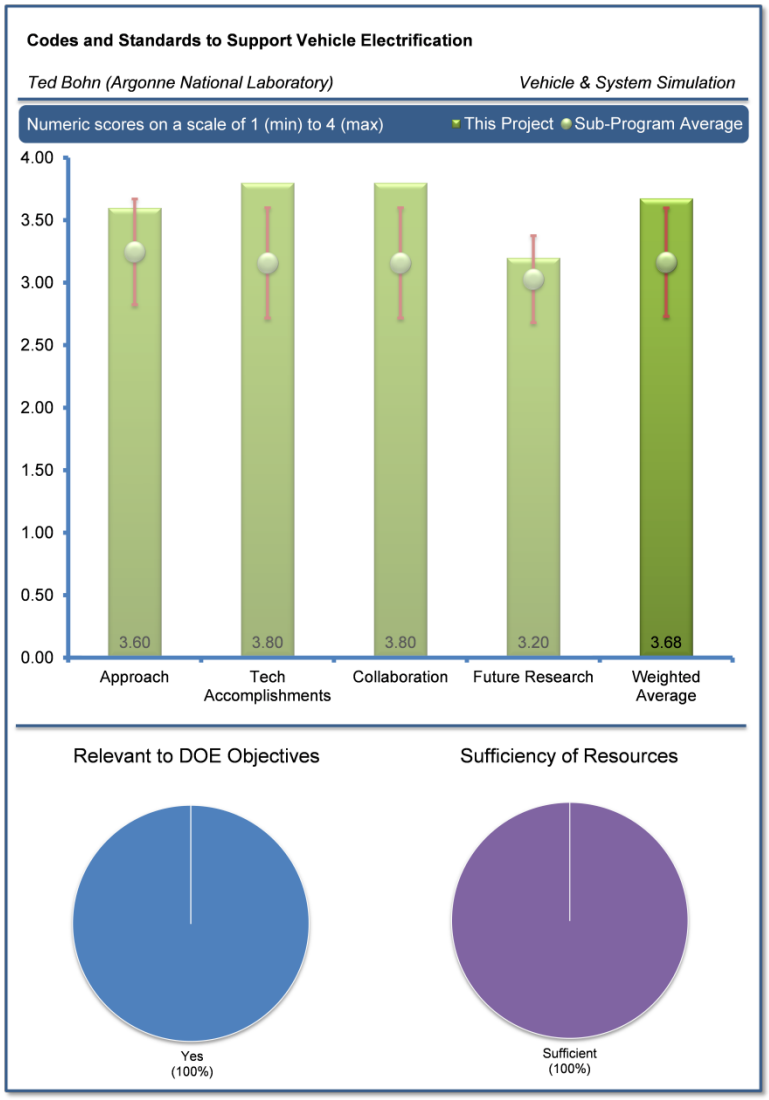
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

There were mixed comments from reviewers regarding this topic. One reviewer observed that new refrigerants and coolants are being proposed, and further recognized that this proposal includes a test platform that will be an excellent test bed for evaluating these new fluids. This same reviewer indicated that the U.S. AFRL is trying to do a better job on thermal management for satellites and that both agencies could benefit from an exchange of ideas. Another reviewer described that proposed future efforts are to further model analyze concepts for combining cooling loops to assess benefits, add new components, and refine the model. The reviewer additionally observed the selection, building, and evaluation of prototype systems via bench test, based on results. Further, the reviewer suggested that implementing at the vehicle level to test and validate combined cooling loop strategies, if ultimately promising. The reviewer noted that this approach is valid, but recommended the active involvement of OEMs sooner rather than later to identify and develop mitigation strategies for any potential showstoppers be they technical or business in nature. Another reviewer liked the idea of involving the OEM for vehicle-level integration, but cautioned it cannot be done too soon. The reviewer asserted that they will bring vehicle-level requirements, from their perspective, of which the researcher may not be currently aware. The reviewer concluded, the sooner the better. The final reviewer to comment expressed that the path from model to vehicle is not outlined very well.

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

One reviewer indicated that financial resources were insufficient. Five reviewers indicated that financial resources were sufficient. A reviewer commented that the resources for the task are sufficient. Another reviewer explained that this is an important problem and the budget appears to be adequate. Another reviewer said that based on the proposed future work, it appears that the funding level may be sufficient for bench testing of components and systems, but was unsure that it will be sufficient for a vehicle-level project. This person acknowledged that reviewers have the luxury of suggesting all manner of additions to the project scope, but the PI will have to work with the reality of limited funding and circumscribe the scope of the project appropriately.

Codes and Standards to Support Vehicle Electrification: Ted Bohn (Argonne National Laboratory) – vss053



Reviewer Sample Size

This project was reviewed by five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The reviewers agreed on project's relevance and provided a range of comments. One reviewer indicated that this project supports the wider adoption of EVs through development (and hopefully adoption) of new standards which directly contribute to displacing petroleum use. The reviewer noted that the government plays a key role in bringing together industry to ensure compatibility of vehicles and charging points with each other and utilities, and developing these standards is a necessary function for government. As such, the reviewer said, this project is successfully advancing the necessary interconnectivity of vehicles to grid for wider EV adoption. A similar comment was reiterated by another reviewer in that the development of appropriate codes and standards is essential to the introduction of new products and technologies; without them, sustainable large-scale market penetration is much less likely. This was further supported by another reviewer who indicated the standards developed from this program will lower the risk for OEMs to put electrified vehicles into the market, as well as give end-consumers confidence that these new systems (charger connectors, etc.) will not be made obsolete in the vehicle lifetime, reducing consumer risk. A different reviewer discussed in detail that the standardization of hardware- and software-based-interfaces between vehicle and grid is essential to lower the component costs both in the vehicle and at the EVSE level. In addition, the reviewer noted that as electrical vehicles need to be cost competitive to conventional gasoline-powered vehicles, this project contributes substantially to create unified component reference design platforms that allow mass-production. Another reviewer said that standards are of critical importance for electrified vehicle market acceptance and growth and noted that the impact is global and crosses industry boundaries; multiple standards bodies are involved.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Most reviewers had positive comments on the approach, with some additional substantive comments. As one reviewer indicated, considering the complexity of the stakeholder network and the time limitations to reach technical consensus the achievements of this project are very significant. The reviewer noted in particular that the interdependencies between the different standards were monitored during the codes and standards development process. Another reviewer said that the project clearly seems to be addressing its technical barriers, and seems to be effective. A different reviewer stated that it seems the ANL have a world-wide knowledge of standards roadmaps for electrification and accept responsibility for their timely evolution. The reviewer pointed out that current emphasis is placed on connections, communications and wireless charging. Another reviewer pointed out that the hardware development, which this project indirectly supports, is beneficial and the schedule for completion seems in line with the

auto OEM manufacturing requirements, which is a very positive aspect of this project. A different reviewer noted that the approach seemed to be sound, however the presenter talked so fast it was challenging to follow the presentation, and on many areas gave excessive detail. Another reviewer indicated that the key approach to overcoming technical barriers by this project is to involve as many players as possible. The reviewer said that several big suppliers are being properly engaged in working groups, forums, etc. but that it was unclear from this presentation whether the international community will be involved to any great extent (they are not currently), and whether there are sufficient resources to do so. As such, the reviewer suggested that this project could benefit from increased vendor participation, and particularly international vendors which are not evident in the presented material. Another concern from the reviewer was that one of the key barriers noted is establishing consensus between competing approaches (at low cost), and it is not evident that the current approach evaluates the costs and benefits of each approach to reach consensus.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Most of the reviewers had positive commentary regarding the technical accomplishments and progress of the project. In particular, one reviewer indicated that the key technical accomplishment is the completion of protocols and standards which allow the design and building of hardware that is ready to test—a significant step that was accomplished by this project. The reviewer also noted that progress will be further shown and be more evident when pilot projects are launched using technology that adheres to the protocols developed. The same reviewer indicated that although as noted above, the project would benefit from wider international cooperation, the work completed thus far, and the schedule adherence thus far, suggests that the technical barriers will be overcome in the coming year. Another reviewer specifically noted that considering the barriers, the following technical accomplishments are outstanding: SAE J1772 coupler standard implemented (AC [alternating current], DC [direct current]); SAE J2931-based vendor technologies evaluated; significant progress on SAE J2954 development; and SAE J2990 development initiated. Other commenters indicated that this project appears to be on-track regarding technical accomplishments. In addition, another reviewer stated that clear roadmaps, schedules, and evidence of driving to timely completion were presented. The final commenter said the project impacted development and/or revision of numerous (24 are shown on Slide 7) relevant standards for electric-drive vehicles and related systems.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

This project received mostly positive commentary regarding collaboration and coordination with other institutions. One reviewer indicated that the very nature of this work is collaboration. As indicated by the reviewer, it appears ANL is taking a leading role in coordinating multiple activities across multiple world-wide standards making bodies. This is reiterated by two other reviewers. One said that the main theme of this project is collaboration between multiple parties to generate standards and that this project seems to be effective in this area. The other reviewer noted that all relevant stakeholders are involved in the standardization developments; the speed of development and the technical results reflect that the process is very well coordinated. One reviewer had mixed comments and indicated that this project has involved academia, industry, and government partners. The reviewer said that collaboration to develop and use these new codes are crucial for their adoption and that this project is successfully bringing together the necessary partners to make this happen. The reviewer noted that it is important to keep all manufacturers on the table, and collaborating through SAE should be sufficient, but the partners listed show only two foreign car brands. As such, the reviewer suggested that this process could benefit from wider participation of other car manufacturers. Another reviewer said that the list of partners on Slide 2 is good, except Argonne should also be collaborating with standards development organizations [definitely SAE, Institute of Electrical and Electronics Engineers (IEEE), American National Standards Institute (ANSI), UL, and International Organization for Standardization (ISO); possibly National Fire Protection Association (NFPA), American Society for Testing and Materials (ASTM), etc.]. This reviewer noted that later slides and remarks suggested that the project team is working with such organizations, but these should have been listed among the collaborations/partners.

Question 5: Has the project 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?

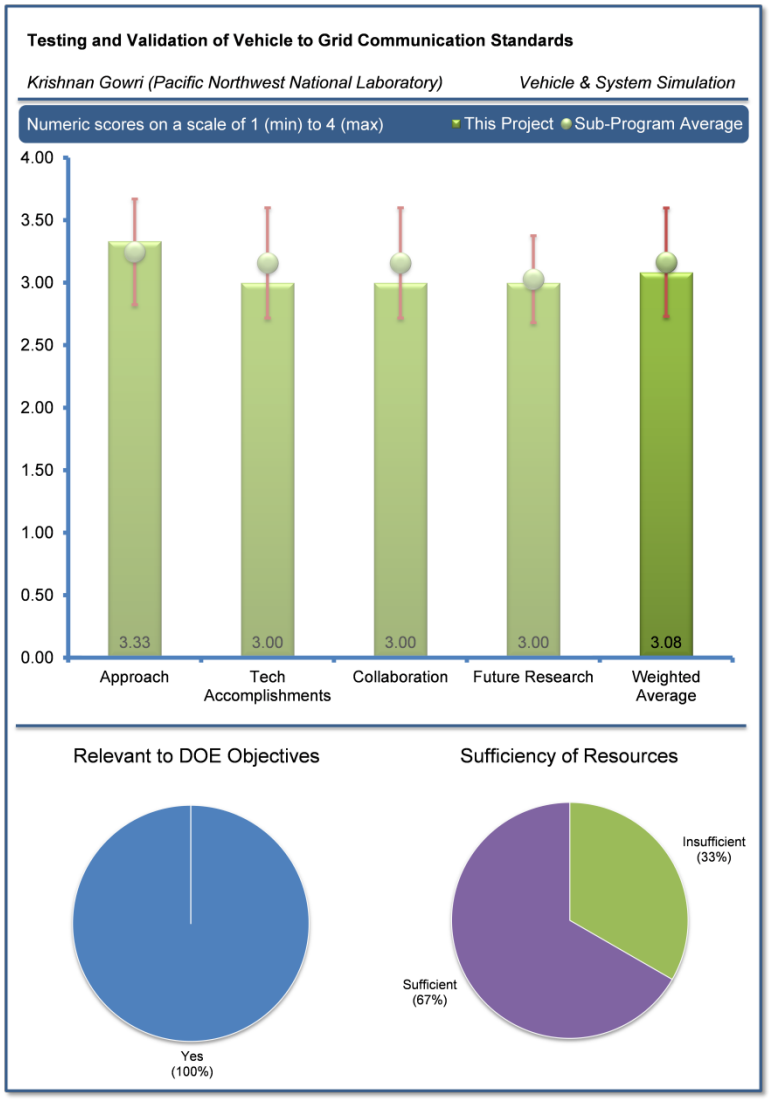
Comments received regarding proposed future research were mainly positive with concerns regarding the timeline of the project. Several reviewers noted that the future research is addressing the right areas and is very well planned out but to be considered is

that this project is in its final year. This is reiterated by another reviewer who said that the future plans look good, but it is not clear if they are feasible within FY 2012. The reviewer suggested that a timeline for future projects and a tie in to technical barriers would help this discussion. Similar comments were provided by another reviewer who indicated that ongoing and future research is focused on completing the work that has been started. The reviewer noted that it is unclear from the presentation materials that there are defined deadlines for individual components. As such, the reviewer suggested that this project would benefit from showing and discussing more specific milestones to be completed. Similar to the comments received above, one reviewer supported that ongoing work is still needed and notes that the proposed validation (and if needed, adjustment) of standards is important. This was repeated by another reviewer who said that systems validation studies are of critical importance and that it seems additional resource will be needed for these activities. That same reviewer added that continued international harmonization will speed market growth due to efficiencies on the producer side and improve regulatory oversight.

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

All of the reviewers indicated that sufficient funds were available for the project. While most comments received supported agreed that sufficient funds were available, some concerns were noted. Two reviewers said that the resources seem to be sufficient or adequate for the work packages to be accomplished. One reviewer indicated that effective project execution indicates sufficient resource and funding. However, the same reviewer saw that the budget has been reduced for 2012—yet the project is moving into system validation trials which would seem to require more resource. Thus, the reviewer noted that particular care should be taken to ensure the project is designed accordingly. Another reviewer discussed that resources are limited for international cooperation work, but are sufficient for U.S.-based work. Nonetheless, the reviewer noted that the project has been meeting schedule and that appropriate resources seem to be in place to complete future work. One comment from a reviewer indicated that the project leverages resources from other programs.

Testing and Validation of Vehicle to Grid Communication Standards: Krishnan Gowri (Pacific Northwest National Laboratory) – vss055



Reviewer Sample Size

This project was reviewed by three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Comments on this project were mixed. One reviewer indicated that the establishment of appropriate standards and protocols for vehicle to grid communications is essential to acceptance and maximizing the value added of electric vehicles to the consumer. The reviewer noted that electric vehicles potentially offer many additional utilities to the consumer including the ability for reverse energy flow and emergency power. Therefore, the reviewer adds that, to unlock this potential, appropriate standards needs to be in place to ensure safety and interoperability for all vehicles and home/ grid scenarios. Another reviewer indicated that consumers and utility providers alike need EVs to communicate with the grid for the successful deployment of this technology on a large scale. A different reviewer noted that the program provides an unbiased evaluation of hardware configurations relevant to implementation of standards developed by the SAE and supported by other DOE activities.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Two reviewers noted that this project provides technical support to SAE standards committees or to the SAE EV standards development process—an approach which is driven by SAE leadership, performing laboratory testing of communication technologies in support of standards activities, and validating end-to-end communications. Of those two reviewers, one discussed that the activities in support of this task are relatively discrete depending upon which standard and slash sheet is being supported and the particular technical support requirement. As such, the reviewer said that it is relatively easy to shake them out. Overall, the reviewer noted that the approach appears to be well organized and reasonable in addressing the particular acute needs of the SAE standards committees for vehicle to grid communications. The second reviewer parallels these comments and indicated that the project appears to be performing the necessary work to inform the standards process. A different reviewer noted that the work conducted has been well planned and effectively conducted. However, the reviewer indicated that other DOE supported organizations (ANL and Grid Integration Tech Team [GITT]) are conducting similar activities which may overlap or conflict with this activity. As such, the reviewer suggested that test work should be coordinated to assure DOE funds are most efficiently used.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Most of the reviewers had positive comments on the technical accomplishments and progress of the project. One reviewer indicated that the progress towards objectives appears to be solid. This is further specified by another reviewer who indicates that a considerable amount of technical progress appears to have been achieved in support to SAE J2847/2, J2836/3, J2836/5, and the ANSI Electric Vehicles Standards Panel (EVSP) Roadmap. The reviewer added that this includes updated isolation monitoring requirements, state and sequence diagrams; harmonization; use case development; home area network (HAN) interaction scenarios; interface requirements for telematics and mobile devices; and a transactive controls concept; as well as participation in various working group meetings. The reviewer also said several presentations have been made as well as a report on Vehicle to Grid Communication Standards Development. In addition, the reviewer noted that a laboratory test bed and field testing of programmable logic controllers (PLC) on mains has been completed for testing SAE J2847/1 messages. The reviewer further mentioned that participation in a number of working group meetings for the ANSI EVSP has been completed. Concerns from one reviewer included that none of the technologies currently under test fully comply with specifications. This reviewer asserted that while much good work has been conducted to evaluate these technologies, a fully compliant technology has not been found. Thus, the reviewer noted that additional coordination with the standards committee will be necessary to find an acceptable solution.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Most of the reviewers had positive comments on the project's collaboration and coordination with other institutions. One reviewer noted that the level of collaboration appears to be appropriate given the nature and scope of the support to vehicle to grid communications standards activities. The reviewer highlighted that Pacific Northwest National Laboratory (PNNL) is working with SAE, EPRI, and several industrial technology developers. The reviewer also added that as ANL is actively involved in SAE standards development for EVs, it is appropriate to remain well coordinated with them as well. Another reviewer indicated that collaboration and coordination with SAE and EPRI is vital for this type of work. The reviewer commented that it appears that the roles and responsibilities of each organization are established and working well. A third reviewer observed that collaboration with hardware suppliers, EPRI and SAE has been outstanding. However, the reviewer asserts that more effort is required to assure that ANL and the GITT are not conducting overlapping or conflicting work.

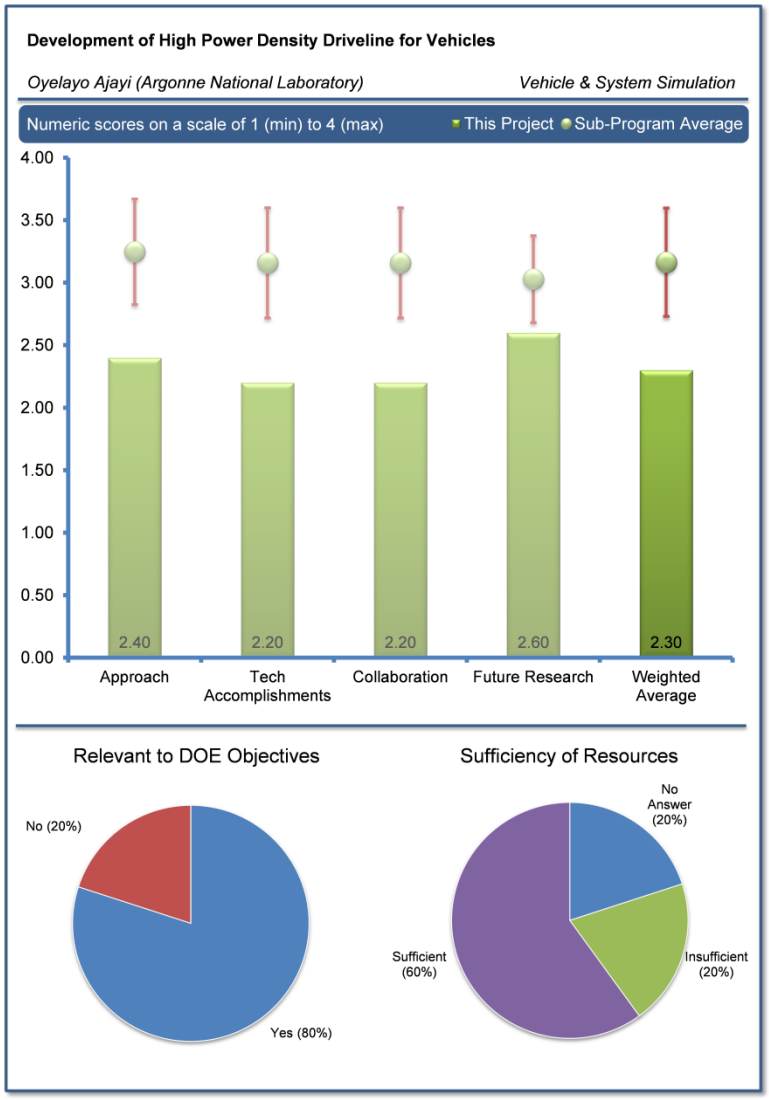
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Reviewers had similar comments regarding proposed future work. One reviewer noted that the future work builds on the past developments in a logical fashion. This was supported by another reviewer who said that the future work or activities for the balance of FY 2012 are logical and appropriate. The reviewer went on to say that several are continuations of existing activities and the remaining are logical next steps. The reviewed added that no future activities for FY 2013 and beyond are presently identified, possibly do to the difficulty of predicting the exact future needs of the SAE standards committees in this area. This was reiterated by another reviewer who indicated that the activity is at a crossroads; looking for technology that is fully compliant with specifications. The reviewer discussed that options are being evaluated and a proper direction sought and asserted that again, this should be coordinated with the GITT to assure that the most appropriate support is being provided to the standards effort.

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

Two out of three reviewers indicated that there were sufficient financial resources for the project. Comments from one reviewer were that resources appeared to be sufficient for the basic SAE technical support. Further, the reviewer noted that a lack of resources was not cited as an impediment to progress. In addition, another reviewer presented that testing has been conducted efficiently and on schedule. The third reviewer discussed that in general the resources for this task seem roughly appropriate, especially since several of the activities are winding down in 2012. However, the same reviewer commented that the task may be mildly under-funded given the scope of some of the technology prototype module and testing activities and time intensive nature of participation on SAE standards committees.

Development of High Power Density Driveline for Vehicles: Oyelayo Ajayi (Argonne National Laboratory) – vss058



Reviewer Sample Size

This project was reviewed by five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer stated that weight reduction in vehicle component systems saves fuel in operation. Another panelist agreed that weight reduction of drivetrain components is a valid approach for reducing fuel consumption in passenger cars and improving freight efficiency in commercial vehicles, and positively contributes to the DOE mission of displacing petroleum. The next observer noted that this project is generally supportive of the DOE objective for reducing petroleum consumption. This observer reported that the focus is on developing surface treatments that improve surface fatigue and wear resistance, which can enable downsizing of gearing and power transfer components. The observer further noted that smaller gearing and bearings drive an overall reduction in powertrain components, thereby improving power density. The same observer explained that the resultant weight savings and smaller package can be an enabler for the design of a lighter weight vehicle that will reduce fuel consumption (e.g., a 10% reduction in weight can deliver a fuel consumption savings of 2%-5%). A different reviewer found that, in theory, high power density drivetrains will support petroleum displacement, but noted that things are less clear in practice. This reviewer was confused by the ambiguous title, and explained that because there are many aspects related to the design of a high density drivetrain, the title should have explicitly included the specific aspect addressed in this research (i.e., improved tribological capacity of gears and bearings). The final panel member agreed that the title is attractive but misleading; this is not a driveline weight reduction project but rather a program to improve the load carrying capacity of gear sets. This reviewer emphasized that this is a confused project.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One panelist noted that the approach seemed good, as it focused on one part of the vehicle at a time while looking for weight reduction opportunities. This panelist indicated that because the potential gains in fuel economy were only theoretical, calling the project a power density development was a bit of a stretch as it is actually a weight reduction, and should be identified as such. Another panel member wrote that the presenter stated that driveline weight comprises 20% of overall vehicle weight. However, this panel member reported that the focus of this research deals with studying materials coatings and lubricant that apply to gears and bearings. This panel member pointed out that these components represent only a smaller part of the weight equation and it does not appear the remaining driveline components are in the project scope. Therefore, this panelist noted that a more realistic assessment of the weight reduction potential was needed, based on the more limited scope, and that the design of the project would be enhanced if specific weight reduction targets were specified over a baseline driveline. The panel member further recommended

the researchers pick a vehicle, quantify the baseline weight of its driveline components under investigation (i.e., bearings and gears), and set a quantifiable weight reduction target that could then be translated into gallons of displaced petroleum to quantify significance to the DOE mission. This person added that this would dictate the advanced material, coatings, and lubricants needed to be used to reach that target. The next reviewer expressed that as basic tribology research, the researchers are quite capable and methods are sound. This reviewer questioned, however, the specific utility of the research that is defined in the title (i.e., to significantly reduce gearbox sizes in typical ground vehicles). The reviewer further stated that, up front, the premise that gearboxes can be significantly reduced in size needs to be further supported, including quantified estimates for typical ground vehicles. This reviewer noted that this should involve an absolute comparison of other failure modes and design considerations and constraints for typical gearboxes, such as tooth bending fatigue for gears and static load capacity for bearings. The reviewer relayed that a relative life improvement analysis is presented for the tribological failure modes under study, but opined that even these lack an absolute comparison to understand in balance if they are significant. The reviewer noted the potential value proposition of the various coating technologies and additives, etc., being analyzed needs to be estimated. This, the reviewer continued, would help insure that the technologies and additives, etc., will be available to typical ground vehicle markets if shown to perform well because high volume markets are quite cost sensitive. The reviewer was unsure if the relative conditions of contact stress and sliding velocity used in the test are representative of, or scalable to, a typical gear or bearing application. This reviewer concluded that these questions should be addressed through better collaboration with partners skilled in the art. A subsequent observer reported that both engine oil/transmission fluid and simulated extreme pressure (EP) gear lubricant (with EP additives) were used for the testing. This observer noted an advantageous approach because the results of the program can be used for both transmission and axle redesign (the latter requires an EP lubricant). The observer indicated that, although perhaps not within the scope of this narrowly focused program, consideration should be given to other failure modes (e.g., bending fatigue, shock failures) and how these modes might become the weak link that determines overall downsizing potential. This observer pointed out that the plan did not include an understanding of how long it may take to wear completely through the coatings, and what the behavior of the gear surface will be as the coating is worn away. The same observer further suggested that this could be an important factor because performance would be expected to drop off sharply once the coating is no longer present. This observer summarized the technical approach to ultimately achieve downsized powertrain components: identify technologies that improve wear, scuffing resistance, and contact fatigue life; quantify required improvement percentage for given amount of downsizing; develop or refine test methodologies for evaluating contact fatigue, wear, and scuffing resistance; test current (baseline) processes and surface treatments as well as the identified technologies for improved surface performance; project potential downsizing that can be achieved based on test results; and identify other potential candidate technologies or processes that could yield even further improvements based on test results. The final reviewer described this project as an academic exercise, a science project, and busy work.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One reviewer stated that the project had developed a test methodology that allows independent control of normal force, rolling velocity, and sliding velocity, and that final selection of parameters was intended to simulate conditions encountered in an actual transmission or axle gear set. Because the operating parameters are typically quite different, this reviewer noted that it would have been helpful to know if tests were run at enough different parametric values so as to obtain data applicable to both transmissions and axles. The reviewer went on to report that baseline friction and wear testing had been completed, along with testing of nine different surface treatments and four different lubricants. This reviewer indicated that a significant finding was that a particular coating may have vastly different effects when different lubricants are used. This reviewer concluded that this suggests an opportunity for matching surface treatment to lubricant type for optimized performance. Another person observed that significant research on tribological performance was conducted with respect to friction and wear. This person remarked that, with that data generated, there was to be a clear link made between this research performed and weight reduction, which is the justification for this project. This person further reported that oil properties (e.g., viscosity and coating properties) also influence frictional and churning losses for gears, which imposes a drag torque between the input and output shafts of drivetrain components. This person concluded that these losses amount to a fuel consumption penalty and need to be considered during the investigation. The next panelist found that the presentation had nice slides but added little value. A different reviewer characterized progress toward goals to date as mostly theoretical. The final reviewer stated that if this project were following a linear timeline, it should be twice as far

ahead as it actually is (i.e., 30% versus 15%). This reviewer noted that a lack of collaboration and project redirection has impeded progress.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One observer observed that work did include partners. Another panelist stated that key partnerships and collaborations included Wedeven Associates, who contributed to the development of test methodology and subsequent evaluation of various processing and lubricant technologies, as well as Afton Chemical, who was developing additive packages that will be compatible with and perhaps maximize the benefits of specific surface treatments. This panelist listed potential collaborators that included the DOE Wind Energy Program, which showed potential to interface with one of several wind turbine gearbox reliability projects, as well as Castrol British Petroleum, a lubricant supplier known to work closely with Afton Chemical. This panelist indicated that missing from the collaborators was the presence of a powertrain component manufacturer or gear design expert, and an OEM. The same panelist acknowledged that the presentation indicated that OEMs are willing to provide guidance but noted OEMs are not included as formal collaborators. The panelist concluded that such representation would be valuable in terms of their knowledge of gear failure modes, and also knowledge of what may have been tested in the past. The next reviewer observed more collaboration than in the previous period, but an automotive or commercial vehicle partner was still needed to be identified. This reviewer recommended that rather than collaborating with a vehicle OEM, a component or system supplier of drivetrain components would be more appropriate. The reviewer pointed out that commercial vehicle OEMs do not typically get down to the level of detail on a component level as an axle or transmission supplier would, and recommended the researchers try there. A different panel member noted that, as in past reviews, this project suffers from poor collaboration. This panel member noted that this project needs a partner with strong gear and bearing design and application knowledge to insure the utility of the research to industry. The panel member speculated that if industry reluctance is truly based on competitive aspects, academia or other government institutions may suffice (e.g., the GearLab at The Ohio State University would be an excellent partner). This panel member further suggested the American Gear Manufacturers Association or the National Aeronautics and Space Administration (NASA) Glenn Research Center, and mentioned that there appears to be a similar research project awarded to Wedeven in 2008 by the DOD. The panel member concluded that this research should reference and build on the DOD Wedeven project as allowable. The final person observed the presenter complaining about the OEM lack of interest, and stated that precompetitive work in this area is hard to justify, making it very challenging to find collaborators. This person also remarked that oil companies are merely providing oil formulations, but are not involved in developments.

Question 5: Has the project 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?

One observer saw a plan to actually measure improvement to fuel economy from weight reduction. Another person noted the project had made a course correction for 2011 from building gearboxes to materials/surface and lubricant evaluation, which is in the right direction. This person suggested that as the project moves forward investigators should link the research back to a weight reduction goal for next year. The next panelist reported that future activity will include a continuation of the testing of each of the surface treatment options and four lubricant packages. This panelist relayed that only friction and wear testing was reported in the results section, so it was assumed that future testing will deal with scuffing and contact fatigue. The panelist also noted that a better understanding of the interaction between various surface treatments and lubricant packages will be necessary to come up with an optimum performance package, which in turn will require close cooperation with additive and lubricant suppliers. This panelist anticipated that at the conclusion of testing, the project will identify one of several surface treatment/lubricant packages that can deliver optimum performance under specific conditions. The panelist further stated that it is possible and perhaps even likely, that different packages will be required for transmission gearing versus axle gearing. The panelist went on to recommend that the investigators pursue an analysis to determine the degree of downsizing possible through use of the aforementioned packages, which requires a general understanding of other failure modes that may come into play (e.g., high cycle bending fatigue or shock load failures). This panelist concluded that this is an area where a subject matter expert from an OEM or powertrain system supplier could make a strong contribution, and help merge the empirical results from this test program into practical guidelines for component and system downsizing. Another reviewer reported that most of the planned activity has not been executed yet, and found that this section was not especially relevant. Having said that, this reviewer noted consideration should be given to other,

relevant application spaces (e.g., wind turbine gearboxes), and noted that there is a current DOE-sponsored program at NREL involving Romax regarding wind turbine drivetrains. The final reviewer called the proposed future research a nice, but aimless list of things to do, because it was broad and hard to pin down.

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

One reviewer found resources to be insufficient, while three found them sufficient. One reviewer noted that the funding seems generally adequate, but the progress to date has been limited, leading one to speculate that either more personnel, or test equipment, or both could help reach meaningful conclusions more quickly. This reviewer reported that according to the project end date, this program will be running another three years, and noted that with additional manpower and equipment, results could be achieved much sooner. The reviewer remarked that if this project can offer a path to significant improvement of power density, obtaining results sooner would be highly desirable. The reviewer acknowledged that adding personnel or equipment might increase the spending rate, but perhaps result in only a modest increase in overall spending, because the project could be completed much sooner. The same reviewer highly recommended that this be considered. Another panelist noted that the resources appear to be relatively lean but sufficient. This panelist added that the tribology testing appears to be relatively low overhead and specimen material cost is likely covered substantially by the collaborators. The final reviewer stated that the project appears to be adequately funded.

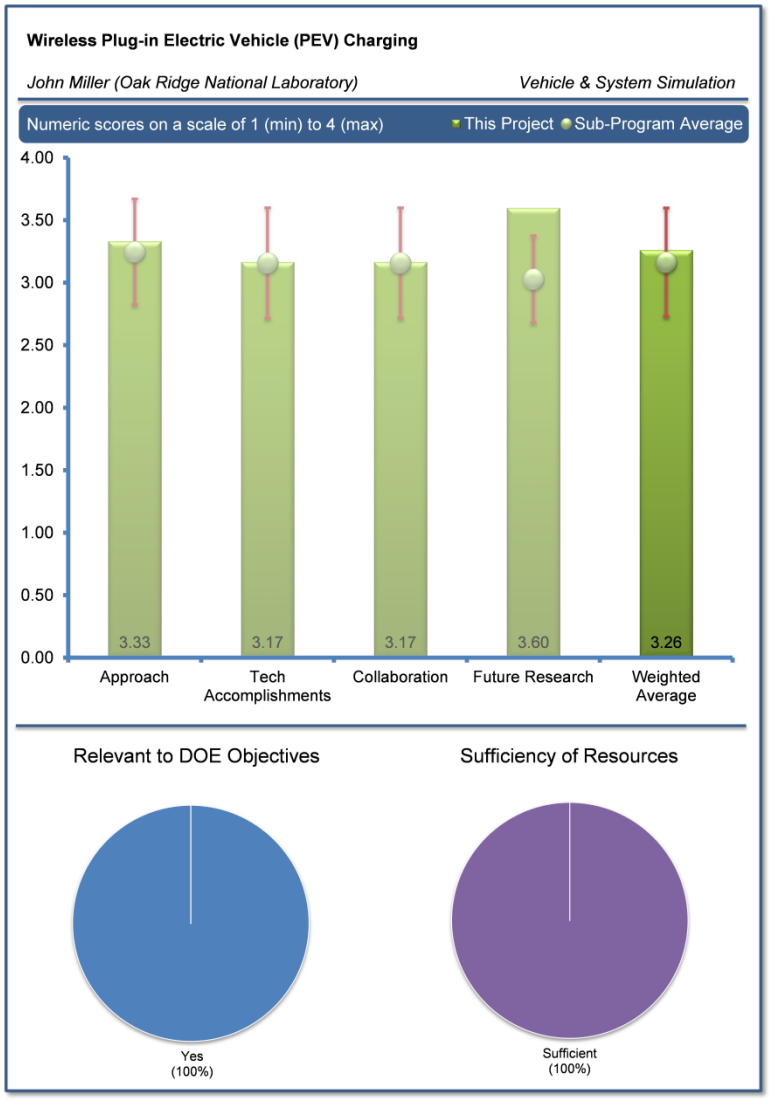
Wireless Plug-in Electric Vehicle (PEV) Charging: John Miller (Oak Ridge National Laboratory) – vss061

Reviewer Sample Size

This project was reviewed by six reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Two reviewers had similar comments indicating that wireless charging for EVs, if successfully adopted in large scale, could help displace petroleum, and that it has the potential to reduce petroleum consumption by maximizing the electric miles driven. Another reviewer stated that wireless power transfer has the potential to make electric vehicles less expensive to purchase and maintain, and easier to operate. A different reviewer noted that ORNL has established a foundation of knowledge and experience with wireless power transfer but while success in achieving objectives has been good, a path should be identified to translate this knowledge and experience into support for DOE objectives. Another reviewer specified that the key aspects of this project with respect to the overall DOE objectives of petroleum displacement are: for dynamic wireless charging by a reduction of the electrochemical energy storage system size in vehicle (thus reducing cost and mass), overcome range limitations (considering sufficient infrastructure penetration), and no waiting time for charging process to complete; and for stationary wireless charging, improved convenience for customer.



Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Comments regarding the technical approach/objectives to performing the work were mixed. One reviewer indicated that the project developed practical technical information on the wireless charging technology that spanned several iterations of device design. The same reviewer noted that these insights add significantly to DOE's knowledge base for wireless charging technology by identifying critical factors for performance and scalability. Another reviewer said that the key design aspects for the wireless power transfer (WPT) systems are very well addressed in the work approach. The work approach anticipates further development steps in power electronics, cost efficient and safe coil design, and mass optimization on vehicle side. This reviewer also remarked the project anticipates both stationary and dynamic wireless charging. A different reviewer expressed that the team is well integrated, and is on the right track to demonstrate Level 2 charging by the end of the FY. Another reviewer pointed out that the main technical barrier is to make the charging system smaller, more robust, and cheaper. The same reviewer added that this research is a step towards overcoming the barrier but there is a long way to go. Another reviewer said that development of hardware supporting the project's objectives are concentrated in the last few months of the schedule and may be compromised by difficulty in establishing communications. A reviewer also mentioned that since WPT has potential for larger fleet vehicles (delivery vans and transit buses), the reviewer would have liked to see a scenario, if only modeled, where the weight and bulk of the vehicle-side components were given minor consideration.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Most comments regarding the project's technical accomplishments and progress were positive. In particular, several reviewers noted that solid progress or a great deal of progress has been made in the past year and that targets have been met. One reviewer in particular indicated that the system has been constructed, and power transfer has been demonstrated. The reviewer asserted that this is the type of forward-looking research that will push the automotive technology forward. Another reviewer indicated that the project appears to have accomplished its primary design goal and optimized the design performance over several iterations. That same reviewer added that the project also provides the community with useful performance data over a range of coil spacing and frequency ranges. Another reviewer said that considering that WPT is a new development in EV system design, the technical accomplishments and the progress made are very significant and can be utilized both in standardization and technology commercialization. This reviewer observed that new hardware was developed, coupling coil design is key success factor for efficiency of power transfer – performance validated, that the control strategy optimized for minimum mass and size on vehicle side, that the communication concept for WPT charging was developed (Dedicated Short Range Communications-based), and that a coil power ramp up control strategies was developed. One reviewer noted that technical targets have been meet, but no advances beyond currently available commercial hardware are apparent. The final reviewer commented that solid progress has been made mostly on the charging system. However, there is a lack of roadmap for long-term technology development and market adoption.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Three reviewers provided similar comments regarding collaboration and coordination with other institutions. One reviewer commented that through the collaboration with the industry in standards development, the team has helped move the technology substantially closer to commercialization. Another reviewer indicated that Miller is supporting the SAE standards development with this project and has provided the community with useful tutorials via IEEE and other community forums. The reviewer noted that these collaborations accelerates technology development and contributes to lowering market barriers for the technology. The third reviewer acknowledged that ORNL internal collaborations and coordination are evident. However, the same reviewer added that dissemination of information gained should be a focus in the remaining months of the project. Another reviewer said that the partnership is limited and suggested that industry participation and input is desirable. A final reviewer said that collaboration with IEEE needs to be established in additional to collaboration with SAE.

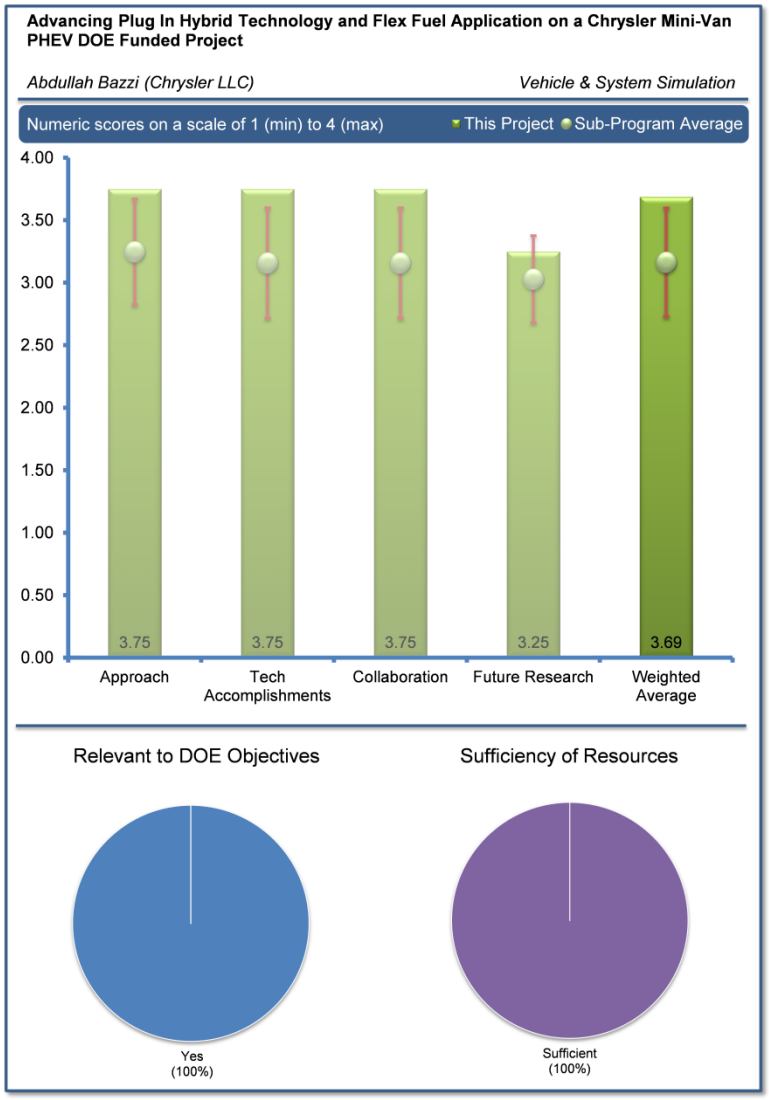
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Some reviewers had positive comments on the proposed future research. One reviewer commended that Miller's work has provided timely information to the research and development R&D community and bringing the project to closure ahead of schedule. The other commenter agreed that overall, this is a solid research project. The reviewer expressed that the project was clearly defined and well-executed. However, the reviewer noted that if the researcher could provide an overview of the forest before showing the tree, the importance of this research would be better established. The third reviewer commented that collaboration with industry partners is essential to focus on the addressed areas for future research. In particular, the reviewer pointed out that research on dynamic wireless charging needs to be enforced as well as the work on fast wireless stationary charging (e.g., to be used for public transportation). The final reviewer remarked that the project will end this year.

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

All of the reviewers indicated that sufficient financial resources were available for the project. One reviewer remarked that ORNL specialized resources appear to have been leveraged effectively. Another reviewer said that the stated milestones are sufficient. One reviewer added that in order to test dynamic wireless charging, investments have to be made in a suitable on-road test-bed. The reviewer noted that although this work is not addressed for this project, it needs to be considered for future research.

Advancing Plug In Hybrid Technology and Flex Fuel Application on a Chrysler Mini-Van PHEV DOE Funded Project: Abdullah Bazzi (Chrysler LLC) – vss063



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer indicated that the program supported both advanced vehicle development and education objectives. Another panelist stated that PHEVs are one of the best ways of reducing fuel consumption, which should fit the overall DOE program goal. The final panel member stated that combining plug-in hybridization and flex-fuel technologies in minivans will no doubt result in substantial petroleum displacement. This panel member pointed out that minivans are perhaps the most common family transportation vehicles, thus powering them with electricity and renewable, bio-based fuels will amount to a significant reduction in petroleum use nationally.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer noted the approach to be methodical and detailed, using a systematic product development process. This reviewer observed that the project was leveraging internal Chrysler and partners' core competencies, but that cold testing was not cold enough. Another panelist noted that the researchers employed a very comprehensive approach that covered many aspects of technologies. The next observer concluded that extensive vehicle testing would provide an excellent foundation for the vehicle demonstration. The final reviewer noted that the overall approach of pertinent technologies integration into a currently available product platform is an excellent approach. This reviewer indicated that this would facilitate rapid commercialization and quick benefit to the nation. The reviewer concluded that the main technical challenges and possible huddles were adequately addressed, or at least considered.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One person observed that the project is on schedule as planned, with adequate analysis and simulation of different components and systems. This person reported that a lot of real-world driving vehicle test data have also be accumulated. Another reviewer agreed that the program is on schedule and that there was an excellent approach for field data collection, but that some technical targets for vehicle performance had not been met. The next panelist noted that the report provided detailed status, and had some technical substance. The final reviewer requested specific details for each phase.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One observer indicated that there was good collaboration with a battery technology developer, and further reported collaboration with vehicle test sites, fleet owner, and national laboratories. Another reviewer noted work with INL on data collection was good and will assure program results are disseminated. The next panel member explained that the project was involving key suppliers and INL where needed. The final panelist suggested actively involving all partners.

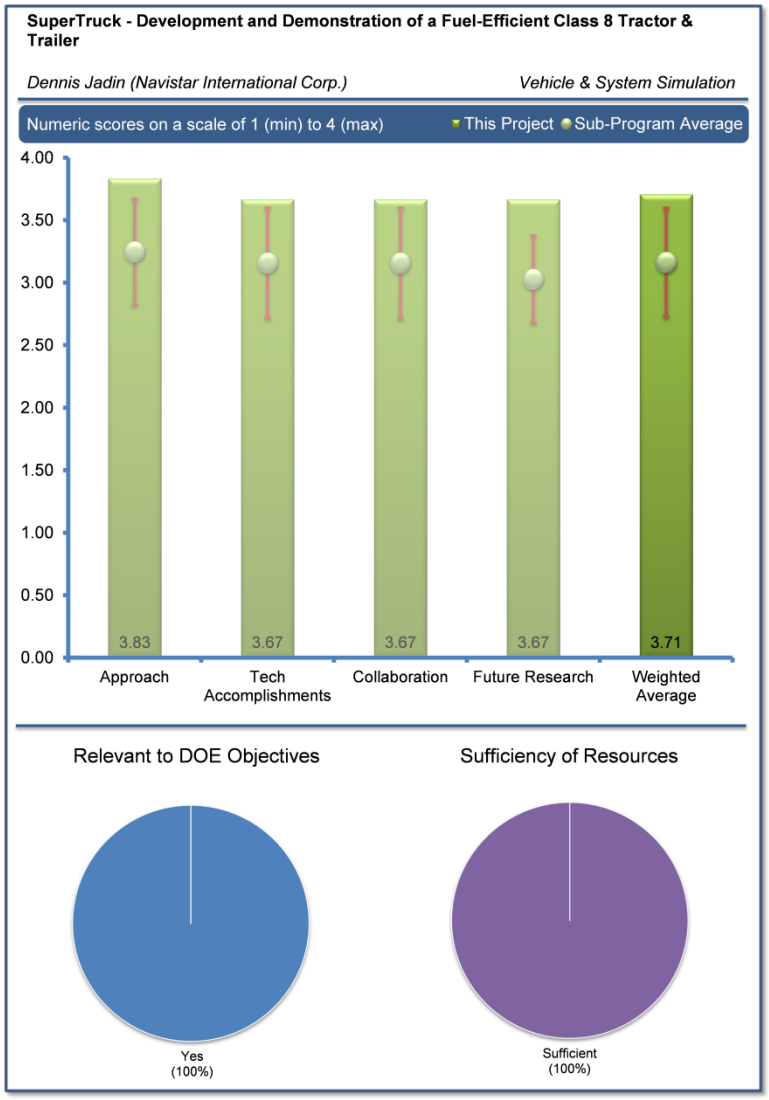
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One panel member saw a clearly defined future work plan in terms of test analysis and data collection. Another panelist looked forward to the building of a field data set that can be evaluated to improve vehicle, driver, and infrastructure performance. The next person exclaimed the future work is on target to the final goal, and emphatically described work as excellent. The final reviewer noted that the proposed future research was on track and following the methodical product development gate process. This reviewer suggested that the researchers should have considered Minnesota, North Dakota, or Michigan's Upper Peninsula for cold testing.

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

Four reviewers rated the resources as sufficient. One reviewer noted that the Chrysler vehicle test resources are excellent, and that the resources assembled for field data collection appear to be working reliably.

SuperTruck - Development and Demonstration of a Fuel-Efficient Class 8 Tractor & Trailer: Dennis Jadin (Navistar) – vss064



Reviewer Sample Size

This project was reviewed by six reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

All of the reviewers agreed on the relevance of the research. One reviewer said that although the project goals are set by the SuperTruck Program, the project goals will no doubt support DOE objectives of petroleum displacement. This was further supported by another reviewer who commented that as with all of the SuperTruck projects, this project's objective is reduction of fuel use by a HD truck by 50%. The reviewer added that achieving this would make a big dent in petroleum dependence which was similarly reiterated by several other reviewers. One reviewer discussed that this project is very relevant to reducing petroleum use and that Navistar with a significant market share in over the road tractors can influence the market highly with adoption of these technologies after concepts are validated and introduced. Another reviewer reinforced that the project is targeting high fuel use vocation and employing a systematic approach to improving fuel efficiency and the final reviewer found that the project objectives are key enablers to energy efficient highway transportation.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Reviewers had very positive comments on the technical approach to performing the work. One reviewer stressed that this project is extremely well-outlined. A second reviewer said that the project is well-focused, integrated, and is likely to succeed. This reviewer's reservations have to do with which technologies were chosen. For long-haul, it is unclear to this reviewer whether hybridization is worth the cost and the weight penalties. Similarly, for lightweighting, the added cost of carbon-fiber composites could raise the cost enough to make the truck more of an experiment than a viable commercial product. For this reviewer, there was also the question of whether the trailer skirts will actually get used. According to this reviewer, Walmart maintenance people have indicated they break easily and get weighed down with snow. According to a third reviewer, the approach of using four main technology buckets; namely hybridization, driveline efficiency improvement, light-weighting and aerodynamic drag reduction is very reasonable. The reviewer noted that these are all proven technologies, and that getting input from customers is also commendable. This will no doubt facilitate ready market acceptance of the final product. The reviewer felt that the use of simulation for various technology optimizations is very good. Another reviewer was particularly impressed with Navistar's voice of customer work. This reviewer was most confident that the project is tackling the bold challenge of 50% performance improvement, through a lens of commercial viability. That is, that the technologies will actually have a payback for the end users and eventually be launched onto trucks with reasonable if not full adoption. Otherwise, this reviewer found that the project's

approach was solid. Another reviewer noted the good organization and approach for addressing potential areas of improvements. This reviewer suggested that the project needs to discuss plans for hitting mass targets given the challenges of adding the HEV system (with increased mass). This reviewer noted a good example of a weighted selection matrix on Slide 13 – could show similar for other areas in the future. The reviewer noted that another good slide is Slide 14, trade-off study of battery size, mass and motor size versus freight efficiency. The final reviewer commented that a detailed technology roadmap with specific incremental efficiency improvement demonstrates the confidence in achieving the program goal.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Most reviewers exhibited positive comments on the technical accomplishments and progress of the project. One reviewer in particular enjoyed the wow factor for pushing the limits on aerodynamics. Another reviewer added that the design of basic concepts and components is well on its way which is a necessary prerequisite for actual construction of a working truck. In addition, the reviewer indicated that individual systems have been demonstrated on mule trucks. The reviewer noted that this is an excellent way to isolate their impacts and prove operability and performance in a cost-effective manner and that actual on-road proof of improvements should accelerate as the project progresses. This reviewer was impressed with the project's accomplishments. The reviewer noted that of particular concern is the weight issue. The reviewer stated that weight has not been that critical for OTR tractor trailers as fleets tend to cube out or not be totally full rather than gross out but that is changing. The reviewer asserted that emissions have added weight, most fuel saving devices add weight, freight is denser, etc. and that weight is becoming very critical. The reviewer agreed that Navistar is tackling this weight issue, but it is an issue for them to meet their goals. Nonetheless, several reviewers discussed that the research's on-going vehicle test for each of the technology buckets demonstrates that they are ahead of the game. One reviewer acknowledged that the project seems to be working toward goals but much work remains. The reviewer observed that results showed better gain with aerodynamic optimization than the target – which is very good. However, gain from hybridization, the reviewer notes, is lower than the target. Similarly, the reviewer pointed out that the weight reduction only achieved 25% of desired goal. Comments to improve the presentation/ research from reviewers were to continue to break down by technology and assess progress versus targets so that it remains clear where the challenges remain. Another reviewer felt that it would be helpful to explain why the hybrid vehicle (Slide 17) can have a better fuel economy while weight is increased by 2,910 pounds and the route is more on high-speed between 60-70 mph (Slide 16).

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Most reviewers acknowledged the project's collaboration and coordination with other institutions. A reviewer indicated that the project had a particularly well-rounded set of collaborators, encompassing all aspects of the vehicle itself, from powertrain to cooling to body to wheels to trailer, as well as modeling and testing efforts to confirm effectiveness of design improvements. A reviewer commented that the project was well-executed with other DOE labs. A third reviewer found that Navistar has developed a solid capable team and that this generally is an area where they excel. One reviewer noted that the integration of multiple technologies, participation and collaboration between team members is essential and identified the project has many key players and participants who are the leaders in their respective technology areas on board. A reviewer suggested that it would be helpful to acknowledge project partners for their contributions with a logo on those slides that they involved in. With a comprehensive list of partners, it would not help too much for the content. The reviewer asserted that with a comprehensive list of partners, it would not help too much for the content. Another reviewer added that the project should clearly list the targeted fleets and/or targeted customers and include voice of the customer requirements or targets to show impact on design process.

Question 5: Has the project 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?

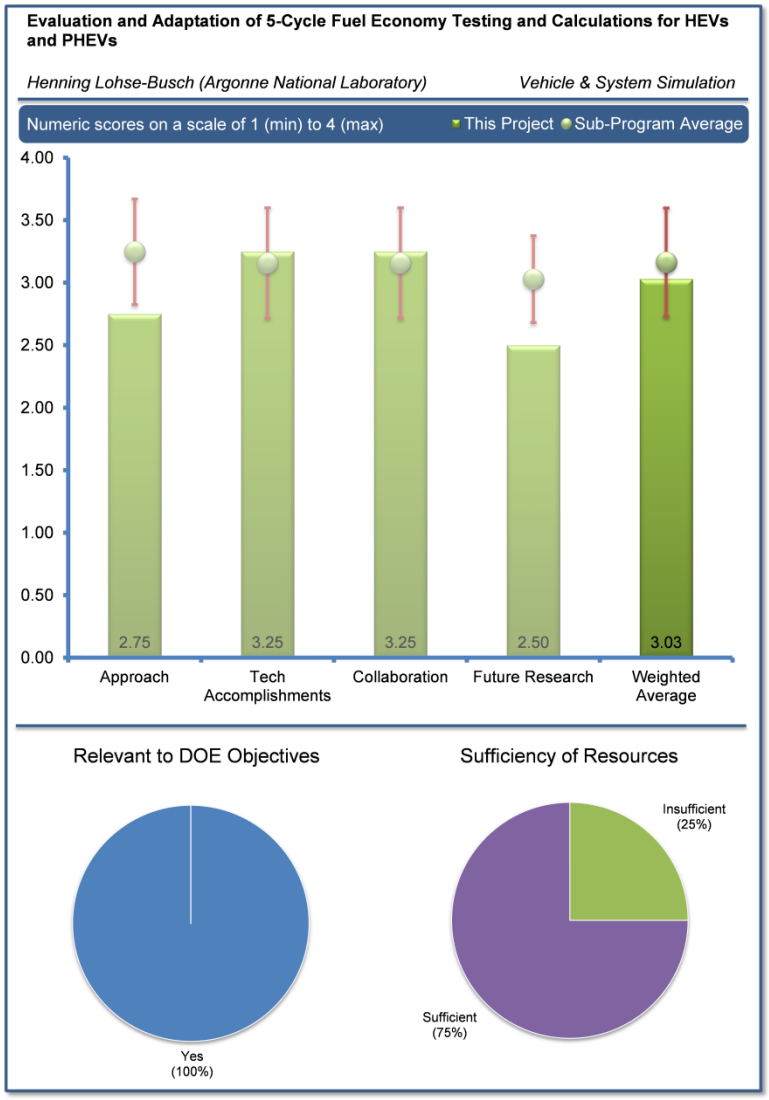
The reviewers had generally positive comments regarding the proposed future research for the project. One reviewer detailed that the project has a plan to further investigate hybridization issues as well and more work on lightweight materials. The reviewer added the plan to upgrade and optimize the various technologies in the next mule truck test is good. Another reviewer indicated that Navistar has a good plan to complete this project in the next few years. The reviewer noted that Navistar's use of the Kentucky route for real-world fuel economy testing is a good example. A different reviewer praised that this was by far the best presentation

on SuperTruck and that the reviewer would personally love to see Navistar push this even further and faster. Another reviewer stated that the future tasks are direct follow-ons to continue logical work plan that covers all aspects of the truck's and trailer's performance, and the final reviewer commented that the future work and research seems to focus on the program objectives.

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

All the reviewers agreed that sufficient financial resources are in place for the project. Comments provided by the reviewers were that it appears the researchers had the right resources in place. Another reviewer commented well done. A third reviewer indicated that evaluating costs of R&D was not a forte of this reviewer, but this project appears to have designed tasks in such a way as to complete all required tasks within the available funds.

Evaluation and Adaptation of 5-Cycle Fuel Economy Testing and Calculations for HEVs and PHEVs: Henning Lohse-Busch (Argonne National Laboratory) – vss065



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

All reviewers agreed that the research project was relevant. One reviewer acknowledged the project as directly relevant to determining the amount of petroleum reduction from use of specific hybrid vehicles. Another reviewer indicated that the project was absolutely critical to understand if certification rules create an unintended gaming for label values versus the real performance of the vehicles. The same reviewer noted that the project provides key information for DOE and EPA to collaborate on standards development tied to emerging technologies sponsored by DOE. Another reviewer commented that as the five-cycle method is derived from emission testing procedures where phase results are used for the fuel economy calculation, the charge balance is not achieved. Thus, the reviewer notes that fuel economy charge correction lines need to be determined for all the phases used (correction method according to SAE J1711). Other reviewers agreed that it is important to adapt EPA fuel economy label calculations accordingly as the penetration of hybrid-electrical vehicles is increasing. The reviewer reiterated that this project analyzes the so-called five-cycle fuel economy calculations designed to reflect real-world driving. Another evaluator mentioned that it is important to understand how stored energy in electrified vehicles affects comparative and real-world measures/ reporting of fuel economy so that consumers have reliable data for buying decisions.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Reviewers had mixed feedback on the technical approach. A reviewer commented that the bulk of the work to date has been methodology development but there is some risk that this methodology development was undertaken with only one vehicle make and without access to hot/cold test facilities. The reviewer added that the methodology should checked / confirmed by early testing of vehicles with different architectures (i.e., EV, Chevrolet Volt) and by including testing on the hot/cold chassis rolls. One reviewer said that the presentation needs to clarify what is meant by charge or discharge. The reviewer questioned if that is that energy coming from the battery, or energy coming from the APUs. The same reviewer admitted having a good understanding of the basic concept of state of charge (SOC) correction over different driving cycle phases, but found the presentation of this data difficult to follow. The reviewer asked if discharge referred to what was happening to the battery during a phase, or if it referred to the correction that needed to be made after the phase has been driven. This reviewer commented that the investigative questions cited were appropriate, but incomplete. An example provided by the reviewer is that the project should test and analyze additional

vehicles; it cannot be assumed that other vehicles will behave the same as the 2010 Toyota Prius. This reviewer noted that a resource-intensive approach – Slide 10 chart required four weeks of testing for only one vehicle. Another reviewer said that the approach appeared very sound given the limited funds and single vehicle sample. This reviewer thought that the project could highlight even more that this is a SINGLE SAMPLE indicator and not conclusive as to a broader population of vehicle architectures. According to this reviewer, the information was available in the presentation, but cautioned it could be flagged at every instance of presenting results, such as on the Summary slide, which appeared to have a broad conclusive statement. The final commenter specified that the key question is whether it would be better to develop a real-world fuel economy label for HEV/ PHEV with a focus on energy efficiency itself instead of using a fuel economy label developed for gasoline vehicles with a focus on emission and adapt it for PHEV. The commenter stated that the chosen approach is valid but the explanations in the diagrams could be improved.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Mixed comments were received on the technical accomplishments and progress of the project. One reviewer indicated that the project had good data and information given limited funding and short timeline. Another reviewer noted that the major contribution is the Charge Correction Curve. One reviewer commented that the project had useful (and fortunate) conclusion that correction required on five-cycle fuel economy label is much smaller than the corrections needed on each phase (five-cycle corrections less than 1% for the Toyota Prius). The reviewer also questioned if this result was applicable to other vehicles since it was only tested on a 2010 Toyota Prius. A different reviewer was concerned that the base method is defined but needs to be extended to the full five cycles and multiple vehicle makes. Additional comments were also that while ANL developed a set of charge correction lines, it was admittedly impractical due to the number of test points needed. This was somewhat reiterated by another reviewer who pointed out that the presenter indicated that the impact of the phase charge imbalances on the final fuel economy label was not as significant as originally expected. A question also came up with one reviewer who wanted to verify it the assumption in the calculation of the fuel economy correction line is a linearization (i.e., if the approximation was correct). Another reviewer commented that the chart on Slide 9 was confusing and questioned if the engine generally charges the battery on low-speed cycles and discharge on high-speed cycles. Another reviewer said that the presenter said that the project is on schedule to complete the study with multiple vehicle makes. The reviewer cautioned that this statement should be confirmed since no schedule was presented. The reviewer specifies that it appears that the project schedule called for work to be completed by Winter 2012 but there is significant work to be done. Another reviewer felt that the question whether the 5-cycle method encourages different design decisions than the 2-cycle method had not really been answered.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Two reviewers noted that the collaborations were good including the collaboration with EPA and others for the limited time and scope of project. One reviewer noted that the research used modeling resources at ANL and used academic resources at Virginia Tech – primary developer is a co-op student. Another reviewer mentioned that the United States Council for Automotive Research (USCAR) was involved in test planning and results evaluation but the extent/value of the interactions were not very clear from the presentations. One reviewer indicated that what was missing is the participation of at least one industrial partner.

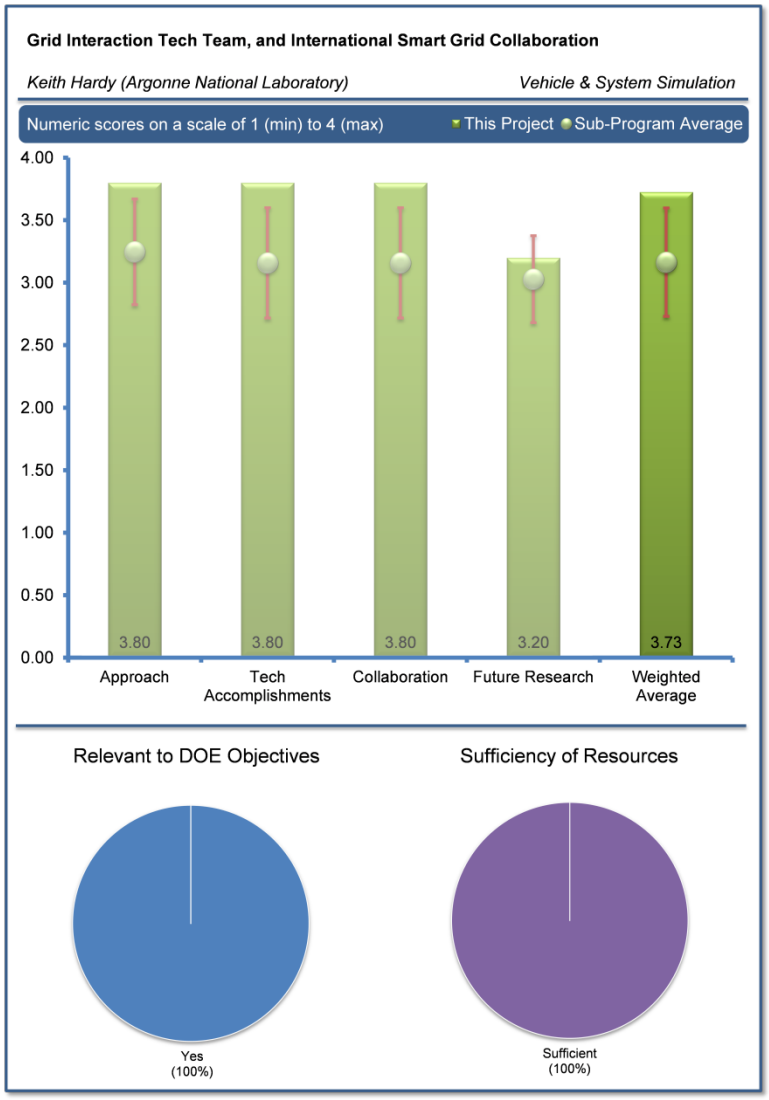
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Comments regarding the proposed future work and proposed future research varied. One reviewer noted that the proposed future research would test different HEVs and PHEVs (which addresses this reviewer's concern from question three). Another reviewer noted that the project could make a few more statements regarding what would be good next vehicles to test with the same approach. The reviewer asked what technologies could create a larger differential than the tested Toyota Prius and what should be tested next. A different reviewer suggested that instead of further testing of the adapted five-cycle method the project work on new dedicated fuel economy labels for PHEVs and HEVs in collaboration with EPA. One reviewer felt that it was difficult to understand whether the remaining work was containable within the project schedule and budget.

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

One reviewer found that funding was insufficient. Three reviewers indicated that the research project had sufficient financial resources. Comments from one reviewer were that the project did good work with the limited funds provided and that the project appeared to be on track for concluding current scope with approved resources. Another reviewer added that this was a cost-effective project but it appears the hot/cold test facilities were available at the time of project execution. The reviewer noted from prior comments that the remaining work schedule and budget should be confirmed. A different reviewer indicated that what was unclear was whether the upgrade of the Advanced Powertrain Research Facility of being five-cycle capable is in any context to the resources utilized for this project.

Grid Interaction Tech Team, and International Smart Grid Collaboration: Keith Hardy (Argonne National Laboratory) – vss067



Reviewer Sample Size

This project was reviewed by five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

All reviewers agreed on the relevance of the research project. One reviewer indicated that ensuring grid interaction by EVs will help EV gain market share, resulting in petroleum displacement. Similar comments were reiterated by another reviewer, who said that this project advances the adoption of EVs, which directly leads to reduction in petroleum consumption. For this reason, the reviewer notes that the project is relevant and supports DOE's objective of reducing petroleum consumption. Another reviewer described that this project is focusing on international development of standards relating to the interaction of electrified vehicles and the electrical grid. Thus, the reviewer agreed that the project impacts the efficiency and market acceptance of cross-industry producers and consumers respectively. The reviewer added that enabling Smart Grid Technology development and deployment advances the ability of consumers to charge their vehicles quickly and cost-effectively. A different reviewer reiterated praise for the relevance of the research commenting that the project had excellent relevance to light-duty vehicles and EVSE. The same reviewer had asked about medium- and heavy-duty applicability and gaps; the answers received focused on commercial versus residential rather than medium- and heavy-duty versus light-duty.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Most of the reviewers provided positive comments on the approach to performing the work. One reviewer remarked that the approach is sound, whereas another commented that it seems the ANL have a world-wide knowledge of standards roadmaps for electrification and accept responsibility for their timely evolution. The project team indicated that current emphasis is placed on connections, communications, metering, and interoperability. Another reviewer commented that this project is overcoming challenges through cooperation and harmonization of other EV funded initiatives. The reviewer noted, through these efforts, significant technical assistance is provided and shared across multiple programs and acknowledged that this approach was sound and consistent with DOE goals. That same reviewer specified that the project is targeting the various levels of grid connectivity which are necessary for a fully integrated system. A different commenter commented that the project is logically organized covering the range of technical barriers with respect to grid interactions issues that need to be addressed now. The reviewer also added that the project dovetails with other related projects at other labs and the standards groups. One reviewer commented that a

lot of activities are conducted under the initiative to address various aspects. However, there is a lack of performance measures by which the team's contribution could be identified.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Most reviewers provided positive comments on the technical accomplishments and progress of the project. One reviewer noted that ANL appears to be on-time in completing milestones with numerous publications and presentations. A second reviewer noted that clear roadmaps, schedules, and evidence of driving to timely completion were presented, and that effective harmonization between the United States and Europe has been achieved. This reviewer noted that challenges remain between the United States and Asia. Another reviewer remarked that excellent progress has been made in producing hardware that is ready for test on pilot projects. The reviewer added that future work must be focused on using this hardware on pilot tests for debugging and standards enhancements and noted that the cost of these units is crucial for wider adoption and must be a focus of research as well. One reviewer noted that the development of the metrology and communication hardware devices is significant. The reviewer added that the overarching support to all grid and EV developer stakeholders is helping break through multiple barriers. The reviewer alluded to the United States' and European Union (EU) agreement for EV interoperability as another example of excellent progress. Another reviewer acknowledged that the team made major progress on hardware development but on other fronts the progress is less clear.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Several reviewers recognized that the project had good collaboration or seemed very good. One reviewer noted that there was formal collaboration between DOE and the EC and alluded that Obama and Merkel pledged to work together on electric transportation. A second reviewer noted that the very nature of this work is collaboration. It appears that ANL is taking a leading role in coordinating multiple activities across multiple world-wide standards making bodies. The same reviewer added that the project is establishing interoperability validation centers in the United States and Europe. Another commenter noted good collaboration is shown between vendors, committees, and international partners. For this reviewer, potential improvement could be shown by incorporating vendors of other electric vehicles such as warehouse jitneys, forklifts, Segways, heavy-duty vehicles, etc. Another noted that the level of coordination with all the various stakeholders is significant. Collaboration with the other labs and the utility industry is also significant. The final reviewer noted a lot of collaborations or interactions. However, this reviewer felt that the coordination of efforts and responsibilities needs clarification.

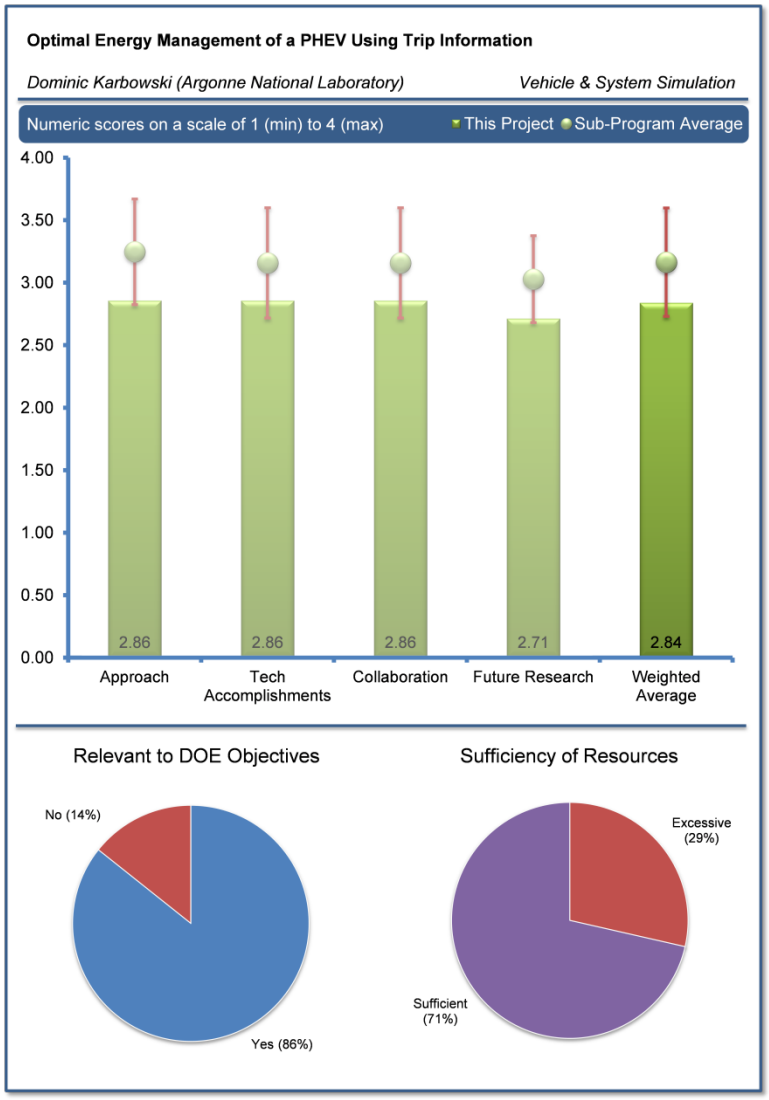
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The comments received regarding proposed future work and research varied. One reviewer summarized that the future plans build on the past work and are focused on near-term needs of EV developers and the standards community. Another reviewer felt that the proposed future work is well focused on ensuring continuous updating of hardware to include the latest requirements. The reviewer agreed that preparing for wireless charging and communications is highlighted and will be important. The reviewer pointed out that cyber security is shown as an area that will need work, but no defined goals are set, which should be included. This was reiterated by another reviewer who did not see details with regard to cyber security. That reviewer noted that this will be increasingly important as vehicles, EVSE, and the grid become more interoperable and should be addressed. The reviewer added that some example pathways for mischief or attacks include denial of charging, and instantaneous coordinated full-power charging (or discharging) of large numbers of vehicles resulting in high aggregate current levels that could overwhelm the grid. Another reviewer commented that the systems interoperability validation studies are of critical importance and added that it seems additional resource will be needed for these activities but 2012 budget is reduced significantly. This comment was added to by one reviewer who indicated that field tests are required and should be a larger part of this project (or part of a new project) to validate and refine designs. Another reviewer expressed that continued international harmonization will speed market growth due to efficiencies on the producer side and improved regulatory oversight. This was also commented on by another reviewer who said that China and Japan are mentioned in the international program development slide but future work does not include much about them. In addition, the reviewer said that there is a lack of partnership with these countries.

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

All of the reviewers agreed that sufficient financial resources were available for the project. Several reviewers commented that financial resources were adequate for the proposed work and that the project has been meeting schedules and is predicted to continue doing so. Another reviewer noted that effective project execution indicates sufficient resource and funding. A different reviewer asserted that there was no mention of insufficient resources, therefore the amount being accomplished with the provided funding appears to be commensurate. Another reviewer observed that because the scope of work is flexible, the project can accommodate a range of budget. One commenter reported that the project closely coordinated with codes and standards and international harmonization work. One evaluator commented that the budget has been reduced for 2012 yet the project is moving into system validation trials, which would seem to require more resource. Thus, the reviewer noted that particular care should be taken to ensure the project is designed accordingly. The reviewer suggested that perhaps separate funding for the interoperability centers is planned.

Optimal Energy Management of a PHEV Using Trip Information: Dominic Karbowski (Argonne National Laboratory) – vss068



Reviewer Sample Size

This project was reviewed by seven reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer noted that including trip information in the PHEV control strategies is very relevant to optimize the overall energy efficiency of the vehicle. Another panelist indicated this project addressed the subject of fuel economy gains, and although labeled as a PHEV program, a positive outcome could be applied across all transportation segments. The next commenter agreed that this approach is a precursor to a full-blown Intelligent Transportation Systems (ITS) and should offer significant fuel savings, even on vehicles equipped with conventional powertrains. This commenter stated that the benefits for PHEVs should be even greater than for conventional vehicles. A subsequent reviewer noted that if successful, this project has the potential to reduce petroleum consumption by more efficiently using the available power on the vehicle. The next panelist wrote that this project attempts to utilize destination knowledge, including road profiles, traffic patterns, etc., to optimize energy management in a short-range PHEV. The panelist indicated that using prior knowledge of these parameters can lead to implementation of conducive control strategies to maximize vehicular fuel efficiency and minimize emissions. The final reviewer found that the objective of the study matches the DOE objective but that the methodology was significantly flawed.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer was of the opinion that it is very important to leverage real time information about the true traffic speed and estimated stop locations and durations by utilizing data from vehicles via vehicle-to-infrastructure (V2I) communication (e.g., via dedicated short-range communications [DSRC]). This reviewer further commented that generation of the target speed should also be influenced by real vehicles that are driving below the speed limit. The same reviewer opined that the approach did not consider a real-world validation of the simulation results, and was completely based on simulations. Another panel member observed an interesting task that has a methodical and logical approach laid out to achieve objectives. This panel member found that the key to the approach is the use of dSPACE ADAS Research Platform Blockset to permit exporting of road data and subsequent processing in Autonomie. The panel member considered it interesting that, if successful, this concept could be utilized in a number of other applications. Such applications, continued this panel member, includes green routing and selection of optimal powertrains for specific routes, not only for light-duty vehicles but other vehicular classes as well. The next panelist relayed that the goal of the project is to develop system-level control strategies for PHEVs that use destination information to determine the optimal control strategy for a PHEV. This panelist shared two suggestions as to how the project could be improved. First, this panelist emphasized

the importance of showing that the adaptive control will not cause a reduction in fuel economy of the vehicle under any circumstances. The panelist described this as a challenging task given the substantial uncertainty in the route and destination prediction when the user does not provide destination information, and further acknowledged that the presenter noted, in the barriers section, the adversity that OEMs have to risk. Second, the same panelist suggested that the team look carefully at implementation issues in the automotive environment. This panelist further observed that the approach seems to be very data and information intensive, and the availability of traffic information may change from one area to another. This panelist finally added that the effect on control performance should be evaluated. Although another reviewer was in favor of the approach being taken, this reviewer would have used many more cycles for the purposes of strategy comparison because the results were being generated through simulation. This reviewer suggested that one option would be to use the data available in the Transportation Secure Data Center to provide real-world drive cycles from various locations in the country. The same reviewer reported that one of the questions from another reviewer was about the lack of statistical variation in the drive cycle that is being simulated, and suggested that use of Transportation Secure Data Center data would partly address that. For instance, explained the reviewer, NAVTEQ could do the routing, and the Transportation Secure Data Center data could provide the statistical variability. Another observer wondered if the baby step presented moves towards the achievement of a viable tool for possible practical applications. This reviewer indicated the research started from a step or two behind the state-of-the-art because there was no real time updating during a long trip, planned or projected in future work. The final panelist found that the study's major weakness was the prediction of a deterministic driving condition (traffic, signals, etc.) and optimization of driving accordingly, which this panelist opined is unlikely to yield significant fuel savings. Also, this panelist had not found the application of control and the human-machine interface to be well noted out.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first reviewer cautioned that the opinions submitted may be somewhat biased because this approach was exactly what this reviewer has been urging this reviewer's company to take, though the ultimate objective for the reviewer's company was to use the simulation to develop 50th percentile component and subsystem duty cycles, rather than improving real-world fuel economy. This reviewer agreed with the PI that the OEMs may be reluctant to introduce technology that does not get the OEMs credit in terms of the fuel economy number on the sticker or something equally concrete. The reviewer noted that could change, however. The same reviewer further explained that the OEMs never previously considered Consumer Reports drive cycle as something they should be looking at, but the OEMs began to consider that as well when it eventually sank in that it is exactly what most customers looked at. Now, expressed this reviewer, all three Detroit OEMs have their version of the Consumer Reports fuel economy cycle, which is used to evaluate their vehicles. It may just take one OEM to consider your approach, opined this reviewer, and the others will likely follow. The second observer indicated that technical accomplishments and progress were acceptable, in the context of the planned project plan. This observer pointed out that about half of the planned work is visiting territories that have been well covered already, and stated that all work done to date is mostly busy work which could be done on as a thesis topic of a Master's degree. The observer further stated that similar technology has been available for a few years now (e.g., Tokyo metro area and surroundings, including Yokohama, etc., offer real-time trip route optimization feedback to a driver once the arrival point has been entered). This observer pointed out that using building blocks from such technology could have saved effort, time, and money. Another panel member reported that the primary focus of the project so far has been in developing a tool that is able to generate a driving cycle given the origin and destination for a trip. This panel member noted this to be a very useful tool, but that it was unclear what the lab has done and what comes from their partner NAVTEQ. The panel member remarked that sharing this tool with other researchers in some form would substantially strengthen the impact of the project. The next observer considered the development of the dSPACE ADAS Research Platform Blockset, as well as the development of Autonomie simulation modules, to be the key technical accomplishments. This observer indicated that it was not clear whether only the Chicago trip was simulated and analyzed, or whether multiple trips where simulated and analyzed. This observer also noted the lack of explanation as to where the data sources come from for traffic pattern speed and stop locations, and related that no statements were made in terms of the actual effect on the vehicle energy efficiency if an optimized control strategy is applied. A subsequent reviewer found that while the task is a little behind schedule, a number of technical accomplishments have been achieved. This reviewer highlighted development of a dSPACE ADAS Research Platform Blockset plug-in that formats information for Autonomie, and successful processing of trip information in Autonomie in which a vehicle speed target is generated. This reviewer further reported that a trip

simulation is then developed based on speed and grade, and the output here can be fed into a distance-based driver for whole vehicle simulation. The final reviewer reported the project had made little progress, and that the majority (and the most important parts) of the research was yet to be done.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer observed that the team has demonstrated a very strong collaboration with NAVTEQ. Another panelist noted that collaboration seemed adequate for this activity, although indirect reference to discussions with OEM R&D engineers should be more detailed and elaborated. This panelist suggested that it may also be good to have discussions with medium- and heavy-duty vehicle manufacturers as their vehicles and duty cycles may benefit the most from this type of technology and subsequent control strategies. Another panel member recommended potential coordination with Jeff Gonder at NREL that may be worthwhile for this project. The next observer noted that the project showed some collaboration, but that it appeared superficial. The following reviewer opined that the researchers should consider also including telematics service companies in the collaboration stakeholder portfolio. This reviewer further pointed out that it is essential to have at least one OEM to validate the simulation results with a physical prototype. The final panel member saw no connection with the end users or other stakeholders in the PHEV domain. This panel member also mentioned that the last bullet on presentation Slide 16 is not justified and at best reflects some naiveté. The same panelist expected to read such a comment on Facebook, but not within a serious R&D program sponsored by a government agency.

Question 5: Has the project 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?

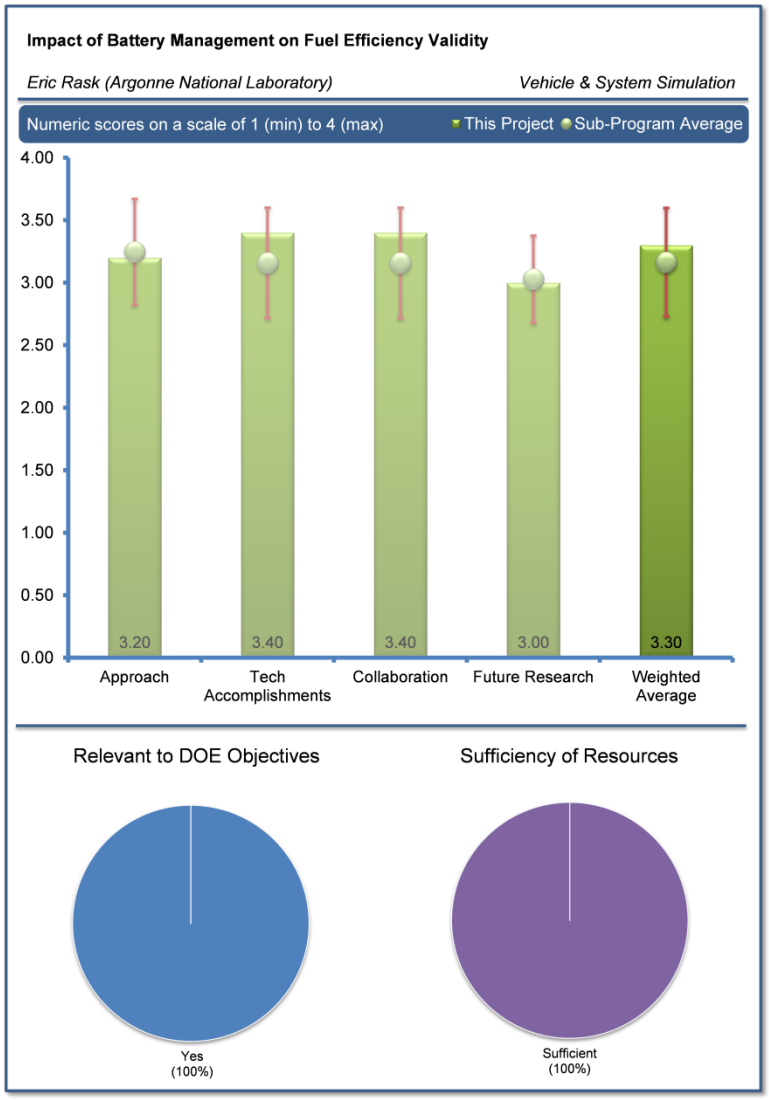
One reviewer noted that future work is relevant and challenging. Another reviewer indicated that the third quarter is the most critical building block, and is the core of the program if it is to produce something worthwhile. In fact, this reviewer considered third quarter to be the real program starting point. The next observer noted that proposed future work made sense given the scope and status of this task. This observer relayed that to provide quality control, it is being proposed to refine the derived drive cycles through added nuances to the discrete driving segments and comparing results to that of real-world drive cycles generated from global positioning system loggers or established database information. This observer further stated that subsequent to this step, efforts will focus on choosing a representative baseline PHEV for study and developing appropriate control strategies, with an ultimate goal of comparing the full trip fuel efficiency of trip-based control to standard control. This observer concluded that it will be very interesting to see what type of overall driving cycle efficiencies can be realistically and consistently achieved. Another panelist referred the reader back to previous statements, which urged the researchers to use the data available in the Transportation Secure Data Center to provide real-world drive cycles to address the lack of statistical variation in modeled drive cycles; and suggested coordinating with Jeff Gonder at NREL. The next reviewer indicated that the researchers should make major revisions to the current research plan. The final panel member suggested that the proposed future research needs to focus on the following topics: validating the simulation results with data from real-world cycles; implementing the control strategies in vehicle prototypes and measuring the effectiveness of these control strategies; generating real-time traffic data from vehicles (via DSRC-based V2I communication); and actively influencing the achievable top speed.

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

Five reviewers found resources to be sufficient, while two found them to be excessive. One reviewer noted that the resources allocated for this task are currently sufficient, but that if the task is ultimately successful and exhibits demonstrable fuel efficiency benefits, it would be beneficial to further fund this activity to achieve its promise and subsequent implementation into conducive vehicle classes and models. Another observer agreed that the resources appear to be sufficient for the simulation related work; however the validation will require more significantly more resources for future research activities. The next panelist commented that the resources are sufficient because the work at this stage is purely simulation-based. A different commenter reported the project was mostly computer simulation with no real-world testing, and that the research funds could be better utilized. The final reviewer suggested that work to date has been covered before and appeared to be busy work of a lower academic level, lacked connection with the end users or other stakeholders in the PHEV domain, and characterized third quarter 2012 as a starting point for the project. In light of these comments, this reviewer opined that even if the entire program funding was $250,000, it would be

considered relatively generous because a competent Autonomie user could accomplish a major part of the intended results with a small fraction of the cost.

Impact of Battery Management on Fuel Efficiency Validity: Eric Rask (Argonne National Laboratory) – vss069



Reviewer Sample Size

This project was reviewed by five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

All of the reviewers provided similar comments on the relevance of the project. One reviewer summarized that while the project does not directly impact petroleum displacement, it allows objective evaluation of technologies that are intended to displace petroleum usage. Another reviewer said that this effort directly supports standards development which is critical for unbiased technology evaluation and assists in the adoption of advanced vehicles. Another reviewer commented that this project supports the evaluation of battery electric and plug-in hybrid vehicle evaluation and comparison to petroleum-based vehicles. The reviewer added that a successful project will advance the robustness and reduce the cost of battery electric vehicles thus encouraging petroleum displacement. A different reviewer suggested that with the consideration of EVs and HEVs, the impact of the battery energy management on the fuel economy needs to be properly considered. The same reviewer added that the project addresses the importance of the Net Energy Change (NEC) metric in correcting standardized fuel consumption tests.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer noted that the project goal is important: improving advanced vehicle test procedures will provide more certainty in the marketplace. The commenter felt that this is a good role for the DOE to get involved. However, the objective of the project is somewhat broad, unclear and open ended. An example provided by the reviewer was that it was unclear what impact the evaluation of state of energy (SOE), SOC discrepancy will feed back to impact vehicle design and standards. Another reviewer summarized that the project is leveraging existing light-duty data to understand NEC trends and sensitivities and apply the findings for an evaluation of medium-duty/heavy-duty vehicles where data availability is very limited. The reviewer added that as this data is limited, it is recommended to collect more data which is also needed to validate the simulations. Another reviewer commented that that the approach of extensive modeling and selected testing to identify opportunities for improved models and improved testing directly addresses the barrier of test protocols. This reviewer commented direct usage for medium- and heavy-duty vehicles. The reviewer suggested that the project needs more effort on the modeling for medium- and heavy-duty vehicle energy consumption modeling. In addition, the reviewer notes that the difference in the battery and vehicle use between light-duty and the medium-duty and heavy-duty fleets are large. Thus, there needs to be more effort to interrogate the data so that there is an understanding as to what can be learned from light-duty to apply to medium-duty and heavy-duty effectively, without running down an unproductive path.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Most reviewers provided positive comments on the technical accomplishments and progress of the project. A reviewer noted that a very important result is the proposed correction procedure for the net energy calculation. The reviewer added that the NEC non-linearity is addressed and that the difference between SOE and SOC is well explained. Similarly, one reviewer commended that the quantification of NEC tolerance effect on fuel economy as a significant achievement. Another reviewer commented that there has been good progress towards the technical goals. The investigations on temperature effects and the sensitivities are promising. A different reviewer added that it is not completely clear from the presentation what the expected completion date of the project is – so it was hard to judge how well the project is progressing toward completion. With that being said, the reviewer remarked that the results presented provide valuable insight into some of the issues involved in coming up with a good standard for measuring PHEV fuel consumption. One reviewer indicated that the investigations into state of charge relative to state of energy are important for improving battery control algorithms and remaining range estimates. A reviewer suggested that more efforts need to be expended on the larger battery systems likely to be used for medium- and heavy-duty applications. In addition, the reviewer added that the suite of analysis needs to be better integrated to improve the robustness of the systems and predictions.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Most reviewers provided positive comments on the project's collaboration and coordination with other institutions. Reviewers remarked that the mix of involved institutions and industrial partners was outstanding, and that all relevant stakeholders for the development of the SAE J2711 test procedures are involved team was involved in standard development with the SAE which was an important goal of this project. Another reviewer acknowledged the strong collaboration through SAE, DOE, Canadian groups and the software for modeling. However, one commenter observed that while the medium- and heavy-duty community appears to be well represented, the HEV/PHEV community does not appear to be involved in the project. The commenter suggested that perhaps it would help to have the automotive OEMs involved as well.

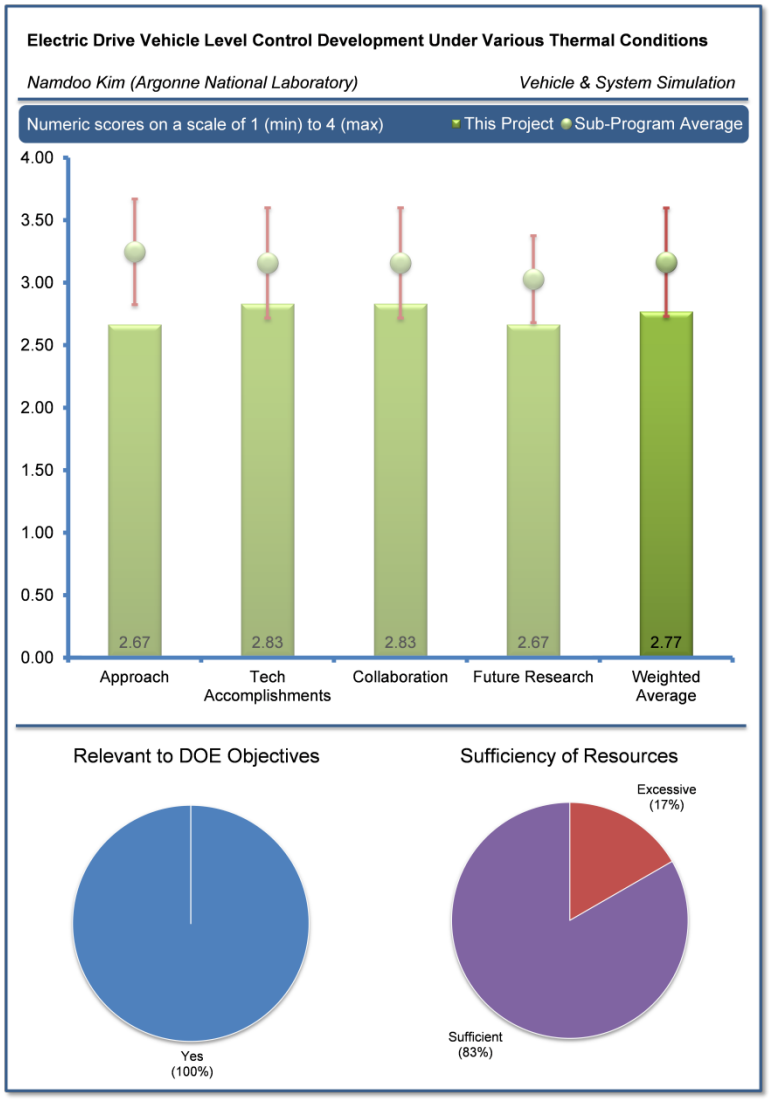
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Reviewer comments on proposed future research were mixed. One reviewer indicated that the proposed work looks good, but wanted to know if there could be more benefit achieved by involving passenger vehicle OEMs as well. Another reviewer identified that the most important future research work is the finalization of the SAE J2711 procedural changes and the evaluation of specific medium-duty/heavy-duty issues. A different reviewer acknowledged that the future work addresses the technical issues. However, the reviewer would like to see deliverables of the future work more clearly defined. The reviewer suggested that the future work should have a direct path to inclusion in modeling and range estimates and added that the presentation identified many other issues that are not clearly addressed in the future work. Similar concerns were reiterated by another reviewer who indicated that the plan for the future work could be more focused. The reviewer mentions that in the future work outlined for light-duty vehicles, it is unclear what impact the team would like to have by the end of the project, especially with the battery monitoring work and by assessing emerging technologies through continuing testing and analysis.

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

All five reviewers felt that the project had sufficient financial resources available. Several reviewers commented that project resources are sufficient, appear to be sufficient, or are sufficient for the modeling efforts. One reviewer noted that the testing effort will require more resources either from the industry or DOE.

Electric Drive Vehicle Level Control Development Under Various Thermal Conditions: Namdoo Kim (Argonne National Laboratory) – vss070



Reviewer Sample Size

This project was reviewed by six reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer explained that there is a measurable benefit to be gained in terms of fuel economy by using effective thermal management, even for vehicles equipped with conventional powertrains. This reviewer expected this to be even more so in the case of electric drive vehicles. Another panel member considered thermal management system optimization of a vehicle to be helpful in increasing fuel economy, which supports the overall DOE objective of petroleum displacement. In particular, this panel member indicated that for high fuel economy vehicles such as EVs and PHEVs, auxiliary loads have a higher impact on the overall fuel economy compared to conventional vehicles, especially considering high and low ambient temperatures. The next panelist remarked that a better understanding of the thermal behavior of advanced vehicle components is of interest to the DOE. Another reviewer commented that auxiliary loads will affect range due to demands on battery, and that due to the nature of subsystem suppliers to cost optimize their particular system, it becomes difficult for the vehicle integrator to optimize all of the subsystems from the vehicle perspective. This reviewer expressed that the project could help give guidance to OEM, system, and subsystem suppliers. The final observer pondered if the industry's current technical competency is so lacking to the point that an esteemed national lab team should invest time and resources in formulating and running models (e.g., MATLAB/Simulink and Autonomie).

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One panelist noted that the approach seemed logical, and that the researchers were analyzing the components under ambient temperatures and then introducing temperature extremes. This panelist found the utilization of the control model to be a good approach. Another reviewer indicated that the approach was straightforward and segmented into a vehicle cooling system and climate control system path, and further observed component validation, vehicle control, and vehicle validation. However, this reviewer wondered what could be accomplished in this project that could not be accomplished by an OEM. The next panel member explained that accurate models of both the electric machines and batteries appeared to be required to achieve the goal of this project. In addition, this panel member asserted that the impact of temperature would be indicated the most on the cold Federal Test Procedure cycle, and was unsure whether lumped thermal models of electric machines and batteries have adequate resolution to capture peak temperatures. The panel member also remarked that it appeared that the focus so far has not been on the cold cycle test. This panel member stated that it is reasonably easy to develop and validate thermal models for normal operating temperatures,

but cautioned it would be considerably harder to develop these for low temperatures because measurement of component efficiency at these lower temperatures is not easy. Further, continued this panel member, even the use of analytical models to represent temperature dependence of efficiency will require significant effort at validation. The panel member also referred the researchers to Professor Heath Hofmann's (University of Michigan) work on developing effective lumped parameter thermal models of electric motors. A different reviewer found that this seems to be a modeling exercise, and inquired about the size of the investigative or R&D portion. The final observer relayed that the goal of the project is to develop a system-level thermal management strategy to improve the vehicle fuel economy, employing an approach of developing a thermal model for each component of the vehicle as well as the system-level control strategy to be able to potentially tweak the control to improve the vehicle fuel economy. This observer found that a substantial part of the year had been spent of developing the system level control for the vehicle, which seems secondary to the goal of the project. The observer was also concerned that the proposed approach is unclear about how the models and the approach can be generalized to other vehicles and other technologies or cooling methods. Therefore, concluded this observer, the impact of the project may be limited.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One observer expressed that the progress had been quite significant, with substantial impact on fuel consumption change due to effective thermal management being seen in the cold cycle. This observer reported that the project is close to 70% complete, but that the presentation did not make clear whether the project will look at low temperature behavior of the various components (i.e., engine, transmission, electric machine, and battery pack). The observer recommended that, if developing models that are valid at low temperatures is not part of the project scope, perhaps it should have been clearly stated. Another reviewer saw good progress to date, and reported that researchers had developed the control model and are verifying it on the Chevrolet Volt. This reviewer also acknowledged the battery thermal data, loaded in Autonomie, as progress. The next panel member asserted that, barring the concerns about the project approach, the team has made significant progress towards developing the vehicle control strategy model and developing the thermal models of various components. A different panelist related that the vehicle model (Toyota Prius) and battery thermal model (Chevrolet Volt) have been validated so far, which is in line with the milestone plan. The final reviewer observed that the start of some level of investigative work in this program was promised by Slide 12. Prior to that point, this reviewer opined that the reported work could have been routine for any analyst relatively well-versed in Autonomie. The reviewer concluded that the values of various constants used in the simulations are mostly guess work, and thus, matching the simulation to the experimental data is the same old art.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer commented that the stakeholder selection reflected the right balance between industry (OEM and battery manufacturer) and multiple National Labs, including a software partner (MathWorks). Another observer indicated that the team had formed many, meaningful collaborations, but noted a closer collaboration with the OEMs could have saved the team substantial time in developing component models and control strategies. The next reviewer explained that this project could have been rated lower by this reviewer, who scored the project higher based on the intent that the next points be addressed in future years. This reviewer perceived the partnership on Slide 2 as the usual vague and escape clause, and further described it as trying to avoid accountability, at least for the DOE Annual Merit Review audience. The next panel member would have liked to see more of an active involvement from component level suppliers and an overall OEM, especially because no specific companies were listed. Because of this omission, the panel member was unable to determine if the collaborators are planned to become involved or are already actively involved. The final panelist expressed that there was significant overlap in the area of development of component thermal models with the project vss046 (Integrated Vehicle Thermal Management - Combining Fluid Loops in Electric Drive Vehicles). This panelist recognized that the presentation does indicate cabin and A/C models were developed at NREL, but pointed out that it did not say whether the electric machine and battery pack models were developed in conjunction with the other project. The final panelist concluded that if these models were already developed for vss046, it would make sense to just use them rather than starting from scratch.

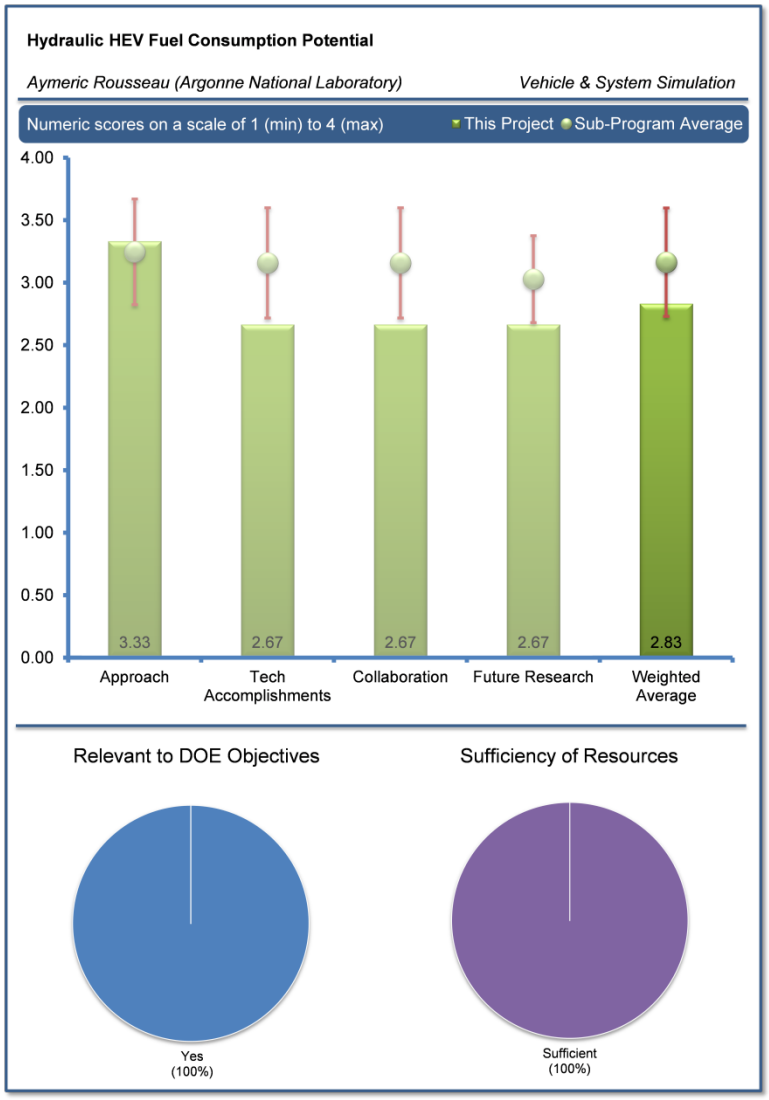
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One observer reported that the proposed future work addresses development of thermal models for other powertrain configuration. This observer indicated that identifying the potential for higher energy efficiencies in component redesign will be the true value contribution of this project, but that first the model must be validated properly. Another reviewer suggested that some effort may be saved with more collaboration with other DOE funded projects, and pointed out that MathWorks may not be the best collaborator for developing an effective engine thermal model. This reviewer further suggested that it would instead be preferable to work with someone who is more familiar with the practical behavior of an engine. The next panel member asked about the other variables considered (e.g., if driver inputs affect the studies). In other words, this panel member wondered if a situation where one driver may consistently drive with the air-conditioning on, while the next driver does not use it at all, would affect the overall system performance. A different panelist expressed that it seemed difficult to develop a robust applicable thermal control strategy when there are no systems and vehicle standardization. This panelist suggested the researchers pick and stick with one throughout the entire process. In other words, continued this panelist, what the researchers are observing today may be completely changed two to three years from now. The final reviewer stated that, barring concerns about the project approach, the team has a solid plan to meet its targets.

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

Five reviewers found resources to be sufficient, while another reviewer observed excessive resources. One reviewer noted that this project appeared to have sufficient resources to draw from. Another reviewer agreed that the resources allocated are sufficient. The next panelist found that no information was reported on resources used or those required going forward. The last reviewer said that the excessive rating was in the context of previous comments, and further questioned if this project is a continuation of a prior year's program because it shows $250,000 for FY 2012, but Slide 5 describes the work done in FY 2011, and Slide 6 shows intended work for FY 2013. This reviewer stated that if this project is a continuation, then full disclosure is encouraged, as presenting only piecemeal funding of a larger program should not be condoned. The reviewer concluded by asking what the value and the return on DOE investment were from traveling to Chenzhen, China to present part of the work done (Slide 21).

Hydraulic HEV Fuel Consumption Potential: Aymeric Rousseau (Argonne National Laboratory) – vss071



Reviewer Sample Size

This project was reviewed by three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One commenter remarked that this project would help DOE determine justification for either future funding or closing of the hydraulic hybrid vehicle (HHV) efforts. Another reviewer indicated that this project produced a good trade off study of fuel consumption performance across various drive cycles between HHVs, series and parallel HEVs, and conventional vehicles. This reviewer stated that not all technologies will perform as efficiently across all applications and drive cycles, so having data that can target the system with the best possible application is beneficial. The final panelist reported that this project is looking at quantifying the extent to which hydraulic hybrids reduce fuel use. This panelist stated that several companies are proposing systems that need to have payback to be purchased in quantities or get DOE funding.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

A first reviewer indicated that it was good to take a step back and review the EPA accumulated work on HHV through the past several years. Another panelist described the scope as fairly broad, and stated that comparing HHV, HEV, and conventional is an all-inclusive task, which is good. However, cautioned this panelist, keeping the data relevant and current will remain daunting as each of these different platforms improves and changes. This panelist recommended that, at the last step, researchers might narrow the drive cycle selection as the different powertrain configurations will be more appropriate and tuned for different drive cycles. The final observer agreed that the use of the EPA models was a good idea to save time and effort, as was changing control to include pump. This observer also opined that if possible, more real-world correlation would be valuable, although this would probably greatly increase the scope and budget.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One reviewer called this project a pragmatic and unbiased study, and remarked that the comparison of HHV with HEV is quite helpful to DOE and to the general technical community. Another observer reported excellent progress to date, including mapping the various configurations and comparing them across several drive cycles. The final panelist reported that both series and parallel hybrid models were developed, and that the series hybrid model correlated well with the EPA model.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One person observed that because there are existing hydraulic and electric hybrid products already in the market, the PI might try to reach out to the actual manufacturers to enlist their support in any models they have already developed and any data they have compiled. This person would have liked to see more definitive industry involvement and comments. Another panel member suggested that collaboration with hydraulic hybrid companies such as Easton and Parker would be valuable. This panel member commented that it was good that the researchers are looking to get the EPA field data to compare with the modeling results because some providers of hydraulic hybrid systems seem to pulling back and others are saying they have a business case. The panel member further found that modeling could provide insights into why and what future systems could include in terms of components, and that more direct communication with the providers of hydraulic hybrid systems could facilitate knowledge transfer from this project to the marketplace. The final reviewer suggested that because Eaton is a stakeholder in this, it maybe should get involved, albeit Eaton would be a biased party. The same reviewer reiterated these remarks for TACOM, who have strongly supported HHV in the past (Dennis Wend and Paul Skalny) along with some funding. This reviewer opined that their input to ANL would be valuable.

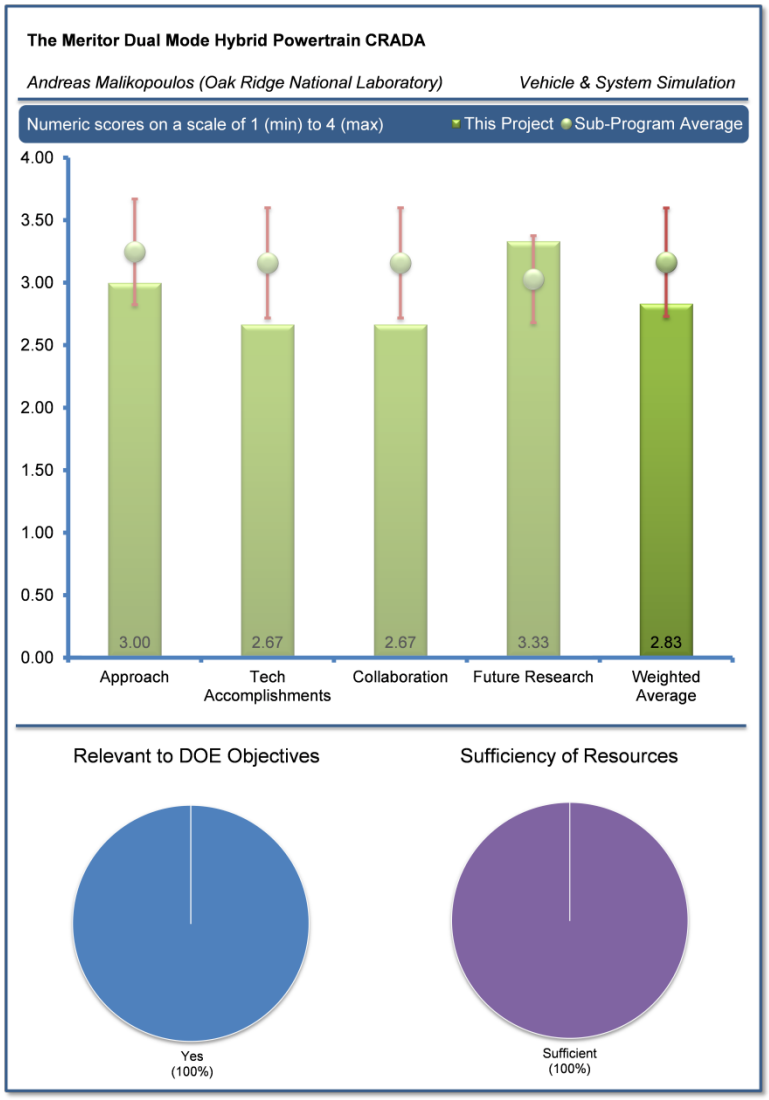
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One observer indicated that the FY 2012 goals seemed logical, but that the FY 2013 goals seemed too broad, with too many variables to include in all permutations and applications. For example, this observer indicated that hydraulics will most likely be limited to best use on a small subset of drive cycles, and suggested starting with those for now. Another reviewer recommended that the researchers look at correlation with field cycle data, if funding allows. The final person asked if DOE should continue to spread the budget of this section of VTP over HHV and HEV, or if it would be sound to down-select to one of them based on technical merits and value proposition. This reviewer further emphasized that there was no need to beat a dead horse.

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

Three reviewers found resources to be sufficient. One reviewer reported that no information was provided on resources used or those required going forward. Another reviewer asked if resources were available to poll data from hydraulic system providers for MD trucks or the EPA data from those providers or fleet users.

The Meritor Dual Mode Hybrid Powertrain CRADA: Andreas Malikopoulos (Oak Ridge National Laboratory) – vss072



Reviewer Sample Size

This project was reviewed by three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Reviewers agreed on the relevance of the project. One reviewer indicated that improved fuel economy reduces oil use. This was acknowledged by another reviewer who indicated that the aim of the dual mode hybrid is to save fuel. The reviewer added that it would provide a HD hybrid solution that might have benefit for long haul trucks, an application for which to date has not had a hybrid system that can save substantial fuel. Another reviewer liked the idea of optimizing a product that is being developed for market. This reviewer noted that while not yet launched, there is room for improvement and will enhance its potential acceptance by the various OEMs once launched, particularly in the Class 8 long-haul (LH) market, where hybrid-electric vehicles are not yet as far along as light-duty or medium-duty.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Comments on the approach to performing the work varied. One reviewer indicated that the research was well presented. Another reviewer added that developing the model, performing dynamometer testing, and then real-world testing is the traditional and correct way to test the system and said that it made sense. A different reviewer indicated that the approach was generally very good but suggested that the optimization schemes could also consider what components are available off the shelf. Otherwise, the reviewer noted, new components would have to be developed for production and quantities for production would be less. One reviewer suggested that for optimization of components, it would be valuable to highlight the system efficiency and not just performance. Another indicated that the model needs correlation with the existing system when it is possible.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Reviewers commented positively on the technical accomplishments and progress. One reviewer remarked that good progress was made on the models—the main goal to date. Another reviewer recognized that the project showed steady progress. Similar comments were made by a different reviewer who indicated that the project is only 15% of the way into the project but that the amount funded assumed spent seems to be in line with the project objectives. The same reviewer added that while not a lot of technical progress seems to have been made this early on in the project, it seems to be on track.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The reviewers had varying comments on the project's collaboration and coordination with other institutions. One reviewer observed that there was a close working relationship with partners identified. Another reviewer commented that with only Meritor and Oak Ridge there seems to be a missed opportunity to rely upon and incorporate data from an engine supplier and/ or truck OEM. The reviewer noted that they have a lot of data around Class 8 fuel economy performance and drive cycles and their expertise could be incorporated into this simulation and model. Another reviewer indicated that the model should be correlated to the drive cycle data off the existing truck or dynamometer powertrain with the Meritor Dual Mode System when an appropriate system is available.

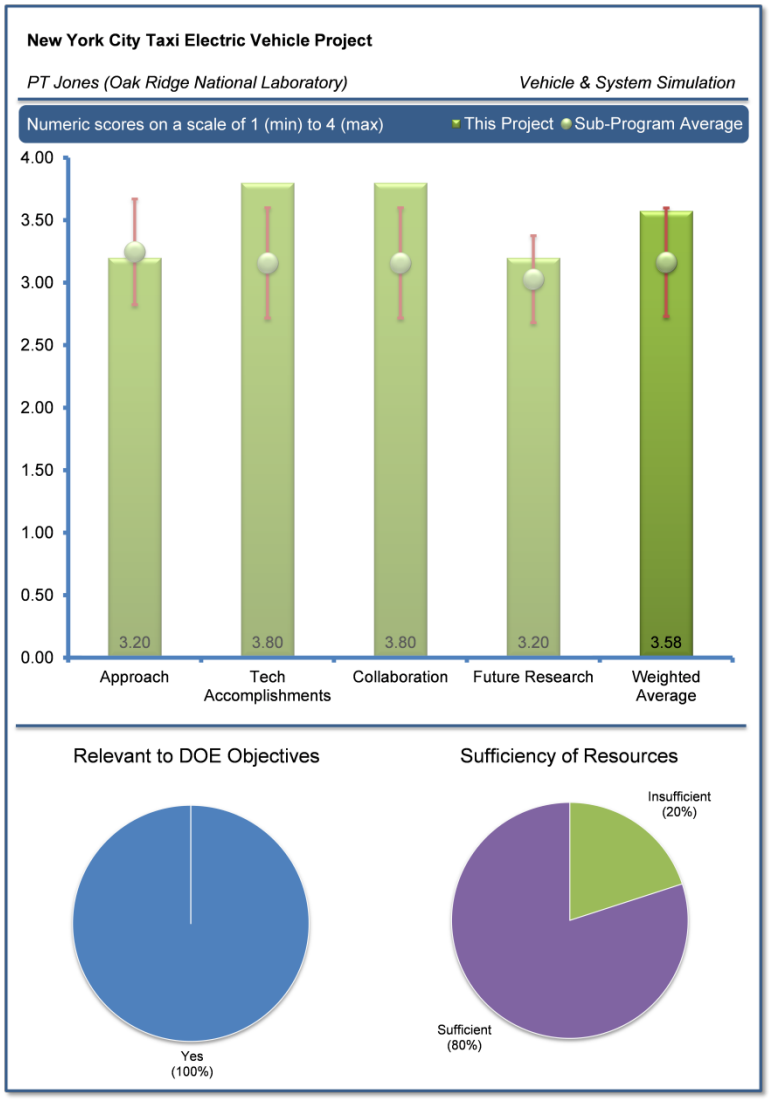
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Most reviewers had similar comments on the proposed future research involved for the project. One reviewer indicated that the presentation identified the next steps and looked forward to progress. This was reiterated by another commenter who said that it would be good to get and present the relation between the model and the bench data. A different reviewer commented that again, it was early on in the project, but the future plans are well thought through—dynamometer work and then real-world testing. That commenter hopes that this section will be more fleshed out at next year's report, as it relates to components, and control strategy optimization progress.

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

All three reviewers felt that sufficient financial resources were available for the project. One reviewer indicated that no information was reported on resources used or those required going forward, while another felt that resources to date were sufficient, and next steps will require more resources.

New York City Taxi Electric Vehicle Project: PT Jones (Oak Ridge National Laboratory) – vss073



Reviewer Sample Size

This project was reviewed by five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Most reviewers provided positive comments on the relevance of the project. One reviewer indicated that reducing the fuel consumption of very large vehicle fleets (such as taxi fleets in major urban areas) is an important step to reach the overall DOE objectives of petroleum displacement. The reviewer noted that the New York City (NYC) taxi fleet represents the largest taxi fleet in the United States. (several 10,000 vehicles) and that the replacement of the standard fuel inefficient Crown Victoria model by the Nissan NV 200 is a major milestone and represents an excellent opportunity to electrify the NYC taxi fleet. This was further reiterated by another reviewer who commented that understanding of a specific duty cycle for purposes of modeling future vehicle performance specifications is critical. That reviewer in particular noted that the specific generation of NYC taxi duty cycle should be viewed as a start of a broader set of duty cycles in support of nationwide understanding of vehicle use. The reviewer also added that the expansion of Autonomie models (in this case Nissan Leaf) will also forward DOE objectives. Overall, a commenter commended that the project helps to determine the feasibility of using locally clean vehicles in a large city for taxi service and that the results of this study will help vehicle designers configure powertrains that are capable of meeting the real-world demands to taxi service. A different reviewer indicated that another contribution of the project is the cycle development methodology which may be applied to other cities. This was recognized by another evaluator, that the project supports large-fleet introduction of EVs. This was supported by another commenter who agreed that the NYC taxi cab driving schedule could help NYC make electrified fleet vehicle buying and charging station location decisions. However, it is not clear that the project deliverables will be validated before NYC makes these decisions.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One commenter remarked that the approach or the methodology and use of tools appeared sound. A second reviewer indicated that the selected approach is a very good combination of utilizing field data (Ford Escape) and simulated NYC taxi drive cycle data (using ORNL DC Gen tool). Further, the reviewer added that a specific Nissan Leaf model is developed in Autonomie and indicated that the approach will lead to the creation of a taxi specific drive cycle that can be used for performance analysis of electrified taxi vehicles in New York. A third reviewer described that the project used a combination of new data, existing HEV data, simulation and existing drive cycle generation tools to develop a drive cycle for NYC taxi cabs. This reviewer also indicated that while HVAC loads are considered as assumptions, the results need to be augmented with data. The reviewer noted that it

seems this will be done by trying to piggy-back on future studies for other purposes. However, the reviewer cautions that there is remaining risk for this barrier. Another reviewer asserted that limited data was available to draw a complete set of conclusions (HVAC loading info absent, etc.) and that it was difficult for the reviewers to assess the urgency of developing this specific drive cycle in advance of getting more extensive dataset (e.g., from Nissan Leaf taxi demo program). The final reviewer indicated that the study of HVAC loads was considered a barrier, but this does not seem to be accounted for in the vehicle instrumentation or analysis.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Reviewers had mixed comments on the technical accomplishments and progress. The first reviewer remarked that the project appears to have met all its objectives. A second reviewer noted that major objectives of study achieved or on track to be achieved. This reviewer added that the project successfully developed an NYC taxi schedule as well as Autonomie model of Nissan Leaf. A third reviewer noted that the presenter said work is 95% complete and on schedule. The results are usable for predictive studies and can be improved when HVAC data become available. Another reviewer indicated that the project resulted in the creation of specific NYC taxi drive cycles and indicated the need for vehicle recharging during vehicle operation (lost fair). The final reviewer commented that the study of HVAC loads was considered a barrier, but little data appears to be gathered in this area.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

All the reviewers had positive comments on the collaboration and coordination with other institutions. Reviewers commented the project is an excellent example of effective collaboration between the different stakeholders from DOE National Labs, industry (Ricardo i.e., OEMs) and the Taxi and Limousine commission, that the collaboration was evident and strong. A reviewer also acknowledged that the project collaborated with the appropriate partners. One reviewer felt that a significant amount of data was leveraged from Ricardo for the project and that models were also developed for Autonomie, so those results would be available to many users in the future. This was, as one reviewer asserted, a good use of existing data-sets and expertise from other groups and laboratories. Furthermore, one reviewer noted that the NYC Taxi and Limousine commission have reviewed the work.

Question 5: Has the project 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?

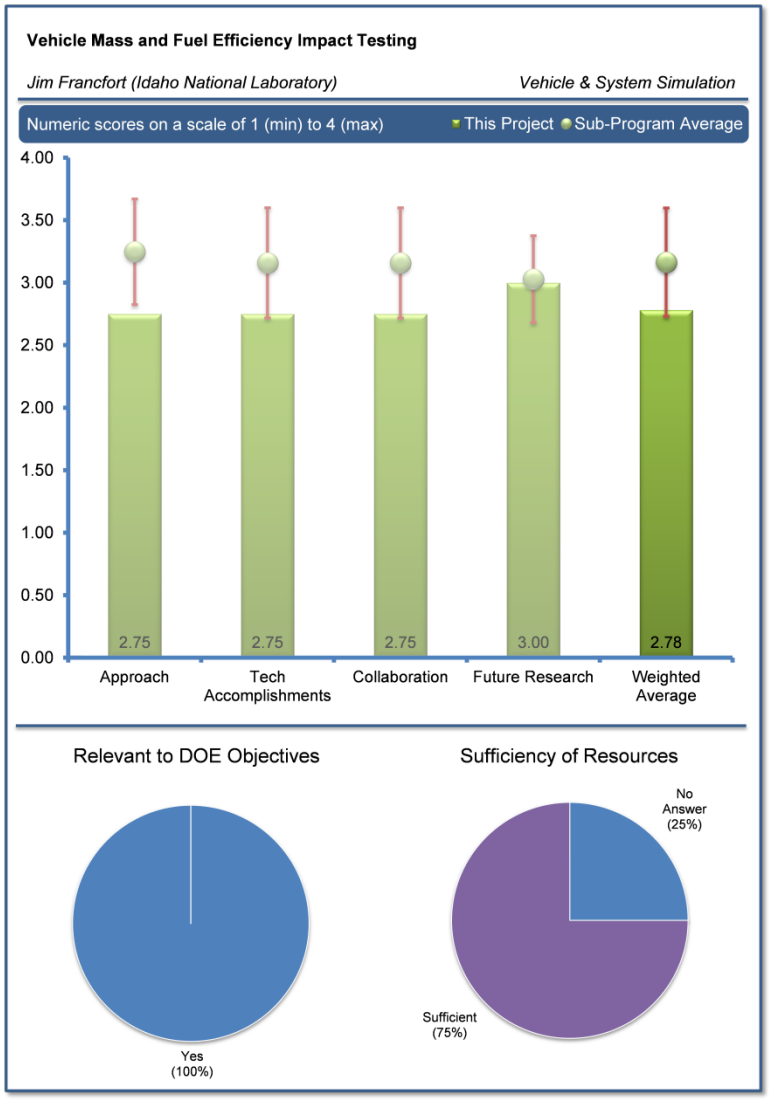
Comments on the proposed future research varied, with most reviewers being concerned with the ability of the project to complete in time. One reviewer noted that a critical barrier is the consumer acceptance of using EVs as taxi, which means that vehicle design parameters need to consider cost-effective operation (customer will not accept higher prices) without compromising customer convenience (such as proper air-conditioning). The reviewer acknowledged that in order to optimize these parameters, a validated simulation model is essential. Optimizing regenerative breaking control algorithms, right sizing the HVAC and to optimize the charging route pattern is all addressed in the future research topic list. A second reviewer expressed concern that the proposed future work seemed to address the technical barriers required from the project, but that it was not clear if this work will be performed though since the project appears to be ending. This was reiterated by another commenter who said that the project is 95% complete and scheduled to end this month, so it was unclear how the future work would be done and asked if there were recommendations. Another reviewer felt that the presentation was not too clear on how work to date fit into overall strategy as tied to NYC taxi schedule, Nissan Leaf modeling/demo program or future priorities for other urban areas for comparison. Also, the reviewer added, how more complete datasets will be (or are proposed to be) obtained such as for the HVAC loading. The reviewer acknowledged that a little more clarity was obtained via Questions and Answers dialog. Another reviewer noted that effectiveness of future work (incorporating HVAC data) relies on modifying the scope of future studies that have different research objectives. This reviewer felt that resource/budget for on-going maintenance (more and more filed data incorporation) was not explained.

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

One reviewer felt that resources are insufficient. This reviewer commented that it appears that this project would require additional resources specifically for model validation and to determine optimal charging routes. Four reviewers felt that resources are

sufficient. One commenter indicated that there were no obvious disconnects noted in resources for the project. The reviewer discussed that there was a relatively small budget for a focused scope that appears to be on track for completion. Another reviewer reiterated that the project is delivered on-time.

Vehicle Mass and Fuel Efficiency Impact Testing: Jim Francfort (Idaho National Laboratory) – vss074



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Two reviewers provided positive comments on the relevance of the project. One reviewer commented that this is a fairly simple, low-cost study, but that it does address a relevant technical issue regarding the impact of mass on PEV performance. The other reviewer indicated that translating changes in vehicle mass to fundamental resistance forces in vehicle can help designers know where to look for improved vehicle performance. A third reviewer agreed on the relevance of the project but asserted that the project did not have a huge impact and questioned why the project was being done.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Comments on the approach to performing the work were mixed. The first commenter said that based on the presentation, it appears that the team has done a good job of limiting variables to create a clear and consistent testing regimen. The reviewer noted that the project was very limited in scope and funding, so the particular study may not have answered every question a person might have, but that it did fulfill its core objectives. Another reviewer noted that the attention to detail in performing the coast down tests looked quite good. The reviewer added that making sure ride height was held constant with mass change was a nice approach. In addition, the reviewer commended that the measurement of tire temperature seemed to suggest good attention to detail. This reviewer also asserted that the significant weakness is going into coast down testing without some analysis of what is expected. The reviewer alluded that the presenter mentioned a rule of thumb of 1% drag for 1% mass change but wanted to know where it came from. The reviewer also questioned what types of changes the basic methods for modeling rolling resistance predicted as well as what the expected impact of even the small ride height or tire temperature changes. The reviewer adds that this analysis might have helped in the final evaluation of the test results. The final reviewer strongly emphasized that the project should be ended.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Two comments were provided on the technical accomplishments and progress of the project. One reviewer commented that the project team appears to have effectively achieved its technical objectives. However, the reviewer noted that it would have been helpful to have had a bit more discussion on the implications of the initial findings. The reviewer added that some of the results were not intuitive and deserved a more detailed discussion—particularly the differences in low speed drag forces between vehicle types. Another reviewer indicated that with a lot of variability expected in coast-down tests, it would have been nice to see some

results on the variability analysis. The reviewer in particular pointed out that the error bars on Slide 9 might help explain if there really is a different trend adding weight versus removing weight. The reviewer continued to say that if there is still a different trend adding versus removing some, explanation is likely needed. Without understanding the variability or having analysis to back expected results the reviewer asserted, that it is hard to know if the data represents real progress.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer noted that this project did not appear to require extensive collaboration, but it has been effectively executed regardless. The reviewer did bring up one point of concern and that is that the industry engagement seemed lacking based on the presentation. The reviewer indicated that it would be surprising if OEMs have not already performed some version of this analysis, and it would have been helpful to get a sense of their findings. The final reviewer strongly emphasized that the project should be ended.

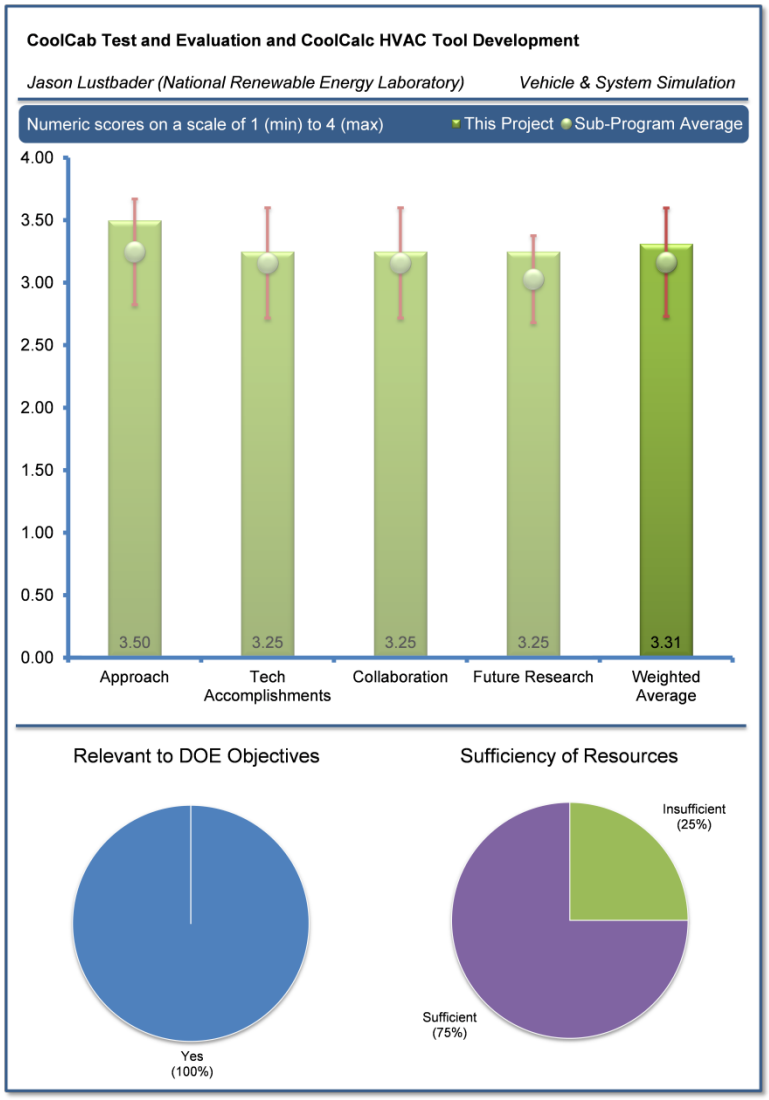
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Comments on the proposed future research varied. One commenter noted that the proposed future research seems okay. The reviewer commented that the team should definitely be careful about understanding and believing the drag change versus mass change before taking those results to the dynamometer test. Another reviewer indicated that it was not clear that the project required significant future work beyond completion of the current analyses. The final reviewer suggested ending the project and moving on to something more relevant.

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

All reviewers agreed that the project has sufficient financial resources. One commenter pointed out that this is a very low-funded project, but that it does not appear to need significant resources.

CoolCab Test and Evaluation and CoolCalc HVAC Tool Development: Jason Lustbader (National Renewable Energy Laboratory) – vss075



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Reviewers provided similar comments on the relevance of the project. A reviewer indicated that much fuel is used for idling purposes still and recognized that modeling improvements for less idling will help bring these technologies to market by showing how they can save fuel. Another reviewer commented that certainly reducing the air-conditioning load would help reduce fuel consumed and that was clear in the project presentation. This was further specified by a different reviewer who commented that the project has the potential for improved design of truck cabs. The project could reduce the idle time of trucks thereby reducing fuel consumption and air pollution emissions. This tool includes improved models plus verification of these models. Another reviewer stated that one really needs to identify how much this would save in fuel from a realistic perspective and baseline—how vehicles are used now, and also how vehicles could be used.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Most reviewers had positive comments on the approach to performing the work. One reviewer observed that NREL has been working in this area since 2000; therefore they have the expertise and background to do the work. The reviewer added there was a logical research plan and that there was an excellent PI. Another reviewer remarked that modeling and looking for methods to reduce thermal load (and proving them out via modeling) is a good approach. This was reiterated by other commenters who indicated that technical approach seemed very good: create the right analysis tools and testing methods to be very precise in evaluating new technologies. Another reviewer commented that creating the model to represent the cab to fill a niche in the modeling tools seemed like a good step whereas another reviewer felt that correlating the models to real-world results is valuable and showed the models are working. One commenter discussed that reducing the thermal load will decrease the fuel needed for idling or energy use in anti-idle systems. A different reviewer would have liked to see how technologies were chosen. Considering the clear expectation of economic payback, the reviewer asked if there was some initial evaluation of cost of the new technologies in order to choose which to analyze first.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Reviewers generally had positive comments on the technical accomplishments and progress of the project. One reviewer mentioned that the Coolcab modeling program was developed and validated, that the effect of paint color was modeled and that the EAR insulation effect was modeled. Another reviewer noted that the project had realistic goals and that the barriers were well understood. A third reviewer noted that the need for modeling tool seems to have been addressed. The reviewer added that it was good to see a user's guide was released with the tool. The same reviewer added that it was certainly nice to see that the goal of 30% reduction in idle air-conditioning and heating loads had been demonstrated. Considering the clear expectation for a target payback period, this reviewer would have expected that some material related to the payback period for the technology would have been discussed (insulation). This reviewer leaves the reviewer with really no idea if the technology evaluated in detail already (insulation) will be even close to economically viable. Overall the reviewer felt that the progress is very good because the modeling approach will be worthwhile to evaluate other new technologies. However, another reviewer cautioned to be aware that there are some people that would question the need to spend $3 million to develop a whole new modeling tool and test methods to figure out that the best way to get HVAC loads down is to insulate the vehicle. The reviewer questioned how one would tell the story that the modeling and testing tools really were needed. Thus, the reviewer noted that once the research showed evaluations of other technologies it would seem like a better argument for the development of the tools. The final reviewer indicated that this was not rocket science, but that it was an interesting project.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The reviewers had positive comments on the project's collaboration and coordination with other institutions. As indicated by one reviewer, there was good collaboration with industry. Another reviewer noted that OEM partners are being utilized. In addition, this reviewer pointed out that fleet partners could help adaption. A different reviewer observed that a number of truck companies involved in CoolCalc model validation and development and also recognized that the insulation package from Aearo Technologies was used. A suggestion from one of the reviewers is that the project should expand their publications to include ASHRAE.

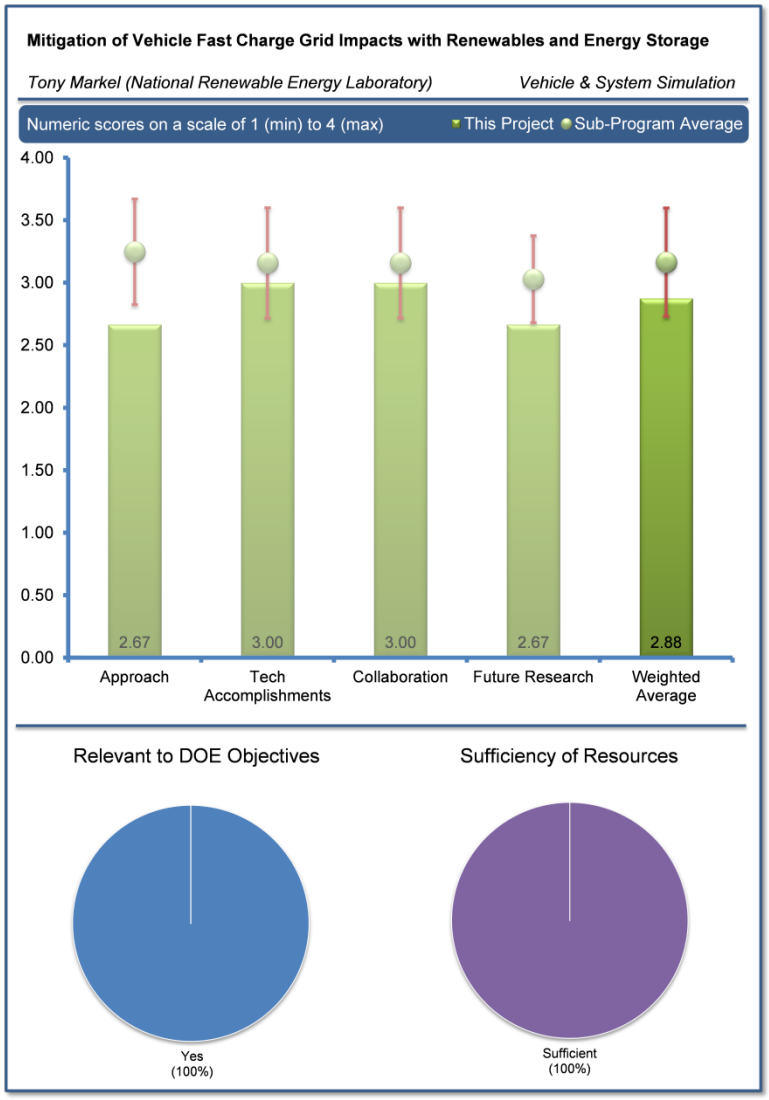
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Most reviewers suggested up other ideas for the project's future research. One reviewer noted to keep going on this project, but to integrate with SuperTruck and weight savings and fuel savings. The reviewer said that everything should be a system approach. Another reviewer noted that future research is planned regarding the economic trade-offs which is what is needed based on the objective of the project. However, the reviewer added that it is not completely clear which new technologies are expected to be analyzed and tested. The reviewer assumes that all of the technologies on Slide 8 will be evaluated. A different reviewer suggested that it would help to devise some ways that the software can be used by fleets or other users that will encourage adaption of more advanced insulation, thermal coatings or barriers, or other items to lessen thermal load that a cab no idle or HVAC system will need to take on. The reviewer added that the software is really helping if people are using it to modify trucks from their current build. Another suggestion from a reviewer is that the project should include actual routes, road data and traffic data. The reviewer indicated that this data should be input into the program so a trucking company can determine their projected return on investment for their route. The reviewer mentioned that the United States Postal Service (USPS) should be interested in this work. This reviewer suggested including life cycle cost for evaluating alternatives.

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

Three out of four reviewers felt that financial resources are sufficient. One reviewer commented to keep going, and also suggested that this project not be done in isolation. Another commenter indicated that resources appeared to be reasonable, while the final reviewer commented that it was hard to tell.

Mitigation of Vehicle Fast Charge Grid Impacts with Renewables and Energy Storage: Tony Markel (National Renewable Energy Laboratory) – vss076



Reviewer Sample Size

This project was reviewed by three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Most of the reviewers agreed on the relevance of the project. One reviewer indicated that demand charges for commercial charging are a significant barrier to deployment of EVs. Another reviewer detailed that the project models electric vehicle fast charging in a fashion that would reduce grid impacts and make it more convenient to electric vehicle drivers to charge their vehicle is certain situations. Thus, the reviewer noted, the convenience would help motivate people to use electric vehicles and displace their use of petroleum. The reviewer added that probably more important with fast charging technology is projection of a normal gas station type refueling experience. The reviewer acknowledged that although most electric vehicle owners charge at their home or place of residence, most unfamiliar consumer still cling to a gas station type analogy so fast charging offers this type of visual analogy to what most people expect. The reviewer also recognized that the use of photovoltaics for providing the energy is also symbolic but asserted that it may not be the most cost-effective solution. The reviewer notes that most utilities would prefer the solar to go toward other peak loads from building or industrial usage and use off-peak renewables for vehicle charging, (nighttime wind). The reviewer indicates that suggesting that photovoltaics are necessary to reduce peak demands from charging would tend to cause a higher cost solution set versus other off- peak renewables. However, the reviewer stated that since the general consumer can actually see the photovoltaic array in proximity to the charging station, the symbolic visual solution is always popular even if it is not as cost-effective as other solutions. The reviewer concluded that both fast charging, which simulates a gas station model and the use of solar energy from photovoltaics can be used to stimulate market adoption; this helps overcome the current market barrier of range anxiety to increase electricity miles. The reviewer suggested that to the extent that this could have been quantified as additional miles traveled would have been beneficial. Another commenter agreed with the relevance of the project but points out that the industry is doing this already, and so questions the necessity of the project.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

A reviewer commented that the approach to performing the work by using real life data as good and lends credibility to the study. However, this reviewer remarked that the use of photovoltaics as the means of providing the renewable energy for the storage system is too narrowly focused. This reviewer suggested that other types of renewable energy sources should also be incorporated such as night time wind energy. In addition, the reviewer notes that showing a cost breakout of various types of renewable energy

for the study would have been beneficial. The reviewer said that even though cost analysis was identified for future work, a preliminary cost chart would have been beneficial. Incorporating the cost data and different renewable energy sources would have moved this to an outstanding small technical study. A different reviewer pointed out that the project initial assumptions on charger use may not be valid and added that as real-world data becomes available, these assumptions should be validated.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Mixed comments were received on the project's technical accomplishments and progress. One reviewer indicated that work proceeded on schedule with results obtained as planned. The second reviewer did not really see any hard number presenting DOE goals in this area in which to make a judgment as to how effective the effort was in meeting the goals. The reviewer indicated that as far as addressing high level barriers, it was okay. The same reviewer indicated that it would have been interesting to try and quantify the barrier with regard to real market adoption. In particular, the reviewer wanted to know if the barrier could be quantified by a market survey which would pose a question such as, would one be more likely to buy an electric car if fast charging was available, and one could refuel an electric car like a normal gas station-type refueling experience. Another market survey sample question suggested by this commenter was whether one would be more likely to buy an electric vehicle if the vehicle could be recharged with renewable electricity. As far as a small dollar analysis project the effort seemed cost-effective and was able to reach some good analytical conclusions. The reviewer referred to the comments from section two, stating that the analysis could have been of more value by showing a basic cost analysis chart since the basis of going to photovoltaic array with an energy storage system was to reduce grid impacts and utility demand charges while making charging more convenient. The reviewer added that without the cost data, the financial motivation to transfer this model to adoption in the market place will be hard. Another reviewer indicated that there were big assumptions and that one should look at using a range of assumptions (i.e., three points versus just one).

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Two reviewers provided comments on the collaboration and coordination with other institutions. One reviewer noted that collaboration with the demonstration partners, AeroVironment and Mitsubishi, was evident in generating the test data. Going forward, this reviewer suggests that partnering with another project team installing fast chargers and a utility will be important in generating the cost data. The second reviewer commented that data from other projects has been used to provide input and support assumptions. This reviewer suggests that as actual charging data becomes available, it would be worthwhile to update assumptions.

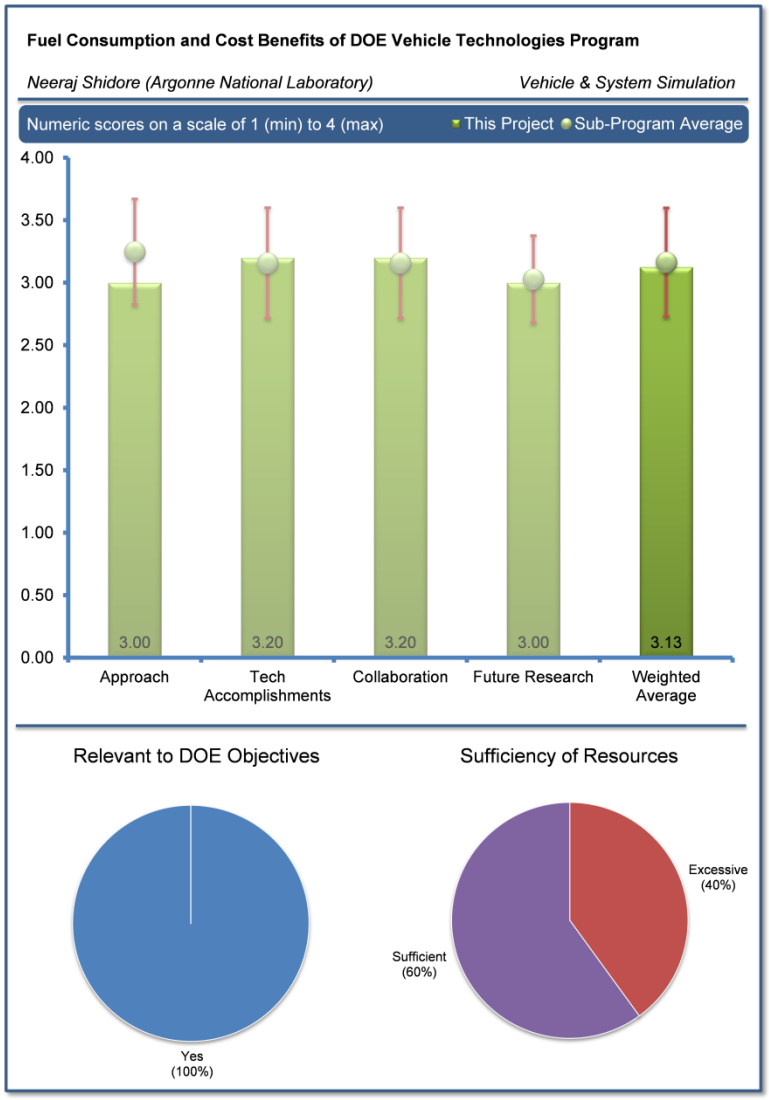
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Mixed comments were received on the proposed future research. One reviewer recognized that the project is scheduled to complete and that all objectives will be achieved at completion. Another reviewer commented that as noted in the future research chart, this is a cost analysis. This cost analysis will be the most important data to collect going forward to increase the value of this project. As this reviewer noted in another comment section, additional renewable energy sources should also be analyzed to show different cost-effectiveness strategies. A third reviewer mentioned that they were not geeked on this project. This reviewer indicated that the project was already being done in the industry, and the reviewer did not see much value-added here.

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

All three reviewers felt that financial resources are sufficient. One reviewer commented that the NREL resources and facilities are easily sufficient to complete the project. Another reviewer thought that the work performed for the stated budget of $120,000 was a bargain. The reviewer added that to get some test hardware, run some testing, and model that data versus the real-life data from the Puget Sound area was quite an accomplishment for this type of funding.

Fuel Consumption and Cost Benefits of DOE Vehicle Technologies Program: Neeraj Shidore (Argonne National Laboratory) – vss077



Reviewer Sample Size

This project was reviewed by five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer commented that the project is designed to track the potential of research to impact petroleum displacement. Another observer reported that this project analyzes dozens of advanced vehicle, component, and fuels technologies, and also includes thousands of vehicles to provide comprehensive guidance to all DOE program sponsors in meeting the petroleum displacement objective. This observer related that this is the largest scale study of such technologies. The next panelist indicated that the relevance of this project is clear, as it addresses a congressional mandate. This panelist believed that it was beyond the intent of the review to evaluate this project against the mandate, and estimated to do so would require evaluation of the 250-page report. The final reviewer wondered what else could be said about the project if it is mandated by the Government Performance and Results Act (GPRA).

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer indicated this approach, as a result of the requirements of a congressional mandate, seems to be quite suitable to the purpose. Another panelist asked if it is mandated that a national lab or another DOE entity perform the GPRA task as an in-house project. This panelist remarked that the GPRA mandate seems to duplicate the periodic evaluations and studies of U.S. DRIVE and 21CT that the National Academy of Sciences (NAS) conducts. The panelist opined that a NAS independent commissioned study would have more credibility. The next observer described the approach as just okay, and expressed that the there was a large assumption that hybrids continue to get less expensive. A different reviewer found no mention of how or whether the predictions will be validated by actual experience. The final person stated that it is always difficult and time consuming to chase data, especially from OEMs. This person suggested that, based on the significant amount of funding for the project on the order of $390,000, it may be wise to use less technical personnel to do the data harvesting to save some money.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One reviewer queried whether MD and HD vehicles have been included in the project budget. This reviewer indicated the study could have been more sophisticated and introduced a what-if probability scheme in the simulation, but that doing so may have resulted in a significantly larger budget and manpower utilization (or waste). This reviewer pointed out that the title and claim of Slide 12 is a huge assumption, and described it as mission impossible and an unrealistic expectation. The reviewer further noted

that the titles and claims of Slides 14 and 15 are not necessarily a valid premise, and that Slide 17 was a hard sell. This reviewer relayed that the presentation claimed results were widely accessed, and suggested it may be worthwhile to compare the number of hits here to NAS, or similar, reports. Another observer's only concern was that the component sets defined on Slide 11 are not necessarily the only ones that may be available in the timeframes shown. This observer stated the evaluation was designed to address the mandate requirements; however, some potential risk may surface in showing a level of potential progress that could forestall investment in future technology development. The observer expressed concern about the availability of future funding in this area at a time when DOE investments in technology are in greatest need. This observer acknowledged that many barriers still exist to get to the goal lines in future decades so Congress needs to be shown the range of technology uncertainty that must be overcome. The final reviewer queried whether the repeated run-all-the-simulations-for-light-duty vehicles step on Slide 18 was a typographical error, or if it is an iterative process (e.g., repeating runs for quality control).

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer indicated that great effort had been demonstrated. Another agreed that collaboration with the appropriate groups to complete this assignment seemed to be in order and complete. The next observer noted that there was a good team outlined on Slide 16, put pointed out that all members have an interest to put the maximum positive spin on VTP because the members are all beneficiaries of the program. This observer suggested that if possible within the GPRA guidelines, it would be far better to have an independent team, perhaps of academicians and retired industry professionals, to conduct such a study. The observer conceded that, if necessary, the simulations could be done by ANL or a commercial analysis house.

Question 5: Has the project 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?

One reviewer urged the PI to continue the great job. Another person pointed out that as this is a once-every-two-years assessment, it is a contained program and does seem to be designed to properly meet the mandate requirements. The next reviewer remarked that stopping this effort, if the GPRA can be reversed by the legislators, would not result in significant loss of quality and tools in VTP's future planning and strategies. This reviewer wondered how the information in this report be viewed 5 years from now, 10 years from now, and at the end of the reported assessment period.

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

Two reviewers found the resources to be excessive, while three found them sufficient. One indicated that the over half a million dollars spent per year on this project could be put to a better use somewhere else in the VTP road map line items. Another reviewer noted that this project should be accomplished with less funding, and noted that researchers should look for ways to utilize the funding more efficiently. The next reviewer deemed the resources sufficient because staff is based on past experience in providing this information to Congress. This reviewer stated that if not, it is certain that the VTP office will not fall short of the intended deliverable to Congress.

Fuel Displacement & Cost Potential of CNG, LNG, and LPG Vehicles: Jason Kwon (Argonne National Laboratory) – vss078

Reviewer Sample Size

This project was reviewed by six reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Reviews regarding the project varied widely. One reviewer strongly commended the idea of looking hard at CNG/ LNG powered vehicles from both the fuel savings and the emissions impact and regarded that this would be an excellent future project. A second reviewer noted that the abundance of natural gas in our nation according to recent reports certainly makes the project an excellent petroleum displacement and added that this project is definitely timely. A third reviewer expressed that that the program is looking at non-petroleum vehicle fuels, albeit ones that are still fossil fuels. This was somewhat reiterated by another reviewer, who summarized that the project is designed to evaluate the petroleum displacement potential of natural gas fuels (CNG, LNG, and liquefied petroleum gas [LPG]/propane)_ to displace imported petroleum and acknowledged that this would clearly be relevant. However, the reviewer indicates that the presentation may not take the project to a calculation of imported petroleum displaced if these fuels are broadly used. The final reviewer provided more extensive comments and felt that the anomalous approach required to be taken by authors makes this study practically irrelevant. The reviewer noted that the authors were told to make specific assumptions and given a specific period of performance. One assumption that was ludicrous, according to this reviewer, was that the alternative fuel had to be used in the same engine to compare performance. The reviewer detailed that the result was that when CNG was used to displace petroleum in the same gasoline engine, acceleration from zero to 60 miles per hour (mph) took 0.7 seconds longer, which was interpreted as 12% fuel consumption penalty when the engine is re-sized to achieve the same performance. According to the reviewer, this was interpreted as a 2% fuel consumption penalty when the engine is NOT re-sized. First, it is unrealistic that a difference of 0.7 seconds would make a significant, noticeable difference to a consumer. This reviewer then questioned who buys a car based on acceleration performance. Secondly, the study failed to take into account sacrifices consumers were willing to make for a cleaner fuel, cheaper fuel, and when the use of a particular alternative fuel is lower-cost operations and maintenance than the conventional fuel. In other words, the reviewer explained, the objective of the study is buried so much into some minor, immaterial, minute detail that has no relevance to the overall scheme of things. According to this reviewer, in the overall scheme of things, what really matters for CNG, LNG, or LPG to displace petroleum is the cost of the fuel (CNG and LNG are about half the price of diesel), the availability of the fueling stations, and range of the vehicle on a tank of that fuel. The reviewer concluded that none of these were taken into consideration.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Most reviewers had extensive comments regarding the approach to performing the work. According to one reviewer, the project is well defined within the tool sets that have been chosen and adds insight to how the use of CNG will affect consumers. However, the reviewer commented that the approach is stated to be one of seeing how gaseous fuels differ in performance from liquid ones. The commenter added that there was nothing stated as to what would be done with this information to develop a valid estimation of imported petroleum that may be displaced and suggested that this should be done on an individual vehicle type basis at minimum. Another reviewer acknowledged that the work is headed in the right direction, but that it was not clear how the project's results will be used to guide future DOE funding decisions. Another comment from a reviewer was that the technical barriers were not clearly stated. The items listed as technical barriers are not technical barriers. According to a different reviewer, the potential benefits of retrofitting legacy vehicles with hardware for diesel/natural gas and gasoline/natural gas should be looked at because it may be more practical in the near future and timely too during this time of abundant natural gas. Another suggestion from one of the reviewers was that the whole presentation should not get hung up on the specification of 0-60 mph because there is a lot more going on in CNG/LNG than looking at the performance specification. It seemed to another reviewer that the potential for petroleum displacement of CNG/LNG could be better determined by looking at existing applications and deployments. The same reviewer asked why the apparent focus on OEM engine data with CNG in wide use in many transport internal combustion engines around the world. The reviewer mentioned that how the fuel performs in original OEM vehicle tests seems like a minor variable easily overshadowed by numerous other variables. According to the reviewer, if the purpose of the study is potential petroleum displacement for the nation, then the study should also describe the approach to macro variables. The reviewer added that if this project is a part of a larger effort, then how it fits that larger effort seems critical to whether the approach is correct and indicated that that information was not sufficiently provided. Or, the objective of this project should be redefined as providing certain inputs into a larger model of petroleum displacement, if that is the case. One commenter rated the approach poor for several reasons. First, according to this reviewer, there was no literature search/review to see what had been done on this subject. If there was a literature search/review, then the authors should have mentioned it. Secondly, the reviewer stated that the authors did not take into account emissions and health impacts (i.e., compare the emissions of CNG, LNG, and LPG against gasoline). Third, the reviewer pointed out that the authors neither took into account nor modeled how cost of fuel, fuel infrastructure, and range would have affected market penetration of CNG, LNG, and LPG vehicles and how such market penetration would have affect displacement of petroleum. Lastly, the reviewer observed that the authors neither took into account nor modeled how much faster and more pervasive petroleum displacement would be if there was a focus first on centrally-garaged fleets such as fleets of vehicles that return to a home base every day for storage, fueling, and maintenance (e.g., urban transit buses and refuse trucks).

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Reviews regarding the technical accomplishments and progress of the project were mixed. According to one reviewer, the project’s progress is in good order and that the final report should be out as soon as possible. Another reviewer mentioned that it looks like most of the work is back-loaded in the FY. The reviewer noted that perhaps things are proceeding according to plan, but the results to date are thin. The reviewer points out that the focus to date has been only on engine technology, not on the influence of driveline and transmission (e.g., gearing ratios) on overall vehicle performance. According to another reviewer, barriers were not well described, but the approach is a sound one for the technical tasks being undertaken. That reviewer continued to point out that the whole discussion of whether an engine would be at the same or a lesser level of power is as much a marketing issue for vehicle producers as it is a technical one. Fleet vehicles such as the Honda can have a lesser level of performance and be quite suitable. This reviewer acknowledged that it may not be so for a general consumer sale product that has to compete with products powered by other fuels. The activity seems to be centered on engine test evaluations rather than on vehicles as a system that may use gaseous fuels. The reviewer opined that this seems to be too narrow to build a really valid argument for the amount of petroleum that can be displaced. This reviewer suggested that another technical approach would have been to do the entire project in simulation. Combustion simulation would have shown the engine power changes and coupled with vehicle performance simulation would have predicted gaseous fuel use such that a comparison to liquid fuels in volume and price could have been completed. The reviewer added that stretching this across multiple vehicle types and powertrain types and sizes would have

created a more comprehensive data baseline to calculate petroleum displacement. A different reviewer strongly expressed that they would have liked to see some more expertise put on this because some of the best engineering minds are now working on CNG/LNG. The final reviewer rated the technical accomplishments and progress as poor because the approach and collaboration was poor.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The project received mostly similar comments on the project's collaboration and coordination with other institutions. One reviewer noted that greater industry collaboration would accelerate this work greatly. According to the reviewer, barriers to having OEMs involved were stated without a definition of how to overcome, and these barriers were not stated as project barriers in the presentation. This was also pointed out by other reviewers. In particular, one commenter said that there is no formal relationship with OEMs, so it is not surprising that there is limited support for fueling maps and other engine performance characteristics. This reviewer also said that it is not clear how component cost data are being used on this project. Another reviewer rated the project's collaboration as poor because it appears that the authors worked only with one or two OEMs. That reviewer noted that there is a good chance that the authors could have obtained comparable or better performance with CNG, LNG, and LPG if the authors had tried more or different OEMs. Another comment was that the project may want to contact some of the retrofitters.

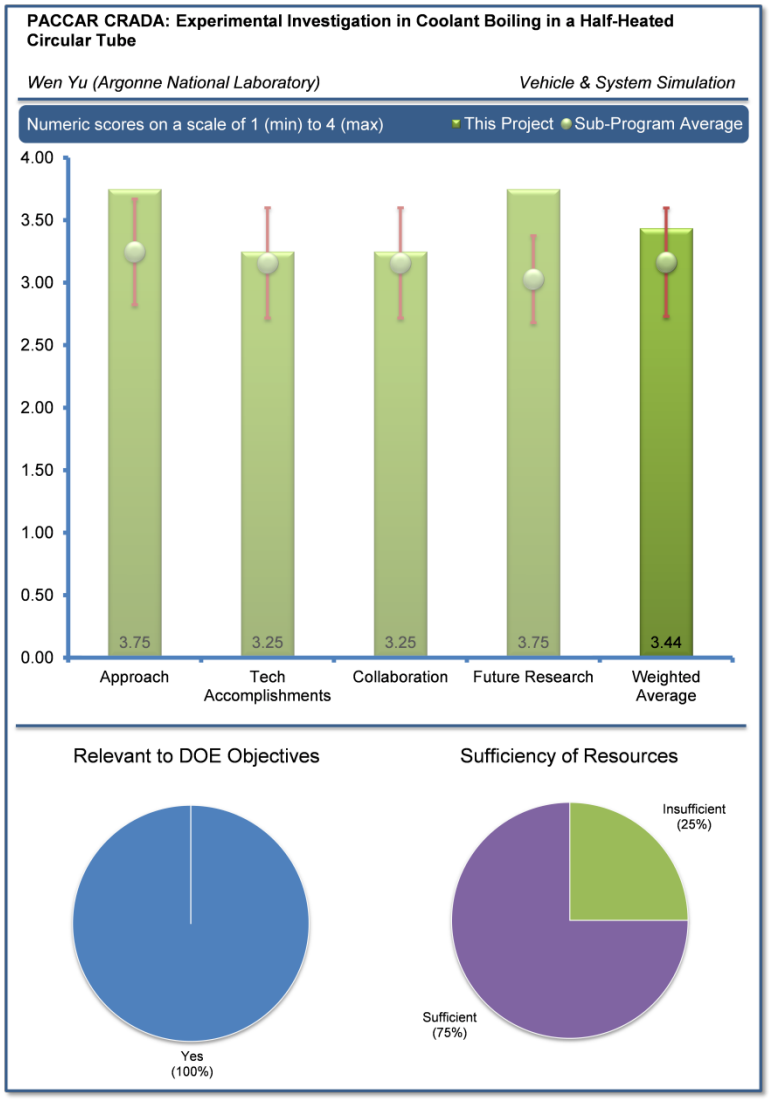
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Comments on the proposed future research varied. A reviewer noted proposed future research is important and strongly warned the researchers not to lose the momentum on this fuel, and another reviewer commented that the proposed future research was okay. Other commenters provided suggestions on future research. One reviewer indicated that progress is easy to understand with future work within the context of the unresolved barriers of OEM collaboration. This reviewer commented that the project needs to include additional subsystems that affect overall fuel efficiency to get to the title objective of understanding petroleum displacement potential. Another reviewer recommended a stronger focus on future engine technologies, including those fueled by CNG or electricity, as ways of displacing petroleum fuels. This commenter asked if there was an opportunity to look at advanced conventional engines (using gasoline) to assess petroleum displacement on this project. A reviewer commented that the study failed to take into account that CNG, LNG, and LPG fuel displacement could take place much faster and more easily in centrally-garaged fleets, i.e., fleets of vehicles that return to a base every day for storage, fueling, and maintenance (e.g., urban transit buses and refuse trucks). This reviewer emphasized that it is absolutely critical that medium- and heavy-duty vehicles be included in any similar studies examining the displacement of petroleum by CNG, LNG, and LPG.

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

One reviewer found that resources are insufficient. This reviewer commented that more technical sophistication is needed on this. Five reviewers felt that the project had sufficient financial resources available. One reviewer commented that it seems to be sufficient for the tasks described, though funds may be insufficient if a broad calculation of petroleum displacement is intended to be accomplished. A second reviewer commented that resources seem sufficient for the scope, and a third reviewer remarked that funding appears to be more than sufficient. A final reviewer remarked that funding is adequate.

PACCAR CRADA: Experimental Investigation in Coolant Boiling in Half-Heated Circular Tube: Wen Yu (Argonne National Laboratory) – vss079



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Comments regarding the relevance of the project were varied. One reviewer reasoned that understanding phase change (boiling) is very important in thermal management. A second reviewer remarked that there is a clear link to energy savings. Another reviewer remarked that this project is relevant. It is important to minimize energy losses due to engine cooling. However, this reviewer strongly takes issue with the fact that the authors failed to estimate what the ballpark (rough order-of-magnitude) benefit in energy savings to the overall scheme of things from their research. In other words, this reviewer would like to know what the payback is from this expensive, esoteric research. Nonetheless, according to this reviewer, the ultimate goals to reduce parasitic energy losses and improve engine thermal efficiency are meritorious. This reviewer has to say, pretty much, that this project is unique. The reviewer knows of no other similar project on this topic. A fourth reviewer commented that improved engine cooling is understood to have a potentially significant impact through reduced cooling system parasitic losses and weight, and/or through improved engine thermal efficiency. This reviewer remarked that quantified estimates of the impact should be established up front to better highlight the potential of this research. The commenter noted that this was brought up in the review questions and answers and that the PACCAR partnership should enable this. This commenter opined that the title of this research was somewhat obscure. The commenter noted that the project should scope in the analysis activity, and identify the intended application (e.g., Investigation of Two-Phase (Boiling) Coolant for a Heavy Duty Engine).

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

The project received mixed comments on the approach to performing the work. One reviewer praised that the project had excellent researchers. In addition, the reviewer indicated that the team presented a reasonable timeline, tasks and goals. Another reviewer felt that the project did superb technical work on a shoe string budget, noted great collaboration with PACCAR, and mentioned that it would be great to bring in additional collaboration partners but funding restrictions appear to be a barrier. A second reviewer opined that the approach involves a pragmatic combination of empirical and analytical methods. In particular, the reviewer noted that the test setup seemed well-designed, being simple and flexible. This reviewer expressed that the review covered the experimental plan relatively well but more information should be provided on the analytical activities planned in the CRADA, including the coupling of the experimental and analytical activities. The reviewer noted that this should be possible without

divulging anything proprietary. The final reviewer pointed out that the design of the experiment is good for obtaining heat transfer rates and heat transfer coefficients for modeling purposes. The reviewer added that the graphs were missing the keys or legends, and that points consisting of different colors and shapes (rectangles, circles, and triangles) were not defined. This reviewer feels that this presentation should have shown why the PI took the chosen approach. In fact, not enough high-level or high-altitude or overall picture material was presented. The approach taken seems to make no sense to this reviewer. However, continued this reviewer, there should have been some literature search or review to show that the author was not repeating something that had already been done and to show that the PI had taken advantage of the results of the previous research and not wasting taxpayer's dollars in starting from scratch.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Comments on the technical accomplishments and progress of the project were mostly positive. A reviewer commented that the project had very nice experimental work and had excellent progress to plan. Another person indicated the project had a well understood test section. One of the reviewers summarized that the design, procurement, fabrication, and assembly of the experimental facility have been completed. The reviewer went on to say that single-phase heat transfer tests and analyses have been conducted as well as two-phase (boiling) and that the project's progress appears to be on schedule. This reviewer did not anticipate any major obstacles or shortcoming to further progress. A different reviewer expressed concern, that the project's progress seems slightly low based on a linear project timeline but the project plan seems end loaded so this may not be an issue. The reviewer explained that funding could be a drag on this project in 2012 and that additional comments were provided in the financial resources section. A general comment was provided by this reviewer on the presentation of results; the reviewer noted that the lack of keys and explanatory information on some of the plots caused some unnecessary confusion.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Reviewer comments on the project's collaboration and coordination with other institutions were mostly similar. One reviewer noted that the project had great collaboration with PACCAR. In addition, the reviewer expressed that it would be great to add other partners if resources permit. Another reviewer mentioned that the project work has a CRADA and that the researchers are working with industry. This was referenced by another reviewer who indicated that the collaboration on this project is limited and that it was the nature of a CRADA. However, the reviewer acknowledged that it seems reasonable that this research will generate valuable non-proprietary information. Another commenter did not expect that collaboration and coordination with more than one other organization (an OEM) was necessary on research of this type. In fact, the reviewer noted that collaboration and coordination with more than one other OEM would hinder the project and raise suspicions.

Question 5: Has the project 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?

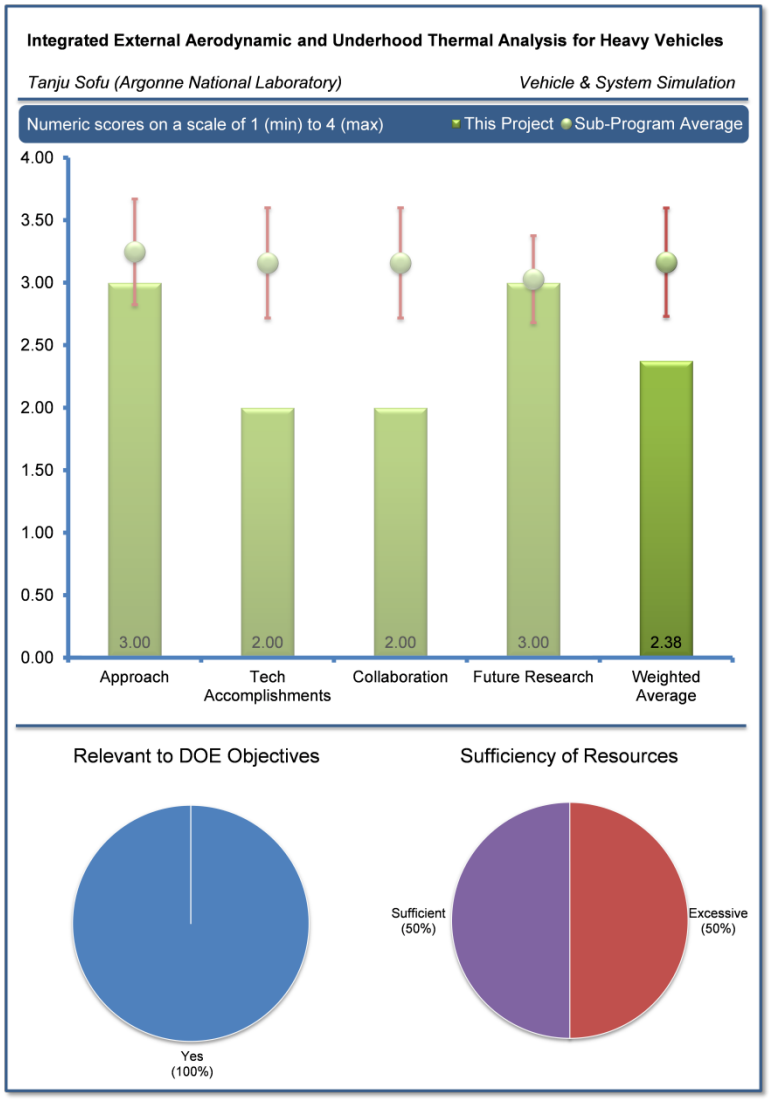
According to one commenter, the authors will continue to collect more boiling heat transfer data, compare experimental results to predicted, theoretical results, and fine-tune as well as validate the computer model for heat transfer. This reviewer remarked that the authors know what they are doing. Another reviewer commented the proposed future research was solid and that it would be nice to have an opportunity to use this equipment to explore additional fluid mixtures and surfaces beyond cast iron. A different reviewer added that future work mainly consists of planned activities with no major decision points or foreseen barriers. Minor changes could include different mixtures of water ethylene glycol and different flow rates than planned depending on results of upcoming tests. This reviewer indicated that the flexibility of the test set-up apparently lends itself to testing a variety of other components, coolants, materials, and surfaces. The reviewer explained that many specific suggestions have been provided by past reviewers for follow-on research. The final commenter suggested that the project can be used to evaluate nanofluids.

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

One reviewer felt that there was insufficient funding. Three reviewers indicated that there were sufficient financial resources. One commenter expressed that funding was too low for the potential of this work. Another reviewer indicated that resources appeared to be adequate. A third reviewer indicated that the budget for this research was lean but the project seemed focused and effective.

The reviewer also stated that the project was a good example of cost-effective research. The project plan seemed end-loaded and the planned budget reflected this, increasing every year. However, the reviewer observed that the 2012 payout so far is reported as only half of planned and cautioned that this could impede progress during the critical phase of the project. This reviewer mentioned that the contribution of the CRADA partner is noted as in-kind cost-share but is not explicitly quantified (i.e., it is assumed everyone is doing their fair share).

Integrated External Aerodynamic and Underhood Thermal Analysis for Heavy Vehicles: Tanju Sofu (Argonne National Laboratory) – vss080



Reviewer Sample Size

This project was reviewed by two reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The reviewers had mixed comments on the relevance of the project. One reviewer felt that the optimization of a cooling package and hood design can lead to significant fuel saving in terms of aerodynamic drag reduction, which is in line with the DOE mission. Another reviewer asserted that this question needed a maybe option. The reviewer pointed out that the subjects of this research are understood to support the objectives of petroleum displacement (aerodynamic drag, engine cooling, selective catalytic reduction system optimization), and associated coupling merits system level analysis. However, the reviewer noted that system optimization as an objective is a little vague. The reviewer indicates that specific deliverables should be clarified to insure relevance to the DOE (i.e., it is foreseeable that this research could result in a sophisticated application engineering tool or methodology of commercial value that may or may not necessarily be used to optimize fuel economy). The reviewer also mentioned that clarification should be provided as to what specific new information the proposed research offers above and beyond the similar past research noted.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Comments on the approach to performing the work for the project varied. One reviewer felt that the analytical approach involves a pragmatic combination of inexpensive one-dimensional (1-D) thermo/flow analysis and computationally expensive CFD analysis and offers high potential. Apparently, this research plan builds on successful results from similar past research. This reviewer expressed that some of the plan is vague and needs clarification. The reviewer explained that it is not clear whether a GCD vehicle model or a specific truck configuration of a foreign manufacturer is being used and why. In addition, the reviewer mentioned that it is not clear if vehicle wind tunnel or track testing is also involved. This, the reviewer cautioned, has implications not only to the plan but to the resource requirements and funding. With regard the project's intent to develop a custom interface to couple the CFD and 1-D flow model, this reviewer suggested that the project should verify that applicable commercial solutions are not available. Another reviewer indicated that the design of the project is correct directionally; however, it needs to be more scrutinized in detail. The reviewer asserted that the benefit of optimized cooling packages is with aerodynamics, not necessarily thermodynamics. As such, the reviewer warned that care should be taken to identify and quantify the benefits in the correct disciplines. This reviewer observed that there appears to be sufficient planning and resources on the thermodynamic side; however,

more resources and expertise on the fluid dynamics side must be planned (external aerodynamics, under hood thermal and airflow).

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Both reviewers acknowledged that the project is new and that it is in the planning phase. One reviewer remarked that because of this, it is difficult to gage the project's progress. This reviewer, however, is concerned with the fact that the CRADA has not yet been formalized over the last couple years. Another reviewer mentioned that the initial work (setting up a 1-D and three-dimensional [3-D] CFD environment) is headed in the right direction.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Comments on the project's collaboration and coordination with other institutions varied. A reviewer commented that the CRADA has not been formalized yet so technically there is no collaboration to date. In addition, the reviewer pointed out that no vehicle OEM or fleets have been identified yet. This reviewer felt that pulling in the involved commercial CFD and 1-D flow software suppliers as partners seems compelling, especially since a custom interface to couple the CFD and 1-D flow models is to be developed. Another reviewer indicated that the engine partner is identified, but that a vehicle OEM partner is missing and that identifying one should be a priority at this point of the project.

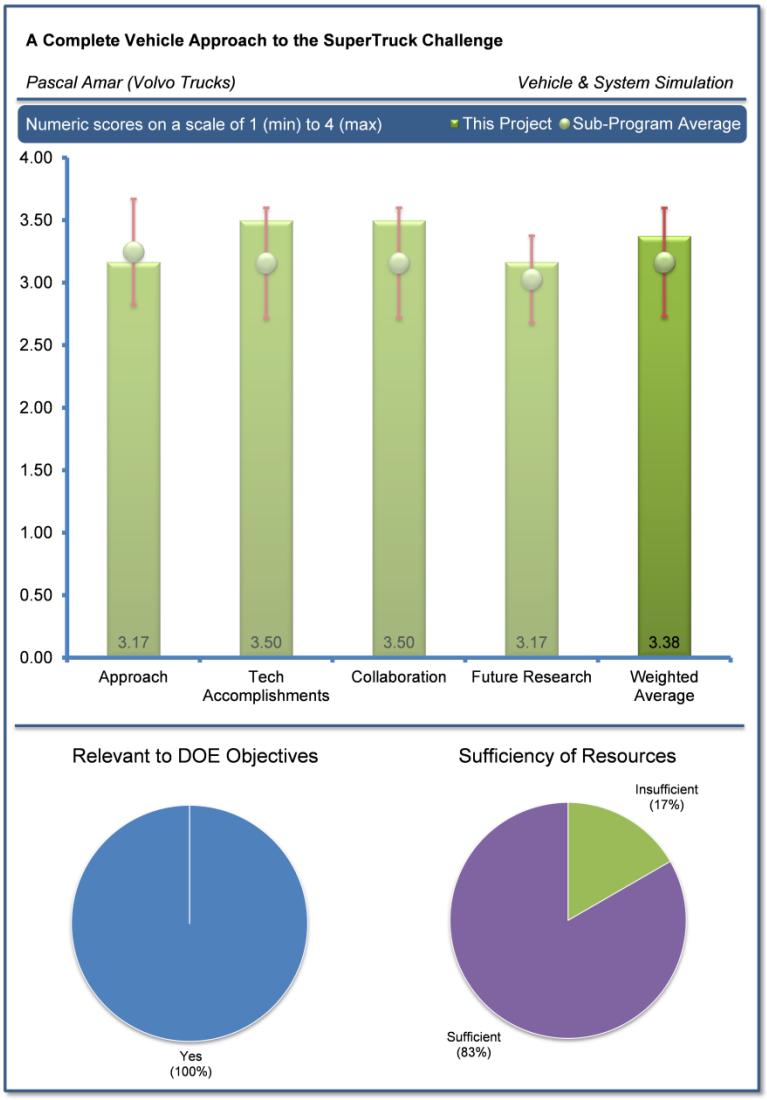
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Mixed comments were received regarding the project's proposed future research. One commenter noted that as this is a new activity this section is not especially relevant but that the planned activity builds on successful past research. The other reviewer expressed concern about not having an OEM partner, which to a certain extent can pose problems. This reviewer notes that the bad news is that OEMs do this work as part of their design process; however, fuel economy is a minor factor in the design. The reviewer remarked that the good news is the project can look at this design work with a sharp focus on fuel efficiency and has to potential to generate promising results. The reviewer concluded that it may be good to approach this program with a clean-slate and with minimal OEM support.

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

Comments received on the adequacy of financial resources for the project were mixed. One reviewer felt that financial resources were sufficient, while another reviewer felt that financial resources were excessive. One reviewer commented that the budget proposed seems reasonable for the scope of work. Another reviewer indicated that the subject is compelling but the budget for this program seems generous, especially considering that the CRADA has not been formalized yet. This reviewer stated that the formalization of the CRADA and more detail on planned vehicle testing is necessary in order to justify the resources.

A Complete Vehicle Approach to the SuperTruck Challenge: Pascal Amar (Volvo Trucks) – vss081



Reviewer Sample Size

This project was reviewed by six reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

All of the reviewers provided similar comments regarding the project's relevance. One reviewer commented that the project objectives are key enablers to energy efficient highway transportation. A second reviewer noted that this project is relevant as it improves the high petroleum using tractor trailers. A third reviewer pointed out that the project is addressing the largest commercial fuel use segment (Class 8 OTR trucks) and is targeting appropriate fuel efficiency improvements. Another reviewer adds that the Class 8 highway heavy vehicles use a lot of petroleum-based fuel (diesel). Successful attainment of the SuperTruck Program objectives will certainly result in significant petroleum displacement. The final reviewer echoed these comments, remarking that successful completion of this project would achieve the petroleum reduction goals established by DOE for the SuperTruck.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Comments on the approach to performing the work were varied. One reviewer felt that the formulation of technology roadmap coupled with simulation and analysis to identify possible technical pathways to meet the program and project objectives is very good. The four key technology approaches of weight reduction, parasitic losses reduction, aerodynamic loss reduction and powertrain improvement were found to be reasonable; however, the reviewer cautioned that simultaneous integration of multiple technologies can be susceptible to serious complications. The second reviewer pointed out that Slide 6 was good and suggested that it could show methodology and selection criteria as to why technologies were chosen or not chosen by one commenter. Another reviewer found that the project had a good use of analytical tools to concept solutions for these challenges. This reviewer found it impressive that the project chose to delay concept selection for anti-idling. The reviewer noted that this area is changing significantly and has little integration opportunities. It is an area that can be delayed somewhat and not affect other decisions. This reviewer asked if there was an opportunity for Volvo along with DOE, to select areas of interest not being worked by the other companies, given that Volvo was behind about a year from the other three SuperTruck projects. The fourth reviewer summarized that the approach in this project is multi-faceted, so that improvements in several areas contribute to achievement of the goals. For example, not only do the light-emitting diode (LED) lights and novel lighting design reduce lighting energy; they also enable additional light-weighting because of the reduced use of copper. The reviewer added that there is significant light-weighting, directly reducing fuel use, and also enabling additional freight to be carried, thus reducing fuel use per ton-mile. This reviewer expressed concern regarding the idling-reduction plan having not yet been revealed and hopes that it involves an integrated, non-

duplicative system. The final reviewer expressed that not many details are offered in aerodynamic improvement and pointed out that the statement is a little bit vague.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Several reviewers had similar positive comments on the project's technical accomplishments and progress. One reviewer noted although the project is building on previous projects, satisfactory progress was made during the first year. With the exception of one item, all the project milestones for the first year were either completed or on track. Another reviewer sated that the project seems to be on track towards achieving the overall goals. This reviewer indicated that several of the elements of the program (e.g., lighting) seem to be elegant and innovative. This reviewer was a bit concerned (for all of the projects, actually) with the skirts. This reviewer referred to interviews with maintenance personnel who indicated that these are not cost-effective, due to snow collection on them and frequent breakage in use. A third reviewer commented that the simulations seem to indicate that progress and targets are possible. Another commenter believed that the project is making technical accomplishments as expected, and observed that significant decisions and progress will be made in the next year. The final reviewer indicated that with one year into the program, the technology roadmap with analytically defined efficiency improvement map should be available.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Comments on the project's collaboration and coordination with other institutions were mixed. One reviewer expressed that Volvo has created a strong team and this will enable good project success. Another reviewer recognized that this project includes contributions from a broad set of partners, covering all aspects of vehicle design and construction. This was supported by another reviewer who felt that the project had many technical components and would no doubt require close collaboration with many key players. The reviewer observed there was clear evidence of collaboration among team members. A different commenter suggested that the project should include a commercial fleet partner and include some voice of the customer information to help justify technology selections and customer requirements. A comment was also made that it was not clear how the partners help the program in more technical details.

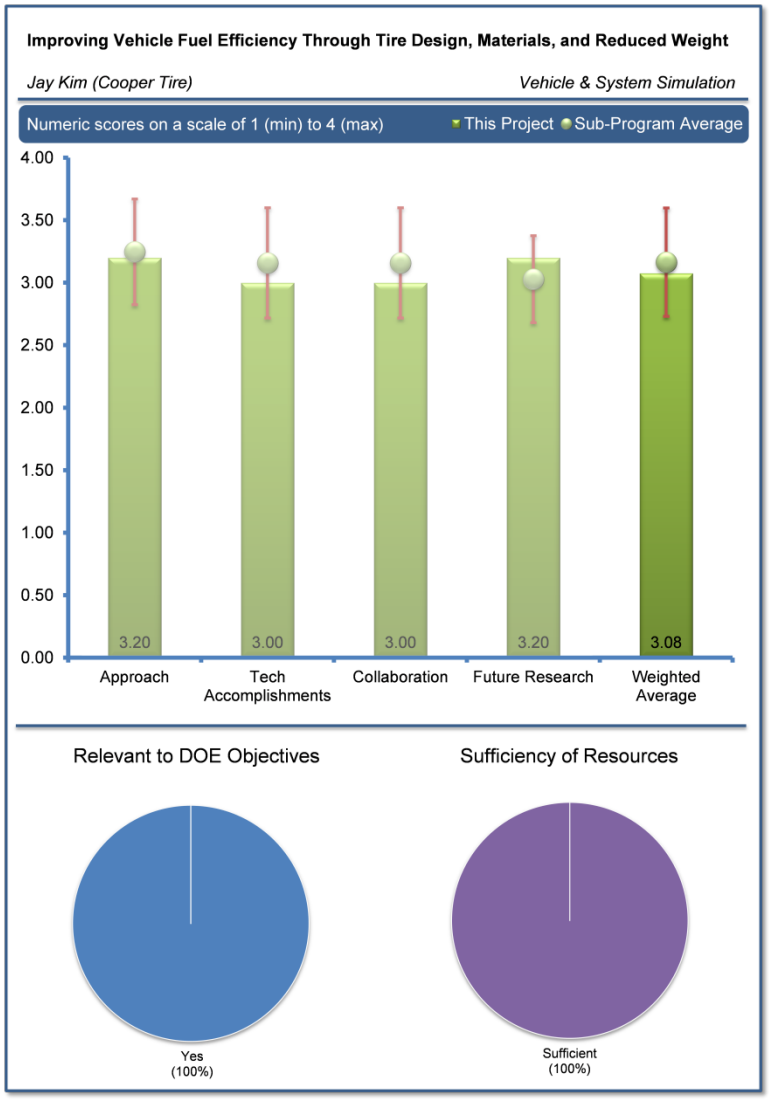
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Reviewers had mixed comments on the proposed future research. One reviewer indicated that this project has solid plans surrounding the various technical opportunities and is particularly interested in the project's approach to weight savings opportunities. Two reviewers expressed similar opinions. One reviewer asserted that this probably would have been a four if the presenter had been at liberty to disclose the idling reduction plan. This was somewhat reiterated by another reviewer who said that while the future work plan looks good, it would be useful if the PI would address contingency plans for resolving unexpected technical problems. The same reviewer explained that a project with as many changes to the vehicle systems as this will encounter unexpected technical issues, for example, lower viscosity and lower lube level may have detrimental effect on driveline system reliability and durability. In contrast, one reviewer expressed disappointment with this project, reasoning that Volvo seems behind on the simulation. The reviewer realized that they came to the party late, but that all of the other OEs have had extensive modeling in the past on this type of project. Another reviewer identified the need for more quantitative statements on the future work. The reviewer explained that the proposed future research is too general, and does not offer too many insights.

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

One reviewer felt that financial resources were insufficient. Five of six reviewers felt that resources are sufficient. One reviewer indicated that resources appear to be sufficient and capable. Another reviewer indicated that given the progress, compared to funds already expended, the researchers appear to have allocated their funding appropriately for achieving their stated goals. A different reviewer commented that the goal is too aggressive with half funding of their competitors.

Improving Vehicle Fuel Efficiency Through Tire Design, Materials, and Reduced Weight: Jay Kim (Cooper Tire) – vss083



Reviewer Sample Size

This project was reviewed by five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Reviewers found that the project supports DOE's objectives. The first reviewer stated that there is a direct relationship between tire fuel efficiency and energy consumption that was well-established in the presentation. Another reviewer added that by addressing rolling resistance of replacement tires, a significant portion of the tire market, a reduction of fleet fuel consumption is possible. This could have an efficiency impact on a portion of the existing fleet with a simple tire retrofit, added the expert. A third commentator added that an achievement of at least 3% fuel efficiency through tire improvement is aligned with DOE's petroleum displacement goals. This person suggested that the PI should characterize how much each of the six approaches would contribute to the greater than 3% goal. The expert also noticed that the performance impact was not clearly predicted in the briefing charts. The final reviewer assured that any reduction in the overall tire weight would reflect positively on the fuel efficiency of the tire. The expert observed that the project has identified six potential areas to reduce tire weight, which could help improving tire fuel efficiency by 3%. These possible fuel savings would support the DOE project objectives, stated the expert.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer stated that the approach strategies and milestones were basic for such a research project. No significant issues were identified, added the expert. The second reviewer to respond noticed that the approach was very wide-ranging, examining a number of technologies to reduce tire rolling resistance such as tread compounds, tire construction (i.e., weight), and air pressure maintenance (i.e., inner liner materials). This person felt that there is an ambitious work plan given the project's identified resources and timeframe. A third commenter was unsure whether there would be decision points that would determine which of the six approaches would be incorporated into the new class of tires (assumed to be one tire construction design). This person asked whether there would be an independent validation test or combined validation tests on the evolving tire design. This expert was looking forward to more detail as the project evolves. The last reviewer to respond felt that the project seems a bit like a let-us-try-everything-we-can-think-of-and-hope-something-works approach.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first reviewer explained that project had recently begun, and noticed that the expenditure of resources is currently small. The reviewer added that the project has made progress in six separate areas of investigation; out of the six progressing areas the Nano-fiber reinforcement, low hysteresis tire profile, and barrier film lining projects are showing promise. The expert felt that it was good to see which of the PI's identifying research areas that had not been successful, as well as reasons why (e.g., fiber-reinforced thermoplastic polymer bead materials). Another reviewer commented on the various approaches, stating that in regard to approach one, nano-fiber reinforcement, it is known that the main two issues with nano-fiber fillers are the dispersion of filler, and the filler-polymer interfacial bonding. The expert added that, based on the concerns raised in the document, these issues should have been addressed first. Otherwise, offering to use conventional materials may not be unique subject for this research, added the expert. This person also suggested that in approach two (the use of thermoplastic polymers), the light weight bead bundle may have not been necessary. The expert also observed that in approach six (the barrier film liner), the lab test showed equal-to-improved air permeation resistance. This person observed that the next step mentioned that arrangement for production trials of the barrier film were made. The expert suggested that it would be more beneficial to have substantial improved properties before running a production trial. This reviewer felt that by developing tire fuel efficiency while sacrificing other tire performance parameters, there may not be an adequate outcome of this project. The following reviewer felt there had been limited progress and it seemed commensurate with the amount of money spent so far. The last reviewer to respond felt that there was good progress through each approach. The expert observed that approach six described a test program in future tense (is planned for) but identified a past time period (1Q 2012).

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Reviewers had mixed feedback on collaborations. The first reviewer to respond felt there was somewhat limited collaboration because only NREL was listed as a collaborator. This reviewer added that suppliers of materials for the various tire components were noted, but were not identified specifically as partners. The second expert to respond stated that the project is finalizing subcontract with NREL, having initial meetings, and the development of plans and strategy with partner shows good collaboration in one area. However, according to this reviewer, in other areas the work is based on buyers' and sellers' relationship. The reviewer suggested that this could have been improved by having more involved collaboration with manufacturers in developing materials for this project. The following commenter observed that there was no real evidence of collaboration beyond in-house or proprietary contacts with suppliers. The last reviewer to comment suggested that in future reviews, the insight into voice of the customer priorities (fuel efficiency, durability, performance, maintenance, etc.) should be included, along with described OEM input/interactions.

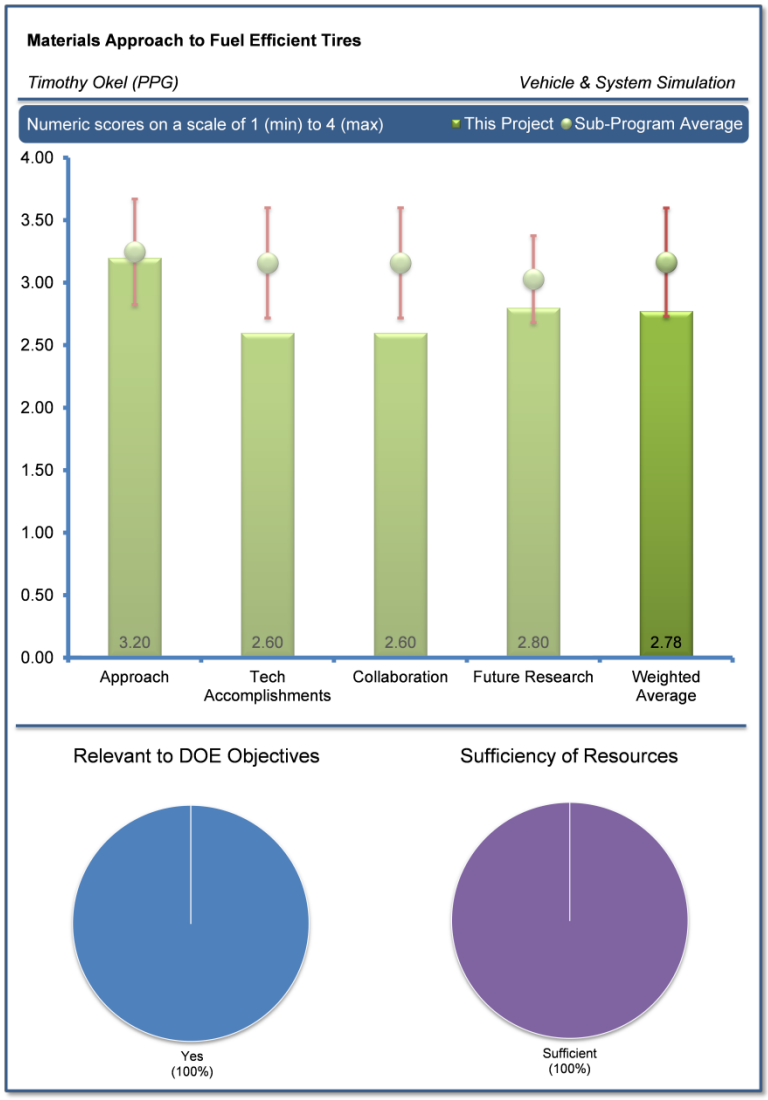
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

According to the first reviewer, as long as clear decision points are reached for each concept and some rationale are developed for why, combining successful approaches makes sense. One commentator felt that the future work was on a logical path – completing development and analysis for each technology for down select in Phase II. This expert reiterated that, as indicated (in slides), the project will continue to develop promising technologies to address any performance deficiencies that may hinder commercialization. A third expert believed the future plans lacked any consideration of performing analysis on the cost of materials, specifically costs of nano-fiber material and processing. The last reviewer to respond asked whether there were any interdependencies between the six approaches that might cause future work delays (this gets back to the comment of not knowing if any of the six approaches are parallel or sequential efforts).

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

All five of the reviewers felt that the project resources were sufficient in order to achieve the project milestones in a timely fashion. One reviewer felt that there was sufficient funding available for the completion of the project. A second added that there was an excellent cost-share balance. The last reviewer felt the resources appeared sufficient, but believed that the amount of work (number of technologies to be examined) was ambitious given the budget.

Materials Approach to Fuel Efficient Tires: Timothy Okel (PPG) – vss084



Reviewer Sample Size

This project was reviewed by five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Reviewers found that the project supports DOE's objectives. One reviewer stated that the achievement of at least 2% fuel efficiency through tire improvement aligned with DOE's petroleum displacement goals. This expert added that there was an excellent characterization of the problem in support of why the two technologies were being investigated. A second commenter stated that the project addressed DOE goals through reducing tire rolling resistance: addresses material technology for rolling resistance and tire pressure maintenance (reducing air leakage). A third reviewer stated that tire fuel efficiency directly relates to tire inflation pressure and added that their energy consumption was well-established. The final commentator to respond stated that the project objective stated that it will design, develop, and demonstrate fuel efficient and safety regulation compliant tire filler and barrier coating technologies that would improve overall fuel efficiency by at least 2%; this should be in-line with the DOE objectives.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

The first reviewer to respond stated that the targeted issues were well-outlined and the approach seeks to identify the best solutions. A second commenter noted a logical approach for evaluation and development of filler and barrier materials, resulting in actual tire testing. The approach seeks to improve tire rolling resistance as well as durability and manufacturability – will produce a more commercially-relevant product. The next expert felt that there was a good indication on the approach/strategy on the development of fillers. The project has identified five combinations of fillers that show potential for improving tread wear while maintaining fuel efficiency. This expert added that the standard technical approach/strategy consisted of the development of the tire's inner layer. The last reviewer to respond stated that the project used key strengths of principal. However, it was a little vague to this reviewer what was different from on-going work.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Reviewers generally saw good progress considering how recently the project began. The first reviewer to respond stated that the early progress appeared to support project objectives. This reviewer suggested having more measures on anticipated milestones. The review presumed a clear milestone progression toward demonstration but lacks any appreciable detail on schedule. The following respondent felt that the accomplishments were good, given that the project had recently begun. The expert explained that the filler materials had already been synthesized in small batches, and were being characterized before submission to tire partners

for further testing. The inner layer films have also been synthesized, with novel dispersion materials to reduce gas permeation. This person stated that the accomplishments to date indicated that further success will be achieved in this project. The following expert said that there were several experiments underway and that significant progress had been made with fillers and the development of the inner layer films at the lab scale, which suggested that barriers could be overcome. This reviewer noted that several experiments are underway. Additionally, this reviewer noted significant results with the development of the inner layer films have been accomplished. The last respondent to comment felt that there was not much data to judge to project on and that the project seemed in-line with 17% completion noted.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The first reviewer stated that the project was limited to principal and current customers and that a great deal of parallel work was on-going at universities (and obviously competitors). The following expert added that the collaboration with a major tire manufacturer (Goodyear) was appropriate – they will incorporate the developed materials from Pittsburgh Plate Glass Company (PPG) into prototype tires for testing. The next reviewer reiterated that Goodyear was identified as a subcontractor, but added that, other than incorporating the new materials into one of their tires, it was unclear exactly what the advisory role entailed. The last commenter felt that the presenter showed good collaboration with a partner, a major tire manufacturer, on building tires for testing using the developed technologies, and suggested that the project could have more coordination with current and other partners in addressing manufacturability issues.

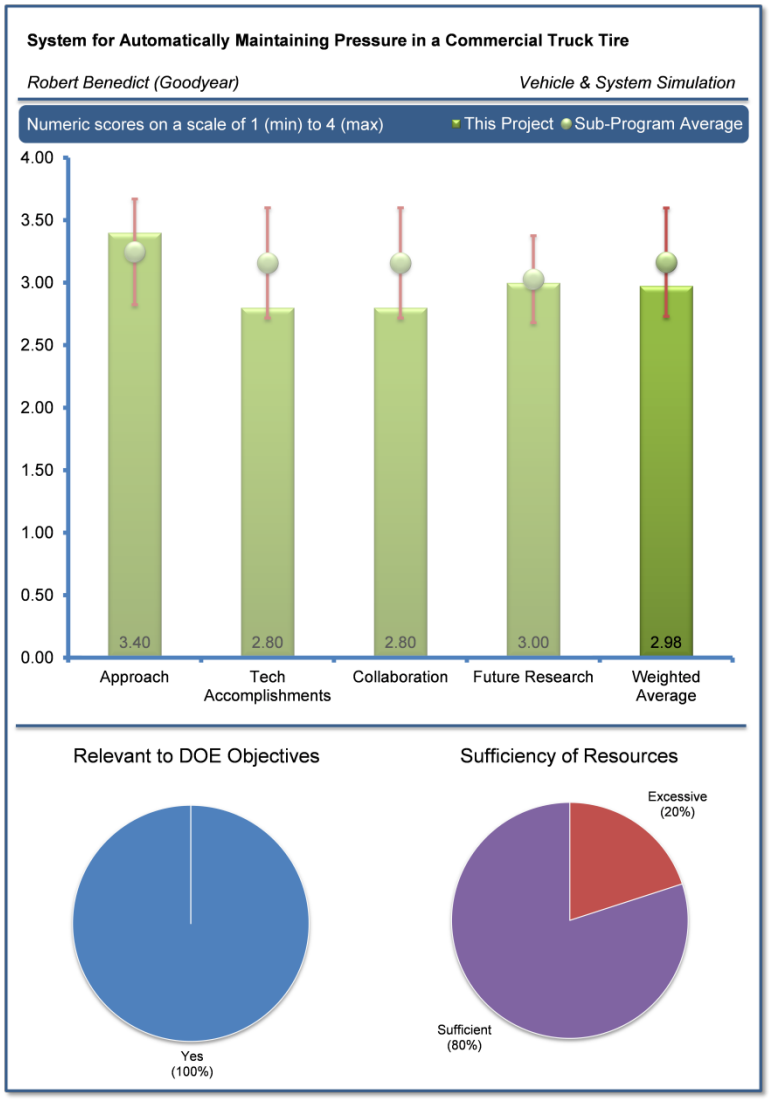
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One expert felt that the future work plan was reasonable – materials analysis and testing for down selection of final materials to be incorporated into prototypes. This person noted that the schedule leaves only about nine months to develop prototype tires, and inquires if this will be enough time to test the completed tires. The next commentator stated that the review only offered one milestone per assessment and included a vague two-phase approach with a tire demonstration in the last nine months of the project. Another reviewer observed that the future plan identified the main parameters for the manufacturability, processing and performance of the fillers; the future plan on inner liners has identified the key metrics and milestones for designing and formulating the coatings; and the risks have been identified but no mitigation plans have been provided. The last reviewer suggested showing the ancillary benefits for increasing knowledge if project approach does not succeed.

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

All five of the reviewers felt that the project resources were sufficient in order to achieve the project milestones in a timely fashion. Two reviewers commented that the resources appeared to be sufficient in order to complete the work identified.

System for Automatically Maintaining Pressure in a Commercial Truck Tire: Robert Benedict (Goodyear) – vss085



Reviewer Sample Size

This project was reviewed by five reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

Reviewers found that the project supported DOE objectives. The first reviewer stated that this project would address fuel efficiency improvements in commercial trucking through automatic tire air pressure inflation and found it was relevant to DOE objectives. This expert added that there is a significant importance of tire inflation to fuel efficiency for commercial trucks. A second reviewer commented that keeping commercial tires at a prescribed pressure would be ideal for fuel efficiency and was well aligned with DOE goals for petroleum displacement. The following commentator believed that the developed system, as claimed, could maintain constant tire pressure, resulting in fuel savings and improved safety by maintaining proper tire inflation. The expert believed that this aligned with the DOE objective on reducing fuel consumption. The last reviewer reiterated that the direct relationship between inflation pressure and fuel consumption is well-known.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One reviewer stated that there was a very clear timeline/plan for developing the design and eventual validation. The second reviewer stated that the approach consisted mainly of a description to the steps taken to develop the system, adding that it was consistent with typical technical system development methods. Another expert noted that this approach involved a novel self-contained air pressure maintenance system, completely contained in the tire. The reviewer believed that this would be appealing to commercial truck owners and that if it worked well, would be preferable to more complex central tire inflation systems for tire pressure maintenance. The next respondent felt that the design and prototypes were properly done and noted that there was a demonstration of a working concept. The last reviewer observed minor variance on the approach known for decades as well as that used on current commercial systems.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Most reviewers found that the project has made good progress. The first reviewer said that progress seemed in line with funding spent to date. A second reviewer stated that the project was on target with the project management plan. The following expert felt that the progress was very good, given that this is the first year of the project. This person explained that simulations have been performed showing that the system is projected to pump more air than the target pumping rate. The next reviewer stated that the

presenter showed progress in system design, modeling, and partial tire prototype development. The last reviewer suggested that the reliability of this product needed to be researched further.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Most reviewers noted that the project has ongoing collaborations. One reviewer stated that the project was very well coordinated with partners and industry. The following expert said the project captured all stakeholders from vendors/suppliers to customers. A third reviewer added that Goodyear was leveraging work done in Europe on a similar system for passenger car tires and that partnerships with local businesses to fabricate test equipment and molds were made. The expert explained that there were no partners specifically identified as part of project, but collaboration appeared to be good nonetheless. The final reviewer stated that the collaboration so far consisted of discussions, visits, request for quotes, and contracts currently in progress with three vendors/suppliers. This person suggested that further coordination with partners would improve the results of the project.

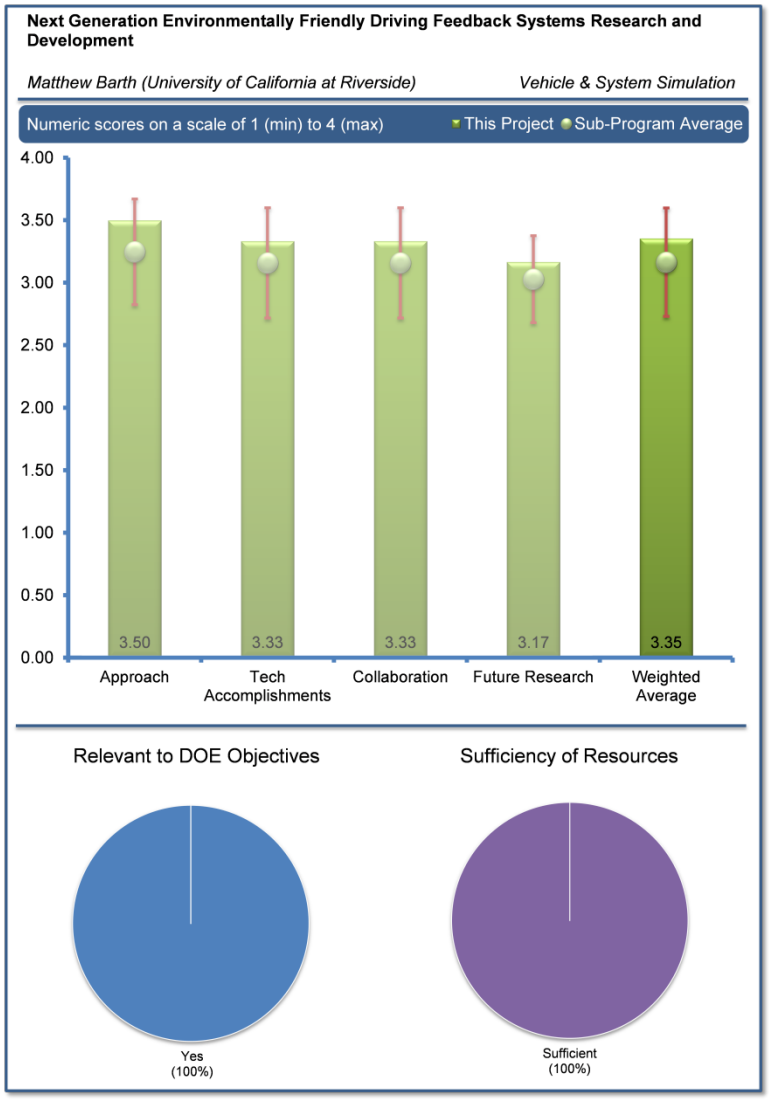
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first respondent stated that the future work plan was detailed and was in a logical progression for proving out the components of this tire concept. The expert explained that vehicle tests would begin in approximately 18 months, leaving sufficient development time for proving tire components. The following reviewer explained that this project is not really research, but rather just the evaluation of a design. The next reviewer is going on the assumption that the light-duty version of this system is progressing towards commercialization. The only comment for future work is how Goodyear has accounted or planned for risks, i.e., this reviewer inquired if might there be design/application modifications that do not scale to commercial vehicle tires. The final reviewer commented that the future plan should consider evaluating the effect of introducing holes and grooves in the sidewall or the structure of the tire. These design modifications may lead to faster tire failure. Additionally, the future plan should consider mitigation alternatives in case the regulator fails, since over pumping may occur and can lead to tire failure. The plan should address the ability of the developed system components, tire, and associated costs to be repaired. Finally, this reviewer suggested that the future plan could review consumers' acceptability.

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

Four of the five reviewers to respond felt that the project resources were sufficient in order to achieve the project milestones in a timely fashion. One reviewer thought the resources were excessive. The first reviewer stated that the resources appeared sufficient for completing the work – significant cost-share from Goodyear to complete work. Another reviewer commented that there are sufficient resources available for the completion of the project, mainly funding. Another reviewer noted excellent cost-share from the recipient; this clearly suggests intent to commercialize. The final expert was unsure why DOE would fund a plethora of Goodyear patents in this area.

Next Generation Environmentally Friendly Driving Feedback Systems Research and Development: Matthew Barth (University of California at Riverside) – vss086



Reviewer Sample Size

This project was reviewed by six reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer found that driver feedback for fuel efficiency is a relevant concept for improving vehicle fuel efficiency and thus is relevant to DOE objectives. This reviewer reported the research team was projecting potential benefits that go significantly beyond the 2% goal for the activity. Another panelist stated that the proposed next-generation driving feedback system has the potential of meeting the DOE goal of reducing fuel consumption by at least 2%. The next person relayed that the project was focused on reducing fuel consumption of fleet vehicles. Another panel member thought the objective to be complementary to many other programs. The final reviewer concluded that operator choices (routing and performance demand) are key attributes that contribute to fuel efficiency and ultimately to DOE petroleum displacement objectives. This reviewer felt that successful integration and demonstration of this system would offer an important tool to both the commercial and light-duty operators.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Most reviewers had positive feedback on the approach, and some offered suggestions. One reviewer said the project appeared to be well-designed and well-coordinated. Another agreed that it seemed to incorporate advanced technology well, with a usable interface. The next person thought that this was generally a good project approach that covered several areas of the project development; however, no information was presented about the specifications, capability or design of the navigation system/equipment that will be available to the driver and passengers. A subsequent reviewer felt that an information aggregator that could aid the operator in achieving fuel efficient driving would be an important tool for both operator and fleet. This reviewer was not clear on how the system would address incomplete information (i.e., how the system will weigh the information that it is trying to aggregate when incomplete real-time information is not available). The reviewer asked if the system will archive hourly or daily trends. The final panelist relayed that the researchers approach combined several separate driver feedback and eco-driving concepts into one project, and that work will extend driver feedback concepts (eco-driving, eco routes) to legacy fleets. This panelist thought it ambitious to develop and refine this set of four tools, but the team was starting with some existing resources (traffic services, maps, etc.) so it should not be a problem. The panelist considered the present focus on fleet applications a good thing, and thought that the concept could be extended to personal vehicles. This panelist noted that the feedback system was fairly

portable, requiring only some tuning (especially for the eco-driving modules) to be transferred among vehicles, and concluded that this would be good for retrofit/legacy vehicle applications.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

One panel member reported that the project was progressing according to milestones. Another thought the project appeared well organized and on track. The next reviewer pointed out that the project only presented initial data, so there was little to judge on, but that the progress seemed to be in-line with the funding to date. A subsequent panelist agreed that the review only offered past progress/milestones and offered no insight into future timing (other than on a FY timescale). This panelist remarked that the review did not identify integration risk and how overall objectives might be compromised if system integration is encounters issues. The next person found limited accomplishments to date, but work on the project has only just started. This person thought the work on estimating intersection delays was interesting, and appeared to show promise in improving routing times for ecodriving. This person concluded that it would be interesting to see what accomplishments will be made in 2012/2013. The final reviewer observed that some barriers were not yet addressed, one being driver acceptance, since no scientific study has been done in this aspect. This reviewer felt the questionnaire was not enough, and that it was biased. The reviewer reported that safety concerns were not specifically assessed and answered, and listed a final unaddressed barrier as having unknown cost-effectiveness.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Some reviewers offered suggestions for possible collaboration. One panel member reported that there were many collaborators on this project, and felt that there were good partners on the technology end of the spectrum. This reviewer pointed out that fleet partners include only state and local government, and felt that it was unfortunate that the PI was not able to secure a private fleet. The panel member noted that it can be difficult to secure the participation of a private fleet (like a trucking fleet) in a research project such as this. Another panelist remarked that there were a lot of partners identified, but that it was not so clear if they are subcontractors that have a stake in making this project a success or if they are merely providing in-kind integration support. The next person thought that even though there are several partners collaborating in this project, collaboration with a commercial trucking fleet could have significant impact. The final reviewer suggested that if not done already, the project should check with the NHTSA on minimizing potential driver distraction issues.

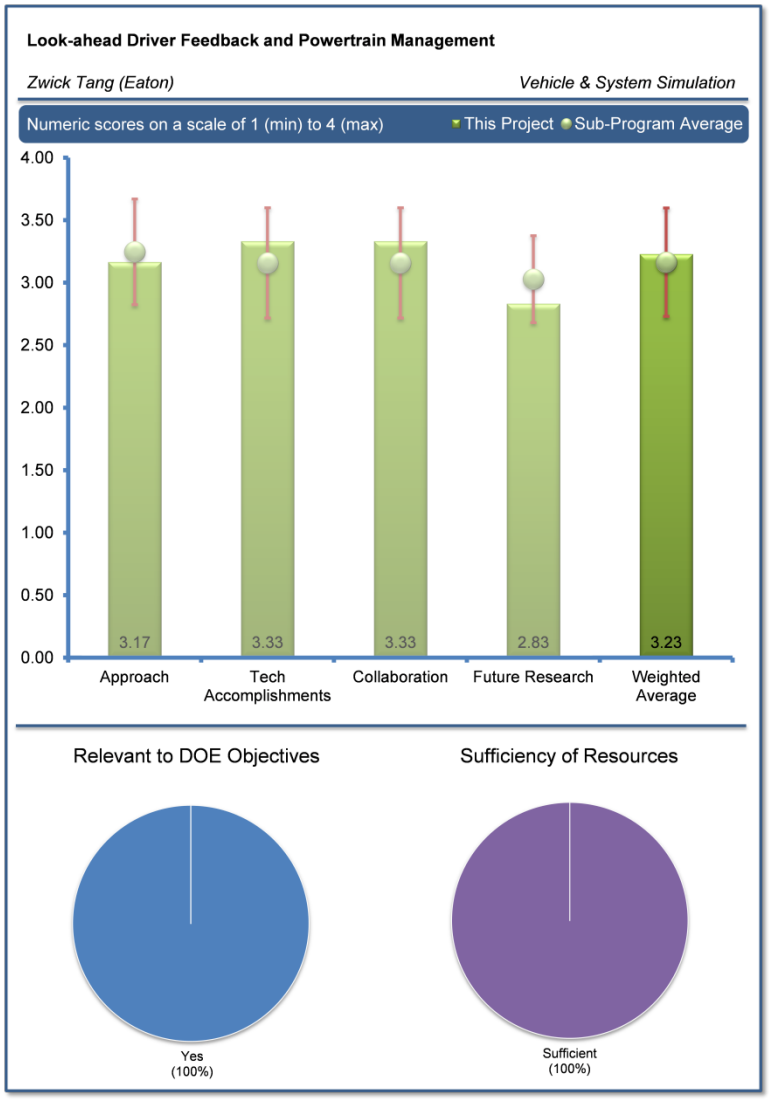
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer felt that much future work needs to be done to complete these modules, but that the work plan seems reasonable, including system integration and several months of vehicle testing. Another observer commented that the review offered an outline of future work but did not identify a distinct timeline/milestone schedule or interdependence between modules/systems. The final reviewer thought that the future research needs to identify clearly the class(es) of vehicles that can use this system, that the future research needs to identify the usability of the system between different vehicle types, that the future research should include costs and benefits analysis on the fuel savings that can be achieved by the system, and that the future plan needs to include development options for the navigation system.

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

Six reviewers found resources to be sufficient. One thought that given the parameters of the work, the funding seemed reasonable to complete the project. Another panelist said that available resources should be sufficient for the completion of the project, mainly funding. The last reviewer questioned how much of the work will be proprietary, and cited the low cost-share by the contractor.

Look-ahead Driver Feedback and Powertrain Management: Zwick Tang (Eaton) – vss087



Reviewer Sample Size

This project was reviewed by six reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer felt that by seeking to reduce fuel consumption by at least 2%, this project aligned with the DOE petroleum displacement objectives. Another person concluded that improvement of commercial truck fuel efficiency is relevant to DOE fuel efficiency goals, and that there is significant opportunity for uptake into the market if the technology is cost-effective and functions well. This person noted that driver feedback is an important component for commercial vehicle fuel efficiency improvement, as driver actions contribute a considerable variability to fuel efficiency. The next panelist concluded that the project would support the DOE goal of reducing fuel consumption by improving commercial fleet fuel efficiency by at least 2% through advisory feedback and power control strategies. A further reviewer related that the project objective was focused on reducing the fuel consumption of fleet vehicles, and that the project appears to be on track to meet the objective. A final observer wrote that this project is complementary to several other projects.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Reviewers provided a range of responses concerning the project's approach. One observer felt there was good progress in this project. Another person pointed out that driver behavior is an important factor contributing to fuel efficiency. This person felt that combining various vehicle information systems to offer operator feedback, which would result in improving fuel efficiency, should offer an excellent tool to drivers that have little or no driver training. The person further thought that it may also provide feedback to operator who exhibit poor driving habits, but that there was not assessment of project risks. The next reviewer found the approach to be logical, and reiterated that it would identify requirements and opportunities for fuel savings, then develop systems to address these opportunities. This reviewer related that the project built on existing sensor technologies and results from driving studies. The reviewer further stated that this system can take a more active role in vehicle operation as the system is connected to engine/powertrain and does not depend solely on driver feedback interface for fuel efficiency improvement, which is important for commercial trucking. This reviewer thought that it appeared to be more integrated with the truck than other project systems, which required consideration of tradeoff of benefits versus difficulty in integration with existing vehicles. This reviewer concluded that minimizing distraction on commercial vehicle applications will be very important. A subsequent observer reported that the presenter mentioned in the approach that they will build upon the exiting and next-gen sensor and information technology, for example, the U.S. DOT V2I communications for safety program. This observer thought this approach could provide them with a step ahead in the development stage and big savings in the project costs. This observer also commented that the first objective of the project, providing advisory feedback, should be achievable with no concerns; however, the powertrain control approach could

have safety related issues, which require more considerations during development. The observer further expressed that the approach should include costs and benefits analysis for each approach. The final reviewer understood that most of the testing will take place in fairly flat driving terrain, and concluded that it would be better if the terrain could be varied. The reviewer also remarked that the interviews they conducted with trucking firms were only with management, and that it would have been better if they could have interviewed drivers also. This reviewer additionally found that it was not clear what the approach is to handling safety issues related to driver distraction and driver workload. The reviewer concluded that otherwise, the approach looked good.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Reviewers generally observed that the project is on track. One person thought that preliminary accomplishments seemed good. Another panelist felt the presenter had shown good progress and accomplishments in several tasks of the project. The next panel member reported that the project appears on track and is being well managed to deliver results. A further reviewer remarked that the PI was progressing toward the project objectives, but there was little insight into details of the planned task schedule. This reviewer reported that discrete task numbers are offered in the review (2.1, 2.2, and 3.1) but only notional phases without milestone dates are discussed. The final observer felt that much of the groundwork had been laid for this project with work completed so far; incorporating information from customers on what they would be interested in seeing. This observer relayed that the project used analysis to narrow down possible fuel consumption scenarios to a small selection of high impact situations where driver feedback can be important. The observer concluded that look-ahead systems offered promise for improving fuel efficiency by responding to environmental factors like traffic and road grade.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer commented that the presenter had good collaboration with several partners including institutions, state and federal government, and commercial companies. Another panel member thought that the collaborations were good, having involved the University of Michigan Transportation Research Institute (UMTRI) and ORNL, along with a commercial fleet. This panel member also reported that the researchers were working with the Michigan V2x test bed to incorporate look-ahead features into system. The next panelist felt that the review did not clearly identify to what level the collaboration, exchange, or support is offered. This panelist asked if any of these partners are subcontractors and therefore are project stakeholders. The final observer suggested that using relatively few links with broad scope for each seems more appropriate than many links with little data transfer.

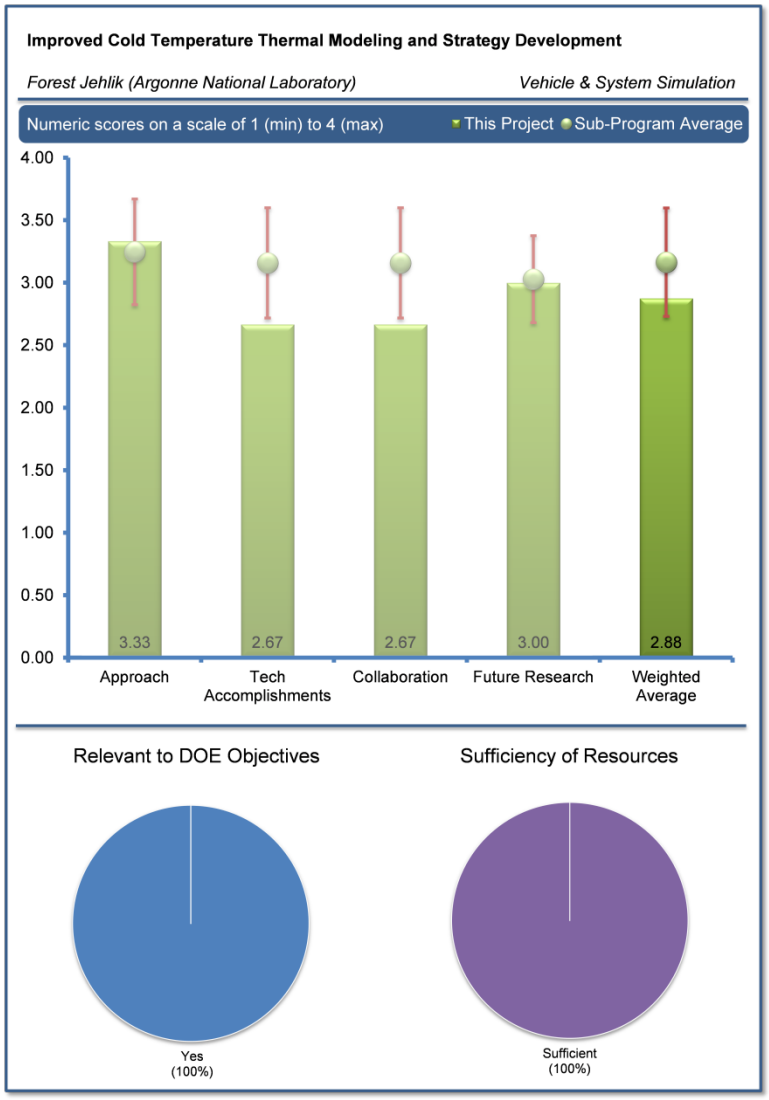
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One commenter thought the future work plan would complete the project effectively, and that field testing of prototype system would be valuable to prove out benefits. Another panelist reported that the presenter had provided information on the first two phases of the project, but that there was no information on Phase III. This panelist noted that the future plan did not identify possible barriers and risk mitigation alternatives; for example, addressing road safety could be an issue. This panelist concluded that the plan needed to include information on the possibility of using the system in current or only future fleet. The final reviewer commented that the future work is only in outline form, and again does not offer any timeline definition.

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

Six reviewers rated the resources as sufficient. One stated that resources appeared to be sufficient to complete the work as described. Another person thought that available resources, mainly funding and data, were sufficient to sustain the project. The final reviewer wrote that there was low contractor cost-share contribution, about 25%.

Improved Cold Temperature Thermal Modeling and Strategy Development: Forest Jehlik (Argonne National Laboratory) – vss088



Reviewer Sample Size

This project was reviewed by three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

One reviewer felt that this project supported the DOE objectives of petroleum displacement but that it must be expanded to include hot temperature modeling. This reviewer pointed out that the sunbelt cities of Phoenix, Houston, and Las Vegas consume lots of petroleum for air-conditioning in their vehicles. Another panelist remarked that as vehicles become more and more efficient, it becomes harder to squeeze out efficiency improvements necessitating examination of areas to date which have been largely overlooked. This panelist thinks that comprehensive examination and understanding of the effects of ambient temperature on fuel efficiency across the drive cycle has the potential to uncover areas to further fuel efficiency improvements. The panelist further stated that, according to the PI, implementation of better heat transfer characteristics and/or waste heat utilization using knowledge of ambient temperature effects has the potential to unlock an additional 10-15% improvement in fuel efficiency.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One panel member concluded that every key element had been covered in the modeling. Another observer found the approach to this task to be reasonable and well implemented, utilizing proven instrumentation techniques and model development (leveraging existing fueling and temperature prediction models and capabilities at ANL). This observer reported that the empirical data and modeling efforts are then used to correlate with one another. The observer found that tests are conducted over broad ambient conditions using a number of thermal channels – engine oil, transmission fluid, etc. – and that presently only two vehicle models (two model years of the Toyota Prius and Ford Fusion) have been examined.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

Reviewers found that progress has been made, and also provided suggestions. One reviewer felt that good progress has been achieved, but that it would be a great opportunity to repeat the data obtained in Canada using the updated ANL Advanced Powertrain Research Facility (APRF). This reviewer noted that in Slide 4, make it clear that A/C was off or on at 35°C during testing. The next observer remarked that task accomplishments include close correlation between cold temperature start-up and lost efficiency which is not surprising. This observer reported that progress has been made in determining thermal signals

providing useful insight into fuel efficiency for cold temperature warm-up including oil temperature and heater core impact, which provides a basis for constructing a portfolio of appropriate thermal signal points and parameters to accurately reflect the effect of ambient temperature on fuel efficiency over broad driving cycles or conditions. This observer further noted that idling efficiency is dramatically affected by cold temperatures which are especially relevant to assessment of hybridization benefits. The observer reported that testing has indicated that ambient temperatures do not significantly affect fuel efficiency once stabilization has been achieved. The observer found that models have been developed to determine fuel efficiency oil temperature dependency; flow rate has been estimated as a function of rpm/ load/ oil temperature with good accuracy after catalyst light off. This observer wrote that at low temperatures, it has been determined that fuel consumption at a given load point greatly decreases as oil temperature rises. The observer concluded that, overall, the steady, broad technical accomplishments have that been achieved are laying the groundwork for further advances.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One panel member urged researchers to get an OEM excited about this work in the near future. Another reviewer related that there has been limited collaboration with other entities including internally with ANL for modeling support, and Environment Canada for thermal modeling chamber usage (until ANL acquired five cycle, full temperature testing capabilities at the APRF this year). This reviewer reported that the PI indicated there has been informal discussion with previous colleagues at GM with regard to the efforts of this task. The reviewer thought that it would be beneficial to expand upon these discussions in a more formal way, including other OEMs, to help channel near-term and future task activities and determine pathways and research that could support commercially viable implementation strategies to improve fuel efficiency through waste heat utilization and improved heat transfer characteristics.

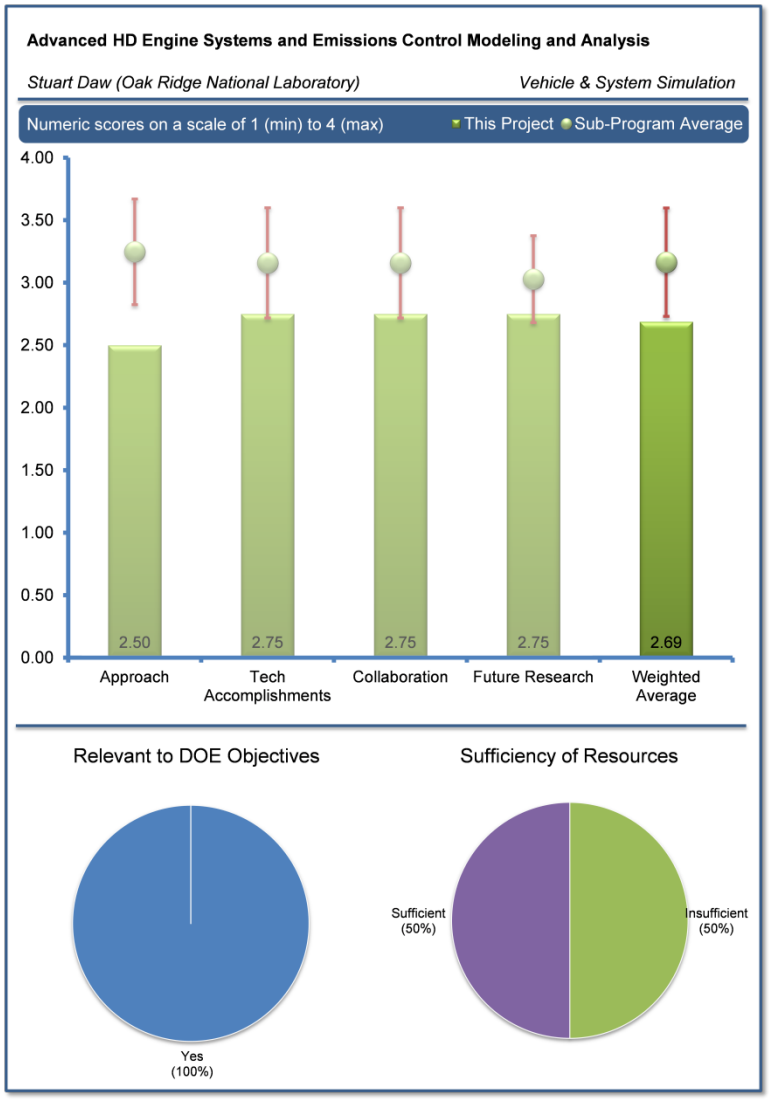
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One person suggested that hot temperature study be included in the near future. Another commenter reported that one of the items identified for future work is defining potential for engineered solutions to reduce real-world fuel consumption. This commenter would suggest putting primary effort into this area in the near-term (in collaboration with OEMs) as this really determines the overall value of the effort. In this commenter's opinion, the potential for fuel efficiency improvements seems to exist given research to date but confirmation and correlation with business realities from the OEMs standpoint is now essential. The commenter further thought that once interest is achieved from the business community (optimistically acquiring cost-share for future activities), it would be logical to incorporate other modeling elements (passenger comfort at NREL and catalyst light off and waste heat utilization at ORNL, as well as assessment of transmission thermal sensitivity) into the efforts of the task.

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

Three reviewers found resources to be sufficient. One reported that this task appeared to have sufficient resources with regards to current technical accomplishments achieved and proposed future activities. Another reviewer added that the funding level is reasonable, but the reviewer would like to see an added bonus for fast deliverables.

Advanced HD Engine Systems and Emissions Control Modeling and Analysis: Stuart Daw (Oak Ridge National Laboratory) – vss089



Reviewer Sample Size

This project was reviewed by four reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first respondent reported that the purpose is to better understand fuel consumption of medium-duty and heavy-duty vehicles, especially as they become hybridized, while also maintaining overall criteria pollutant compliance. A second reviewer described that the project considers emissions effects in MD and HD hybrid trucks. The project will provide tools for design strategies, emissions controls and uses real-world drive cycles as requirements. Decreasing petroleum use requires balancing trade-offs for satisfying multiple criteria simultaneously. The examination of these trade-offs will be more complete and more affordable using the simulation tools that the investigators are developing. This project is developing the tools that allow vehicle designers to predict fuel use effects for alternative emissions control strategies. These tools will help to reduce the time and money required to discover optimal strategies for reducing both emissions and fuel use. An optimal design of MD and hybrid trucks that employ homogeneous charge compression ignition (HCCI) and premixed charge compression ignition (PCCI) strategies can help minimize the cost of vehicle components necessary to improve emissions and fuel economy. The third reviewer stated that whether HD HEV would have significant fuel consumption advantage over conventional diesel is not well known. If in fact it is true based on simulation with enough credibility, then this project would certainly support the DOE petroleum displacement objectives. The final commenter explained that this project will develop simulations that help designed high efficiency powertrains for heavy and medium-duty vehicles. The consideration of aftertreatment devices in the proposed models will ensure that the results are reasonably realistic.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Reviewer comments included suggestions concerning the project's approach. One reviewer acknowledged that the approach is well integrated with other projects at ORNL, including a CRADA with Meritor, in order to get good model input data. This reviewer stated that the modeling effort, however, did not seem to be focused on system cost, which is one of the barriers identified by the team. A second respondent felt that the approach is reasonable to date in that the researchers are establishing the model components and interfaces between components and validating operation of the models. A task that may help reduce project risk is to go through the formal exercise of designing some of the investigation experiments so that they can use the planned experiments to derive requirements for their model development. This will help ensure that the project's simulation suite will perform all aspects of the investigation requirements. The project will be stronger with development of complementary pre and

post processing tools to enhance full analytic capability of the tool suite. Example of tools that may be useful are a pre-processing experiment design tool that would allow analysts to structure their planned investigations, and a post-processor that provides results of key metrics. The third reviewer stated that this is a new project but a good start so far. This reviewer suggested that the project needs to fast forward to HD hybrid because there is a general belief that fuel economy gain would be minimal for long haul HD HEV. The reviewer remarked that the project team would become a big hero if you could convince the community with your study. The final reviewer observed the building of a model that is 2007 compliant, but this is 2012. An effort should be made to incorporate an engine model that meets the emissions requirements needed when one of these vehicles could be introduced (e.g., five to ten years from now). Most emissions occur during transient conditions, so it should be made clearer how this is modeled. In correct handling of transient conditions will likely lead to high uncertainty in the final simulation results.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first respondent stated that it looks like the technical team has made good progress on the development of computational modeling tools and methods, especially for estimating transient engine out emissions and transient emissions control system effectiveness. It was not clear how the team was addressing costs or cost modeling in their work. Another respondent observed that the project has made good progress during its first year by establishing the individual component models. A third respondent commented the technical accomplishments were okay. The fourth reviewer noted that the model building appears to be on-schedule, but a more modern engine concept should be integrated.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The first reviewer stated that most of the collaboration appears to be with other project teams at ORNL. Meritor appears to be the most significant external partner, but the team did not document the interaction with the DOE Advanced Engine Crosscut Team or Cross-Cut Lean Exhaust Emission Reduction Simulation (CLEERS) participants. The second reviewer indicated that the collaboration and coordination with the partners is described at a high level and seems appropriate. There could be more detail provided to document the level of engagement and progress review by the partners (e.g., requirements and design review events/milestones for the project). The third reviewer reported that by nature this project will bring many entities together, collaboration seems to be outstanding. Another reviewer suggested bringing more OEMs on board.

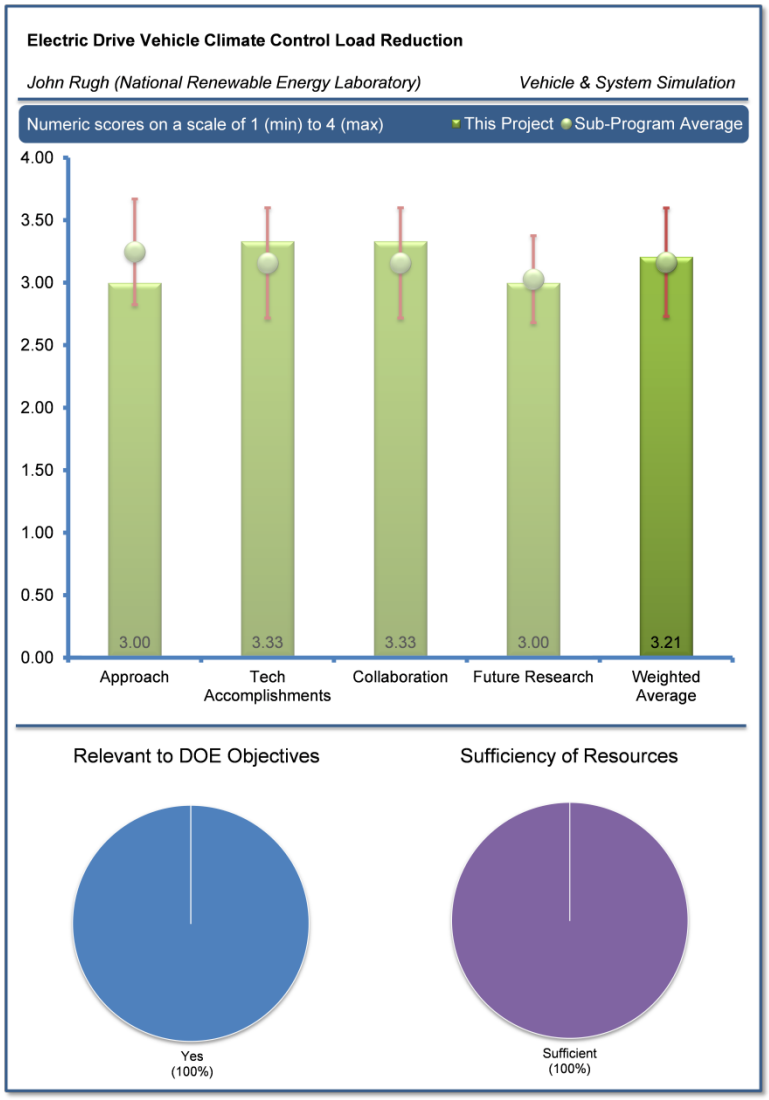
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

Reviewers had mixed input on proposed future research. One reviewer stated that the future plans presented seem like a logical progression of the project. The second commenter commented that the investigator's verbal description of the plans reflected that the project had clear plans for future research, but the written documentation of the poster presentation did not provide as much detail. Another reviewer emphasized again that HD HEV should be the timeliest focus. The fourth and final reviewer felt it is not clear if the future work is feasible within the next year. The future work should also be clearly linked to project technical barriers.

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

Two reviewers found that resources are insufficient, and two found that resources are sufficient. One reviewer commented that resources seem sufficient. The other respondent stated that it was not clear who, besides Co-PI Zhiming Gao, is contributing to the project.

Electric Drive Vehicle Climate Control Load Reduction: John Rugh (National Renewable Energy Laboratory) – vss090



Reviewer Sample Size

This project was reviewed by three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first respondent noted that this project addresses HVAC issues that adversely affect vehicle cost and range. Advancements in thermal management are needed to improve acceptance of electric vehicles in the market. Another reviewer pointed out that a better understanding of passenger comfort will help to better direct battery energy to the passenger cabin, increasing vehicle range. This project could make a significant impact on penetration of EVs in the marketplace. This reviewer expressed that it could also be used to reduce HVAC loads and improve fuel economy of traditional vehicles too, although this project does not seem to consider this aspect.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

One commenter indicated that the CRADA with automobile manufacturers to assemble a team of OEMs to participate in the investigation increases the chances that this project will result in a commercially viable solution to the problem. Balanced approach of modeling and lab testing provides capability to investigate a wide range of combinations that can minimize the cost of the solution. The second reviewer reported that it is not clear what is new and different about this project. Motivation for the project seems strong, but there are not a lot of ideas presented as to how to address the issue technically. Basically, it is not clear what the technical outcomes of this project will be (e.g., a new passenger comfort model, etc.).

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first commenter indicated that the investigator has clearly defined the project goals and quantitative measures of effectiveness. The CRADA formalization appears to be making strong progress. The second reviewer stated that it seems as if little progress has been made, according to presentation. Results were not presented, it is just stated that there was collaboration. This reviewer suggested that the PI should be more specific as to what technical accomplishments were made.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One reviewer felt that the collaboration of the project with a diverse team of OEMs is one of its strongest attributes. The other reviewer stated that collaboration seems to be sufficient, but it should be made clearer how the collaborations will help to accomplish the technical barriers.

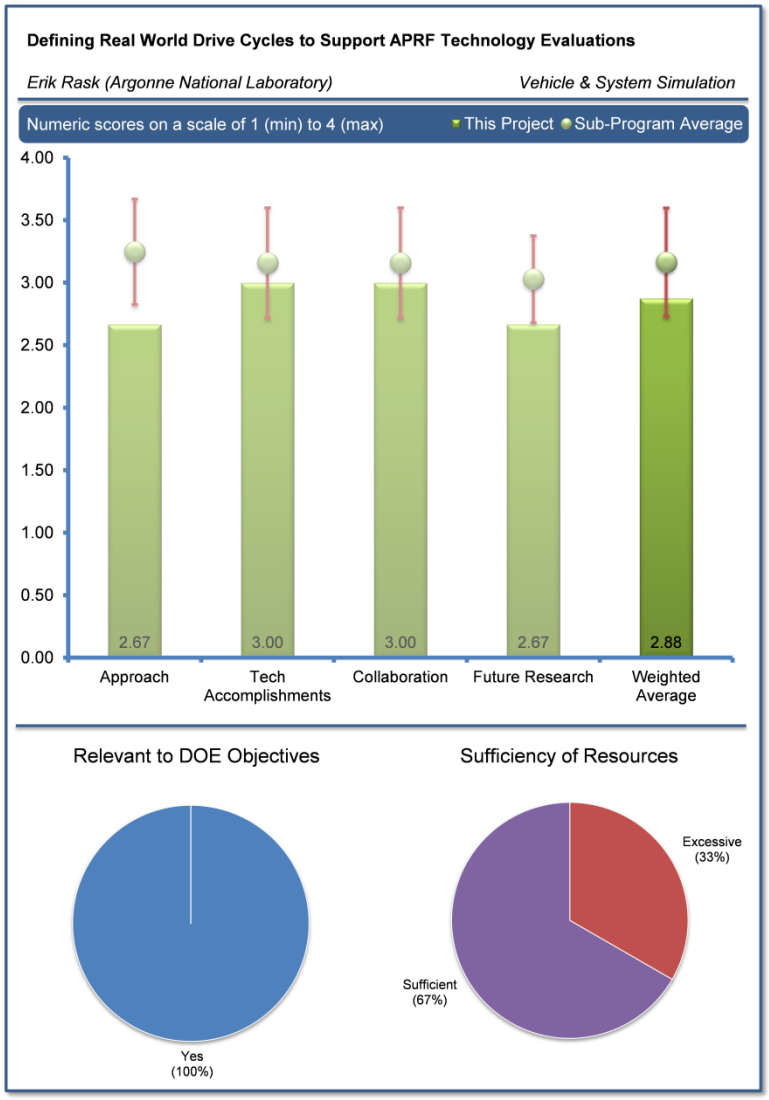
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer indicated that this is a strong approach because modeling and analysis during FY 2012 will narrow down the most promising solutions for validation and comparison in FY 2013, with incorporation of the most promising technologies into production vehicles during FY 2014 and FY 2015. The future research builds methodically to commercialization and increases the chances that this project will lower barriers for EV acceptance in the market place. The second reviewer stated that future work is not clearly defined. It is not clear what will be done, and how it will address the technical barriers.

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

All respondents indicated sufficient resources for this project. One respondent added that resources seem sufficient.

Defining Real World Drive Cycles to Support APRF Technology Evaluations: Eric Rask (Argonne National Laboratory) – vss091



Reviewer Sample Size

This project was reviewed by three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first commenter agreed that this project helps with understanding vehicle demands under real-world driving conditions. The results of this project, if properly disseminated and accepted, could help vehicle manufacturers develop high-efficiency vehicles with better customer acceptance. A second reviewer described that the long-term measure of success of technology development is its impact that is proportional to degree market penetration. This project seeks to develop standardized test procedures that minimize resources required to accurately estimate vehicle performance in response to a range of drive cycles to include five real-world cycles. If the project can accomplish this goal, then it should help the community save money in predicting the impact of design alternatives and enhance cross organization consistencies. Unfortunately, it is unclear how project results are extensible or useful outside of ANL.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

The first respondent stated that this is a good start with some interesting insights shown for results; however, the approach should be expanded to include calibration procedures and random validation tests that employ the APRF. The validity of the test procedures should be validated by other Labs. Another reviewer reported that this project will only make an impact on energy vehicle design/energy usage if the drive cycles developed are adopted by regulatory agencies. Vehicles are currently evaluated under a very specific set of drive cycles, and it is potentially risky for a manufacturer to optimize around a non-regulated drive cycle. With that said, it is important to develop a strategy to test vehicles in real-world conditions to determine the true impact of new technologies. It is already known that the regulated cycles do not match real-world conditions, so maybe this project should have focused more on making a real-world cycle part of the compliance process (or at least providing the data to support this action).

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first reviewer stated that the accomplishments seem to be in-line with objectives/barriers. Another respondent acknowledged some interesting initial results but cautioned that they have not identified a structured method for measuring estimation error as a function of the APRF sampling characteristics that would be necessary/sufficient for accurately determining a minimal set of APRF measurements for any given vehicle architecture.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

The first reviewer observed that a significant amount of work and data is leveraged through collaborations. This part of the project seems to be strong. The second reviewer reported that little evidence was presented regarding the role of other national labs and other partners in providing constructive review and/or validation. When one is developing standard procedures to address cross organization inconsistencies, it is critical to have stakeholder participation. This project comes across as insular to ANL.

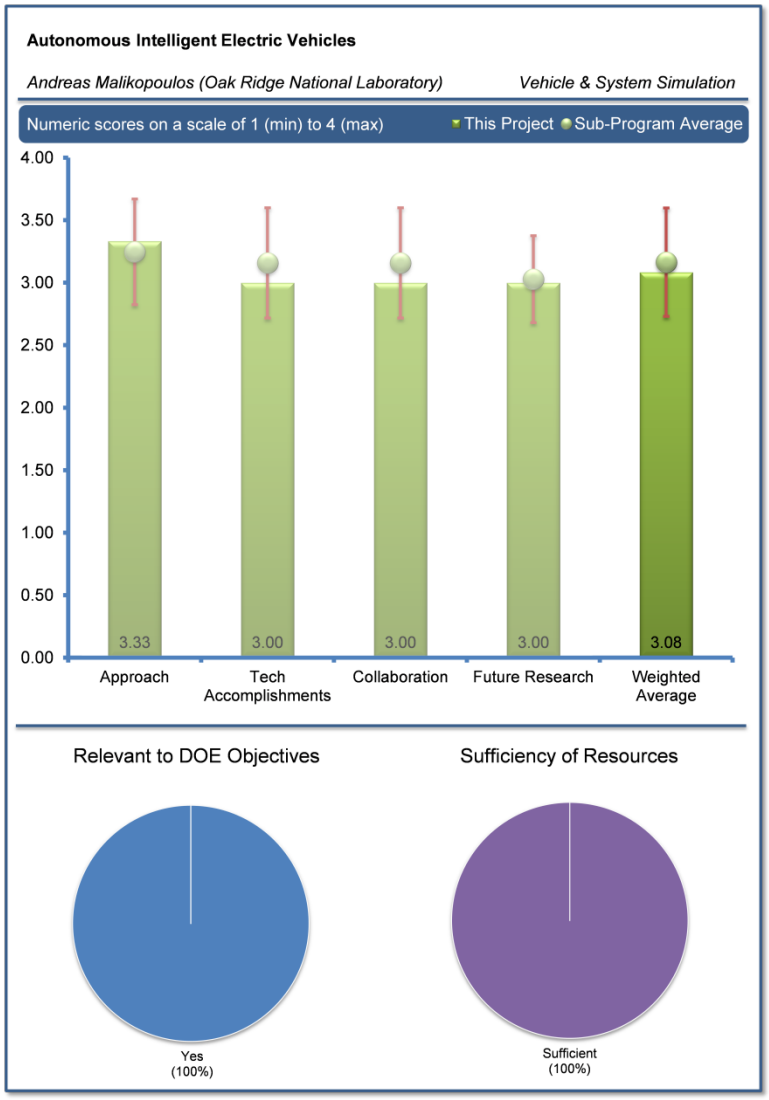
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer indicated that future testing plans are very good, and the data the tests will supply should be useful. Wider acceptance of the newly proposed drive cycles should be pursued in some way though. Another respondent stated that future work does not indicate that the project will result in structured, transparent test procedures that are defensible and extensible outside of ANL. Future work statements should be re-evaluated in scope of utility to the broader goals of Vehicle Systems and VTP.

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

Two reviewers indicated that resources are sufficient. A reviewer commented that resources are sufficient, and existing facilities are being used. One reviewer indicated excessive resources. This reviewer said it is unclear whether this project requires less or more resources because the usefulness and validity of the results outside of ANL are unclear at best.

Autonomous Intelligent Electric Vehicles: Andreas Malikopoulos (Oak Ridge National Laboratory) – vss092



Reviewer Sample Size

This project was reviewed by three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first respondent said yes, this project will help optimize energy usage of hybrid-electric vehicles by developing control optimization methods. The second reviewer also stated yes, the goal is to improve the fuel efficiency of hybrid vehicles. A third reviewer described that innovative control algorithms can help further the fuel efficiency and emissions performance of HEVs and PHEVs. This task takes the approach of optimizing not only the entire engine/vehicle control system but additionally potentially incorporating means to apply controls that proactively adapt to individual driving styles and road conditions. In short, to be able to optimize the entire trip efficiency by adapting control strategies to driver acceleration, braking, and speed tendencies, as well as driving cycle and terrain attributes.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

Comments on the approach received mixed results from reviewers. The first reviewer felt that the approach to this task is excellent, proceeding rationally from an extensive literature review to assess state-of-the-art power management systems, to the development of a PHEV simulation model in Autonomie, to implementation of stochastic control algorithms to maximize PHEV operation in real time. This task draws from discrete time control Markov processes to achieve instantaneous equilibrium operating points throughout the drive cycle. The approach, if successful, has potential application across all vehicle classes. A second reviewer was not sure how this is different than other control strategies. The limitations of the individual components/subsystems to switch to a dramatically different operating point in real time would likely limit the ability of the system to maintain optimal system efficiency. Perhaps the introduction of stochastic-based control methodologies is the main contribution. The final reviewer suggested that the efforts to make a real-time optimization strategy that can be used on a physical prototype should be mentioned. The methods employed for this project are not new, so the reasons for them not being adopted my manufacturers should be briefly mentioned.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first respondent noted that the project appears to be on-track. A second reviewer indicated that strong progress has been made performing the background research, establishing project partners, and developing the control algorithm. The third respondent commented that this task is a relatively new start, having begun in December 2011. Given its relatively short duration so far, technical accomplishments have been solid with respect to the extensive literature review, establishment of a series/ parallel PHEV

model in Autonomie including implementation of prototypical power electronics and electric machines (PEEM) and supervisory control model architecture, and the derivation and submission of the stochastic control algorithm.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

Generally comments on collaboration and coordination are positive. One reviewer said a that collaborations are appropriate for this stage in the project including an industrial Class 8 truck equipment manufacturer, the CLEERS Consortium, and various other elements within ORNL. This reviewer also recommended staying in coordination with ANL with regards to Autonomie model development aspects. If the approach looks promising, it is suggested to seek an additional private sector vehicle entity in which to test this approach for Class 3-6 or light-duty vehicles. It would also be a good idea to reach out broadly to the vehicle industry as a whole and assess commercial interest in this approach and objectively convey it. Another reviewer stated that collaboration seems strong, but should be more clearly defined. This reviewer questioned what Meritor is providing and whether they will implement these strategies in test vehicles. The final reviewer reported that some collaboration has been established with industry.

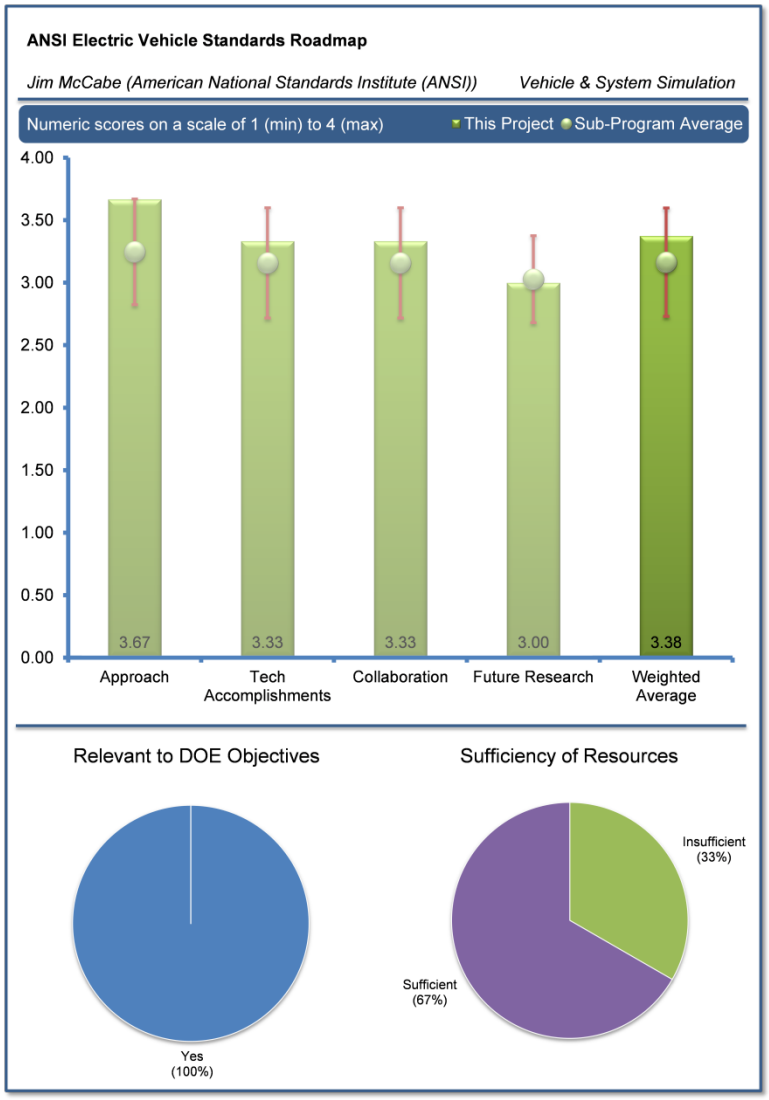
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first commenter stated that future research follows through with the original plan in a logical manner. The second reviewer reported that proposed future work is on point. As indicated in proposed future work, it is very important to proceed now with work to assess and quantify the potential benefits of this adaptive control approach and compare it to existing power management control algorithms. This should be done as much as possible in an apples-to-apples way to fairly assess the pros and cons of this approach and should be verified by industry. The final reviewer indicated that the implementation of this work into a real-world application is a very critical aspect. More detail regarding this process should be included in the presentation. Hardware in the loop integration is a significant task, and a clearer and focused plan should be presented for this work. For example, this reviewer questioned if the models developed during year one can be directly implemented into a controller and run real-time. A clear plan of this transition would help give confidence that the project will finish on time.

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

All of the reviewers indicated that resources are sufficient. One reviewer stated resources seem sufficient. Another reviewer noted that resources appear to be sufficient for this effort. The final commenter pointed out that resources for this task are sufficient at this point, although if success is strongly demonstrated additional resources may need to be considered to maximize applicability.

ANSI Electric Vehicle Standards Roadmap: Jim McCabe (American National Standards Institute) – vss093



Reviewer Sample Size

This project was reviewed by three reviewers.

Question 1: Does this project support the overall DOE objectives? Why or why not?

The first reviewer said that this was really well done in terms of finding the holes in standards. This reviewer would love to see this extended to medium-duty and heavy-duty truck applications, and thought that Smith and Navistar were willing to participate based on the Question and Answer Session at the end of this presentation. Another respondent stated that great value added work – very relevant to the future of both commercial and passenger car EVs.

Question 2: What is your assessment of the approach to performing the work? To what degree are technical barriers addressed? Is the project well-designed, feasible, and integrated with other efforts?

The first respondent felt that not only was the approach solid, but the report out was solid as well. This respondent emphatically stressed to keep this going. The second reviewer said organized for short-, mid-, and long-term issues.

Question 3: Characterize your understanding of the technical accomplishments and progress toward overall project and DOE goals.

The first reviewer said project is lightly funded, yet receives bang for the buck return on setting standards. Another reviewer stated that this is more coordination than technical accomplishments, which is why the reviewer rated this Good versus Outstanding.

Question 4: What is your assessment of the level of collaboration and coordination with other institutions?

One respondent stated that it is hard to herd cats; they seem to do it well.

Question 5: Has the project 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?

One respondent strongly suggested pushing this to MD and HD truck segments. This reviewer suggests keeping this updated.

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

Most of the commenters indicated sufficient resources. The only respondent to elaborate felt that this project requires additional support as it is pivotal to the success of the EV industry.

Section Acronyms

The following list of Acronyms cited within this section is provided as a reference for readers.

Acronym	Definition
AC	Alternating Current
A/C	Air-Conditioning
ADA	American with Disabilities Act
AEV	All Electric Vehicle
AFRL	Air Force Research Laboratory
ANL	Argonne National Laboratory
ANSI	American National Standards Institute
APEEM	Advanced Power Electronics and Electric Machines Program
APRF	Advanced Powertrain Research Facility (ANL)
APU	Auxiliary Power Unit
ARRA	American Recovery and Reinvestment Act
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASTM	American Society for Testing and Materials
BEV	Battery Electric Vehicle
C_d	Coefficient of Drag
CFD	Computational Fluid Dynamics
CLEERS	Cross-Cut Lean Exhaust Emission Reduction Simulation
CNG	Compressed Natural Gas
CRADA	Cooperative Research and Development Agreement
DC	Direct Current
DOE	Department of Energy
DOT	Department of Transportation
DSRC	Dedicated Short-Range Communications
DTNA	Daimler Trucks North America
EAR	E-A-R Thermal Acoustic Systems
EDV	Electric Drive Vehicles
EP	Extreme Pressure
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ESS	Energy Storage Systems
EU	European Union
EV	Electric Vehicle
EVSE	Electric Vehicle Supplemental (Supply) Equipment
EVSP	Electric Vehicles Standards Panel
FMVSS	Federal Motor Vehicle Safety Standards
FY	Fiscal Year
FOA	Funding Opportunity Announcement
GEN2	Generation 2

Acronym	Definition
GITT	Grid Integration Tech Team
GM	General Motors Corporation
GSA	General Services Administration
GPRA	Government Performance and Results Act
GHG	Greenhouse Gas
HAN	Home Area Network
HCCI	Homogeneous Charge Compression Ignition
HD	Heavy-Duty
HEV	Hybrid Electric Vehicle
HHV	Hydraulic Hybrid Vehicle
HVAC	Heating Ventilating and Air Conditioning
IEEE	Institute of Electrical and Electronics Engineers
ITS	Intelligent Transportation Systems
INL	Idaho National Laboratory
ISO	International Organization for Standardization
LD	Light-Duty
LH	Long-Haul
LED	Light-Emitting Diode
LNG	Liquid Natural Gas
LPG	Liquefied Petroleum Gas
MIT	Massachusetts Institute of Technology
MD	Medium-Duty
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NEC	Net Energy Change
NFPA	National Fire Protection Association
NHTSA	National Highway Traffic Safety Administration
NIST	National Institute of Standards and Technology
NiMH	Nickel-Metal Hydride
NREL	National Renewable Energy Laboratory
NY	New York
NYC	New York City
1-D	One-dimensional
OEM	Original Equipment Manufacturer
ORNL	Oak Ridge National Laboratory
OTR	Over The Road
PCCI	Premixed Charge Compression Ignition
PEEM	Power Electronics and Electric Machines
PEV	Plug-in Electric Vehicle
PHEV	Plug-In Hybrid Electric Vehicle
PI	Principal Investigator

Acronym	Definition
PLC	Programmable Logic Controller
PNNL	Pacific Northwest National Laboratory
PPG	Pittsburgh Plate Glass Company
R&D	Research and Development
SAE	Society of Automotive Engineers
SOC	State Of Charge
SOE	State Of Energy
SOFC	Solid Oxide Fuel Cell
3-D	Three-dimensional
TRU	Trailer Refrigeration Unit
UK	United Kingdom
UL	Underwriters Laboratories
UMTRI	University of Michigan Transportation Research Institute
USCAR	United States Council for Automotive Research
U.S. DRIVE	U.S. Driving Research and Innovation for Vehicle efficiency and Energy sustainability
USPS	United States Postal Service
V2I	Vehicle-to-Infrastructure
VTP	Vehicle Technologies Program
WPT	Wireless Power Transfer