1. Vehicle Systems

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 DOE announced the selection of 10 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.

Subprogram Feedback

DOE received feedback on the overall technical subprogram areas presented during the 2015 Annual Merit Review (AMR). Each subprogram technical session was introduced with a presentation that provided an overview of subprogram goals and recent progress, followed by a series of detailed topic area project presentations.

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

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

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

Question 3. Were important issues and challenges identified?

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

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

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

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

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

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

Question 10. Has the program area engaged appropriate partners?

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

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

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

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

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

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

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

Subprogram Overview Comments: David Anderson (U.S. Department of Energy) – vss000

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

Reviewer 1:
The reviewer said that the background overview was adequately provided along with the objectives.

Reviewer 2:
The reviewer responded yes, and commented that it is very difficult to share so much in such a short time. Slides here are meant to inform for future reference maybe rather than to be good presentation slides for sharing information at the event. The reviewer thought that this is fine for this sort of overview. The reviewer suggested that it might help to more clearly identify the budget levels for the various levels and for the past, present and future budget years.

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

Reviewer 1:
The reviewer said that there is an attempt to have a balance between the near-, mid- and long-terms, but the challenge is bridging the development to realize the benefits into the vehicle level system.

Reviewer 2:
The reviewer thought there is an appropriate balance, and elaborated that this was difficult to understand when the reviewer first began attending and participating in the 21st Century Truck Partnership (21CTP). The reviewer has found the research, development, design, and deployment chart to be useful. The reviewer suggested that maybe a chart that lays out the major areas on such a timeline would help.

Question 3: Were important issues and challenges identified?

Reviewer 1:
The reviewer said that different focus areas are linked together to achieve the overall Vehicle & System Simulation (VSS) objectives. The reviewer said that results and data are developed and shared; this serves the ability to validate the results.

Reviewer 2:
The reviewer was unsure if issues and challenges were identified. This seemed to be more of an informing and sales presentation rather than one that discusses challenges on the projects. The reviewer suggested maybe one slide and two minutes to expand this thought, or ignore it.

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

Reviewer 1:
The reviewer indicated that some of the issues and challenges were highlighted, but concrete plans to address them were not illustrated.

Reviewer 2:
The reviewer said that plans were not really identified, other than at a very high level.

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

Reviewer 1:
The reviewer said yes, and elaborated that there is clear evidence of the system approach taken.

Reviewer 2:
The reviewer said yes, and explained that there was noted continuance of various projects such as SuperTruck.

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

Reviewer 1:
The reviewer said yes, in almost every focus area, the VSS portfolio supports many activities. The reviewer pointed out that the presenter was very specific in illustrating the different projects and their benefits.

Reviewer 2:
The reviewer said yes, and explained that it was and is obvious that the focus of this organization is petroleum reduction across the vehicle sectors and that it spans research to deployment.

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

Reviewer 1:
The reviewer said yes, the team and the management appear to have a good understanding of the challenges and what to focus on; the team is covering all areas of the portfolio projects.

Reviewer 2:
The reviewer commented yes, albeit difficult with such a broad focus. Sometimes this reviewer sees some projects that seem to go on in perpetuity in some specific areas.

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

Reviewer 1:
The reviewer indicated that the Vehicle Technology evaluation along with the data collected is very useful, and serves many benefits. The reviewer pointed out that Modeling and Simulation approach and the tools used are very useful.

Reviewer 2:
The reviewer said that strengths are when a project quickly develops the understanding, solutions and tools quickly in a particular area and then makes it available to developers or end users for true deployment. The reviewer noted that true change must follow it into the hands of users and this can be very difficult and time-consuming.

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

Reviewer 1:
The reviewer agreed that the projects do have benefits, and the approach taken is very innovative. The reviewer elaborated that the key aspect that needs to be explained is how these benefits and associated findings are being used by the industry.

Reviewer 2:
The reviewer sees many innovative ways to approach barriers, and pointed out Cool Cab as an example.

Question 10: Has the program area engaged appropriate partners?

Reviewer 1:
The reviewer responded yes, and pointed out the different DOE laboratories, academia and industry.

Reviewer 2:
The reviewer thought so, though this is difficult to measure. Each program needs to continue to be evaluated on this topic. According to the reviewer, a reviewer can generally tell pretty easily if the Principal Investigator is proud of or embarrassed by how well the project team collaborates with their partners.

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

Reviewer 1:
The reviewer said yes, and commented that there is a clear evidence of the collaboration between the different areas and partners.

Reviewer 2:
The reviewer elaborated that some projects display effective collaboration, others very poorly. This reviewer noted this on each project review.

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

Reviewer 1:
This reviewer would like to see integrating all the component level and simulation into a single vehicle to determine the true benefits for technology improvement, efficiency, system cost, and weight reduction.

Reviewer 2:
This reviewer suggested keeping a focus on efficiency as a strategy and not diverting too much attention to alternative fuels, etc.

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

Reviewer 1:
The reviewer thought the overview was very comprehensive, from a high level. The reviewer noted that specific details and data were not provided, something that would have been good to see from a comparison to last year's activities.

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

Reviewer 1:
The reviewer suggested staying focused on tractor-trailers with so much fuel being used.

Reviewer 2:
The reviewer pointed out that one area of interest is to evaluate different vintages of vehicles with similar technologies produced in different periods, and see what changed in the areas of weight, cost, efficiencies, and consumer acceptance. The reviewer also suggested assessing how the simulation and modeling tools measure against the actual physical design.

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

Reviewer 1:
This reviewer prefers seeing the VSS overview at the end of the individual VSS project reviews at the Annual Merit Review; this way the overall achievements can be reviewed after the specific projects have been illustrated.

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

Reviewer 1:

The reviewer recommends continuing with the VSS projects; the benefits realized toward the goals are seen in many areas. The reviewer would like to see more comparative data, in both the components and vehicle level, evaluating current production vehicles and how they measure against the funded areas.

Reviewer 2:

The reviewer suggested marketing this review a little more to those organizations that can help deliver desired change (i.e., software/app developers, marketing people, leaders at the truck builders who integrate so many of these technologies, and fleets).

Project Feedback

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

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Class 8 Truck Freight Efficiency Improvement Project	Rotz, Derek (DTNA)	1-14	4.00	3.83	3.83	3.83	3.88
Plug-In Hybrid Medium-Duty Truck Demonstration and Evaluation Program	Myasato, Matt (SCAQMD)	1-16	3.00	3.10	3.20	3.00	3.08
Medium- and Heavy-Duty Vehicle Field Evaluations	Kelly, Ken (NREL)	1-20	3.75	3.75	3.75	3.50	3.72
DOE's Effort to Improve Heavy Vehicle Fuel Efficiency through Improved Aerodynamics	Salari, Kambiz (LLNL)	1-23	3.38	3.13	3.13	3.38	3.22
Idaho National Laboratory Testing of Advanced Technology Vehicles	Shirk, Matthew (INL)	1-27	3.38	3.75	3.25	3.13	3.52
Advanced Vehicle Testing and Evaluation	Jacobson, Richard (Intertek)	1-30	2.80	2.80	3.60	3.10	2.94

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Advanced Technology Vehicle Lab Benchmarking (L1 and L2)	Stutenberg, Kevin (ANL)	1-34	3.10	3.50	3.00	3.00	3.28
Development of High-Power Density Driveline for Vehicles †	Ajayi, Oyelayo (ANL)	1-37	3.00	2.67	3.00	2.67	2.79
SuperTruck - Development and Demonstration of a Fuel-Efficient Class 8 Tractor and Trailer	Zukouski, Russ (Navistar)	1-39	3.13	2.88	3.25	3.13	3.02
CoolCab Test and Evaluation and CoolCalc HVAC Tool Development	Lustbader, Jason (NREL)	1-42	3.83	3.67	3.67	3.50	3.69
A Complete Vehicle Approach to the SuperTruck Challenge	Amar, Pascal (Volvo Trucks)	1-45	3.33	3.17	3.33	3.33	3.25
EV - Smart Grid Research and Interoperability Activities †	Hardy, Keith (ANL)	1-47	3.50	3.50	3.40	3.10	3.44
Testing of Wireless Charging Systems for Codes and Standards Development	Carlson, Barney (INL)	1-50	3.67	3.83	3.17	3.83	3.71
Electric Drive Vehicle Climate Control Load Reduction	Rugh, John (NREL)	1-53	3.50	3.17	3.00	3.00	3.21

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
High-Efficiency, Low-EMI and Positioning Tolerant Wireless Charging of EVs	Lewis, Allan (Hyundai)	1-55	3.38	3.38	3.13	3.25	3.33
Wireless Charging	Onar, Omer (ORNL)	1-58	3.00	3.50	3.13	3.13	3.28
Zero-Emission Heavy-Duty Drayage Truck Demonstration	Choe, Brian (SCAQMD)	1-61	2.67	2.67	3.00	2.83	2.73
Zero-Emission Cargo Transport Deployment Projects	Williams, Nicholas (Houston-Galveston Area Council)	1-64	2.13	2.00	2.25	2.38	2.11
Thermal Control Projects	Singh, Dileep (ANL)	1-67	2.80	3.00	2.70	3.00	2.91
Cummins MD & HD Accessory Hybridization CRADA	Deter, Dean (ORNL)	1-71	3.20	3.30	3.30	3.00	3.24
Vehicle Thermal Systems Modeling in Simulink	Lustbader, Jason (NREL)	1-75	3.50	3.50	3.75	3.50	3.53
Advanced Climate Control and Vehicle Preconditioning	Meyer, John (Halla Visteon)	1-78	3.25	3.25	2.88	3.25	3.20
Electric Phase Change Material Assisted Thermal Heating System (ePATHS)	Wang, Mingyu (Delphi Automotive Systems, LLC)	1-81	3.17	3.33	3.50	3.17	3.29

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Impacts of Advanced Combustion Engines †	Curran, Scott (ORNL)	1-83	3.63	3.50	3.13	3.25	3.45
Powertrain Controls Optimization for Heavy-Duty Line Haul Trucks	Smith, David (ORNL)	1-86	3.38	3.13	3.38	3.13	3.22
Integration of PEVs with the Grid †	Pratt, Richard (PNNL)	1-89	3.25	3.25	2.75	3.25	3.19
Powertrain Codes and Standards Development	Duoba, Mike (ANL)	1-92	3.13	3.38	3.25	3.13	3.27
Green Racing Protocols and Technology Applications	Jones, Perry (ORNL)	1-94	3.30	3.30	3.30	3.20	3.29
Technology Requirements for High-Power Applications of Wireless Power Transfer	Onar, Omer (ORNL)	1-99	3.38	3.38	2.38	3.25	3.23
Accelerate the Development and Introduction of Advanced Technologies through Model-Based System Engineering	Rousseau, Aymeric (ANL)	1-102	2.90	2.90	2.90	3.00	2.91

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Fuel Displacement Potential of Advanced Technologies under Different Thermal Conditions	Rousseau, Aymeric (ANL)	1-106	2.90	3.00	3.00	2.90	2.96
Analyzing Real-World Light-Duty Vehicle Efficiency Benefits	Gonder, Jeff (NREL)	1-110	3.50	3.30	3.00	3.30	3.31
Smart Grid Requirements Study	Markel, Tony (NREL)	1-113	2.83	2.67	2.83	2.50	2.71
Unitary Thermal Energy Management for Propulsion Range Augmentation (UTEMPRA)	Chowdhury, Sourav (Delphi Automotive Systems, LLC)	1-116	3.50	3.50	3.00	3.17	3.40
Zero-Emission Cargo Transport Projects (ZECT)	Cole, Nancy (SCAQMD)	1-118	3.25	3.13	3.38	3.25	3.20
Medium-Duty ARRA Data Reporting and Analysis	Kelly, Ken (NREL)	1-121	3.75	3.63	3.75	3.38	3.64
Fleet DNA Phase 1 Refinement & Phase 2 Implementation	Kelly, Ken (NREL)	1-123	3.88	3.75	3.75	3.63	3.77
Multi-Speed Gearbox for Commercial Delivery Medium-Duty Plug-In Electric Drive Vehicles	Chavdar, Bulent (Eaton)	1-126	3.25	3.13	3.13	3.13	3.16

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Integrated Boosting and Hybridization for Extreme Fuel Economy and Downsizing	Tsourapas, Vasilios (Eaton)	1-129	3.25	3.25	2.88	3.13	3.19
Advanced Bus and Truck Radial Materials for Fuel Efficiency	Martin, Justin (PPG)	1-132	3.17	3.33	2.83	3.33	3.23
Evaluate VTO Benefits (BaSce) †	Shidore, Neeraj (ANL)	1-135	3.13	3.38	3.25	3.25	3.28
Design and Implementation of a Thermal Load Reduction System in a Hyundai PHEV to Improve Range †	Rugh, John (NREL)	1-138	3.75	3.38	3.75	3.63	3.55
Advanced Transmission Selection to Provide Accurate VTO Benefits †	Shidore, Neeraj (ANL)	1-141	3.25	3.50	3.25	3.25	3.38
Integrated Network Testbed for Energy Grid Research and Technology Experimentation (INTEGRATE) †	Hunter, Brian (NREL)	1-143	3.25	3.25	3.50	3.25	3.28
Accessory Loads Analysis †	Carlson, Richard (INL)	1-146	3.25	3.38	2.75	2.75	3.19
PEV-EVSE Interoperability Project †	Jacobson, Richard (Intertek)	1-148	3.70	3.40	3.80	3.50	3.54

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Lessons Learned about Workplace Charging in The EV Project †	Smart, John (INL)	1-152	3.38	3.13	3.50	3.25	3.25
eVMT (Electric Vehicles Miles Traveled) †	Carlson, Richard (INL)	1-155	3.50	3.50	3.75	3.50	3.53
Overall Average			**3.29**	**3.27**	**3.22**	**3.19**	**3.26**

Note: † denotes poster presentation.

Class 8 Truck Freight Efficiency Improvement Project: Derek Rotz (DTNA) - arravt080

Presenter

Derek Rotz, DTNA.

Reviewer Sample Size

A total of three reviewers evaluated this project.

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

Reviewer 1:

The reviewer found the project team's approach as evidenced in every Annual Merit Review (AMR) to be outstanding. The project team made hard tradeoff choices along the way, always sharing the right level of detail. The reviewer noted the project team had a nice presentation/unveiling at Mid America Truck Show in Louisville. The reviewer stated that the project helped to prove that SuperTruck is not just a research and development (R&D) project but an incubator and demonstrator of real technologies available now and soon.

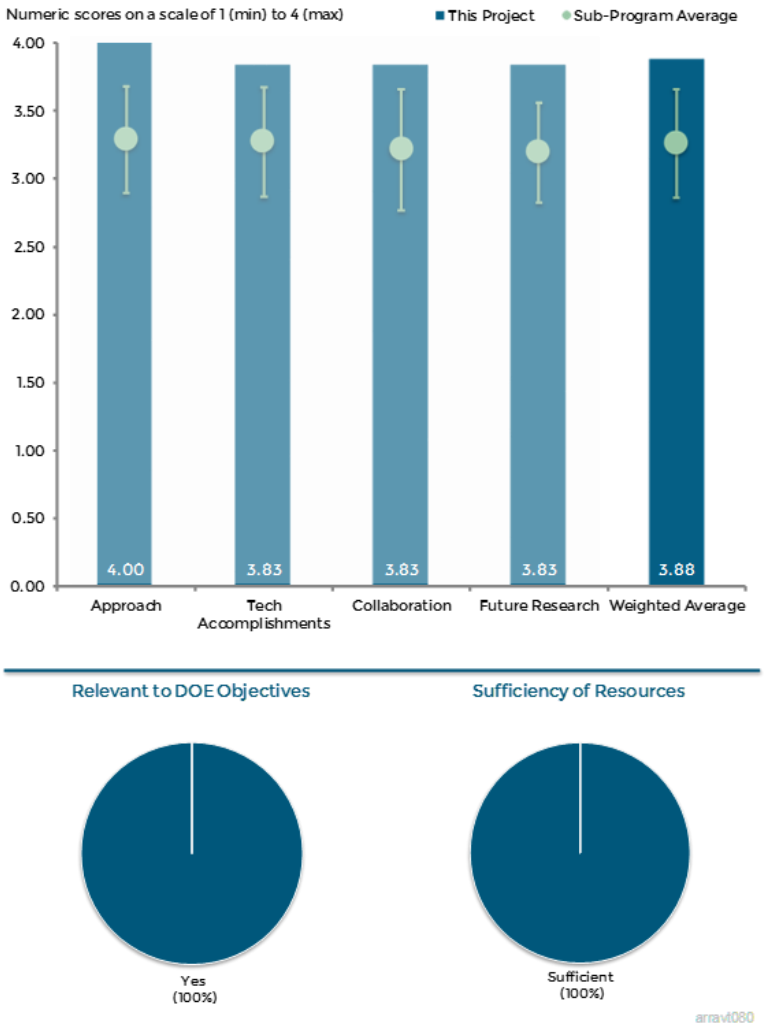

Figure 1-1 Class 8 Truck Freight Efficiency Improvement Project: Derek Rotz (DTNA) - Vehicle Systems

Reviewer 2:

The reviewer indicated that the approach taken is very comprehensive, including many beyond state-of-the-art technologies from engine to vehicles, allowing this project to well over-achieve the program goals. While many of the technologies are not commercially viable even in 2025-2030 time frame, such as those super-light materials and hybrids, it does clearly demonstrate the roadmap to achieve the program goals. The reviewer stated that the project is very well done; however, there is no noticeable benefit with hybrid. In particular, this approach may conflict with eCoast because eCoast wants to minimize braking for optimal efficiency, while hybrid wants to recover most of the braking energy. The reviewer added that one can imagine that this program can even do a much better job if the funding is not used for hybrid.

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

Reviewer 1:

The reviewer said 12 miles per gallon (mpg), wow, well done. The reviewer stated that the project team used this program and its resources to tackle many of the major tradeoff decisions. Distributed cooling, aggressive aerodynamics, e-coast and/or hybridization, waste heat recovery (WHR), and on and on. The reviewer added

that the project team were very aggressive on mpg and ton-mile/gallon even with unaffordable technologies. The project team clearly went aggressively after all that is possible rather than stopping at the requirement. The reviewer appreciated the green, yellow, red clarification of commercially available technologies. The reviewer stated that the project team could have gone one level deeper and included mpg predictions for the three scenarios, red, yellow and green, which would have taken this to outstanding.

Reviewer 2:

The reviewer remarked that achieving 12.2 mpg regardless of what kinds of beyond state-of-the-art technologies is an unbelievable achievement. This program also demonstrates great potential with their eCoast technology that could be put into production. The reviewer added that it is still questionable what kind of achievement a hybrid can make from this project.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:

The reviewer stated that the list of collaborators is very extensive and evidence that all have benefited from this experience.

Reviewer 2:

The reviewer said that it is great to see that the program has used many partners.

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

Reviewer 1:

The reviewer commented that even though the project is concluded, there is evidence that work will continue.

Reviewer 2:

The reviewer pointed out that the mission is accomplished, and no more on the future work.

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

Reviewer 1:

The reviewer noted great mpg gains.

Reviewer 2:

The reviewer said yes, many technologies developed under this program, such as eCoast, can bring immediate impact on supporting the overall U.S. Department of Energy (DOE) objective of petroleum displacement.

Reviewer 3:

The reviewer pointed out that Class 8 heavy-duty (HD) tractor-trailers are a huge opportunity.

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

Reviewer 1:

The reviewer said well done.

Plug-In Hybrid Medium-Duty Truck Demonstration and Evaluation Program: Matt Myasato (SCAQMD) - arravt083

Presenter

Matt Myasato, SCAQMD.

Reviewer Sample Size

A total of five reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that as this project reaches the very data- driven commercial industry, it has great importance to produce accurate data to support economic investment in the future.

Reviewer 2:

The reviewer noted that the project is nearly complete, with most deliverables met. Better data collection and analysis are required.

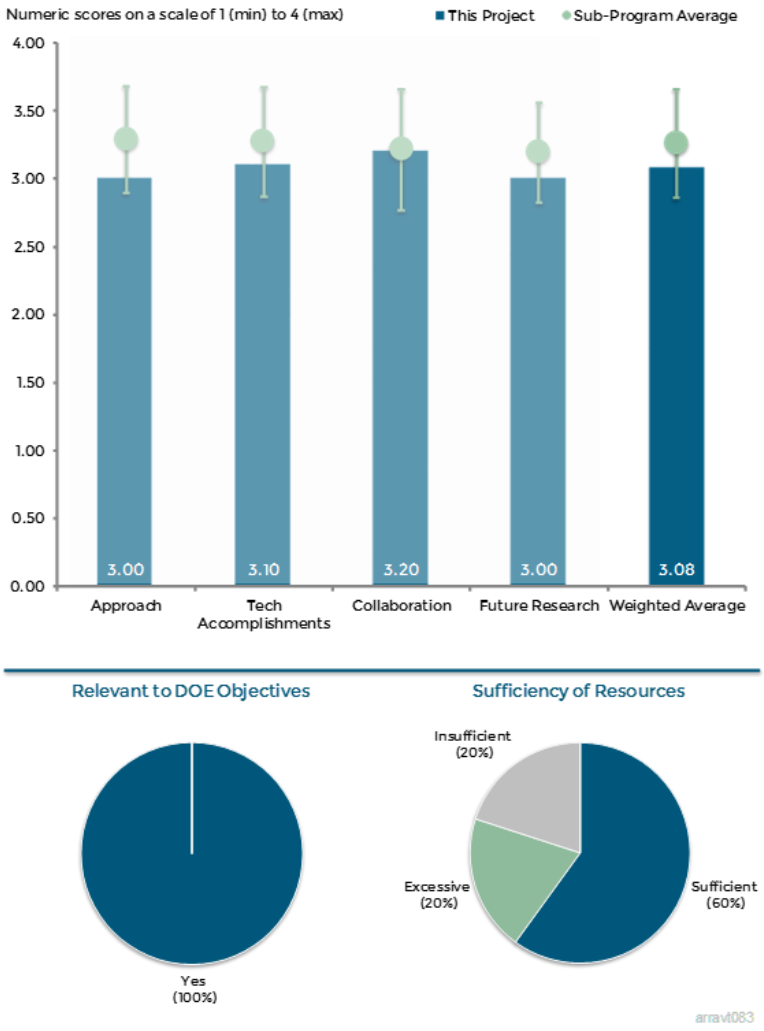

Figure 1-2 Plug-In Hybrid Medium-Duty Truck Demonstration and Evaluation Program: Matt Myasato (SCAQMD) - Vehicle Systems

Reviewer 3:

The reviewer indicated that a good partner selection allowed vehicles to be acquired and placed into operation for field data collection and technology evaluation. As this is a late phase report, the approach was not fully detailed in this presentation. The reviewer added that some trucks will be deployed during the month of June, but the project ends in July, so there will be limited time for data collection in some types of trucks.

Reviewer 4:

The reviewer reported that the approach is good, shows performance and use across many vocations and locations. Smart charging and battery sizing were considered for the variety of operation.

Reviewer 5:

The reviewer reported that the overall approach summary included designing, developing and deploying plug-in hybrid electric vehicle (PHEV) drive systems in Class 2 pick-ups and vans and in Class 6-8 work trucks. The approach for the performance assessment included in-use data, user surveys and laboratory testing; however, few details were given about approach specifics for the past 12-month evaluation period, or for each of the assessment types. The reviewer commented that regarding the Odyne truck design, it sounds as though the truck just runs as a conventional vehicle when the battery has not been charged. The reviewer assumed that this made for a simplified (and perhaps cost-minimized) implementation, but a preferable approach would have been to design the vehicle to achieve hybridization benefits from the electric motor and energy storage system

(such as regenerative braking and engine downsizing/load leveling) even when the battery was not fully charged.

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

Reviewer 1:
The reviewer remarked that this demonstration (though expensive) was absolutely necessary for this particular market acceptance. Because over 60% of petroleum is used in commercial vehicles, adaptation of electric propulsion is critical to achieving reductions in petroleum usage.

Reviewer 2:
The reviewer pointed out that for a fleet demonstration with such funding, one would anticipate higher fidelity data from the vehicles to analyze the success and usage in the fleets. This data would include second-by-second fuel use, battery use, velocity, temperature, etc. The reviewer added that most importantly, these data would be analyzed per the technology and drive cycles. The reviewer added that this technical data in the field is critical in understanding the powertrain systems for improvements and advancement.

Reviewer 3:
The reviewer commented as stated above, technologies representative of commercially available systems were deployed and placed in service in multiple duty cycles, and data was gathered with various powertrain calibrations, allowing for continued development during the program.

Reviewer 4:
The reviewer stated that the vehicles have been deployed and data is being transmitted to show effectiveness. The project could include better information on reliability and maintenance issues encountered.

Reviewer 5:
The reviewer reported that the overall accomplishments included deployment of 296 medium-duty PHEVs into 64 different fleets around the country. The presentation included some fuel economy and emissions performance measurements, though these seemed to be measured over repeated, standardized drive cycles rather than from the real-world deployments. The reviewer added that the results that were shown also included some apparent errors. For example, two different baseline conventional vehicle fuel usage numbers for the same driving distance scenario on Slide 11, and a claim of 50% or greater greenhouse gas (GHG) reduction on Slide 12 that seemed to be contradicted by the fuel consumption data on that slide, particularly considering potential GHG emissions from producing the electricity for charging the PHEVs. The presenter also acknowledged that the data was old and in need of updating, indeed two of the plots were unchanged from the 2014 presentation. The reviewer added that it would have been nice to see more quantitative in-use data from the deployed vehicles presented, along with comparisons of the PHEVs to comparable conventional and comparable hybrid electric vehicles (HEV) (i.e., non-plug-in) baseline vehicle variants. The reviewer stated that the presentation included results from a survey of users regarding their observations and satisfaction with the vehicles; however, the survey sample size needs to be larger in order to draw much in the way of definitive conclusions. The presentation did not mention metrics on job creation (another goal of the American Recovery and Reinvestment Act [ARRA] program); the presenter indicated that these would be included in the final report.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer pointed out that the project involved multiple partners and seemed to include a good level of collaboration and coordination.

Reviewer 2:
The reviewer suggested that the project team might have considered broader partnerships beyond VIA and Odyne, perhaps a couple of the Class 8 companies funded in the SuperTruck program.

Reviewer 3:
The reviewer said that the project team had a good partner selection allowing for field-test-capable vehicles (though somewhat delayed for some vehicle types), fleet management, data collection operation and analysis.

Reviewer 4:
The reviewer cited a good team of Electric Power Research Institute (EPRI), South Coast Air Quality Management District (SCAQMD), California Energy Commission (CEC) and numerous fleets to deploy, test and coordinate.

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

Reviewer 1:
The reviewer stated that, although this was an expensive program overall, most results were achieved. The reviewer would have preferred seeing higher-quality data and analysis from the vehicles.

Reviewer 2:
The reviewer stated that the project team briefly discussed the request for more funding to allow for completion of evaluation (data collection) period and final report. For $45 million in DOE funding, it would seem that these two areas are critical and should have been planned for in the project planning

Reviewer 3:
The reviewer commented that due to California Air Resources Board (CARB) delays in certification, the project was said to be delayed but the proposal to obtain additional outside funding to provide additional data is valuable.

Reviewer 4:
The reviewer said that the project did not include a specific future work slide, perhaps because the DOE-supported portion of the project is scheduled to end this summer. It was good to hear that the data collection and analysis will continue at least through the end of the year with the support of SCAQMD funds.

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

Reviewer 1:
The reviewer said that this project directly supports the petroleum reduction mission of DOE as well as deploying advanced technologies into the market.

Reviewer 2:
The reviewer said yes, proven petroleum savings were discussed.

Reviewer 3:
The reviewer commented that fleet demonstration of these vehicles shows petroleum use reduction potential.

Reviewer 4:
The reviewer said yes, the deployed PHEV trucks are expected to displace petroleum. To the extent that the project advances the commercialization potential of PHEV trucks, it could take credit for enabling even larger levels of petroleum displacement. The reviewer added that it would have been nice to see the in-use

displacement and the long-term commercialization potential discussed/quantified in more detail, though it was encouraging to hear the presenter say that the vehicle manufacturers have begun selling to other customers.

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

Reviewer 1:
The reviewer noted that the project is acquiring (?) additional funding from outside sources after the contract ends.

Reviewer 2:
The reviewer said it seems like a large funding amount for vehicles with fairly high technology readiness numbers; the reviewer realized that there were a large number of vehicles deployed, and perhaps there is a difference between ARRA expectations and typical DOE return on investment.

Medium and Heavy-Duty Vehicle Field Evaluations: Ken Kelly (National Renewable Energy Laboratory) - vss001

Presenter

Ken Kelly, National Renewable Energy Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that the approach of the medium- and heavy-duty field testing project has proved to be excellent. The fleet selection and the vehicle and equipment manufacturers in the project have provided very useful data analysis and published reports. The reviewer added that the data collected including drive cycle, operating costs, fuel economy and chassis dynamometer testing has provided an excellent data set to evaluate the fleets.

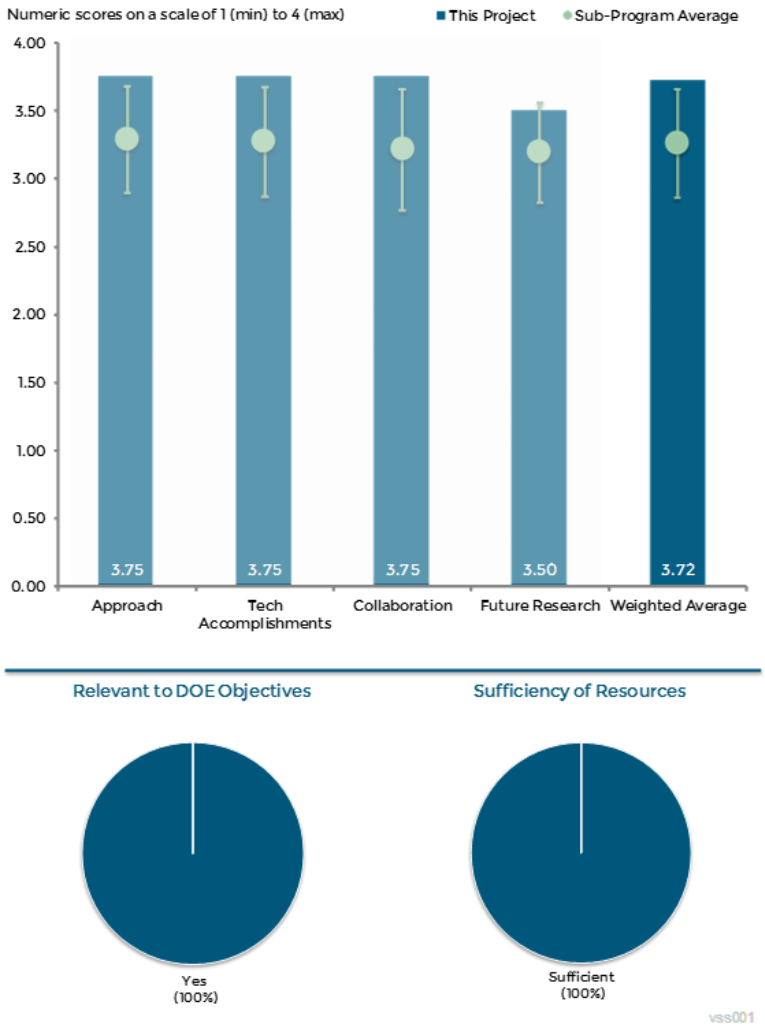

Figure 1-3 Medium and Heavy-Duty Vehicle Field Evaluations: Ken Kelly (National Renewable Energy Laboratory) - Vehicle Systems

Reviewer 2:

The reviewer said that the approach is methodical and well laid out. It is unbiased and is able to evaluate the technologies over real-world duty cycles.

Reviewer 3:

The reviewer commented that the excellent utilization of limited resources to both conduct core work and to add in emerging work to complement project objectives.

Reviewer 4:

The reviewer reported that the project addresses the barriers identified by generating unbiased data on technology usage, as well as drawing conclusions regarding the effectiveness of the technologies under real-world conditions. The result of this work is valuable knowledge of the strengths and weaknesses of each technology and their appropriateness in a given application. The reviewer added that this activity can be characterized as a support role, in collecting and interpreting the data. One suggestion would be to take a lead role to advise and engage with partners to define the parameters of the study up front. The reviewer suggested, for example, recommending the most appropriate technology based on the fleet and their operating

characteristics. Over time, there should be enough data in Fleet DNA database to make recommendations for future studies.

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

Reviewer 1:
The reviewer commented that technical accomplishments in fiscal year (FY) 2015 have been excellent. Close coordination with DOE including Clean Cities and 21st Century Truck Partnership has helped to get information out to the public about the project. The reviewer added that several new fleet evaluation efforts have been kicked off this year and data collection and reports of ongoing activities have provided technical reports that were published and presented to the industry.

Reviewer 2:
The reviewer noted the excellent selection of fleets and technologies.

Reviewer 3:
The reviewer reported that the achievements have been to plan and present a well-executed program.

Reviewer 4:
The reviewer observed that completing three data collection reports and continuing four others is a sizeable workload for the scope and budget. The reports contain valuable information for understanding potential fuel savings and as a guide for fleets to make informed decisions.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that the collaboration and coordination in this project is outstanding. Without support from the industry partners this project would not be very successful. The reviewer added that the industry partners are absolutely necessary to the success of this project.

Reviewer 2:
The reviewer praised excellent work with Clean Cities and industry organizations to engage fleets.

Reviewer 3:
The reviewer reported that the collaboration is well laid out and results in a well-balanced dataset. The reviewer did not see from the material who the end users were or how the data and analyzed results were actually shared.

Reviewer 4:
The reviewer pointed out that there was an excellent selection of reputable fleet partners to collaborate on the programs. It is not clear how these results feed back to the original equipment manufacturers (OEMs), however, for them to make system improvement.

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

Reviewer 1:
The reviewer commented that continued funding of these efforts to include other fleets and other technologies is highly recommended to support Vehicle Technology Office objectives. The reviewer deemed this work to have provided a great return on investment.

Reviewer 2:
The reviewer stated that the proposed future work will provide additional valuable information to this project. Data from additional fleets as technology advances will help to evaluate new technologies and performing cross-cutting analysis rather than only single-fleet analysis will allow the evaluation of tradeoffs of the technology evaluated against different duty cycles, which will be useful.

Reviewer 3:
The reviewer noted that the proposed next steps make logical sense. The reviewer was disappointed to see that the platooning technology was not included in any significant way. The reviewer thought this technology is one of the most exciting opportunities that requires greater understanding, especially what needs to happen to the following vehicles to increase their efficiency.

Reviewer 4:
The reviewer stated that the program is effective and continues to do good work. The reviewer would like to see this work executed in more of a project format with clear start and end dates, rather than an ongoing activity.

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

Reviewer 1:
The reviewer remarked that the project is very relevant to the DOE objectives. It is necessary to have projects like this one that provide unbiased data and analysis to determine how the advanced technology systems are actually performing in real-world situations.

Reviewer 2:
The reviewer stated that real-world field test of technologies goes beyond the hype and will truly confirm the efficiencies and stated fuel economy (FE) improvements.

Reviewer 3:
The reviewer said yes, data available to fleets provides adoption incentive. Real-world data supports ongoing technology advancement.

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

Reviewer 1:
The reviewer said that the resources in this project appear to be adequate.

DOE's Effort to Improve Heavy Vehicle Fuel Efficiency through Improved Aerodynamics: Kambiz Salari (Lawrence Livermore National Laboratory) - vss006

Presenter

Kambiz Salari, Lawrence Livermore National Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that this is a well-established and solid approach by the project team, tested and proven over many years of research. The effort to address the tanker sector is interesting, as most research to date has focused on box trailers. The reviewer added that science-based computational work is appropriate to explore the design space. The integrated approach using the generic speed form (GSF) model, despite practical implementation difficulties in the real world, is essential to show what is possible in truck aero drag reduction. (One key benefit of this work is demonstrating the aero drag reduction possibilities with new creative solutions.)

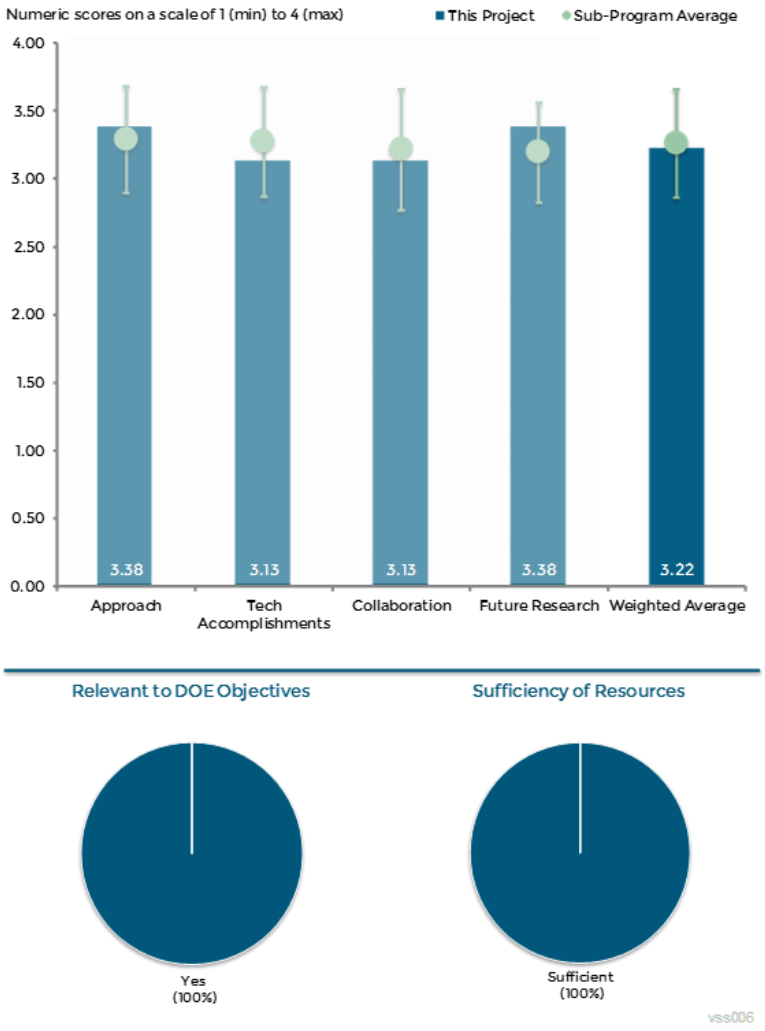

Figure 1-4 DOE's Effort to Improve Heavy Vehicle Fuel Efficiency through Improved Aerodynamics: Kambiz Salari (Lawrence Livermore National Laboratory) - Vehicle Systems

Reviewer 2:

The reviewer reported that this is a very important topic and is excited that DOE continues to fund this area of research and testing. Reviewing the materials, the reviewer was somewhat concerned that there is not as much collaboration with the industry. This project is not discussed in the industry as much as the reviewer would expect or desire. The reviewer added that the approach of comparing results from computational fluid dynamics (CFD), various wind tunnels, along with some field testing, is crucial to understanding the performance and in getting buy-in from the industry on real-world results of these devices. The reviewer pointed out the team is looking at developments and testing them. For example, analyzing vented side skirts, which was only really shown this past March at the Mid-American Trucking Show in Louisville and this team has already assessed them. The reviewer praised this as well done.

Reviewer 3:
The reviewer commented that the project rightly focuses on aerodynamic drag of Class 7-8 tractor-trailers, which is a significant contributor to fuel consumption. The emphasis on tanker trailers is questionable, given the relatively small population of tankers compared to dry van trailers.

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

Reviewer 1:
The reviewer stated that there has been a great deal of skepticism of these devices, so this data is very important to adoption and savings in real-world fuel use. It seemed to the reviewer that more progress could be made, given what was presented.

Reviewer 2:
The reviewer commented that the work is addressing the overarching barrier of aerodynamic drag; however, the work does not appear to include technical implementation barriers, such as the impact of the larger trailer skirts and underbody panel on the tractor. There are operational barriers to low-ground-clearance skirts that need to be addressed. The reviewer added that weight, durability and heat in the engine compartment make the underbody panel challenging to implement. Closer work with tractor and trailer partners would assist in identifying these issue and in providing workable solutions.

Reviewer 3:
The reviewer commented that the team has already been successful in helping bring practical and effective aerodynamic devices to the market overall, saying this is a very significant accomplishment to feed Vehicle Technologies Office (VTO) goals. This work has helped make this real-world implementation possible. The reviewer added that it was good to highlight fuel economy reduction by use of rough skinned shipping containers as an aside in the presentation, it will be interesting to see if Lawrence Livermore National Laboratory (LLNL) can come up with a creative solution here. The GSF1's ability to reduce drag at higher yaw angles could have benefits in the real world, as most trucks experience some yaw in regular operation (no truck is ever in a no-crosswind situation). The reviewer also said tanker trailer drag reduction concepts are quite interesting, particularly the centerline or side skirts that are similar to those used in box trailers. The ideas presented will not involve major redesign of existing tankers (which would make fleets uncomfortable because of cost and operational considerations). The reviewer added that it is very good for the team to look at the aero effects of platooning, this appears to be an area for improvement, as there are tradeoffs associated with platooning (balance of increased efficiency from close spacing but compromises in truck performance if spacing is too close). Collaboration with the National Renewable Energy Laboratory (NREL), who is working on the platooning effort, is important.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer commented that the team has a good list of partners, including OEMs, trailer manufacturers, and aero device manufacturers. The team has worked with a selection of fleets as well, which is very important for future commercialization and acceptance. The reviewer added that the collaboration with NREL on the platooning project is of particular interest, and will add to the knowledge base of this emerging technology.

Reviewer 2:
The reviewer would have liked to see more evidence of exact interactions from the industry and government. The reviewer asked what the team/program is learning from the field to help make this project even more successful. Strong team, though, and if they are engaged, this is less of an issue. This team too often criticizes industry for not adopting these devices, but this program is not set up to understand deeply all the benefits and consequences of each concept. The reviewer added that this focuses mostly on the FE performance. Kambiz

did a great job this year defining the team's place in looking at out-of-the-box concepts to pull the topic for discussion, which is quite helpful.

Reviewer 3:
The reviewer reported that direct collaboration with trailer manufacturers was not evident in the presentation, which is necessary to translate results into production.

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

Reviewer 1:
The reviewer commented that the future research is a continuation of excellent work. Underbody treatments and integration potentials for tractors and trailers will be good to explore further, and will support other DOE efforts such as SuperTruck.

Reviewer 2:
The reviewer reported that it is good to complete this work. The reviewer was not sure much effort should be continued on tankers, as the weight penalty of adding devices and lack of payload hauling affect the net benefit. Tankers leaving their dock 100% loaded at 80,000 pounds (lb.) are at the legal limit. Adding 500 lb. for aerodynamic devices and lowering the material hauled by the same amount is very costly to the fleet and not a good economic decision. Also, the reviewer said tankers have a 20-year life, and as they are so expensive (10 times that of dry vans), it is best to stay focused on dry vans and reefers. The reviewer strongly supports the efforts on trailer aerodynamics and platooning. This can critically help the future of platooning, a rather simple, high fuel-saving concept.

Reviewer 3:
The reviewer commented that GSF1 development is intriguing, and would like to see the shape evolve into a truck in the future, by including grille opening for the cooling system, tractor-trailer gap and ground clearance. The reviewer recommended keeping the focus on the dry van box trailer as opposed to tankers, with respect to the potential impact dry van trailers would make, given their much larger population in service.

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

Reviewer 1:
The reviewer stated that aerodynamics are important for us to understand to improve mpg on tractor trailers.

Reviewer 2:
The reviewer commented that the project has actually demonstrated petroleum displacement, as the work has already resulted in deployment of aero devices to displace petroleum. The reviewer added that aero drag reduction on trucks is a very important petroleum displacement opportunity.

Reviewer 3:
The reviewer said yes, tractor-trailer aero is a key lever for further fuel consumption reduction.

Reviewer 4:
The reviewer said that we need more suppliers in this space and this work can help pull in new manufacturers and innovation. We are just starting to see this on next-generation skirts and rear tails. The reviewer added that this work may already be pulling in new ideas.

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

Reviewer 1:
The reviewer indicated that the resources appear to be sufficient for the work being performed; the team is making good use of the funding they receive.

Reviewer 2:
The reviewer stated that funding is sufficient for the importance of the topic

Reviewer 3:
The reviewer was a bit concerned about depth of the work.

Idaho National Laboratory Testing of Advanced Technology Vehicles: Matthew Shirk (Idaho National Laboratory) - vss021

Presenter

Matthew Shirk, Idaho National Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that this program correctly encompasses the necessary evaluation of real-world field data that is fundamentally needed to validate development models from the OEMs and provide data to consumers for increased adoption of this technology. The reviewer also said the project might consider (or has considered) a broader regional control to get added field data by geographical and environmental controls.

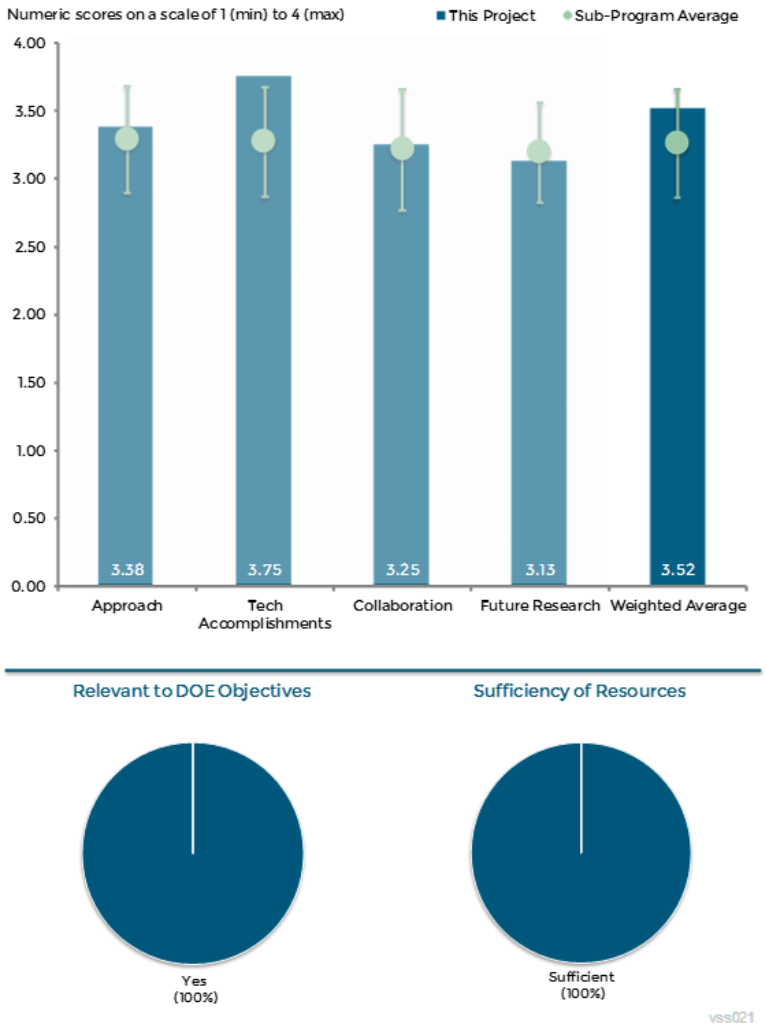

Figure 1-5 Idaho National Laboratory Testing of Advanced Technology Vehicles: Matthew Shirk (Idaho National Laboratory) - Vehicle Systems

Reviewer 2:

The reviewer thought this type of inexpensive, real-world verification of technologies is a good additional validation of bench tests. It is so important to understand the performance of technologies during general operation "out in the wild." One to two million dollars for all these models is a relatively low amount of money.

Reviewer 3:

The reviewer commented that the objectives and scope in the beginning should have pointed out that this study was limited to passenger cars. The reason for including internal combustion engine passenger vehicles was never made clear. The reviewer thought a very poor aspect of the approach was not controlling for the drive cycle. Drive cycle is a significant, if not critical, influence on energy consumption.

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

Reviewer 1:
The reviewer commented that with some additional iterations, this program is very necessary to validate both developmental assumptions (modeling) and customer information.

Reviewer 2:
The reviewer reported that the project team is on track to plans and reporting conditions of operation to compare to the more standardized bench and track testing. The reviewer added that the project team had a pretty comprehensive set of tests and published quarterly. The reviewer also said it is nice that a common project is testing batteries/components as well as conducting track and real-world testing. The project supports commonality in approach and reporting to help consumers and OEMs.

Reviewer 3:
The reviewer expressed no issues with the technical accomplishments.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer observed that it was a truly outstanding effort to bring in six major OEMs and other national laboratories on a collaborative effort. Other programs, simulation model development, could benefit from this example.

Reviewer 2:
The reviewer reported always having wondered if the stakeholders of these programs are truly gaining the benefit of this data collection and taking full advantage of the opportunity. OEMs in particular already have the cars released and in production, so sometimes they do not want to hear this information, as it may require improvement efforts, etc.

Reviewer 3:
The reviewer had no issues with collaboration and coordination. The reviewer could not suggest any improvements here.

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

Reviewer 1:
The reviewer had no comments on proposed future research other than that drive cycles should be controlled for in future research.

Reviewer 2:
The reviewer stated that finishing the scope and digging deeper into stakeholder questions will help.

Reviewer 3:
The reviewer reiterated that the project team might consider (or has considered) a broader regional control to get added field data on geographical and environmental controls.

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

Reviewer 1:
The reviewer commented that this project supports DOE's goal of petroleum reduction and energy security. The comparison of data on electric vehicles (EVs) with internal combustion engine (ICE) vehicles is meaningful.

Reviewer 2:
The reviewer stated that it is crucial to follow development into deployment and ensure that the products/technologies are delivering and can help with the next round of design generation.

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

Reviewer 1:
There were no reviewer comments on resources.

Advanced Vehicle Testing and Evaluation: Richard Jacobson (Intertek) - vss029

Presenter

Jeremy Diez, Intertek.

Reviewer Sample Size

A total of five reviewers evaluated this project.

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

Reviewer 1:

The Advanced Vehicle Testing & Evaluation (AVTE) project is very well designed and provides a thorough assessment of the vehicles selected. Some additional information on the drive cycles and their repeatability would be helpful to understand how to interpret the results. Also, the reviewer said, showing comparable data from conventional vehicles operating under the same conditions would help give a good relative comparison.

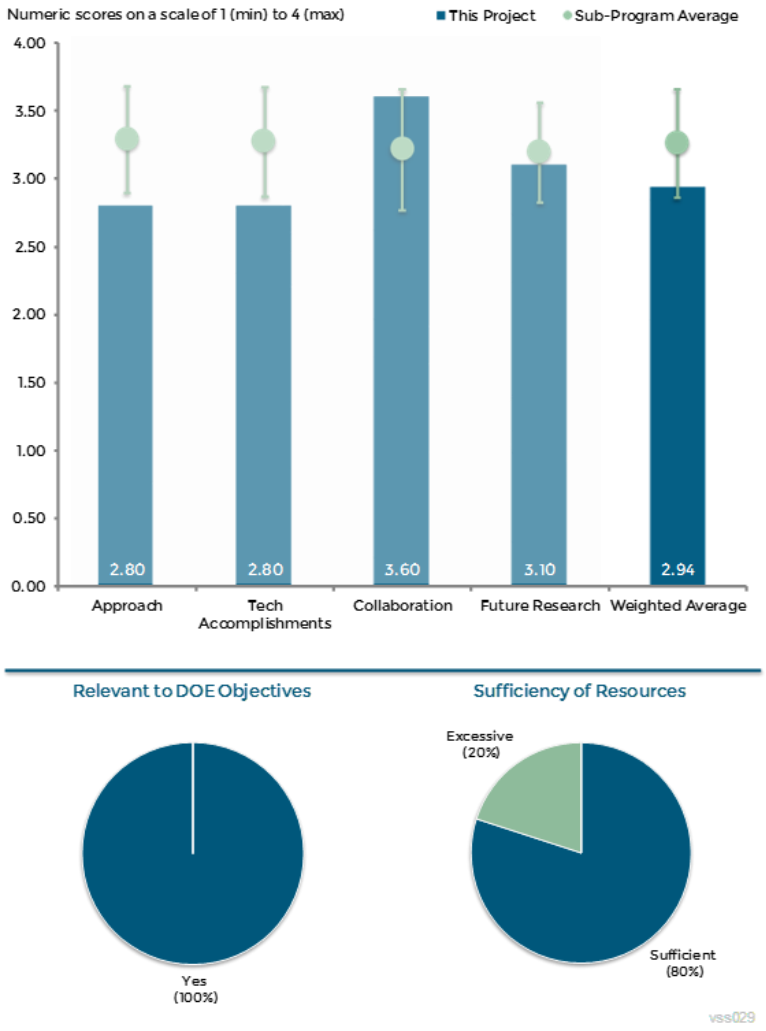

Figure 1-6 Advanced Vehicle Testing and Evaluation: Richard Jacobson (Intertek) - Vehicle Systems

Reviewer 2:

The reviewer listed the strengths of the approach, which include monitoring a small number of each vehicle type over a long period of time and many miles of driving; collecting data on vehicle/component efficiency; and performance over the testing period. The reviewer also enumerated the weaknesses, which include questionable representativeness of the partner fleet operating profiles relative to typical operation of the vehicles in the hands of consumers (admittedly an inherent limitation of deploying them into applications that will quickly accumulate a lot of operating miles); narrow climate representativeness - most of the vehicles seemed to be deployed in Phoenix, which represents a climate on one end of the spectrum. This was acknowledged as a reviewer comment from 2014 that the team will try to address as part of future work, but appeared still not have been addressed. Minimal baseline vehicle data collection and accessibility, data collection and reporting on baseline vehicles (representative of comparable conventional counterparts to the tested vehicles and/or of the best-selling vehicles on the market) would be one way to control for the potential representativeness issues of the drive cycles and climates in the selected fleets, and would provide valuable on-road data in its own right for those vehicles currently dominating the light-duty market. The reviewer said that in response to a question at the end of the presentation, the presenter mentioned that baseline data is sometimes collected from comparable conventional vehicles when they exist; however, this did not sound like it happens all (or even most) of the time, and after looking at posted results for several HEVs and EVs at the provided website (avt.inl.gov), there did not seem to be any baseline conventional vehicle information available.

Reviewer 3:

The reviewer commented that the objective of the project is to provide on-road test data from advanced vehicles to Idaho National Laboratory (INL) for later analysis. The approach is based on purchasing and instrumenting vehicles, which are then loaned to fleets after baseline testing. The reviewer added that because acquiring new vehicles can be more difficult in some states compared to others, it is good that Intertek is now involved, with an office in California. In addition to instrumenting the vehicle and providing data, Intertek mentioned that numerous test procedures were developed (battery, component durability, vehicle testing, etc.). The reviewer also said that this effort appears to be a duplication of existing industry procedures. If Intertek does leverage these industry procedures, then modifications should be minimal and require minimum effort. A lot of the information collected prior to vehicle testing is available publicly. For example, vehicle specifications, performance, etc. can be quickly found online. Regarding baseline testing, if the tests need to be performed, a comparison should be provided with published values (e.g., performance from Car & Driver Magazine). Collecting on-road vehicle energy consumption and cost is important, especially if all the data is made publicly available. Currently, it appears that only aggregated test data is available. The reviewer recommended considering sharing additional information through a database. Because one of the main objective is to produce lifecycle fuel economy and cost, some of the testing should be done outside of fleet, which is well known for having much different drivers' behaviors and driving cycles than usual drivers. Without at least a comparison, the results from the on-road data cannot and should not be generalized outside of fleet drivers.

Reviewer 4:

The reviewer stated that the project team established procedures, data collection and publication procedure, allowing information to be shared with the public. The reviewer questioned the coast-down data accumulation, noting that the amount of effort required seemed high.

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

Reviewer 1:

The reviewer commented that while good progress has been made, some additional work to evaluate medium- and heavy-duty MD/HD vehicles should be included.

Reviewer 2:

The reviewer commented that the project accomplishments include acquiring and placing over 90 vehicles representing a range of advanced technologies in fleets, and collecting over 4 million miles of data during fleet testing. Some of the approach limitations (with respect to representativeness of the vehicle operating profiles, climates and accompanying baseline vehicle data) translate to limitations for the accomplishments. The reviewer added that summary results on the collected data are posted on the avt.inl.gov website. Because these data seem to be collected without manufacturer participation (or non-disclosure agreements) it would be nice to also have micro data (such as a representative weeks' worth of data for each vehicle) publicly available as well per the Argonne National Laboratory (ANL) D3 data availability model. Though perhaps this would be an INL rather than an Intertek activity.

Reviewer 3:

The reviewer stated that public information does not include all available use data, only a summary sheet. The reviewer asked if there is a mechanism that would allow full drive cycle and vehicle related information to be available to the public.

Reviewer 4:

The reviewer stated that the first section of the accomplishment lists the 2013 test data summary from the 2013 Ford Fusion (Slide 8). All this data, and more, can be found online. While it is helpful to have them in a single location, the reviewer was unsure why this is listed as an accomplishment. The second section of the accomplishment provides on-road fuel economy measurement (Slide 9). The reviewer asked how these values

compare to those from other websites and sources. More and more real-world fuel economy data is becoming available from a wide range of vehicle technologies. The reviewer recommends that Intertek highlight how their project is different and/or complements data provided by drivers.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer remarked that collaboration with other institution is very well defined, with distinct roles and responsibilities.

Reviewer 2:
The reviewer commented that the collaboration and data has multiple partners and is well coordinated.

Reviewer 3:
The reviewer commented that the project demonstrates a large degree of collaboration and coordination with other institutions. The strongest collaborations seem to be the following: work with fleets where the vehicles are placed in service and obtaining fueling log data from the fleets, in which the reviewer asked whether the fleets are also relied on to report kWh charged for electrified vehicles from charging equipment that reports this data like a fuel sale; and work with INL on procedure development and to store, analyze, and produce summary reports on the data; The reviewer also stated that additional collaborations include the following: collaboration with ANL on additional test procedure development and chassis dynamometer testing, though the extent of ANL's interaction with Intertek versus INL was unclear; collaboration with NREL on MD/HD vehicle conversions, though this seemed to be more of a future work activity because limited information was given; and collaboration with the Society of Automotive Engineers (SAE) on the interoperability testing, though this testing was the focus of a different project review (i.e., vss169).

Reviewer 4:
The reviewer stated that there is a good mix of collaborators, but the project team needs to determine additional mileage accumulation partners and look for other temperature extremes, not just Phoenix high temperatures.

Reviewer 5:
The reviewer said that vehicle OEMs, electric vehicle supply equipment (EVSE) manufacturers and other labs have been engaged. Partner fleets (EZ Messenger and Total Transit) could be expanded with more fleets and/or locations. Industry access to data could be improved, but INL analysis of the data is helpful and shown in separate presentation/review.

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

Reviewer 1:
The reviewer pointed out that plans for future work addresses concerns noted above. Future work to further the establishment of new test protocols has significant value.

Reviewer 2:
The reviewer stated that the proposed future work includes continuous improvements on test methods, procedures and reporting approaches, expansion of fleet operators to help address current representativeness issues with operating profiles and climates, and expansion of scope to include MD/HD vehicles, which currently seems to be lacking. The presentation also highlighted ongoing testing plans as additional future work, to include completion of multi-year testing for the currently-deployed vehicles and initiation of testing on new, advanced vehicle technologies, which is valuable to continue adding to the body of knowledge being generated by the project. The reviewer stated that these future work plans are valuable for the reasons indicated. Additional future work should consider including more baseline conventional vehicle testing

representative of mainstream vehicles on the market to compare against the advanced-technology vehicle performance, not to mention the intrinsic value of such detailed field data on vehicles dominating the current market that would not otherwise be broadly available for researcher use.

Reviewer 3:
The reviewer said there needs to be a consideration in the vehicle selection process for projected vehicle mix in the consumer fleet, as well as possible considerations for MD vehicle mileage accumulation.

Reviewer 4:
The reviewer observed that most of the future challenges and technical barriers (Slide 13) are related to charging rather than vehicles. As a result, the reviewer asked if the objectives of the program be revisited to address these barriers. In addition, future research appears to be focused on doing the same thing with improved process rather than on how the project could evolve to answer additional questions. Because questions are currently evolving, one would expect that the type of testing performed or data collected would evolve as well, which does not appear to be the case.

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

Reviewer 1:
The reviewer said that the project obtains field test data on advanced technology vehicle performance that would not otherwise be available and provides a sanity check on the in-use performance of these vehicles.

Reviewer 2:
The reviewer commented that these datasets made public have high value as they are generally not available and have a number of customers from OEMs, national laboratories, universities, and other technical suppliers.

Reviewer 3:
The reviewer said that independently gathered vehicle use and performance data is critical for consumers planning on making the investment into advanced vehicle technologies.

Reviewer 4:
The reviewer pointed out that the project provides on-road test data for advanced vehicles for fleets

Reviewer 5:
The reviewer said yes, acquiring data to help understand and develop electric drive and new advanced technologies is key to reducing petroleum displacement.

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

Reviewer 1:
The reviewer stated that the resources seem adequate for the work described. It might be a useful exercise to inventory the performance changes seen over time from past vehicle testing, and to assess the value and applicability of lessons learned when performance degradation has been observed, in order to confirm the appropriateness of the testing intervals and durations currently used.

Reviewer 2:
The reviewer said that with the advance of technologies, the reviewer would expect the cost of vehicle instrumentation and data collection to significantly decrease. The current budget of $6 million (Slide 2) for 50 vehicles (Slide 15) seems very high. If vehicle energy consumption is one of the key parameters, the reviewer asked if data could be collected on a larger number of vehicles for much smaller funding through simple on-board diagnostic (OBD) instrumentation.

Advanced Technology Vehicle Lab Benchmarking (L1 and L2): Kevin Stutenberg (Argonne National Laboratory) - vss030

Presenter

Kevin Stutenberg, Argonne National Laboratory.

Reviewer Sample Size

A total of five reviewers evaluated this project.

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

Reviewer 1:

The reviewer commented that testing is comprehensive and in-depth and the reporting is also excellent.

Reviewer 2:

The reviewer asked if the benchmarking test and measurement approach use a standard testing methodology based on approved industry standards. This needs to be stated up front.

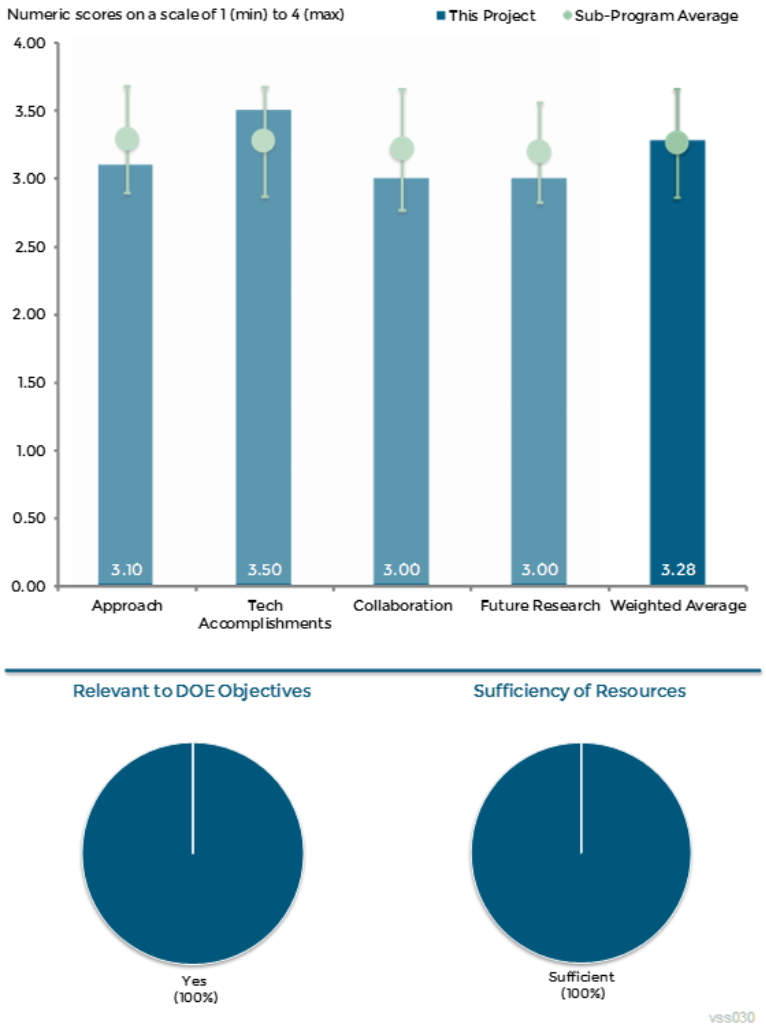

Figure 1-7 Advanced Technology Vehicle Lab Benchmarking (L1 and L2): Kevin Stutenberg (Argonne National Laboratory) - Vehicle Systems

Reviewer 3:

The reviewer reported that the Advanced Technology Vehicle Lab Benchmarking, Level 1 and 2 is a long and well- established project. The approach to the testing activities has been refined in a variety of ways over the years. The reviewer added that this includes continually improving testing methods, instrumentation, equipment, analysis procedures, and so forth. At this point, it has probably become more difficult to continue and refine the process, although there are likely still areas that can be made more cost effective, such as the improved instrumentation techniques alluded to this year. In this context, the reviewer said that, as a mature project with the continuing requirement to prove value and reduce costs, it may be beneficial to conduct a blank-sheet exercise looking at the scope of the whole project from a fresh perspective, in this case questioning long-standing assumptions, scope, processes, and procedures. The reviewer stated that it is quite possible little may come of such an exercise, but it is feasible that a new scope, approaches, cost reduction opportunities, streamlining mechanisms, data dissemination strategies, and/or customers, may be identified or enhanced to further increase the overall value proposition of the project.

Reviewer 4:

The reviewer stated that the selection of which vehicles undergo Level 1 testing and which vehicles undergo Level 2 testing seems arbitrary. There needs to be standard operating procedure or protocol.

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

Reviewer 1:
The reviewer commented that there was excellent throughput in terms of testing and reporting results and the reports were well done. The value of the program is in providing independent, timely, high-quality (accurate) test results.

Reviewer 2:
The reviewer stated that this year the project has been looking at a variety of vehicles including battery electric vehicles (BEVs), range-extended BEVs, PHEVs, diesels, and compressed natural gas (CNG) conversions. There have been a number of accomplishments including revised instrumentation methods, evaluation of idle stop/natural gas vehicles (NGVs), EV energy consumption versus ambient temperature, understanding variations in BEV range, in-depth blended PHEV evaluation, and aggressive thermal usage assessment. The reviewer added that the revised instrumentation methods have aided in streamlining the data acquisition process and cost control, while idle stop impacts for CNG operation have been quantified. Interestingly, for aggressive cycles, the negative energy impact of air conditioning (A/C) is largely mitigated by other factors including improved losses and heating, ventilating, and air conditioning (HVAC) is not the only contributor to high EV energy consumption under cold operating conditions. The reviewer stated that overall, a respectable list of accomplishments across a wide variety of areas was evident.

Reviewer 3:
The reviewer noted that it would be good to show the comparison between what the OEMs had published with their test results.

Reviewer 4:
The reviewer has no issues with technical accomplishments.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer pointed out that there was excellent collaboration with regulatory and industry partners. The project produces timely, high-quality results.

Reviewer 2:
The reviewer commented that the project has an extensive list of institutions with which it collaborates and coordinates in the government, industry, standards definition organizations (SDO), and international arenas, and although not specifically mentioned, academia as well. There are no obvious gaps in partner collaboration or coordination, but it is important to be continually probing existing partners and considering new ones whether for input on testing activities or as potential new end users of the data.

Reviewer 3:
The reviewer said that closer collaborations with OEMs would be useful to share dyno data; this would provide a better comparison of the benchmarking.

Reviewer 4:
The reviewer noted that the U.S. Environmental Protection Agency (EPA) has not been included. This is a significant omission. The reviewer added that comparisons with EPA data should have been shown and discussed wherever possible. Another reviewer last year made the same comment about making EPA a formal partner on this project, and the reviewer does not understand why such a partnership has not been pursued. The reviewer finds this to be inexcusable.

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

Reviewer 1:
The reviewer commented that the program continues to make good progress with appropriate future choices for testing properties.

Reviewer 2:
The reviewer stated that the authors need to come up with a systematic methodology for selecting which vehicles under Level 1 or Level 2 testing. Second, the objectives of assisting in codes and standards development was stated; however, no results were presented on the impact of this project on SAE J1711 and J1634.

Reviewer 3:
The reviewer stated that the Advanced Technology Vehicle Lab Benchmarking Level 1 and 2 project goes through a screening process with industry and government to identify the most appropriate vehicles to test (whether Level 1 or 2). A key driver is often the uniqueness of a particular technology and how well it fits into the overall testing portfolio, as well of course as vehicle availability. The reviewer added that the projected upcoming Advanced Vehicle Testing Activity (AVTA) vehicles to be tested include a wide range of BEVs, HEV, a bi-fuel CNG, and a range-extended EV, with the emphasis continuing on BEVs. This provides a good cross section of the current vehicular state-of-the-art.

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

Reviewer 1:
The reviewer pointed out that this project supports DOE objectives of petroleum displacement by benchmarking state-of-the-art vehicles; providing independent and public data for evaluation of emerging technologies; and supporting model creation and validation, standards development, and DOE target setting. In short, the Level 1 and 2 benchmarking helps accelerate the evaluation of advanced vehicles and technologies, facilitates and guides research and development, and helps promote adoption of advanced vehicular technologies.

Reviewer 2:
The reviewer stated that this is a useful, independent, public source for technology assessment/evaluation.

Reviewer 3:
The reviewer said that there is no doubt that this project produces and disseminates data useful to DOE for analyzing petroleum displacement and energy efficiency.

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

Reviewer 1:
The reviewer suggested more resources for analysis.

Reviewer 2:
The reviewer stated that resources are sufficient for this project.

Reviewer 3:
The reviewer had no basis to contest the level of funding on this project.

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

Presenter

Oyelayo Ajayi, Argonne National Laboratory.

Reviewer Sample Size

A total of three reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that while the intent of this project is excellent, the results indicate that there was a mismatch between approach and resources available. In particular, one of the three investigation paths was more time-intensive than anticipated by the project planners.

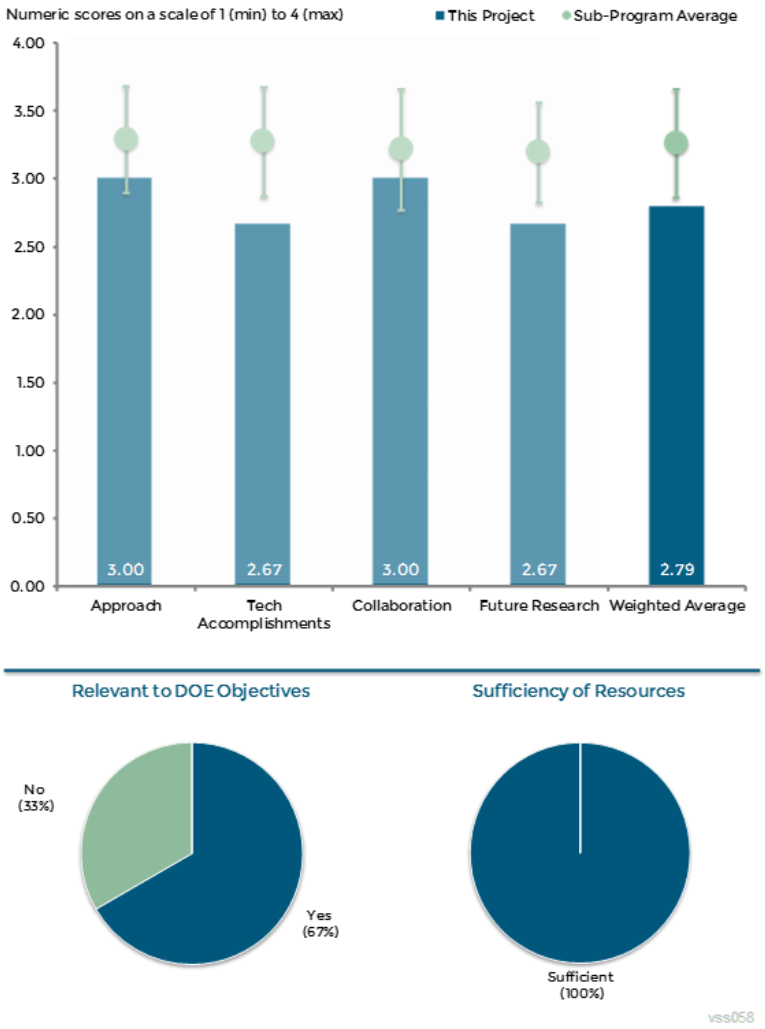

Figure 1-8 Development of High Power Density Driveline for Vehicles: Oyelayo Ajayi (Argonne National Laboratory) - Vehicle Systems

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

Reviewer 1:

The reviewer stated that the achievement of this project is relatively weak.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:

The reviewer commented that the project involves partnerships with several commercial companies that could potentially help transition technology advancements into the market.

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

Reviewer 1:
The reviewer reported that this project is ending this year, so there is no future work proposed.

Reviewer 2:
The reviewer indicated that the project has ended.

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

Reviewer 1:
The reviewer observed that the project tried to develop mechanisms required for high-density drive lines. High density drive lines are an enabler of improved vehicle fuel efficiency.

Reviewer 2:
The reviewer said that this research supports the overall DOE objectives, but in an area with relatively low potential to succeed.

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

Reviewer 1:
The reviewer noted that the project investigators discovered that the resource allocations were insufficient to perform the full matrix of experiments necessary to complete the planned investigations within the project schedule. As a result, one of the three technology investigation areas was incomplete at the end of the project. The assigned assessment that the resources are sufficient is because the project ends in FY 2015 and additional resources would not affect the project outcome.

SuperTruck - Development and Demonstration of a Fuel-Efficient Class 8 Tractor and Trailer: Russ Zukouski (Navistar International Corporation) - vss064

Presenter

Russ Zukouski, Navistar International Corporation.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

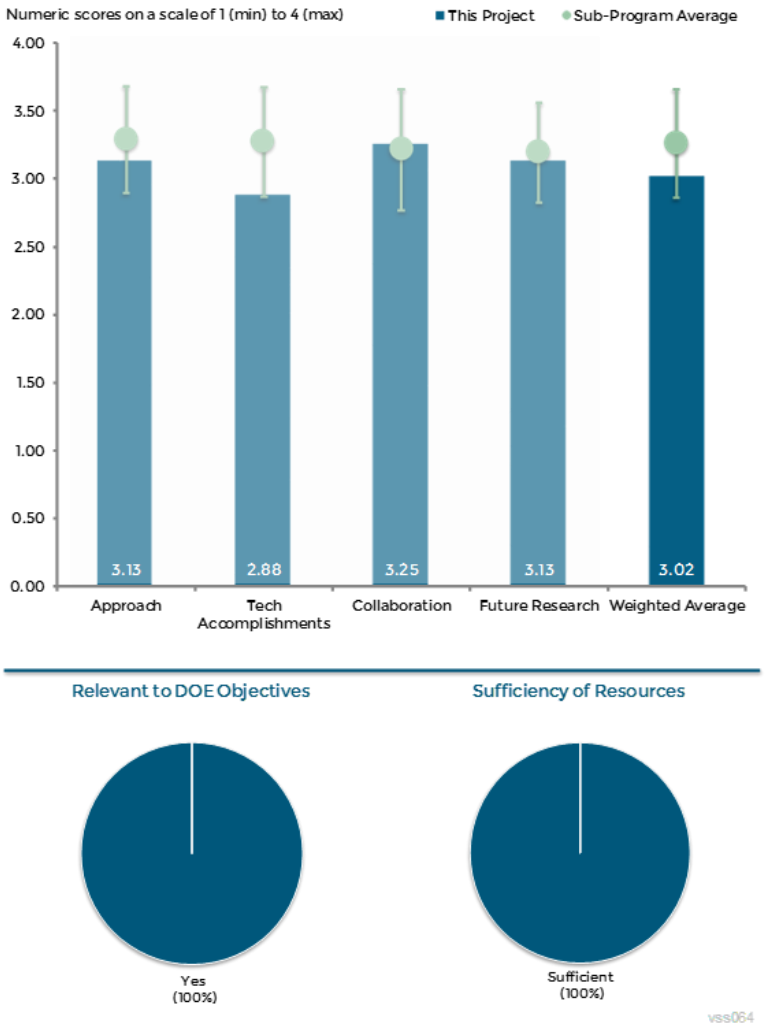

Figure 1-9 SuperTruck - Development and Demonstration of a Fuel-Efficient Class 8 Tractor and Trailer: Russ Zukouski (Navistar International Corporation) -Vehicle Systems

Reviewer 1:

The reviewer liked seeing a standardized way to show fuel economy percentage by individual contributor. The reviewer understood the pause period and the change in strategy on hybridization. The reviewer was unsure of the approach to understanding the contribution of various concepts to their prediction during the next phase of testing, either via bench tests, specific vehicle tests before the full demonstrator exists. Also, the reviewer did not understand how the collaborators are working with the Navistar team.

Reviewer 2:

The reviewer stated that the presentation does not indicate consideration of roadway condition, for example, the International Roughness Index (IRI), which should have a significant influence on achieving objectives. The reviewer added that consideration of the impact of double trailers should be included, as these have potential freight capacity benefits, but it is uncertain how they impact efficiency.

Reviewer 3:

The reviewer commented that the approach includes all needs that can help the program to achieve the program goals; however, waste heat recovery (WHR) via Rankine cycle is not part of plan for the 50% goal.

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

Reviewer 1:
The reviewer believed good progress is being made toward completion, but found little evidence in this presentation (e.g., concern over approach to definitively understanding the percentage contributions of each action). The reviewer expected more detail on cab redesign decision making, light-weighting, and even the hybrid decision. The project team only briefly shared the decision which caused the reviewer to question the depth of analysis in these areas. Another example is the decision to go to 48 volts for idle reduction A/C and hotel loads. This was a decision reached by Navistar and not any of the other SuperTruck teams, the reviewer thought. Some detail on that decision would be helpful and the reviewer thought should have been shared.

Reviewer 2:
The reviewer pointed out that only Slide 16 shows the accomplishments with no tangible improvement since the program resumed in 2014. It seems that there is very little development at a vehicle level.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer said collaboration seems good, but saw little evidence that led the reviewer to feel confident that there is as much joint learning, both ways between the team and collaborators.

Reviewer 2:
The reviewer observed that the presentation does not indicate interaction or partnering with U.S. Department of Transportation (DOT)/Federal Highway Administration (FHWA)/Federal Motor Carrier Safety Administration (FMCSA). This type of partnership may prove beneficial to the project, especially in light of the forthcoming Comprehensive Truck Size and Weight study mandated by Congress in MAP-21.

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

Reviewer 1:
The reviewer stated that the future work is comprehensive with a detailed technology road map toward the goal.

Reviewer 2:
The reviewer reported that there was not much detail on the next phase of the effort - prototype and validation. When the first two teams were at this stage about a year ago, they both shared much more detail on their plans. The reviewer does not have the confidence that this team will learn as much without understanding the plan to review/understand the performance of the vehicle.

Reviewer 3:
The reviewer commented that the project should consider the impact of albedo on surfaces as well as potential for incorporation of photovoltaics on the surfaces to assist with power demands

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

Reviewer 1:
The reviewer said significant MPG improvements

Reviewer 2:
The reviewer indicated that heavy tractor-trailer fuel efficiency is our single biggest opportunity in transportation.

Reviewer 3:
The reviewer pointed out that this not only supports DOT objectives, but also the DOT Clean Transportation Sector Initiative goals of 80% GHG emissions reductions by 2050, as well as EPA objectives.

Reviewer 4:
The reviewer said yes, this project will support the overall DOE objectives of petroleum displacement if Navistar can deliver what they are supposed to deliver in meeting the program goals.

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

Reviewer 1:
The reviewer said resources seem sufficient, but with lack of plans, was not sure.

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

Presenter

Jason Lustbader, National Renewable Energy Laboratory.

Reviewer Sample Size

A total of three reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that the project is well designed. The milestones are distinct and easy to understand. The project progression is very orderly. The reviewer added that the mirror image between the technology development and the analytical tool development is an important breakthrough. Too many tech development projects either develop the analytical tool after the technology development or do not develop one at all.

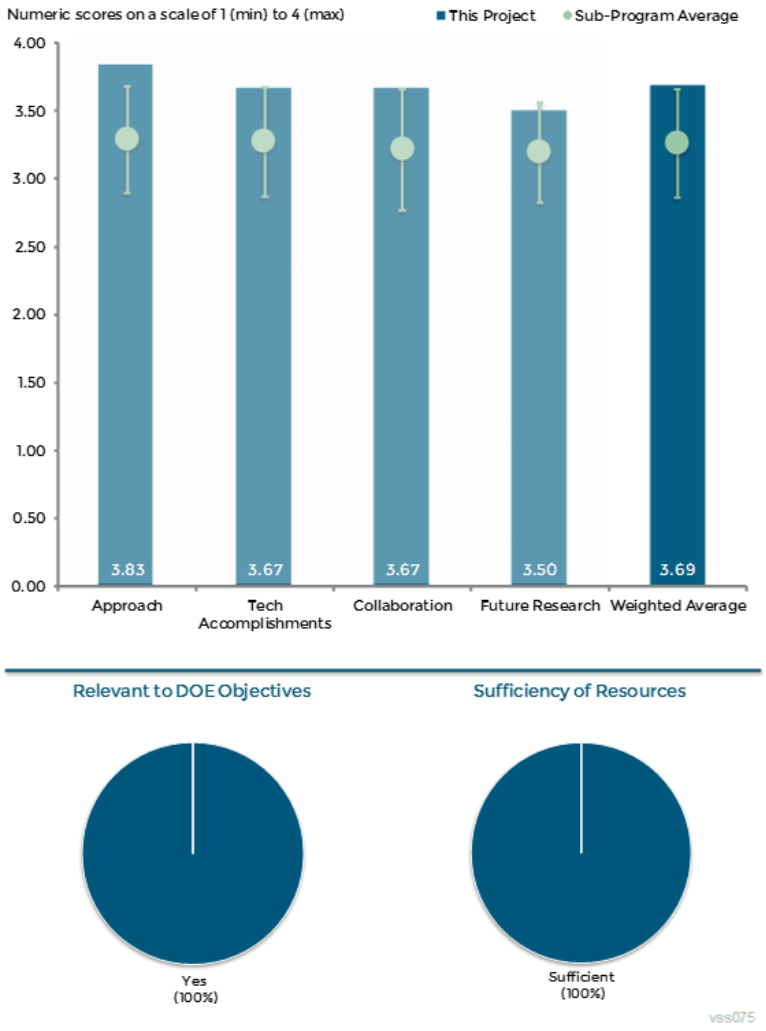

Figure 1-10 CoolCab Test and Evaluation and CoolCalc HVAC Tool Development: Jason Lustbader (National Renewable Energy Laboratory) - Vehicle Systems

Reviewer 2:

The reviewer stated that the approach appears to address all the sources of heat that influence the temperature in a sleeper cab. The model development will be a useful tool in future sleeper cab design activities. The reviewer would be interested to see if this approach could be applied to day cabs as well.

Reviewer 3:

The reviewer commented that this project is really engaging stakeholders and is focused on an important area of idling and not distracted by other areas. The reviewer added that the project team understands the end users well. The team appreciates the marketplace well but the reviewer would encourage a two-year versus three-year payback. Used good drive cycles for battery charging assumptions. The reviewer suggested developing a fuel cost per battery charge, a key calculation. It helps to review both of these programs at the same time.

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

Reviewer 1:
The reviewer indicated that this project is projected to exceed the overall goals. More test data would increase the confidence in the results. The reviewer added that beyond a reduction in fuel use, an improvement in passenger comfort could be expected as well. If the new technologies become mainstream, the reviewer doubted the cost delta will be that great, at which point the discussion about payback period will become moot. Overall, a great methodical march toward obtaining a couple percentage point reduction in fuel consumption.

Reviewer 2:
The reviewer commented that the accomplishments on insulation, paint and shades are good but the reviewer would like to see more focus on zoned or targeted cooling areas as well.

Reviewer 3:
The reviewer reported that meeting deliverables and metrics, here at the end of the project. Testing and modeling with the same people at the same time helps with expertise and meeting the goals of the project. The reviewer added that lowering heat loads in the summer as you look at the solutions. The project is efficient, and the project team upgraded modeling tools. The reviewer then stated insulation, paint, curtains and shades. 35.7% versus 30% goal for best cab combination. The reviewer also said curtains are a real key part of the solution it seems.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer said that this team/project appears to have excellent collaboration with industry partners. Companies talk about this project outside of the DOE and this review annually.

Reviewer 2:
The reviewer stated that the collaboration is good. The reviewer would like to see more Tier 1 suppliers involved. The OEMs are clearly the main lead here, but the reviewer thought the Tier 1 suppliers have a lot to offer.

Reviewer 3:
The reviewer expressed a desire to see what the potential users think of the analytical tool. The ability of different users to plug in their own high-fidelity models of their engines and electric power generation capability would ensure a long life for this tool. The reviewer added that the types and amounts of collaboration, while not explicitly discussed, seem appropriate at this developmental stage.

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

Reviewer 1:
The reviewer pointed out that the program is about done. Delivery of tools that are robust for the few industry stakeholders is a crucial deliverable for success.

Reviewer 2:
The reviewer commented that the proposed future research is a logical progression that increases the value of this project's products.

Reviewer 3:
The reviewer reiterated the desire to see further study on zoning or targeted cooling areas.

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

Reviewer 1:
The reviewer noted that this is very relevant and oftentimes a forgotten fuel use for over-the-road Class 8 tractors. Drivers live in these vehicles and are only allowed to drive 10 hours per day and rarely is slip seat operation maximized. The reviewer added that this is important work.

Reviewer 2:
The reviewer stated that hoteling in line haul trucks can use as much as one gallon of fuel an hour. Battery or no-idle solutions are heavy and expensive. The reviewer added that any technology that can reduce the thermal load would benefit enormously in energy requirements.

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

Reviewer 1:
The reviewer said good use of resources and speculated that with more funding more validation testing could have been performed.

Reviewer 2:
The reviewer stated that funding seems sufficient and efficient use to have been made of it, given activities completed.

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

Presenter

Pascal Amar, Volvo Trucks.

Reviewer Sample Size

A total of three reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that the approach taken is quite comprehensive, including many beyond state-of-the-art technologies, which should be adequate to help the program achieve its goal. It would be helpful if the final vehicle demonstration can use the same routes as its competitors in Texas, which can provide more or less apple-to-apple comparisons

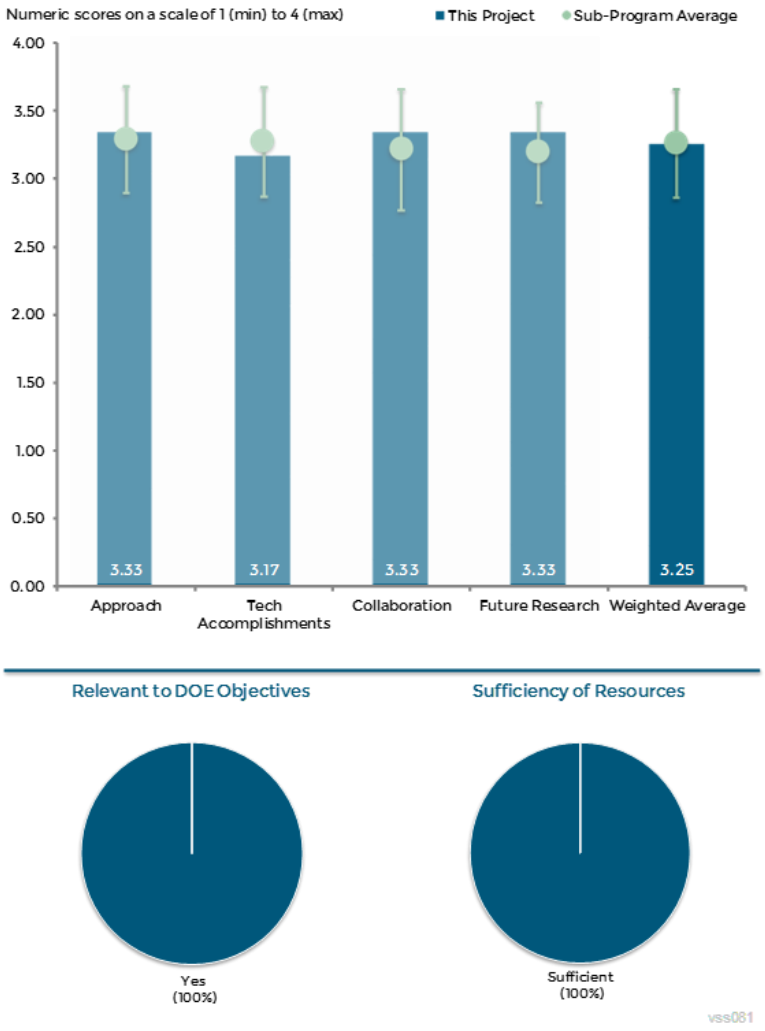

Figure 1-11 A Complete Vehicle Approach to the SuperTruck Challenge: Pascal Amar (Volvo Trucks) -Vehicle Systems

Reviewer 2:

The reviewer was somewhat disappointed with this review. The reviewer said that 80% of it was discussing commercializing trailer aerodynamics. The reviewer believed that Volvo's approach and accomplishments are strong, but expected to see evidence of it during this review. For instance, the reviewer thought it appropriate that reviewers are shown a test plan for the demonstrator vehicle going forward, validation of concept performance predictions, plans to test over the road, etc., but none was provided.

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

Reviewer 1:

The reviewer said excellent, believing that the accomplishments are there even though little evidence was shown other than the truck chassis has been built. The reviewer would have liked to see how the detailed designs and prototyping met expectations. The reviewer then asked what the major successes, issues, and problems were, and how were they overcome.

Reviewer 2:
The reviewer commented that there is no final vehicle MPG or improvement mentioned compared to last year's progress, although it reports quite a bit intermediate accomplishments. So, it is hard to judge the program progress.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer reported that there was not a very long list and nothing new was shared on collaboration successes to show evidence that there is extensive learning from this effort across all parties.

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

Reviewer 1:
The reviewer believed there is a plan for the final year of effort, which was not shared.

Reviewer 2:
The reviewer remarked that it looks promising to achieve the program goals.

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

Reviewer 1:
The reviewer stated that many technologies proposed and being used have potential to be put into production in the 2020-2025 time frame. Therefore, this project supports the overall DOE objectives of petroleum displacement.

Reviewer 2:
The reviewer said HD Class 8 tractor-trailer fuel efficiency is the single biggest action we can take in petroleum reduction in transportation.

Reviewer 3:
The reviewer stated that the project demonstrated MGP improvements and had good plans for phase two.

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

Reviewer 1:
The reviewer said it is amazing to use half the budget of their competitors to achieve the same program goal. Well done.

EV - Smart Grid Research and Interoperability Activities: Keith Hardy (Argonne National Laboratory) - vss095

Presenter

Keith Hardy, Argonne National Laboratory.

Reviewer Sample Size

A total of five reviewers evaluated this project.

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

Reviewer 1:

The reviewer observed that there were no issues. This, the reviewer believed, is a necessary activity, and the national laboratories are best positioned to lead this it.

Reviewer 2:

The reviewer commented that standards are clearly a great role for DOE and the laboratories. It is not entirely clear how important the lab testing described is supported by industry and coordinated with similar testing being done in industry.

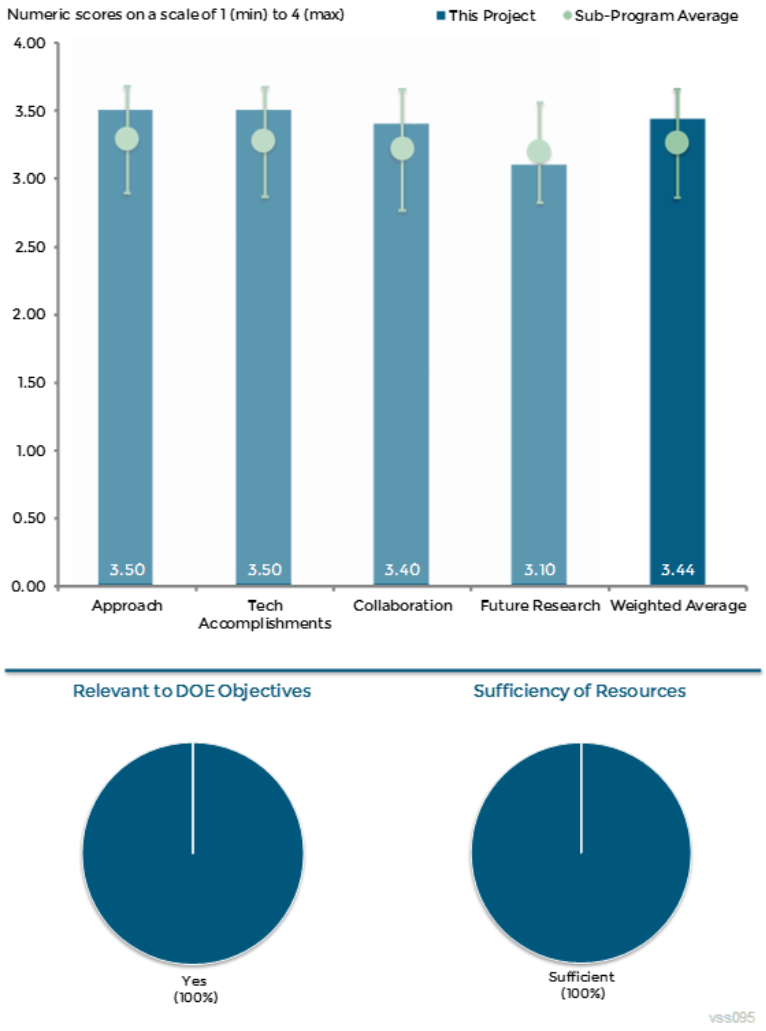

Figure 1-12 EV - Smart Grid Research and Interoperability Activities: Keith Hardy (Argonne National Laboratory) - Vehicle Systems

Reviewer 3:

The reviewer said the approach seems appropriate, although there was not much information in the package on approach.

Reviewer 4:

The reviewer pointed out that the overall driving impetus behind EV-Smart Grid Research and U.S. – European Union (EU) interoperability is to be the technology, systems, communications, and standards leader to drive interoperability of PEVs worldwide. If the United States and E.U. are not the leaders, China will become the de facto leader, which will have serious negative consequences for U.S. competitiveness in the vehicular development/commercialization and grid communications space. The reviewer added that working hand-in-hand with the E.U. is a force multiplier to strengthen the U.S. position in this area and maintain a competitive edge with regard to electric-drive vehicles, infrastructure, and grid communications, as well as grid robustness and enhanced utilization of renewable energy sources. The reviewer also said that the approach of joint U.S. and E.U. interoperability centers, parallel SAE and International Organization for Standardization (ISO)/International Electrochemical Commission (IEC) standards development, standardized verification tools, and specifications for a common U.S.-E.U. test device is a strong approach to accelerate and harmonize the

United States and E.U. around global EV interoperability requirements. Additionally, the focus on a common integration platform with open-source control architecture and software is a good approach enabling seamless grid integration of a variety of distributed energy resources, HVAC, and metering elements.

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

Reviewer 1:
The reviewer stated that the harmonization activity (BMW i3 testing) appears to be progressing quite well.

Reviewer 2:
The reviewer commented that it appears that ANL has moved the standards efforts along well and made important contributions.

Reviewer 3:
The reviewer said that there have been technical accomplishments on a number of fronts, including facilitating development of standards including associated development of compliance tools and test procedures, development of embedded controls, EV/EVSE/grid communication modules, and sensing and metrology equipment. Prototype E.U.-U.S. AC interoperability test equipment has been developed, a common test vehicle settled upon (BMW i3 EREV), and the development of a standard integration hardware-in-the-loop (HIL) platform is underway. The reviewer added that a common integration platform with open-source software and control architecture is being developed.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that there appears to be close collaboration and coordination with other institutions domestically and overseas, primarily through the joint codes and standards activities including SAE/ISO-IEC/National Institute of Standards and Technology (NIST)/Institute of Electrical and Electronics Engineers (IEEE) and the Global InterOP Team. This collaboration/coordination has been and is an ongoing effort essential to overall success of the project. The reviewer assumed that relevant industrial participants (such as controls manufacturers, home energy service companies, EVSE manufacturers, etc.) are represented within the codes and standards committee structure.

Reviewer 2:
The reviewer said no issues here.

Reviewer 3:
The reviewer reported that clearly the team is coordinating with SAE but there are so many other organizations involved in this space and the reviewer did not see any mention of these.

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

Reviewer 1:
The reviewer noted that the proposed future work is well delineated into several areas including codes and standards committee support, embedded controls and communication, sensing and measurement, testing infrastructure, and integrated verification/hardware studies with a final goal of technology transfer in 2018. This structure provides the framework for moving forward over the next several years, realizing that milestones are determined by committees and may change. The reviewer added that the structure lays out a logical sequence of tasks being driven from the top level by joint U.S.-E.U. codes and standards committee decisions.

Reviewer 2:
The reviewer observed no issues.

Reviewer 3:
The reviewer commented that standards always seems to be a never-ending sink for resources. While this is important, the reviewer would like to see a clear path toward an end goal with a limit on the resources.

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

Reviewer 1:
The reviewer pointed out that standardization would improve the chances of large-scale acceptance of these technologies.

Reviewer 2:
The reviewer commented that this project is highly relevant to the overall DOE objectives of petroleum displacement because for electric drive vehicles to transition from the early adopter phase to the broader mass market will require an improved value proposition and mitigation of present consumer concerns including limited range and associated driver anxiety. The reviewer added that improving the interoperability of the EV/EVSE/grid space will potentially permit EVs to provide value-added services to the grid/home and will broaden access to recharging infrastructure helping to alleviate range anxiety. These developments can potentially contribute to a cascading effect whereby battery sizes could be reduced (due to expanded availability of recharging infrastructure) thus reducing vehicular costs.

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

Reviewer 1:
The reviewer repeated the observations of reviewers from the previous year that resources are probably sufficient to address the SAE activities, but insufficient to cover some of the other activities.

Reviewer 2:
The reviewer said inconclusive, funding information is not provided

Reviewer 3:
The reviewer reported that it is difficult to value this effort compared to other needs for resources.

Testing of Wireless Charging Systems for Codes and Standards Development: Barney Carlson (Idaho National Laboratory) - vss096

Presenter

Barney Carlson, Idaho National Laboratory.

Reviewer Sample Size

A total of three reviewers evaluated this project.

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

Reviewer 1:

The reviewer commented that there was excellent testing setup and coordination with other relevant regulatory authorities. The primary value is in helping to establish standards and procedures for wireless and EVSE test equipment. The reviewer added that the independence provided by a government-funded laboratory is also invaluable.

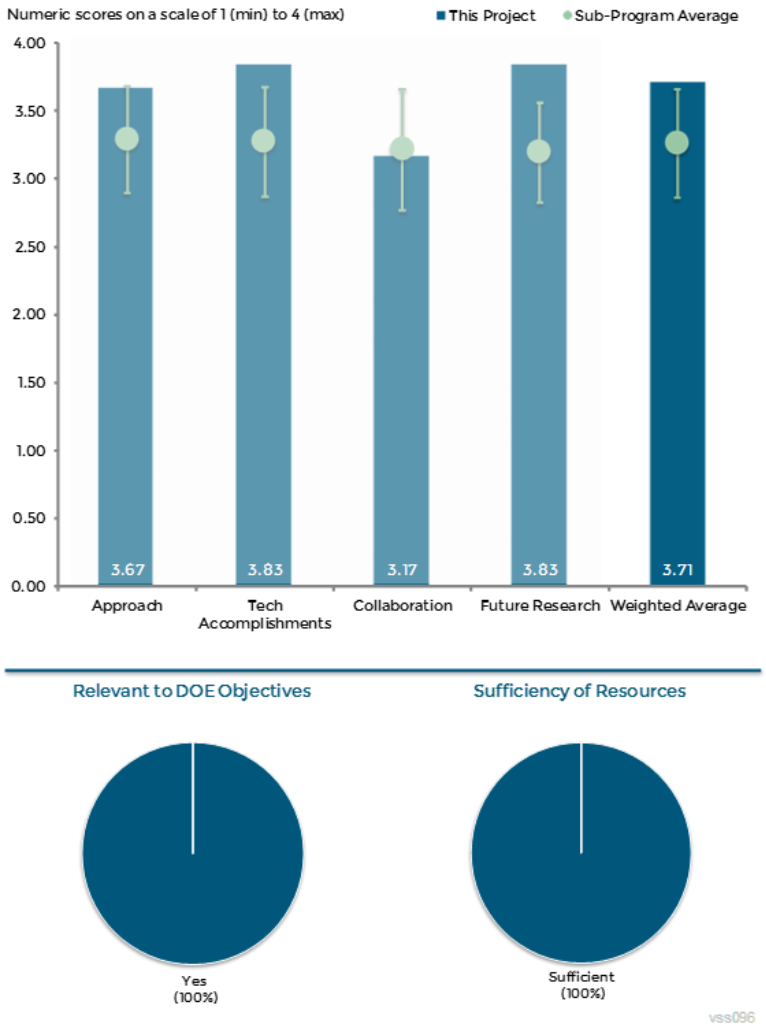

Figure 1-13 Testing of Wireless Charging Systems for Codes and Standards Development: Barney Carlson (Idaho National Laboratory) - Vehicle Systems

Reviewer 2:

The reviewer said that there was a thorough job of testing the equipment and clear, concise reports on the INL website.

Reviewer 3:

The reviewer reported that this is an essential program in the adoption of EVSE technology. Effective standardization will result in greater efficiency and reduced safety issues to the end user (John Q. Public), thus lowering the barrier for mainstream acceptance of EV technology; however, the reviewer is anxious that DOT is independently moving forward in the Global Technical Regulation (GTR) process defining safety performance test procedures and pass/fail criteria without any reference to this work. It is noteworthy to point out that their assumptions may negate some of the outcome of this project. The reviewer expressed great concern about the breakdown of communication between DOE and DOT that has occurred in the past year and half. This breakdown is exemplified by this project, and it is one that must be rectified. In addition, on June 16, 2015 Argonne National Laboratory was awarded funding by DOT intended to support development of test protocol and pass/fail criteria for this GTR regulation.

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

Reviewer 1:
The reviewer remarked that there was excellent technical output that contributes to the advancement of wireless charging technology.

Reviewer 2:
The reviewer noted that quantifying the magnitude of the difference between bench and in-vehicle is an important contribution; however, the reviewer asked how the project comes to terms with the rather low in-vehicle charging efficiency (Chevy Volt), compared to the higher in-vehicle efficiency numbers claimed by Hyundai in vss102. The reviewer also asked if there are any plans to evaluate the charger being used in the Hyundai. Because the stated objective is to provide unbiased and independent testing for wireless charging systems, it would make sense to have the Mojo Mobility charger being used at Hyundai tested independently at INL. The reviewer asked if the intent is to test only charging systems from the awardees of funding opportunity announcement (FOA)-667 or is it just logistics (non-availability of the system in the desired vehicle, etc.).

Reviewer 3:
The reviewer reported that the approach was well defined and thus far conducted for assessment. The reviewer would like to see, as part of this program, well defined, and documented, repeatable test procedures for the charging procedures. The reviewer further offered to provide DOE and ANL a Level 3 test procedure.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that the project team could establish stronger ties with ultimate users of the test technology being developed (for example, Underwriters Laboratories).

Reviewer 2:
The reviewer commented that this project was, and is, ripe for greater collaboration with DOT/National Highway Safety Administration (NHTSA) to define Safety Performance metrics for regulatory purposes.

Reviewer 3:
The reviewer pointed out that the partners to this project are listed as EPA ENERGY STAR®, Evatran LLC and the SAE Standards Committee. In the Accomplishments (Slide 13), the testing of EVSE equipment from four awardees of FOA-554 (GE, Eaton, Delta, and Siemens) was mentioned. The reviewer asked if these companies are not partners on this project.

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

Reviewer 1:
The reviewer noted that several conductive systems and a couple of wireless charging systems have been tested. It would be great if INL also published comparisons of all the different charging systems in one report.

Reviewer 2:
The reviewer stated that the project team is continuing their current activity. The reviewer then asked if there are opportunities for expansion of scope.

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

Reviewer 1:
The reviewer said that advanced technology is needed for making EVs more mainstream.

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

Reviewer 1:
The reviewer directed attention to previous comments. If the testing is restricted to a few (wireless or conductive) charging systems primarily because of budget constraints, perhaps there is merit to increasing the budget a little to allow a wider range of testing to be done.

Reviewer 2:
The reviewer commented that the resources appear to be sufficient given the scheduled work.

Electric Drive Vehicle Climate Control Load Reduction: John Rugh (National Renewable Energy Laboratory) - vss097

Presenter

Matthew Jeffers, National Renewable Energy Laboratory.

Reviewer Sample Size

A total of three reviewers evaluated this project.

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

Reviewer 1:

The reviewer commented that the tools and instrumentation used are effective. The reviewer added that the question is how the thermal comfort evaluation method addresses the subjectivity of the heat or A/C acceptance performance.

Reviewer 2:

The reviewer said that after a couple years of work in this area, the path toward achieving the goal (10% improvement on EV range) is not clear. With so much emphasis on the transient cool-down or warm-up periods it was not apparent from the presentation that the major deterioration of range in hot or cold weather is getting the most attention. The reviewer added that perhaps the researchers have other data that these transient periods deserve the most attention toward meeting the range goal.

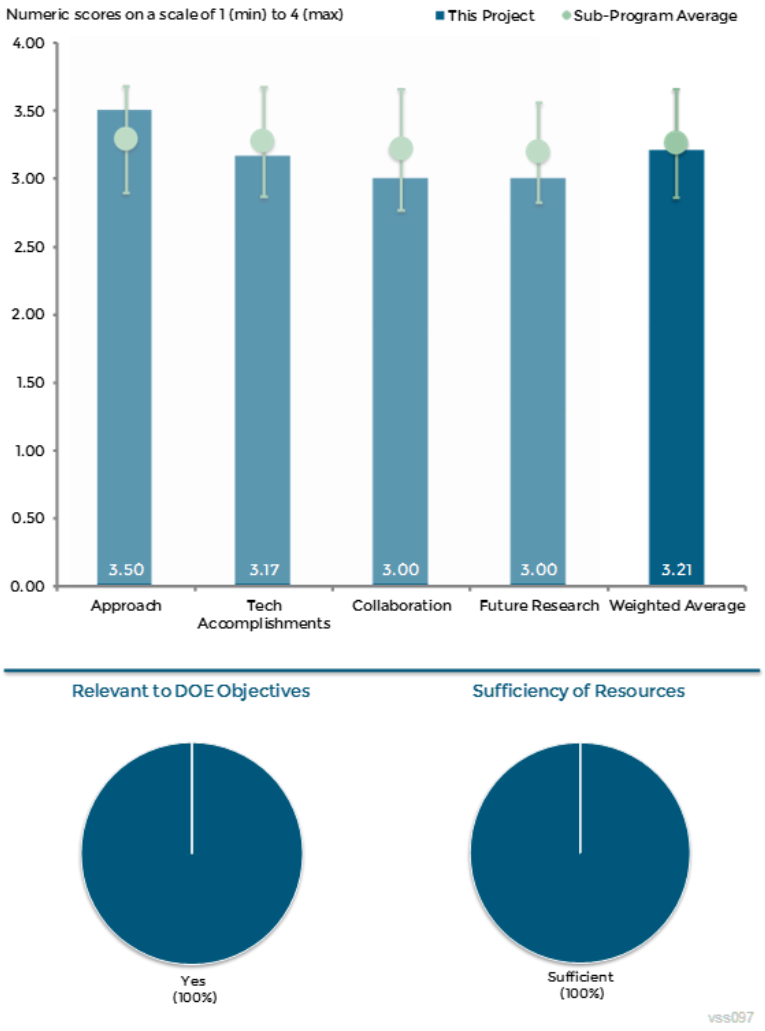

Figure 1-14 Electric Drive Vehicle Climate Control Load Reduction: John Rugh (National Renewable Energy Laboratory) - Vehicle Systems

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

Reviewer 1:

The reviewer commented that the data shown was well illustrated. The reviewer emphasized that it would have been good to show how many vehicles and types were tested.

Reviewer 2:

The reviewer stated that some presentation of an organized path toward the 10% goal would be helpful. Pieces of data show promise, particularly with the supplemental direct ducting to the occupant. The reviewer added that if reducing the starting cabin temperature (from solar load, etc.) in the case of A/C is not a major contributor to increasing the range over the total driving cycle then the emphasis on evaluating potential improvements versus focusing on features for steady-state efficiencies may be unwarranted.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer noted that it would be good to illustrate the specific type of collaboration between partners, other than just listing who they are.

Reviewer 2:
The reviewer assumed there was good collaborations, good partners (including a Ford cooperative research and development agreement [CRADA]) but an HVAC auto system supplier is seemingly absent.

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

Reviewer 1:
The reviewer suggested having real-world evaluation to assess the consumer's acceptance of the proposed design changes.

Reviewer 2:
The reviewer stated that the project team is in the last year of project, and it is not clear if objective will be met to logically wind down the activity

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

Reviewer 1:
The reviewer stated that this topic is very relevant to DOE objectives of more efficient EVs and enabling technologies because cabin HVAC is a major source of range deterioration.

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

Reviewer 1:
The reviewer assumed that funding was sufficient, there being no evidence of a resource shortage in the information presented.

High-Efficiency, Low-EMI and Positioning Tolerant Wireless Charging of EVs: Allan Lewis (Hyundai) - vss102

Presenter

Allan Lewis, Hyundai.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer reported that the approach enables interoperability because this wireless power transfer (WPT) uses the industry standard 85 kHz, and the approach is recognized for the stretch goal of high power transfer (over 20 kW). Also the approach of a stretch goal of greater than 6.6 kW is important for possible future MD and HD application.

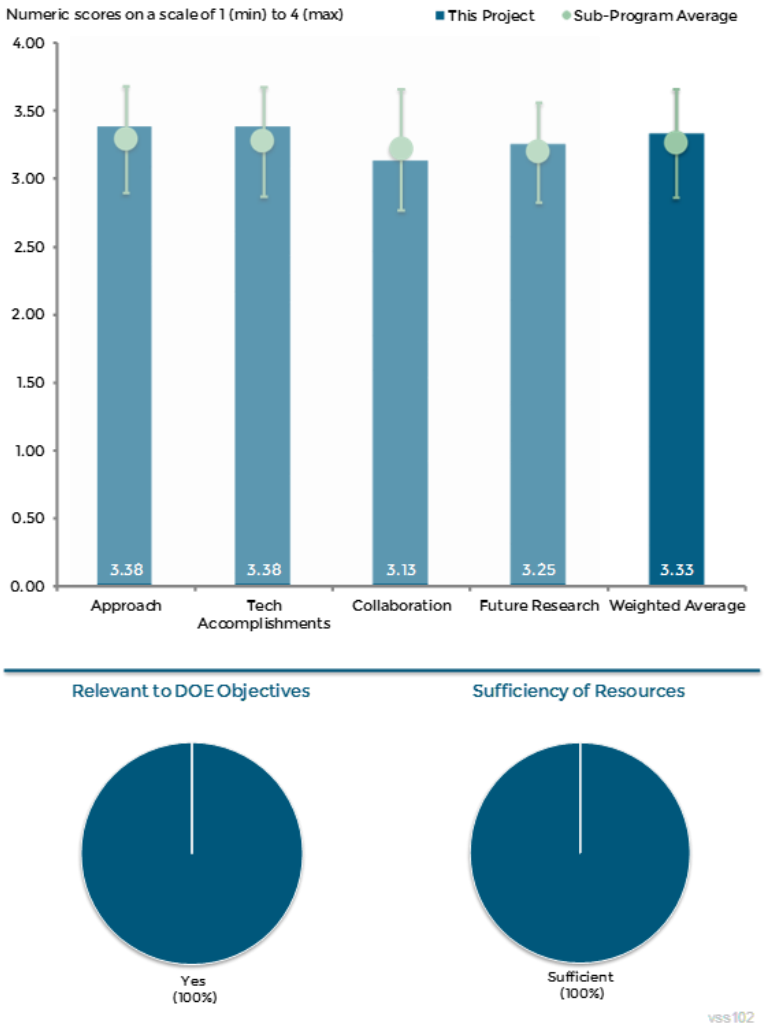

Figure 1-15 High-Efficiency, Low-EMI and Positioning Tolerant Wireless Charging of EVs: Allan Lewis (Hyundai) - Vehicle Systems

Reviewer 2:

The reviewer commented that the overall project approach involved progressing the developed WPT system through three benchtop generations and will next involve integrating and demonstrating the system on five test vehicles. This approach of refining the system on the bench before taking it into the demonstration vehicles seems prudent. Indeed, the presentation highlighted good technical progress with each benchtop iteration. The reviewer stated that the presenter indicated the benchtop setup was made with no structure around it that might mimic the influence of the vehicle body, and that this was done to demonstrate worst-case electromagnetic emissions. While it is good to make such worst-case observations, it would have been helpful to evaluate some benchtop scenarios with a mocked-up vehicle body surrounding it in order to sanity check the modeling estimates about impacts on efficiency and electromagnetic emissions in a more realistic test scenario.

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

Reviewer 1:

The reviewer stated that technical progress showed much success, and most importantly, showed shortcomings and discussions centered on addressing those.

Reviewer 2:
The reviewer listed the project accomplishments, which included: reducing the footprint of the system through the three benchtop generations; improving the design to a roughly 20 kW power capability (though it has only been tested to 10 kW, which is higher than the official 6.6 kW project goal); demonstrating improving efficiencies in each generation—achieving wall-to-receiver efficiencies over 90% for the benchtop demonstration (of similar magnitude to conductive charging); demonstrating electromagnetic emissions below international standards in most cases;, and identifying an engineering need to address E field emissions along the length of the vehicle, which the presenter felt should not be a problem once the team starts to introduce shielding during the vehicle integration phase.

Reviewer 3:
The reviewer noted that the technical accomplishment is good but appear to be delayed/behind schedule in comparison to 2014 AMR vss102 slides timeline and progress. The demonstrated direct current (DC)-to-DC efficiency of up to 96% across a wide misalignment tolerance is a very good accomplishment. The reviewer added that as well as the low emissions measurements field emissions around the system. The timeline since Phase 2 demonstration (February 2014), for example, integration into vehicle, appears to be in slight delay. The reviewer also said that it has been more than a year since the Phase 2 demo and the vehicle integration is still in progress.

Reviewer 4:
The reviewer indicated that E field measurements appear to be at the edge of safe emissions limits set by International Commission on Non-Ionizing Radiation Protection (ICNIRP) in 2010 for the general public. Commercial product designs usually provide a safety margin that ensures system operational states that are well within the safety region. The reviewer added that the project team should work on increasing the operational safety margin with respect to E field exposure for the prototypes.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that collaboration is good. Mojo Mobility has significant WPT system experience, and Hyundai has significant automotive manufacturing experience. The reviewer also commented that this collaboration has the necessary elements for a potential production WPT.

Reviewer 2:
The reviewer reported that the collaboration appears to be good between Hyundai, the Mojo Mobility sub-recipient, SAE International, and Next Energy.

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

Reviewer 1:
The reviewer pointed out that the proposed work appears to be focused on integration and validation. It would be nice to see a plan for high power demonstration.

Reviewer 2:
The reviewer noted that the project is pending approval to extend the project beyond the originally scheduled end date, and the future work seems appropriately focused on integrating the Gen 3 benchtop prototype into five test vehicles. It seems it might be a good idea to perform the integration on one or two vehicles first, in order to uncover any unforeseen issues before completing integration on the last few. The reviewer added that the presenter also made encouraging comments about a commercial viability study indicating that the system may be commercializable at a reasonable price point following the end of the project.

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

Reviewer 1:
The reviewer remarked that development and demonstration of wireless chargers are critical for advancing EVs in the marketplace. This work facilitates the progress of charging technologies.

Reviewer 2:
The reviewer stated that wireless charging with interoperability capabilities promotes more electric miles traveled by ease of use for consumers as well as reduced occurrence of forgot-to-plug-in.

Reviewer 3:
The reviewer commented that the project is relevant to DOE's petroleum displacement goals as it stands to make vehicle charging more convenient and automatic, which could make PEVs more attractive and able to displace greater amounts of petroleum.

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

Reviewer 1:
The reviewer reported that the resources appear to be sufficient for this large project which includes the development of a high-power WPT system as well as its integration into a production EV.

Reviewer 2:
The reviewer stated that the project seems to be progressing on or under budget.

Wireless Charging: Omer Onar (Oak Ridge National Laboratory) - vss103

Presenter

Omer Onar, Oak Ridge National Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that there was a very thorough project design and execution. The program has advanced the state of the art and is wrapping up with good results.

Reviewer 2:

The reviewer commented that the approach taken is beneficial in providing a path for wireless charging. The one item the reviewer questioned is the underlying benefits toward standardizing the protocols and standards.

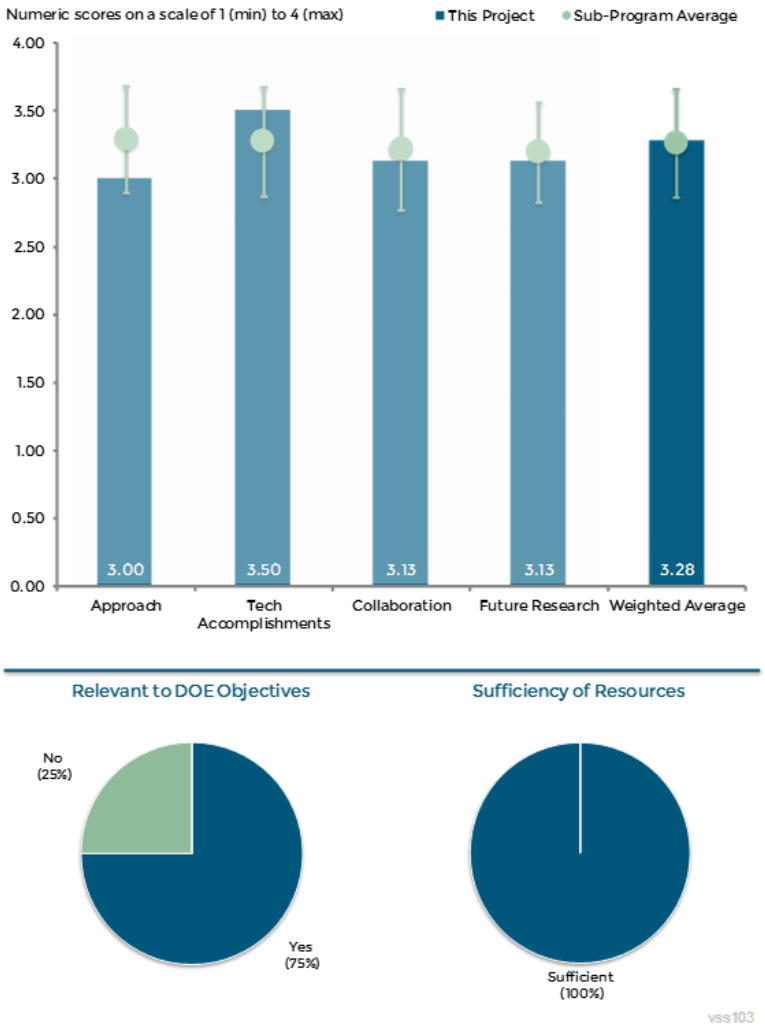

Figure 1-16 Wireless Charging: Omer Onar (Oak Ridge National Laboratory) - Vehicle Systems

Reviewer 3:

The reviewer indicated that the impact of integration with physical infrastructure, i.e., pavement, should be considered early on, as it may have an impact on vehicle integration.

Reviewer 4:

The reviewer indicated that Oak Ridge National Laboratory's (ORNL) approach still seems to be at odds with the SAE J2954 standards, in terms of the central frequency. Despite designing a power electronics component that can operate at this frequency, the rest of the work appears to be using a different frequency than what has been decided upon by the SAE J2954 committee. The reviewer added that it was reasonable at last year's AMR for ORNL to continue on this path because the SAE committee had not fully committed to 85 kHz; however, now that this decision has been made, the work that ORNL is doing at 22-26 kHz is only marginally useful.

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

Reviewer 1:
The reviewer said that it appears all objectives have been met or exceeded. The technical work is very impressive.

Reviewer 2:
The reviewer observed that the work to date is progressing according to plan.

Reviewer 3:
The reviewer commented that there has been some slippage in milestone dates, and the delay between the first milestone demonstrations of the bench test to the in-vehicle demonstration of the second milestone (1.5 years expected)) seems unduly long.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer pointed out that coordination with appropriate partners is very good, including proof-of-concept vehicles. The reviewer asked if there will be technology transfer or commercialization.

Reviewer 2:
The reviewer did not see the larger scope of involving other OEMs and suppliers to achieve a common standard and protocol.

Reviewer 3:
The reviewer stated that there appears to be a good level of collaboration for this project; however, the reviewer wondered why INL has not been brought into this project with their wireless charging test setup. The reviewer asked if this is something that ORNL plans going forward.

Reviewer 4:
The reviewer reported that collaboration with DOT is not described. This is a concern because there may be some advantage to at least recommend to DOE that this coordination take place, especially in terms of physical infrastructure, for example, placement in pavement. The reviewer added that the interaction with SAE J2954 should be described, as well as the potential impacts of their efforts on this project.

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

Reviewer 1:
The reviewer commented that the development was probably too far along to change once the J2954 committee made its decision, but there seems to be no contingency plan to mitigate the possibility that the committee would make the decision they did. Otherwise, the planned future work seems logically organized.

Reviewer 2:
The reviewer stated that although the impact of infrastructure on project objectives is listed as a barrier, there is no recommendation for considering it as the project moves forward, or as a follow-on project.

Reviewer 3:
The reviewer recommended engaging other enterprises in this project, as a next step, to drive a common standard and implementation protocol. The project outline did not specify clearly the eventual outcome of the project.

Reviewer 4:
The reviewer pointed out that the project is completed in FY 2015.

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

Reviewer 1:
The reviewer noted that this not only supports DOT objectives, but also the DOT Clean Transportation Sector Initiative goals of 80% GHG emissions reductions by 2050, as well as EPA objectives.

Reviewer 2:
The reviewer stated that the project facilitates adoption of EVs by making the charging process simpler.

Reviewer 3:
The reviewer indicated that WPT is seen by a significant proportion of industry observers as having high potential for consumer acceptance that could increase the attractiveness of PEVs; however, this project does not advance the state of the art of WPT because the standard has moved away from the project's design.

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

Reviewer 1:
The reviewer stated that resources appear to be sufficient.

Reviewer 2:
The reviewer remarked that the resources appear to be sufficient for the stated milestones.

Zero-Emission Heavy-Duty Drayage Truck Demonstration: Brian Choe (SCAQMD) - vss115

Presenter

Brian Choe, SCAQMD.

Reviewer Sample Size

A total of three reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that this is a challenging project for such an R&D-focused demonstration. It is obvious that the program always had uptime challenges and it is unfortunate that the program is behind. The reviewer added that the approach should have had more failure mode effects analysis (FMEA) type actions to meet deliverables on time, though the program is progressing.

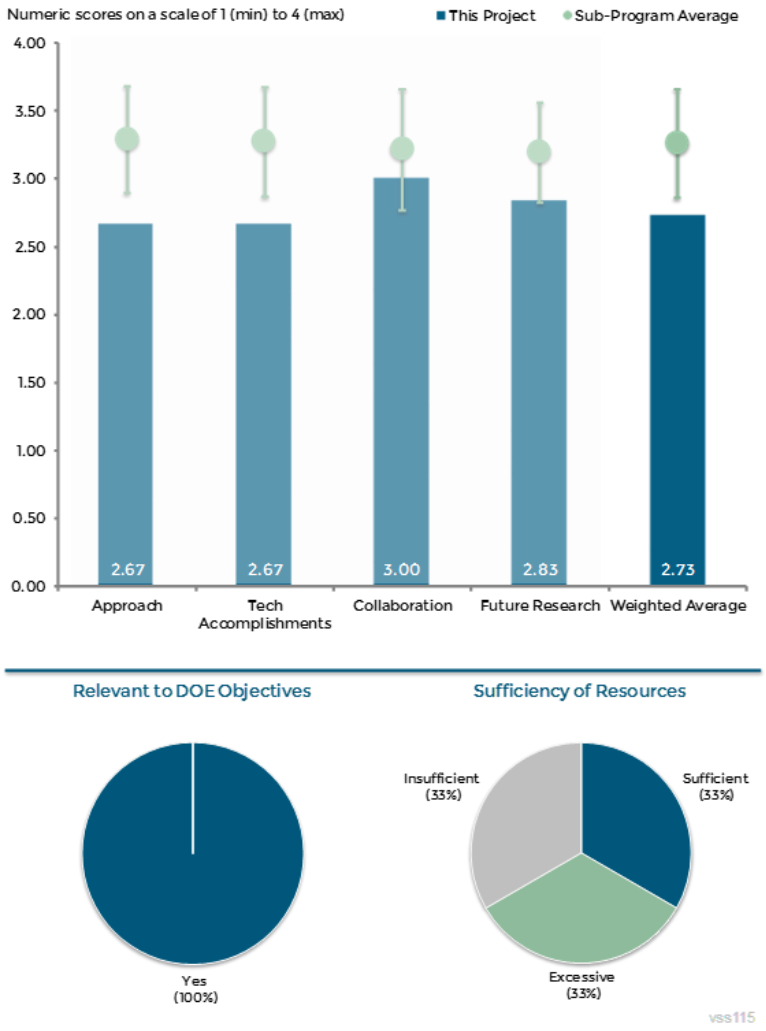

Figure 1-17 Zero-Emission Heavy-Duty Drayage Truck Demonstration: Brian Choe (SCAQMD) - Vehicle Systems

Reviewer 2:

The reviewer reported that the program would benefit from a strong technical lead, given its significant development and manufacturing component. A technical lead by an OEM or technical partner would be familiar with and have experience in addressing the technical challenges. The reviewer added that having different technologies (two different BEV architectures and later a natural gas [NG] HEV) to the program doubles/triples the development and manufacturing scope and effort beyond that originally planned. It would be advisable to focus on completing one BEV architecture alone to maximize the learnings from that technology in service, before embarking on technology number two and number three.

Reviewer 3:

The reviewer stated that, with an overall goal to demonstrate zero emission drayage trucks, the approach is good. It is challenging to get functioning prototypes out on the road for the first time. The reviewer added that it is not clear what mechanisms are in place to capture the operational issues with these vehicles. NREL will collect the quantitative information on performance, but the reviewer asked about information for each truck type that addresses how well it can replace the current baseline vehicles. Things like the percentage of routes it can cover and any performance anomalies that would dissuade a fleet operator from acquiring a certain design/technology are potentially important.

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

Reviewer 1:
The reviewer commented that the existence of operational zero emission drayage trucks is a breakthrough by itself.

Reviewer 2:
The reviewer commented that notwithstanding all the challenges, trucks are built and overcoming uptime and performance issues. The reviewer is sure massive learning is going on by the participants. These should be fully documented and shared with as many people as possible, including other manufacturers and interested parties.

Reviewer 3:
The reviewer indicated that significant technical problems led to deployment delays and a two-year extension request. The reviewer would like to see specific performance indicators that quantify the benefits of this technology in service such as fuel saved/emission reduced, etc. compared to baseline.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer reported that collaboration appears to be effective and at an appropriate amount.

Reviewer 2:
The reviewer cited a good team focused on these few trucks for this particular demonstration. The reviewer asked if the project team have or has considered some form of advisory group. This could have other interested parties help with solutions and significant and quick learning. The reviewer was not sure that this is a possibility within the DOE rules on such projects but would love to see this.

Reviewer 3:
The reviewer pointed out that the principal investigator (PI) does work with integration partners TransPower and U.S. Hybrid; however, the integration partners should play a larger role to ensure the functionality of the vehicle and provide adequate support during the deployment phase, because the vehicles put into service are essentially mule vehicles with a high propensity to break down.

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

Reviewer 1:
The reviewer stated that the proposed work is a logical progression of the current effort.

Reviewer 2:
The reviewer recommended that the project team complete the deliverables and document all learnings.

Reviewer 3:
The reviewer commented that the addition of an NG HEV architecture unnecessarily expands the scope of the project and introduces significant additional technical risk which the project cannot afford. The reviewer advised that the project team focus on existing HEV architectures and collect more data on them to gain a better understanding of the benefits.

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

Reviewer 1:
The reviewer reported that although there are only few drayage trucks in the country, their regions of operation cause real issues with air quality, etc. The great news is that we have an early adopting vocation/duty cycle that can help demonstrate a potential long-term petroleum replacement solution for a great deal of other truck applications.

Reviewer 2:
The reviewer said that technically this program contributes to petroleum displacement; however, the drayage application is not a major contributor to petroleum consumption by commercial vehicles on a national scale. Even the most successful outcome of a drayage application will not result in a large dent in fuel consumption, because the technologies deployed in a drayage application will not translate well to long-haul trucking where most of the fuel is consumed.

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

Reviewer 1:
The reviewer guessed that this has to be insufficient as many of the partners are pulling out.

Reviewer 2:
The reviewer said that not much money was spent in the first years of the program. It will be difficult to make up the spend.

Zero-Emission Cargo Transport Deployment Projects: Nicholas Williams (Houston-Galveston Area Council) - vss116

Presenter

Nicholas Williams, Houston-Galveston Area Council.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

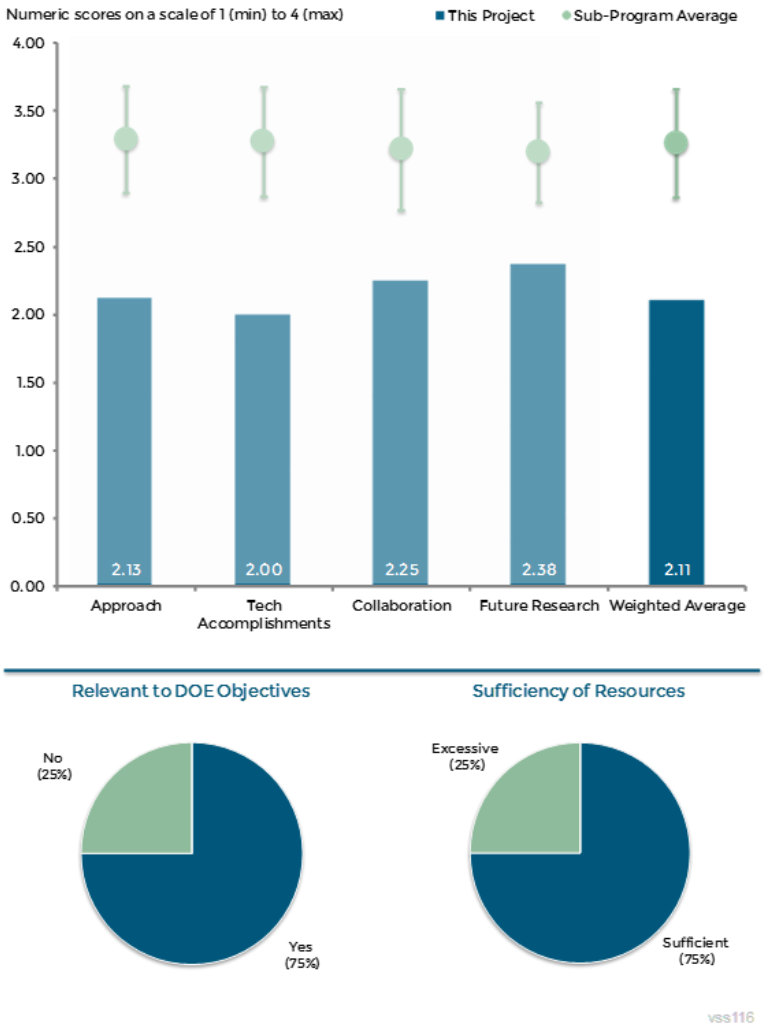

Figure 1-18 Zero-Emission Cargo Transport Deployment Projects: Nicholas Williams (Houston-Galveston Area Council) - Vehicle Systems

Reviewer 1:

The reviewer stated that though there has been limited progress from last year, and the selection of fleet partner should ensure some level of evaluation, there needed to be simulation of largest benefits from this type of technology deployment to ensure industry support. The reviewer added that the technology maturity level may not have been appropriate for full vehicle deployment without a vehicle integration partner with substantial committed resources, an appropriate infrastructure partner and appropriate technology resources to plan both primary and auxiliary plan to acquire useful information that could be better used to project benefits of technology deployment versus other infrastructure deployment.

Reviewer 2:

The reviewer pointed out that unfortunately, this project has a risk of producing demonstration data contrary to wide acceptance as it may re-emphasize the extent of the barriers.

Reviewer 3:

The reviewer commented that the project from the hydrogen (H_2) and EV side is well behind schedule; problems associated with partnership required new contracting.

Reviewer 4:

The reviewer noted that two of the key items on the presentation's Approach Slide were to make sure that the deployed technologies are available and that they are cost-effective; however, these elements are contradicted by the limited vehicle availability through the first two-and-a-half years of the project and the plan to use huge subsidies to fund the vehicle purchases with no clear plan of how to ultimately make the technology cost-effective. The reviewer added that, when asked about how commercial viability might ultimately be achieved,

the presenter could not offer any concrete details and simply stated that the hope would be that prices would ultimately come down and that the project team hopes the demonstration will increase exposure and interest in the technology. The reviewer would have preferred to see the approach lay out a precise vision for how the project will help overcome commercialization barriers and give detailed plans on data to be collected and comparisons to be made with traditional cargo transport powertrain technologies.

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

Reviewer 1:
The reviewer noted that the first year reporting period had very little funding spent, due to difficulty engaging appropriate partners. Scope change to reduce number of trucks required should have allowed new focus to evaluate various vehicle technology potentials and commercial viability.

Reviewer 2:
The reviewer reported that this area of technology application is critical in achieving meaningful reduction in petroleum use as this sector uses over 60% of the resources; however, the barriers are very real and this project defined them very well.

Reviewer 3:
The reviewer stated that the presentation's one slide of accomplishments was not very encouraging for a project that began in October 2012. For the most part accomplishments consisted of adjusting partnering arrangements, project plans and issuing a call for proposals. The reviewer added that it would have been nice to see more technical detail, such as specification requirements and selection criteria for respondents to the proposal call, or projected performance for the vehicle designs from the winning proposers.

Reviewer 4:
The reviewer commented that vehicles have not yet fully been procured, and are behind schedule. This project requires some attention in getting these vehicles into fleet.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer pointed out that there was a problem with the initial partners. This project could use additional support and technical knowhow from a large OEM.

Reviewer 2:
The reviewer said that, based on the project delays and challenges encountered, the project does not seem to have had very effective collaboration and coordination to this point. It is particularly disappointing that financial collaboration from state and local entities seems to have fallen through entirely.

Reviewer 3:
The reviewer stated that the project may have benefited by a more direct relationship to the SuperTruck programs and leveraged combined resources.

Reviewer 4:
The reviewer noted that difficulties in obtaining vehicles (and partners) is indicative of the technology readiness for this type of vehicle mission (duty cycle) and an inability to make a strong business case in the near-term without substantial incentives or regulation involvement.

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

Reviewer 1:
The reviewer indicated that with the exception of the award to United Parcel Service (UPS) for AMP to deliver 16 electric delivery vehicles, all the substantive project work remains in this future work category. Given the challenges to date, the most logical plan may be to complete work with UPS and the AMP vehicles and cut losses on the remainder of the project. The reviewer added that if the project is to be extended, the approach shortcomings should first be addressed with a clearer value articulated, to include at this point making a compelling justification for the value to be realized beyond that from the much farther advanced Zero-Emission Drayage Truck demonstration in Southern California.

Reviewer 2:
The reviewer stated that the approach described is solid and hopefully can produce meaningful data for hydrogen fuel cell and EV hybrid acceptance into the field.

Reviewer 3:
The reviewer reported that there are barriers in getting the procurement and implementation of the vehicles into the fleet.

Reviewer 4:
The reviewer said it appears there is an appropriate plan to complete the initial intended deliverables, though the delays raise questions concerning the capability of this team to meet the planned goals.

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

Reviewer 1:
The reviewer stated that while it does in theory, though there should be a minimum requirement to model and indicate vehicle technology benefits and cost in near and longer terms.

Reviewer 2:
The reviewer noted that successful commercialization of fuel cell trucks for port operations and of BEVs for parcel delivery would certainly help displace petroleum, but the focus of this project seems to have had challenges navigating bureaucratic obstacles. The reviewer added that the presenter was not able to make a compelling case for how the project helps address key barriers from DOE's Multi-Year Program Plan (MYPP) or how it could ultimately help realize national benefits through viable commercialization of the proposed technology, so this does not seem to be a very relevant use of Federal funds.

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

Reviewer 1:
The reviewer stated that in addition to the reasons already conveyed in the previous sections, the project expenditures have been significantly under budget, which is good because next to nothing has been accomplished.

Reviewer 2:
The reviewer said that H_2 hybrids would be excessively expensive. Very little progress has been made with partners, this was modified.

Thermal Control Projects: Dileep Singh (Argonne National Laboratory) - vss132

Presenter

Wenhua Yu, Argonne National Laboratory.

Reviewer Sample Size

A total of five reviewers evaluated this project.

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

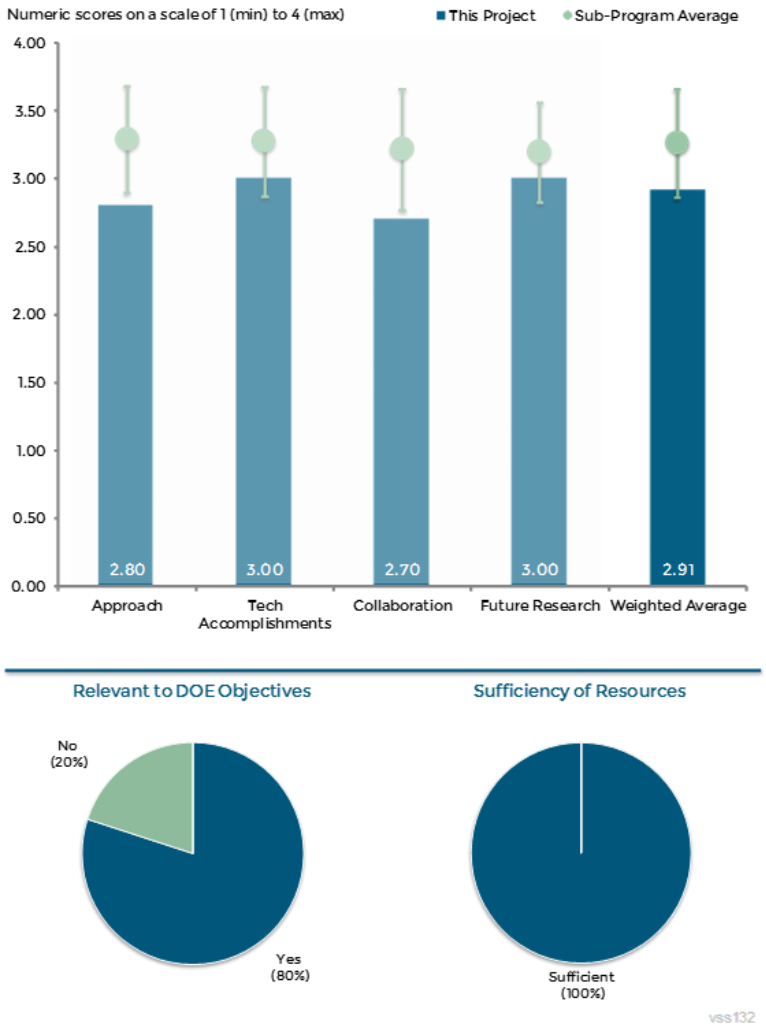

Figure 1-19 Thermal Control Projects: Dileep Singh (Argonne National Laboratory) - Vehicle Systems

Reviewer 1:

The reviewer stated that overall the approach was good. A rough quantification of the potential cost savings associated versus the cost of the cooling system should be considered. In the presentation, more clarity in describing the control variables would be helpful. The reviewer suggested flow rate, power output from power electronics, etc.

Reviewer 2:

The reviewer noted interesting basic research work that may be useful in industry. It is not clear that addressing only inverter cooling would actually lead to eliminating the low-temperature loop due to battery cooling issues.

Reviewer 3:

The reviewer said that in general, this is a very methodical approach. All the work so far revolves around steady-state operating conditions in a lab environment. The reviewer added that more thought should be given to how the system would perform in real-world conditions and the likely challenges that would be faced in making it feasible.

Reviewer 4:

The reviewer commented that the technology being evaluated is relatively old and the reviewer suggested studying more recent technologies for comparison.

Reviewer 5:

The reviewer indicated that the authors need to justify their focus on inverters although the thermal control technology can be applied to any power electronic component. For example, the reviewer asked if it is because of all power electronic components, inverters generate the most heat. The authors need to justify why the team focuses on using a coolant inlet temperature threshold of 105°C (even though it was explained orally during the reviewer's question and answer. The reviewer added that the authors did not explain what the costs,

disadvantages, and/or demerits are of subcooled boiling technology in the presentation (although the benefits were explained), see related comment below on collaboration. Also the reviewer pointed out that the authors did not explain why they chose the COMSOL model to provide thermal simulations, when it is a fairly new model and has not undergone the same kind of use and testing as older, more traditional models available.

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

Reviewer 1:
The reviewer noted there was good progress so far. Experimental demonstration of hardware in a transient setting that emulates real-world operation will be critical to the validation of the technology.

Reviewer 2:
The reviewer pointed out that there was good progress on understanding steady-state operating conditions as mentioned before. Reality bites, however, and there should be more effort on accounting for the severity of the underhood environment, and its effect on the behavior of the power electronics module and the coolant system. The reviewer added that transient cycles are mentioned, but it may be necessary to employ some non-standard cycles to test the capability of the system under extreme operating conditions. The standard Federal Test Procedure (FTP) cycles may not be sufficient. The reviewer also stated that improvements to the cooling system as addressed by this project definitely help in reducing fuel consumption, ultimately resulting in petroleum displacement, but the vehicle cannot be sold if it cannot satisfy the operating needs of the vast majority of its drivers. The reviewer also reported that in the previous accomplishments slide (Slide 8), the results of the various studies are very informative, perhaps it would be helpful to look at the impact of variability in the various input parameters. For example, the junction temperature numbers are very precise; the reviewer asked if it would make sense to show it as a band of temperatures within which the temperature could lie.

Reviewer 3:
The reviewer remarked that the design changes shown do provide improvements in the cooling performance; this was done on an earlier generation Prius. The reviewer added that the question was the most recent production Prius evaluated to assess the improvements made.

Reviewer 4:
The reviewer stated that progress is good. Some issues were not clearly spelled out in the presentation, such as how robustly the process of sub-cooled boiling can be maintained in a highly variable ambient environment.

Reviewer 5:
The reviewer had an issue with the simulation predictions even though they so far agree with only the single-phase laminar flow in the Toyota Prius power electronics cooling channel and directed attention to earlier comments under the Approach section concerning use of the model for simulation.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that collaboration with other institutions seems appropriate.

Reviewer 2:
The reviewer said that the project could use some additional automotive industry partners to provide best overview of the problem.

Reviewer 3:
The reviewer commented that the response to last year’s comments indicated that there is no industry collaboration at the current stage because the research activities are at a fundamental level. Following up on the

theme of the previous comment, even though what is being carried out is basic research, it would still be beneficial to reach out to industry experts to understand the constraints under which they have to operate, so that these aspects are incorporated into the research plan well in advance.

Reviewer 4:

The reviewer pointed out that the authors should have collaborated formally with Toyota to have the OEM evaluate at least theoretically how practical their thermal control technology (of using subcooled small channel coolant) for the inverter or other power electronic component in the Toyota Prius. The reviewer asked how the Toyota design engineers would view the impact of this technology on the vehicle's maintenance and operation, impacts the authors did not consider.

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

Reviewer 1:

The reviewer said that the project is concluding with good progress.

Reviewer 2:

The reviewer had some additional questions that could be considered in the future, including wide band gap materials that have the ability to withstand higher temperatures. The reviewer asked if a new cooling technology is really necessary with wide band gap, or is the use of engine coolant with existing cooling strategies feasible. Also, improved cooling could be used to eliminate one cooling system, thus saving cost. The reviewer asked if it is possible that improved cooling could also (or instead) be used to improve the power density of the PE. The reviewer also asked what kind of cost savings might be possible from this strategy.

Reviewer 3:

The reviewer commented that using more severe drive cycles may be warranted.

Reviewer 4:

The reviewer had the same comment as above in the approach concerning use of the model for simulation.

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

Reviewer 1:

The reviewer indicated that employing boiling cooling could be an enabler to help eliminate the additional cooling system that is usually required for power electronics in a hybrid system. Elimination of the additional cooling loop should help reduce system costs, making hybrid systems with their associated fuel savings more affordable and more widely adopted.

Reviewer 2:

The reviewer stated that if a workable design (eliminating low-temperature loop) can be arrived at, it would definitely help in reducing cost, improving reliability, and more important, reducing cost and encouraging higher adoption rates for EVs.

Reviewer 3:

The reviewer said that means of reducing propulsion system mass by eliminating low-temperature coolant loop helps improve vehicle efficiency.

Reviewer 4:

The reviewer reported that the authors did not justify the need for this project at the beginning. The project team neither showed how much reduction in dollars-per-kWh could be achieved with this technology nor

whether the target of reduction of $8/kWh is feasible. The reviewer added that there is also no demonstration of how much petroleum displacement would occur with achieving this target.

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

Reviewer 1:
The reviewer commented that the work seems to have adequate resources based on the results presented.

Reviewer 2:
The reviewer said that funding appears reasonable for the significance of this project; if this funding was more than $500,000, the reviewer would raise an objection.

Cummins Medium-Duty & Heavy-Duty Accessory Hybridization CRADA: Dean Deter (Oak Ridge National Laboratory) - vss133

Presenter

Dean Deter, Oak Ridge National Laboratory.

Reviewer Sample Size

A total of five reviewers evaluated this project.

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

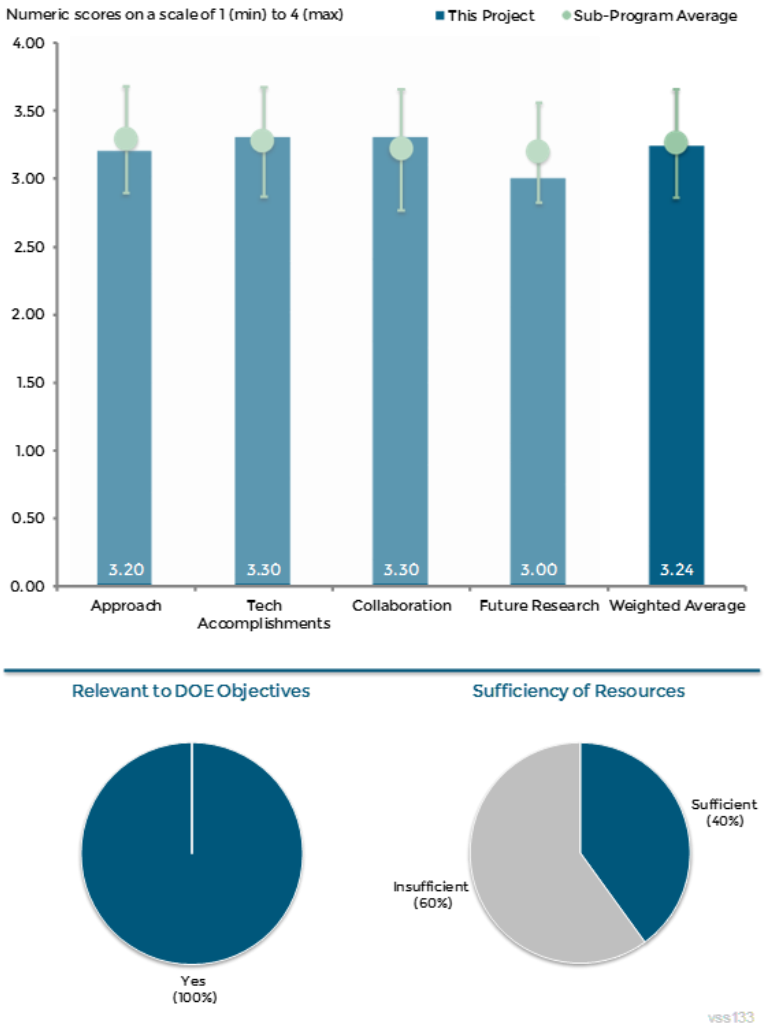

Figure 1-20 Cummins Medium-Duty & Heavy-Duty Accessory Hybridization CRADA: Dean Deter (Oak Ridge National Laboratory) - Vehicle Systems

Reviewer 1:

The reviewer stated that the project team had a strong approach that started with detailed physics-based modeling to show which HD and MD vehicle accessory components and which duty cycles would benefit most from accessory electrification. The reviewer added that modeling results are verified through HIL testing. System performance will be optimized and measured (and compared to a baseline system) through full system testing on a dynamometer test cell. Also, the reviewer said that from 2014 to 2015, emphasis appears to have shifted from component testing to on-road system testing in a vehicle. The reviewer asked if this change was requested or approved by the VTO.

Reviewer 2:

The reviewer indicated that the project needs to consider some other critical barriers including costs and weight of the developed system. Also, the project needs to address human behavior (i.e., driver) for better understanding of hotel use.

Reviewer 3:

The reviewer commented that this project contributes to overcoming most barriers. The capability being developed can enable overcoming the barriers if used to identify cost effective alternative accessory drive system designs. The reviewer stated that it is not clear how this project overcomes the cost barrier, perhaps by avoiding new design solutions that do not provide adequate benefits.

Reviewer 4:
The reviewer pointed out that the trade-off of cost/weight on line-haul economics of both conventional and proposed system should be taken into account to show whether it is a significant factor when considering the objective of reducing GHG emissions.

Reviewer 5:
The reviewer said that this review was presented by a person other than the PI (Mr. Deter). It is a multi-year project and it should be noted to all PIs with multiyear projects that the reviewers are different so the original purpose of the project should be restated. Specifically, the reviewer added what Cummins' objective was in pursuing a CRADA. This needs to be clearly stated so that the outcomes could be assessed against the intended purposes of the CRADA.

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

Reviewer 1:
The reviewer stated that since last year, two milestones have been completed and two others have been started. The physics-based accessory models appear to have additional detail over last year. The reviewer added that the 2014 and 2015 slides both show (apparently the same) data indicating that for HD line haul trucks, electrification of accessories for anti-idle hotel load needs is a more effective application than powertrain hybridization. The reviewer concurs, but unless this project has produced substantially higher-fidelity data in support of this conclusion, this is not a new finding. The Proposed Sleeper Cab Idle Mitigation no longer includes connectivity with shore power, engine start/stop capability, or traction assists to the engine. The reviewer also said Integration of NREL's Cool Sim Model, Conventional Air Conditioning Testing, Electric Air Conditioning Testing, and Prototype Testing and Vehicle Integration were achieved this year. Developed and designed a new prototype system that was first assembled and is being tested in an HIL environment as well as being prepped to be installed in a test vehicle.

Reviewer 2:
The reviewer said that there are significant accomplishments; however, the mitigation plan should think beyond the development of the systems. The project should also consider the economic trade-off between fuel consumption and use, costs and weight of the system.

Reviewer 3:
The reviewer commented that it was hard to understand the technical path and how it intertwined with Cummins' work. By not having the PI present, questions could not clarify the technical work. The reviewer added that there was also no Cummins representative there to support. The reviewer could assume that the work could lead to a positive conclusion but was not sure. Achieving a full system model is a very necessary task to complete for future development of new versions of the accessory drive system. The reviewer added that how well this was done could not be assessed from what was presented.

Reviewer 4:
The reviewer noted that as a tool development project it can enable the overcoming of barriers if applied diligently. It would be helpful to understand the range of truck propulsion and accessory topologies this tool is intended to support. The reviewer added that for a Class 8 line haul this effort seems a bit mismatched. For other truck applications that have several non-mobility based accessory requirements in addition to the traditional accessories, this capability may be more meaningful. The reviewer asked how this model integrates different duty cycles for the vehicle; for the engine; for the engine water pump. Electrified accessories open the door to new accessory duty cycles that could provide an efficiency gain of their own. The reviewer asked if there is a means to operate the accessories differently from how they operate when mechanically coupled to the crankshaft.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer said that the project has good collaboration with partners from industry and national laboratories.

Reviewer 2:
The reviewer reported that collaboration seems appropriate for the scope of the effort.

Reviewer 3:
The reviewer stated that the project team had added a productive collaboration with NREL since last year in response to a reviewer comment as well as collaborations with EMP and Masterflux. The reviewer asked if the collaboration with Meritor that was reported in 2014 has simply run its course, or did it fall apart.

Reviewer 4:
The reviewer pointed out that it is a CRADA so coordination is pre-established.

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

Reviewer 1:
The reviewer stated that there is not much time left in this project timing, so suggested just finishing what was planned, as it makes sense on the surface.

Reviewer 2:
The reviewer commented that the project should consider expanding the future work to other areas.

Reviewer 3:
The reviewer indicated that the proposed future work is to follow through with the project and that this seems appropriate.

Reviewer 4:
The reviewer said that one of the stated 2014 objectives was to "Test the new prototype system on a powertrain in the VSI Powertrain Test Cell." In 2015 this has been changed to read, "Test the new prototype system in a real world setting on a test vehicle using one of Cummins test trucks." While real-world data is very important, testing of the prototype system in the VSI Powertrain Test Cell is more controllable and repeatable and should not be shortchanged. The reviewer added that it is good to see the electrified accessory system being baselined against conventional accessories.

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

Reviewer 1:
The reviewer reported that this not only supports DOT objectives, but also the DOT Clean Transportation Sector Initiative goals of 80% GHG emissions reductions by 2050, as well as EPA objectives.

Reviewer 2:
The reviewer remarked that the project has potential for large savings in fuel consumption of HD line-haul trucks.

Reviewer 3:
The reviewer said that because one of the biggest wastes of fuel in line-haul trucks is from accessory loads when resting, as well as when in operation, a new approach to saving fuel due to accessory (hotel) loads will reduce petroleum use.

Reviewer 4:
The reviewer stated that this project is likely to result in electrified accessory systems that reduce or eliminate overnight HD truck idling, resulting in substantial fuel consumption and GHG emission reductions. It will also dramatically reduce local pollutant emissions in areas where truck drivers take their rest periods.

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

Reviewer 1:
The reviewer commented that the project team appears to be making excellent progress along a productive track. Consider providing additional resources so that the team can also develop HD transit bus accessory systems.

Reviewer 2:
The reviewer stated that this project seems resource-constrained, which may help explain its current narrow focus.

Reviewer 3:
The reviewer pointed out that given the complexity of simulating many components and configurations, optimizing these configurations and then validating on an actual test vehicle, the funding seems to be modest.

Reviewer 4:
The reviewer indicated that the project seems to have sufficient resources to complete as scheduled.

Reviewer 5:
The reviewer said the project has sufficient resources.

Vehicle Thermal Systems Modeling in Simulink: Jason Lustbader (National Renewable Energy Laboratory) - vss134

Presenter

Jason Lustbader, National Renewable Energy Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that there was a very good flow to information and solutions.

Reviewer 2:

The reviewer thought the approach is good and that being able to model the system performance and components accurately is a useful tool, especially if it can be co-simulated with Autonomie.

Reviewer 3:

The reviewer commented that the approach is well done. To the extent that it does not duplicate commercial activities, it provides value.

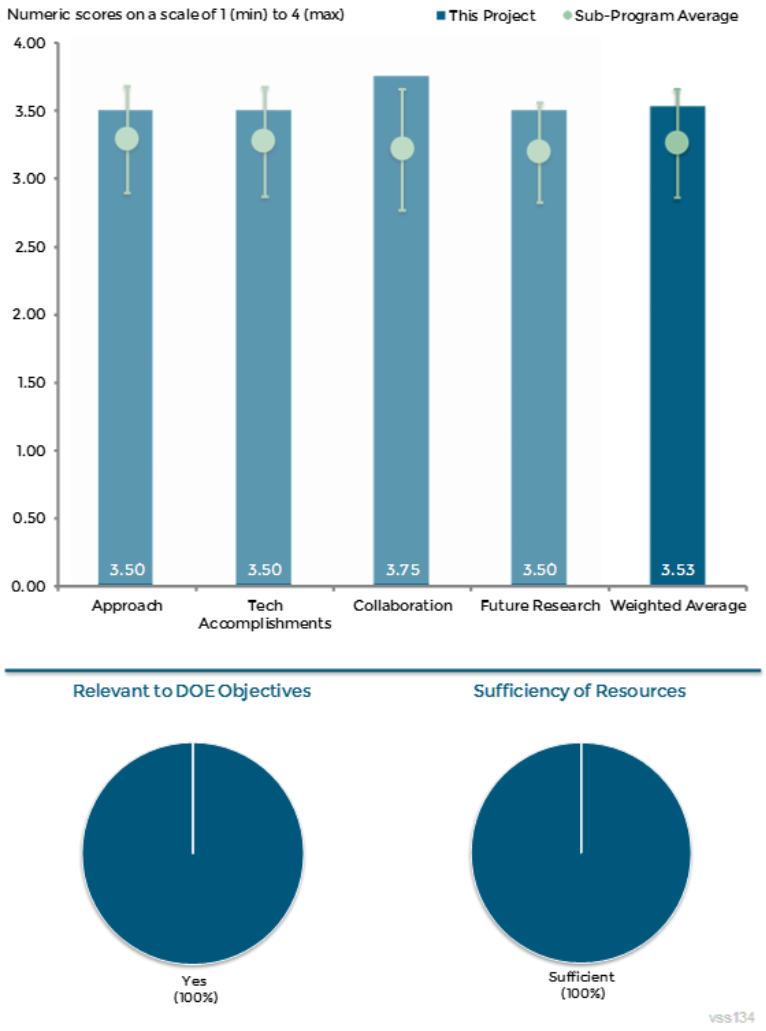

Figure 1-22 Vehicle Thermal Systems Modeling in Simulink: Jason Lustbader (National Renewable Energy Laboratory) - Vehicle Systems

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

Reviewer 1:

The reviewer reported that the project objectives have been met successfully. There are some inherent limitations on what can be modeled due to the breadth of the available design space, but these have been addressed to the extent possible.

Reviewer 2:

The reviewer indicated that the accomplishments appear in line with the program, although the reviewer would like to see the details behind the vehicle cabin model and whether this can be further optimized.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that the project provides good connections and collaborations with users of the software.

Reviewer 2:
The reviewer pointed out that the collaboration with Tier 1 and an OEM is good to see although the reviewer is not sure that the Daimler Trucks North America (DTNA) participation is actually relevant to this project.

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

Reviewer 1:
The reviewer would like to see this program leverage the Cool Cab HD sleeper program and understand if there are other cooling philosophies that can be applied such as zoning, etc.

Reviewer 2:
The reviewer commented that the plan seems appropriate, in particular the validation steps and proof-of-concept projects with industry partners.

Reviewer 3:
The reviewer noted that the project goal of applying developed Simulink tools with industry partners to look at system tradeoffs in co-simulation with Autonomie has implied requirements on the Autonomie project to maintain and ensure compatibility with NREL's Thermal Model. It is also likely that the Autonomie project will be required to provide some level of support functions to ensure the success of these studies with industry partners. The reviewer asked if there is a commitment by DOE to maintain compatibility of these models and enough support to ensure that this capability will function long enough to provide significant return on investment (e.g., three to five years).

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

Reviewer 1:
The reviewer believed that small steps in modelling capability will lead to bigger steps in production as we use the tools to better understand our ecosystem.

Reviewer 2:
The reviewer pointed out that this project is filling a gap in the tools needed to address the design of vehicle systems that minimize energy consumption for management of thermal loads. The current generation of light-duty EVs experiences significant range reduction when operating in extreme temperatures. The reviewer added that HD vehicles also consume large amounts of energy performing thermal management functions. This tool provides the light- and heavy-duty R&D communities with capabilities to evaluate concepts with potential to increase EV range (while operating in extreme temperatures) and increase the fuel efficiency of HD vehicles.

Reviewer 3:
The reviewer said that we need to develop pathways to conserve in all sectors.

Reviewer 4:
The reviewer commented that this addresses the design of non-propulsion systems that represent parasitic loads that consume fuel energy. The project also enables study of design improvements that lead to more efficient systems

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

Reviewer 1:

The reviewer stated that the resources appear to be adequate.

Advanced Climate Control and Vehicle Preconditioning: John Meyer (Halla Visteon) - vss135

Presenter

Heido Crandall, Halla Visteon.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer reported a good basic timeline and progress from modeling through hardware and integration and testing, and a wide range of ambient temperatures in the project scope.

Reviewer 2:

The reviewer stated that the three-tier approach from analysis to design to demonstration is appropriate.

Reviewer 3:

The reviewer commented that gaining electric range without driver discomfort is certainly important in view of the present state and cost structure of lithium-ion (Li-ion) batteries. May benefit the analysis to including drive cycles off-grid origin. For example, the reviewer cited outdoor parking in peak winter or summer temps. This will bring into the analysis optimization of the HVAC in more realistic conditions and not only pre-conditioning for range extension. The reviewer also said how the calculations for energy use have been made, pre-conditioning reduces overall efficiencies.

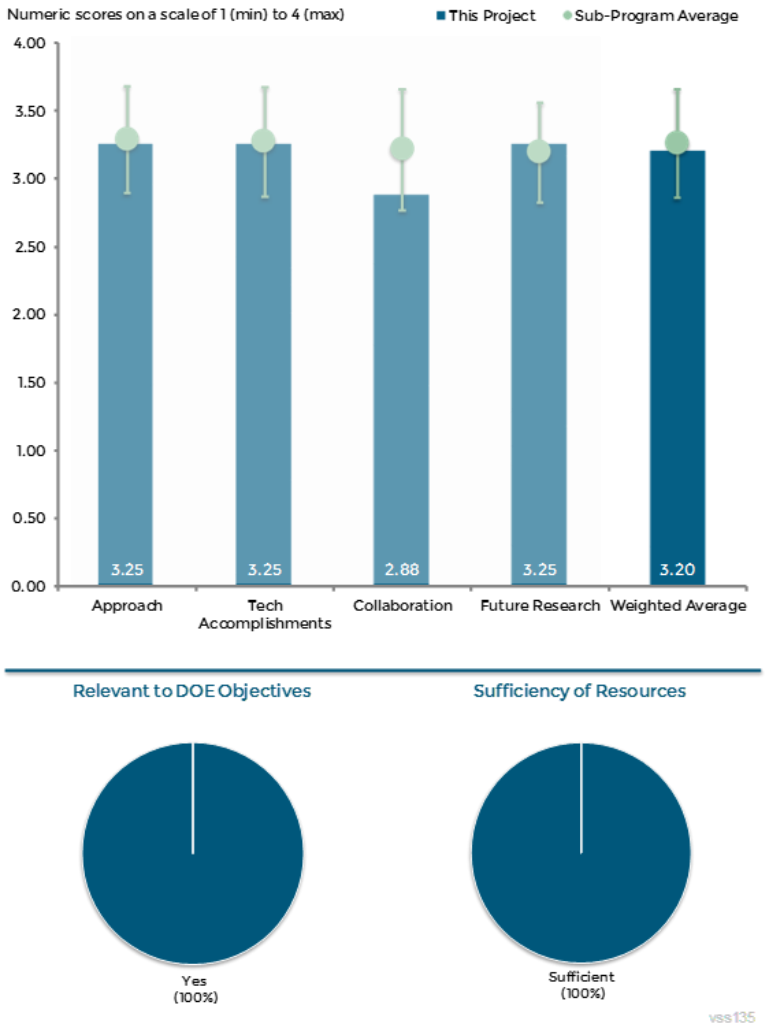

Figure 1-23 Advanced Climate Control and Vehicle Preconditioning: John Meyer (Halla Visteon) - Vehicle Systems

Reviewer 4:

The reviewer indicated that the Halla Visteon Advanced Climate Systems for EV Extended Range project is focused on developing advanced HVAC systems to reduce the impact of climate control loads in PEVs and thereby extend vehicular range. The project utilizes a combination of modeling and testing to identify, verify, and prioritize load reduction opportunities and solutions while maintaining passenger comfort. The reviewer added that several key areas are being considered including cabin pre-conditioning, thermal energy storage, refrigerant system efficiencies, and perceived comfort control and zonal strategies. The approach incorporates a classic phased strategy of subsystem design and specification development; design, fabrication, and validation; and integration and vehicle validation. The reviewer also commented that a model year (MY) 2015 Kia Soul EV with a heat pump and positive temperature coefficient (PTC) heater options has been selected as the test vehicle. One question comes to mind, the reviewer said, asking if any passive load reduction elements are being considered as part of this project such as solar glazing, reflective paint, cab insulation, etc. If not, it may

be good to consider them, as it could lower the overall requirements on the advanced HVAC systems, making them more technically and economically viable.

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

Reviewer 1:
The reviewer noted a number of demonstrated accomplishments including the establishment of performance targets for vehicle test range improvement at six target temperatures (cold to hot); several vehicle-level evaluations in cold, hot, and wind tunnel conditions; wind tunnel evaluation identifying overconsumption as a potentially large energy savings opportunity; potential benefits from driveline thermal storage have been established; a variety of systems, modelling, and correlation activities have been conducted; as well as development of improved refrigerant and coolant loop architecture designs. The reviewer added that the revised refrigerant loop configuration appears to be a simplification likely to lower the cost of the system, while the revised coolant loop adds a component (battery) likely to increase overall costs. In summary, the reviewer said, these technical accomplishments have demonstrated respectable progress toward achieving the range extension performance targets established by the project. The progress currently achieved is most prevalent at the colder operating temperatures, while continued improvement is clearly needed for the moderate and high ambient temperature conditions. The reviewer also stated that the project has presented potential (although vague) solutions to these challenges.

Reviewer 2:
The reviewer commented that this is a very well-structured and necessary analysis that will need publication. It explores the optimization of HVAC in EV space with range and comfort as control variables. The reviewer said, as stated previously, this needs to be completed with non-grid-connected optimization systems and baseline.

Reviewer 3:
The reviewer stated that the progress is on schedule.

Reviewer 4:
While the reviewer understands the importance of vehicle selection, the reviewer was not sure if this would be considered a technical accomplishment, unless the plan included vehicle architecture; the additional testing to identify areas of opportunity for HVAC efficiency gains was far more interesting and impressive. The modeling correlation/validation established a high level of confidence in the project progress thus far.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer commented that a good selection of partners, assuring proper harvesting of available heat, and estimation of the HVAC system improvements.

Reviewer 2:
The reviewer indicated that the project team consists basically of Halla Visteon, Hyundai America Technical Center, and NREL, not a broad team but one that covers all the required aspects from modeling, testing, technology development, through vehicle integration and evaluation up the chain. In other words, a lean team with the required basic elements. As mentioned, the reviewer said Hyundai's participation throughout will help maintain a focus on value not just performance, which is key for ultimate acceptance into the marketplace. It may be good to consider an additional HVAC systems technology developer for the team, especially if the challenges currently facing achievement of performance targets at moderate and high temperatures prove to be particularly stubborn.

Reviewer 3:
The reviewer stated that this would clearly be improved researching multiple OEMs and varied battery cooling strategies. The reviewer believed there is too much implied commercial system development within this project.

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

Reviewer 1:
The reviewer stated that at a high level, future work is sufficiently well-detailed and sequenced for the rest of FY 2015 and early FY 2016. It would have been good to provide some information on future work through FY 2016. The reviewer added that some elucidation of the key barriers/challenges and the potential options for solving/mitigating them has been provided, although additional insight and detail would be beneficial.

Reviewer 2:
The reviewer pointed out that integrating the heat storage tech will be critical in demonstrating in vehicle cold temperature range extension.

Reviewer 3:
The reviewer noted that plans for advanced consideration of energy storage systems (ESS) coolant integration is a good plan, comfort modeling in extreme ambient conditions would be valuable and is also planned. Evaluation on standard drive cycles would be valuable for comparison and contrast to other systems and costs and benefits.

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

Reviewer 1:
The reviewer pointed out that clearly the alignment with DOE goals was in the presentation and highlighted benefits of project success.

Reviewer 2:
The reviewer stated that EV range reduction in cold weather is significant. Addressing this use for real-world concerns is critical. The reviewer added that developing and demonstrating this technology is also critical.

Reviewer 3:
The reviewer commented that this project supports the overall DOE objective of petroleum displacement as development of advanced climate control systems for PEVs will lower auxiliary load requirements on the vehicle, thereby increasing vehicle range and improving consumer acceptance.

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

Reviewer 1:
The reviewer stated that this project is 50/50 cost shared. Resources for the project are sufficient.

Electric Phase Change Material Assisted Thermal Heating System (ePATHS): Mingyu Wang (Delphi Automotive Systems, LLC) – vss136

Presenter

Mingyu Wang, Delphi Automotive Systems, LLC.

Reviewer Sample Size

A total of three reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that the investigation, design, implementation with go/no-go gates is a proper approach. On schedule, design complete for bench testing prior to in-vehicle demonstration.

Reviewer 2:

The reviewer commented that this is a new look at an old technology that will benefit from some new optimization. The reviewer still has interest in off-grid soak time versus effectiveness for this type of technology, and how this will affect thermal battery management. The reviewer asked if there will be a durability side effect.

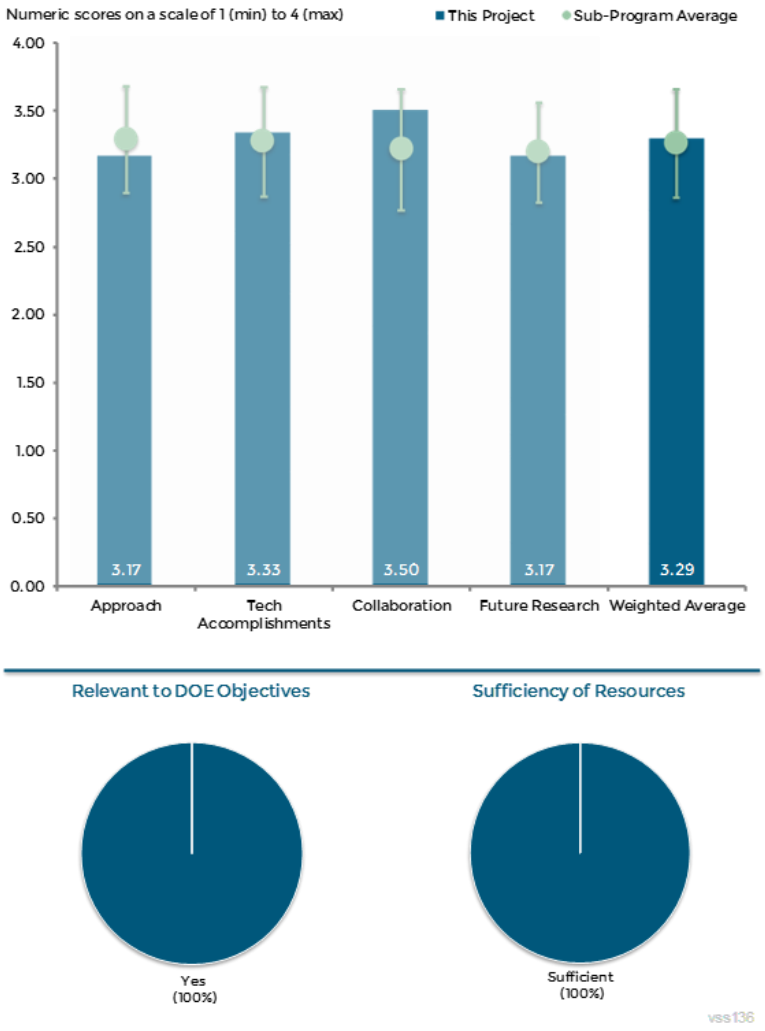

Figure 1-24 Electric Phase Change Material Assisted Thermal Heating System (ePATHS): Mingyu Wang (Delphi Automotive Systems, LLC) - Vehicle Systems

Reviewer 3:

The reviewer reported that the approach seems feasible and uses standard industry tests. It would be useful to show sizing and heating demographics needed and where the system will or will not work (or what size systems would be needed for various temperatures/humidity levels). The reviewer added that extended soak requirements might be needed to accommodate periods where a vehicle is not parked in garage (and plugged in) and how long thermal storage could last. In these cases, a comparison of grid energy required to heat phase change material (PCM) versus battery energy required to heat and/or maintain PCM would be useful, especially as it compares to the baseline battery heating system.

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

Reviewer 1:
The reviewer pointed out that the project team is on target to date. The design and initial packaging are complete, three heaters have been tested on bench. The reviewer added that two PCM materials are now being considered, working on manufacturing process for such a material.

Reviewer 2:
The reviewer stated that there was good progress through budget period one with design and PCM selected and modeled. Further integration work and vehicle-level validation; will be interesting to see in budget periods two and three.

Reviewer 3:
The reviewer believed that this project is a bit narrow in scope when compared to the entire issue.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer commented that the industry collaboration is good with a vehicle OEM, PCM supplier and system supplier. The reviewer suggested the project should also consider another OEM partner to acknowledge any other design requirements.

Reviewer 2:
The reviewer believed that good partners were selected for expected project scope.

Reviewer 3:
The reviewer said that there was a proper blend of industry and suppliers to demonstrate the 20% improvement of EV range in cold temperatures.

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

Reviewer 1:
The reviewer remarked that the project team was on track to demonstrate technology.

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

Reviewer 1:
The reviewer commented that EV-Everywhere will require vehicles to deliver expectations to the customer per range. Addressing the heating concerns in cold temperature is essential; this project addresses this.

Reviewer 2:
The reviewer reported that this project will further enable EV deployment by lowering cost and/or improving range

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

No comments were received in response to this question.

Impacts of Advanced Combustion Engines: Scott Curran (Oak Ridge National Laboratory) - vss140

Presenter

Scott Curran, Oak Ridge National Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that the investigation of advanced combustion technology using system simulation with engine efficiency and emissions map generated in an engine test cell provide the most valuable input to the development of new engine technology. If transient engine maps are made available, this research will be able to help industry to develop the after-treatment system.

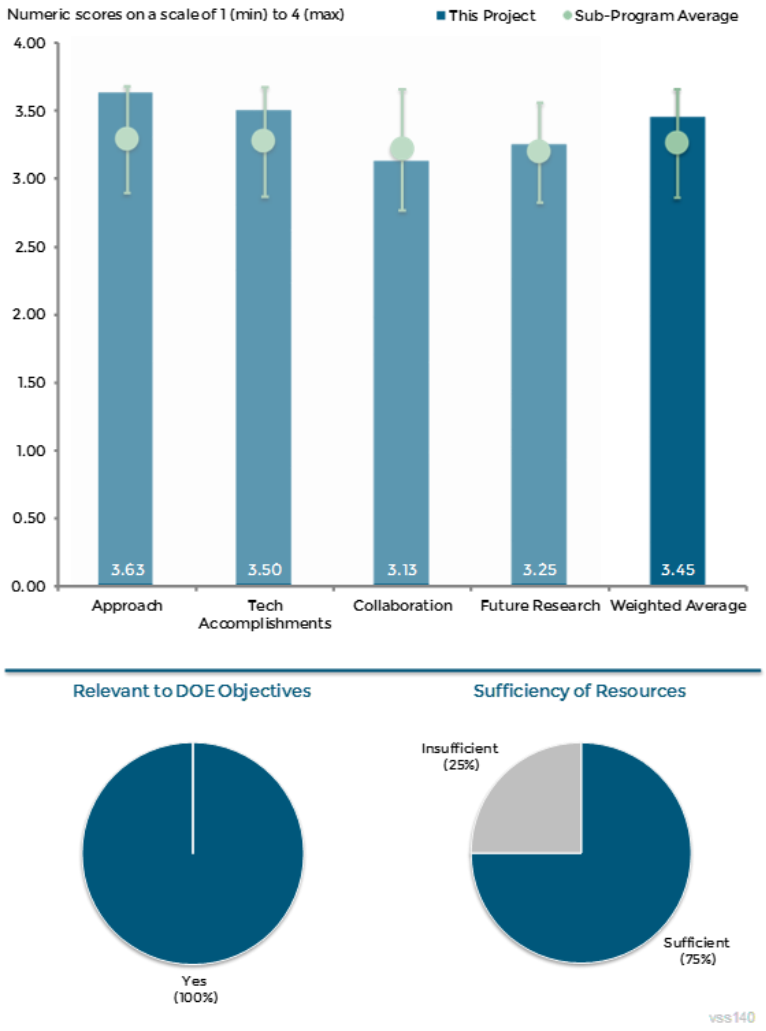

Figure 1-25 - Impacts of Advanced Combustion Engines: Scott Curran (Oak Ridge National Laboratory) -Vehicle Systems

Reviewer 2:

The reviewer cited a solid approach in this rather short-term project, with good progress to date.

Reviewer 3:

The reviewer commented that the approach using steady-state (SS) maps is a good start, but will only go so far. Transients are the biggest hurdle that need to be overcome, especially when mode transitions are concerned. The reviewer thought that the technologies associated with aftertreatment have not been fully understood and this reviewer's recommendation would be to pursue an aftertreatment Tier 1 partner or at least someone who can assist in modelling and providing guidance on where this technology is going.

Reviewer 4:

The reviewer indicated that the research is structured well and focuses on understanding in-vehicle benefits of a new combustion regime, based on operating points found in representative drive cycles. This work is deeply integrated with complementary efforts in combustion. The reviewer added that one weakness that should be better acknowledged in the research is the use of SS engine maps in a transient vehicle simulation. Some discussion to highlight the shortcoming of this approach, based on what is known about reactivity controlled compression ignition (RCCI) transient behavior, would be welcome.

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

Reviewer 1:
The reviewer indicated that the project team appears to be achieving the goals of the project.

Reviewer 2:
The reviewer commented that the results achieved help to overcome the critical barrier.

Reviewer 3:
The reviewer reported that a significant amount of simulation results has been generated, given the modest budget. The results of this work benefit continued combustion research, particularly the need to develop controls for mode switching between conventional diesel combustion (CDC) and RCCI. The reviewer added that the project needs to get more clarification regarding hybrid RCCI versus conventional fuel economy improvement. If this comparison is true, they are essentially combined RCCI/hybrid benefits, which makes it difficult to separate out the benefits.

Reviewer 4:
The reviewer stated that the program appears to be on track but the reviewer did not think the full impacts of temperature and the aftertreatment system have been fully understood. For efficient conversion the aftertreatment needs heat and lots of it. The reviewer added that the results so far look good on the combustion side, but the final tailpipe numbers will not be what is needed unless the AT system is converting efficiently.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that the collaboration with ANL and the other research team is very good. The research team should also consider collaboration with universities, which will make the resource available to young graduate students to better understand the importance of vehicle simulation in the development of new engine technologies.

Reviewer 2:
The reviewer reported a great list of partners, but expressed skepticism of programs that do not highlight specific examples of the help from and output to key collaborators. The reviewer suggested that the project team share these successes in these reviews.

Reviewer 3:
The reviewer commented that, as previously mentioned, the reviewer would like to see an aftertreatment Tier 1 on the team or involved in the project.

Reviewer 4:
The reviewer indicated that collaboration appears to be more ORNL internal. Would like to see a bit more interaction with external organizations who work on RCCI.

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

Reviewer 1:
The reviewer stated that the project team needs to model the transient responses into the program and concentrate on a good aftertreatment model. Interpolation between points in a steady-state map only goes so far.

Reviewer 2:
The reviewer reported that the PI should report the energy consumed in RCCI operation, CDC, and other traditional engine operation. The energy saving resulting from replacement of traditional engine operation by RCCI should be specifically reported.

Reviewer 3:
The reviewer indicated that the future research direction seems appropriate as the simulation activities accompany combustion research. The project team's continued work on aftertreatment refinement and transient operations would be more relevant to support combustion research than the evaluation of HEVs, PHEVs, etc.

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

Reviewer 1:
The reviewer remarked that the application of new combustion technology will continue to play a major role in improving the efficiency of on-road vehicles.

Reviewer 2:
The reviewer commented that any combustion model that increases brake thermal efficiency (BTE) is in the right direction.

Reviewer 3:
The reviewer said that these engines have relevance, have been studied before and can benefit from these types of investments.

Reviewer 4:
The reviewer said that this is a critical step to determine the fuel efficiency of a technology to evaluate system performance in a vehicle. The efficiency gains measured in a test stand do not translate one-to-one to gains made in-vehicle. The reviewer added that this research helps to clarify vehicle-level gains of the technology.

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

Reviewer 1:
The reviewer stated that the development of transient map, especially after-treatment system, needs more time, efforts, and supplies, especially for the RCCI engines.

Reviewer 2:
The reviewer noted a good amount of output given the modest resources.

Powertrain Controls Optimization for Heavy-Duty Line-Haul Trucks: David Smith (Oak Ridge National Laboratory) - vss141

Presenter

David Smith, Oak Ridge National Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

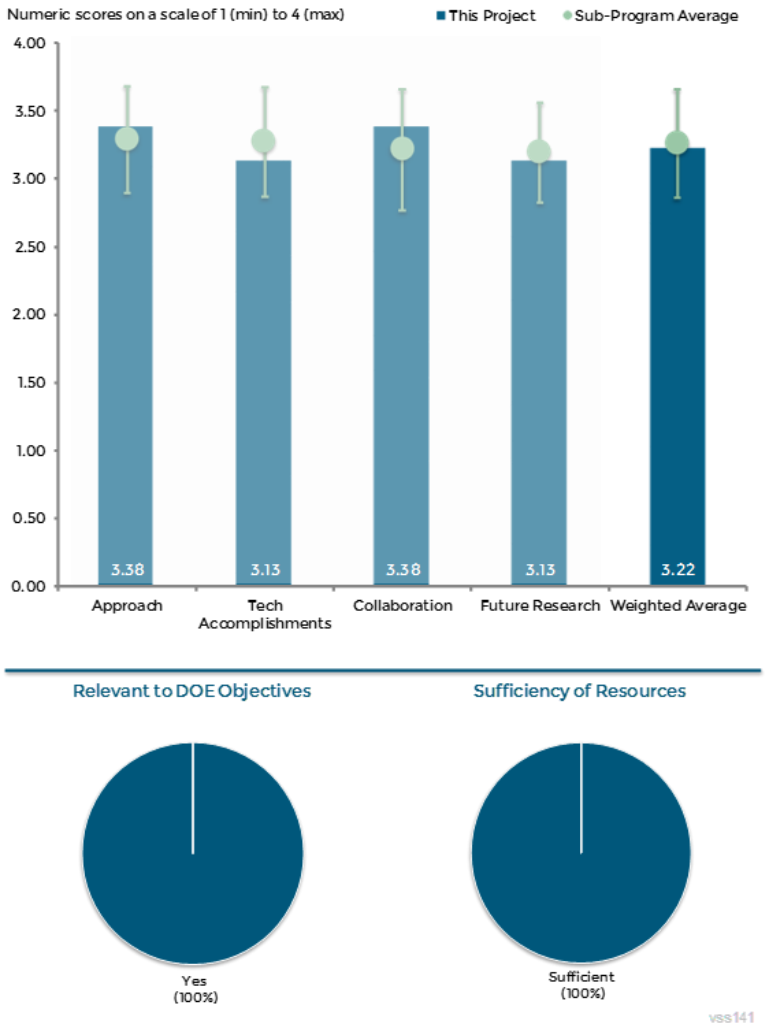

Figure 1-26 Powertrain Controls Optimization for Heavy-Duty Line-Haul Trucks: David Smith (Oak Ridge National Laboratory) - Vehicle Systems

Reviewer 1:

It took the reviewer a second reading, but this project addresses a methodical, logical, sound approach to solving a pressing problem in Class 8 cargo haulers. The issue is complex and this project is using what appears to be an excellent combination of simulation and hardware development techniques.

Reviewer 2:

The reviewer stated that the project shows a good approach plan in all areas including modeling, testing, implementation, and system optimization.

Reviewer 3:

The reviewer noted that the project is well structured and leverages test cell data on RCCI and other sources to develop simulation models to evaluate the potential of RCCI in combination with series and parallel hybrid systems. The reviewer would argue the benefits of a parallel hybrid powertrain on line-haul operation is minimal, given the relatively high cruise control usage of the vehicle and low opportunity for regenerative braking. Having a parallel hybrid on board would not significantly affect the operating points of an RCCI engine as opposed to an RCCI engine without a parallel hybrid. However, the reviewer noted a series hybrid powertrain would be different, and potentially more interesting, in that using an RCCI engine with a series hybrid (or range-extended PHEV) has the potential to run the engine in significantly different points on the map, particularly in the low-load range where RCCI is most efficient. The reviewer added that the results from a series or PHEV hybrid configuration would be very interesting.

Reviewer 4:

The reviewer noted that this project overcomes the barriers within one Class 8 truck vocation. The products of this effort could be applied to other Class 8 vocation projects in the future.

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

Reviewer 1:
The reviewer believed that all projects that address freight moving efficiency rate high on the scale of energy savings and reduced oil dependency.

Reviewer 2:
The reviewer stated the project accomplished progress in modeling; however, more work is needed in the engine testing and optimization steps.

Reviewer 3:
The reviewer stated that the modeling approach and results so far look well poised to generate insights into the effectiveness of RCCI with a hybrid powertrain. The ultracapacitor/battery pack benefits will be highly drive-cycle-dependent. The reviewer added that ultracapacitors will be effective to capture energy from short, quick braking. However, on relatively long, steep grades, the ultracapacitor will reach its energy limits and the battery its power limits rather quickly. The reviewer suggested looking into that sort of drive cycle.

Reviewer 4:
The reviewer stated that the project has made good progress toward completion. It is hard to understand the remaining scope and how the test runs of the hybridized system will be conducted. The reviewer asked what the complete scope of the project is and how much experimentation is planned.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer noted a very good mix of stakeholders and national laboratory talent.

Reviewer 2:
The reviewer stated that the project shows good collaboration with several national laboratories and industry.

Reviewer 3:
The reviewer noted good leveraging of knowledge with other teams in ORNL, ANL and NREL.

Reviewer 4:
The reviewer noted great leveraging of the other capabilities in industry and government. The reviewer asked if the EPA and NHTSA are involved.

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

Reviewer 1:
The reviewer stated that the future plan includes steps for confirming what has been done earlier.

Reviewer 2:
The reviewer believed that the findings on a series hybrid or PHEV variant of the project will be of more interest than a parallel hybrid, given this reviewer's belief that an RCCI engine will not operate much differently with a parallel hybrid as it would with a series hybrid.

Reviewer 3:
The reviewer believed that it is not fully clear what the final products of this project are. The reviewer asked if it is the capability to conduct component-in-the-Loop (CIL) simulations of a hybrid HD powertrain, or is it to

estimate the potential advantage of this architecture, or is it to develop the control strategies for RCCI in a hybridized powertrain.

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

Reviewer 1:

The reviewer noted that it could provide fuel savings.

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

Reviewer 1:

The reviewer believed that project resources are sufficient.

Integration of PEVs with the Grid: Richard Pratt (Pacific Northwest National Laboratory) - vss142

Presenter

Richard Pratt, Pacific Northwest National Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer noted a valid technical approach. Results have significant applicability to DOE EV-Everywhere goals.

Reviewer 2:

The reviewer stated that much work has been done on this by others, including utilities, and the reviewer did not see this grounded in any of this other work. The reviewer did not see issues like power factor being addressed. Kilowatt loads can be much higher if feeder power factors are low. The reviewer believed that this seemed too academic and needed more system realities addressed.

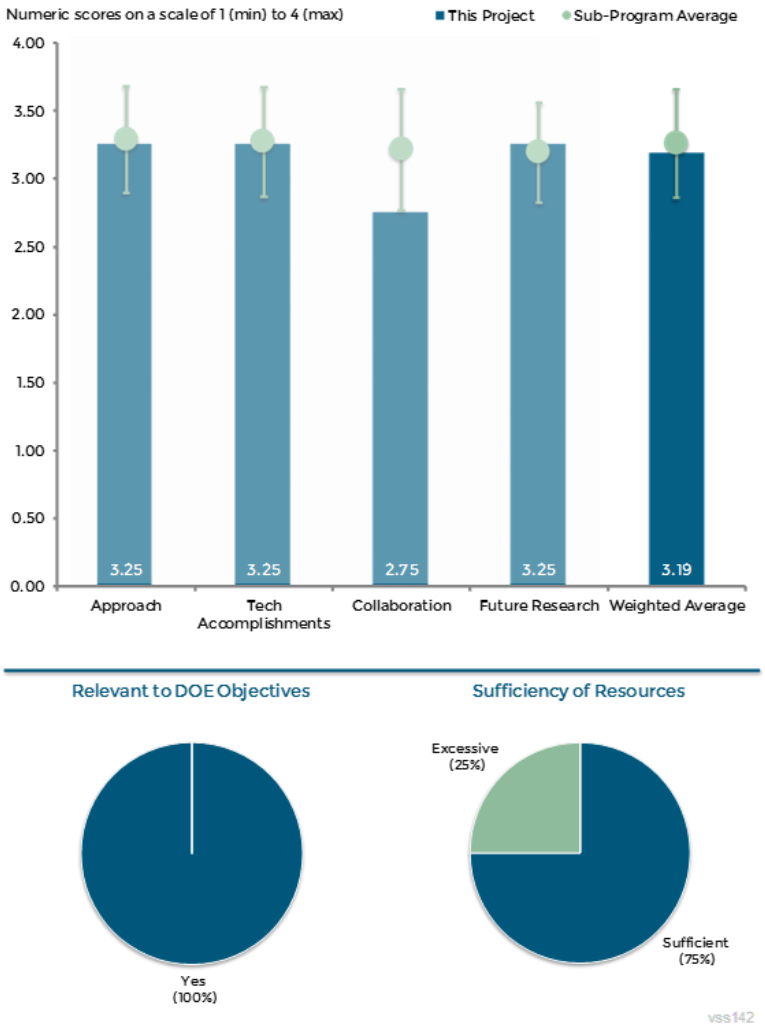

Figure 1-27 Integration of PEVs with the Grid: Richard Pratt (Pacific Northwest National Laboratory) - Vehicle Systems

Reviewer 3:

The reviewer stated that the overall strategy is to quantify distribution effects from PEV responses to utility tariff structures and explore and emphasize PEV V1G (one-direction charging) economic value while minimizing distribution feeder impact. In short, how to maximize the benefits/lower the costs of EVs to consumers while simultaneously reducing the challenges and enhancing the benefits of EVs to the grid. The reviewer believed that the approach to this project is well thought out, logical, and has a natural economic value to utilities and consumers. At the more detailed level, the approach of modeling PEV / Grid Integration of uncontrolled charging and time-of-use (TOU) charging on distribution feeders and conducting economic value propositions is well delineated with value-added results.

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

Reviewer 1:

The reviewer believed that results are tightly focused on original project objectives. Progress is on schedule.

Reviewer 2:
The reviewer stated that the project has an extensive list of technical accomplishments and results including market and distribution feeder simulation results and systems-level observations. A broad and significant level of technical results have been achieved, providing useful information for utilities, consumers, OEMs, and standards definition organizations (SDOs). The reviewer noted that these results are currently useful to utilities and consumers as well as looking over the horizon to potential issues/opportunities in the future. The reviewer added that some of particular interest include knowledge that not all combinations of grid services are compatible (i.e., demand response and time-of-use rates), quantification of feeder limitations when vehicular battery capacities increase (and subsequent charging rates and times increase), and that uncontrolled and time of use charging on moderately loaded feeders can exceed distribution transformer limits. Furthermore, the addition of use cases to the project and specific insights on control and communication requirements is a value add.

Reviewer 3:
The reviewer believed that while the analysis appears rigorous, it is not clear how useful the results are across various actual grid conditions. The assumptions appear the ideal case and may not be applicable in other real-world situations. The reviewer stated that the analysis appears good, but the assumptions and conclusions weak.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that work with INL to obtain EV project data was critical to the credibility of results

Reviewer 2:
The reviewer stated that overall, the level of collaboration and coordination with other entities is acceptable. However, the reviewer would like to echo the comments from other reviewers last year indicating that an increased level of collaboration with utilities, EVSE manufacturers, SDOs, and other entities would be beneficial, including the NREL INTEGRATE project.

Reviewer 3:
The reviewer said that it did not appear that much interaction had taken place with utilities who are actually facing this issue in real time like San Diego Gas & Electric (SDG&E). Some utilities have done their own analysis and it was not clear this was reviewed or considered. The reviewer added that other labs have also done similar analyses that was not referenced.

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

Reviewer 1:
The reviewer noted that the project is nearing completion. Future projects should consider workplace charging and the integration of lessons learned from this project into the overall.

Reviewer 2:
The reviewer stated that lab modelling efforts are important but need to be more clearly guided by real industry situations and problems. Maybe an industry advisory group would add some strategic value.

Reviewer 3:
The reviewer stated that the proposed future research is very well documented and detailed. It provides a clear sense of where the project would like to go and expected outputs covering a number of important areas including additional simulation quantifying potential PEV market value and renewable integration, as well as communication and technology requirements to support value-optimized use cases. The reviewer noted that

communication and control technology hardware and standards hardware are also proposed to be addressed. Additionally, as part of the path forward, three research areas are clearly identified and reinforced through the multi-lab collaborative, namely simulation, emulation, and hardware.

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

Reviewer 1:

The reviewer stated that this project is relevant to DOE objectives of petroleum displacement as it offers specific results and prognostication in maximizing the value proposition of EVs while minimizing or even enhancing their value with respect to the grid. In this way, it is likely to help further consumer acceptance of EVs while mitigating infrastructure challenges.

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

Reviewer 1:

The reviewer stated that resources for this project are sufficient.

Reviewer 2:

The reviewer believed it was hard to determine the relevant cost/value for this project. Modelling is important and can be expensive, but modelling for modelling's sake is not a high priority.

Powertrain Codes and Standards Development: Mike Duoba (Argonne National Laboratory) - vss143

Presenter

Mike Duoba, Argonne National Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer noted excellent use of existing resources and partnerships with relevant industry and government partners.

Reviewer 2:

The review believed that the approach taken will provide a path forward to a common test standard.

Reviewer 3:

The reviewer stated that consideration of how consumers might use a hybrid system in the real world would seem to be very useful in this work. The rating of the system will depend heavily on the test cycle or condition used to determine the rating. The reviewer continued that if the test does not correlate with real-world usage, the rating will not be very useful. The reviewer added that evaluations of hybrid powertrains has suffered from this problem in the past. Fuel economy test cycles that are acceptable for a conventional powertrain (FTP75, etc.), often do not give results that match real-world operation. The adjustments made by EPA to address this issue are evidence of this challenge. The reviewer stated that although it is clearly a very challenging issue, it seems it would be worthwhile to make an attempt to define some test protocols that would correlate with customer usage. Industry partners may be able to help.

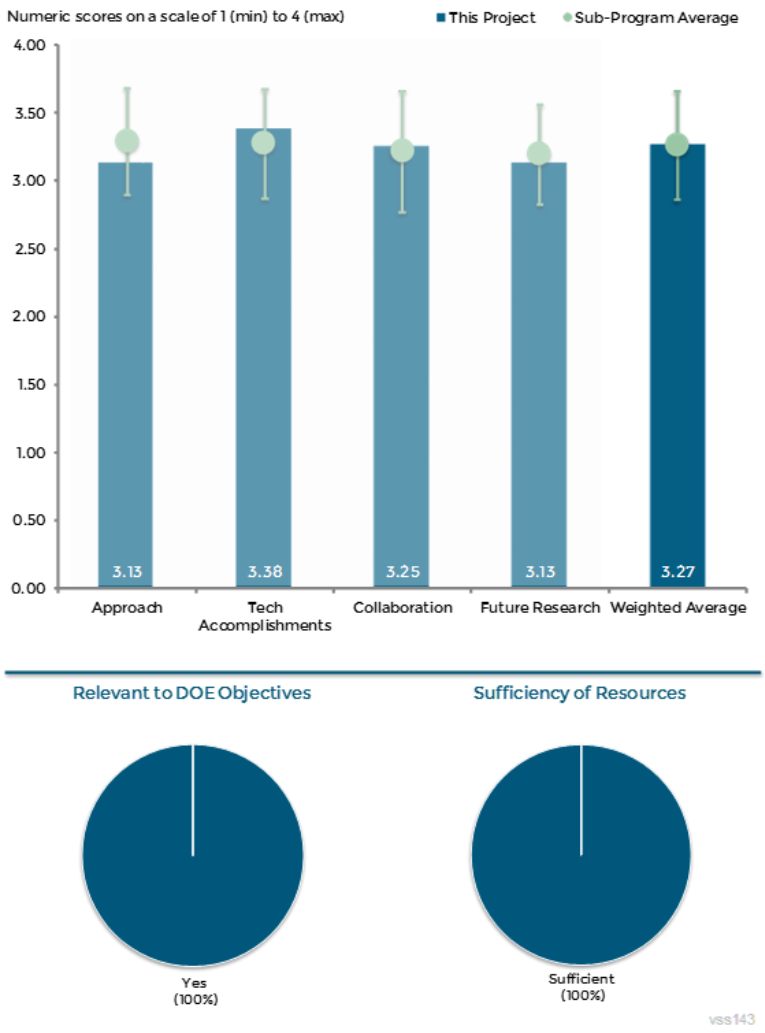

Figure 1-28 Powertrain Codes and Standards Development: Mike Duoba (Argonne National Laboratory) - Vehicle Systems

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

Reviewer 1:

The reviewer believed the project has made a big impact on automotive electrification standards. It provides independent authority that industry respects.

Reviewer 2:
The reviewer stated that the example provided comparing a Prius to a Sonata is acceptable, and would like to see a comparison of multiple tests on the same vehicle.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that all of the appropriate stakeholders appear to be accounted for in this project.

Reviewer 2:
The reviewer stated that the collaboration seems reasonable. One potential opportunity that was not mentioned is collaboration with the SAE J2711 working group. The reviewer added that this is the HD version of the hybrid test procedure for passenger cars (J1711). This working group focused primarily on chassis dyno testing, but has considered additional work that would focus on powertrain testing. The lead for the group is Paul Chambon at ORNL, but the reviewer was not sure of the current status.

Reviewer 3:
The reviewer noted that having the OEMs' support with their vehicles will provide vehicle selection and additional test data.

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

Reviewer 1:
The reviewer recommended expanding the number of vehicles tested, with support from OEMs. The will drive acceptances from the OEMs for a new way of testing that could result in a new rating system.

Reviewer 2:
The reviewer believed the project take necessary steps to finalize the project objectives.

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

Reviewer 1:
The reviewer stated that a better definition of hybrid power ratings would be very useful to consumers as well as industry, and a transparent methodology could help consumers better understand hybrid system capability and allow them to make good decisions in purchasing hybrid products.

Reviewer 2:
The reviewer stated that the project addresses consumer information gaps in comparing conventional and hybrid vehicles. Helps to demystify hybrid vehicles.

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

No comments were received in response to this question.

Green Racing Protocols and Technology Applications: Perry Jones (Oak Ridge National Laboratory) - vss144

Presenter

Perry Jones, Oak Ridge National Laboratory.

Reviewer Sample Size

A total of five reviewers evaluated this project.

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

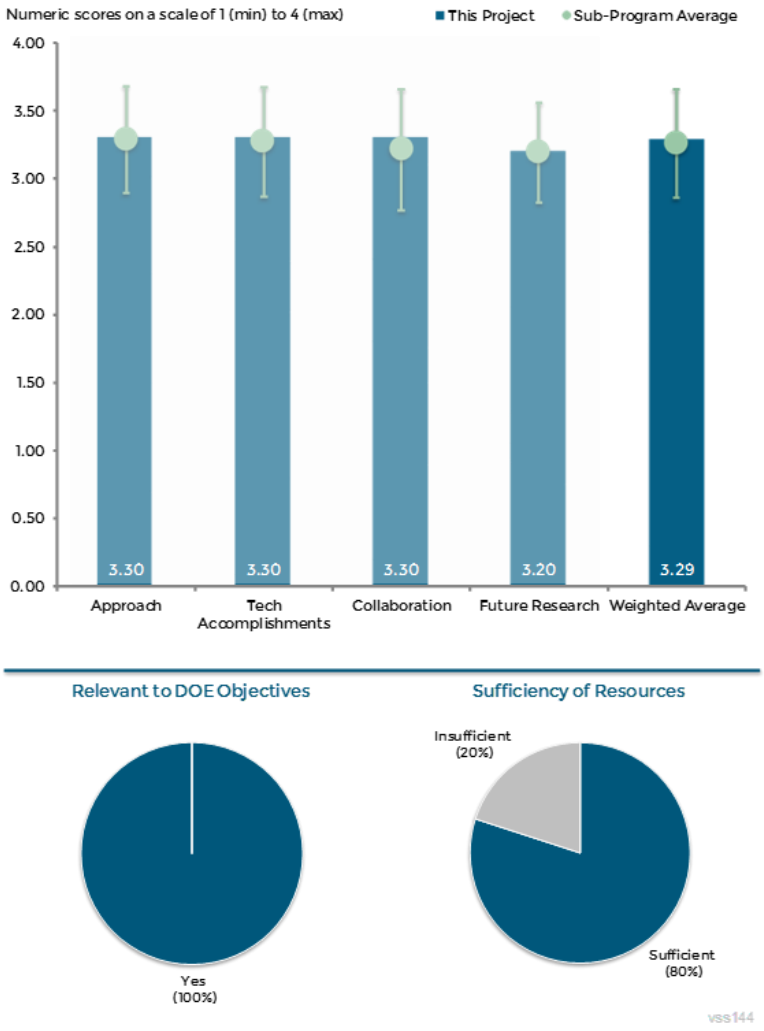

Figure 1-29 Green Racing Protocols and Technology Applications: Perry Jones (Oak Ridge National Laboratory) - Vehicle Systems

Reviewer 1:

The reviewer stated that the objectives and relevance were well illustrated. The reviewer believed the approach was slightly weak; the reason of the delay of six months by Dyson was not explained except to say they will recover, without explaining how. The Green Racing Simulator served a good purpose to help explain the advanced technology

Reviewer 2:

The reviewer stated that as an intensely competitive activity, racing inherently encourages teams of creative, motivated people to develop and implement practical solutions in the shortest possible time. The reviewer added that racing provides a means for widely publicized demonstration and rigorous testing of new technologies. As a spectator sport, racing makes these innovations highly visible to a fan base that disproportionately includes technology early adopters. The reviewer suggested that because of the involvement of multiple sponsors, racing also results in significant leveraging of DOE's investments. The project is trying to show the link to consumer vehicles – Win on Sunday, sell on Monday. The reviewer noted that assignment of green racing points based on technologies used and results achieved seems to be working effectively. What would really be convincing is for an alternatively fueled race car to beat a conventionally fueled race car head-to-head (e.g., by taking advantage of greater effective octane).

Reviewer 3:

The reviewer indicated that this project seems to be an attempt to get sanctioning bodies of major racing series to implement and promote the use of non-fossil fuels. That, in and of itself, is in line with the objectives of DOE to displace petroleum fuels. The reviewer emphasized that racing bodies are economically driven entities who will implement change to improve their economic state. Seldom do they do anything for any other reason. The reviewer believed that the promotion of non-fossil fuels and energy efficiency can help these race series by promoting themselves as responsible citizens; making the events more sustainable. Promoting them as such

opens the door to fans that may be heretofore unreachable due to what they perceived as wasteful use of resources. The reviewer stated that the added effect of having large fan groups see their entertainment medium moving to a sustainable technology can start to validate the technology for use in their personal transportation. To see change takes the fear out of change. Regarding the presentation, the reviewer noted a couple of definitions could have made it easier to understand the project. Namely, what is the definition of Green Racing and what is the reasoning for the development of the protocols?

Reviewer 4:

The reviewer stated that the overall concept of leveraging and increasing awareness/acceptance of advanced vehicular technologies and fuels through motor sports is unique and has merit. The reviewer added that Green Racing provides a venue to trial test and showcase these technologies and can serve as a gateway to introducing them into consumer vehicles, which indeed has been the case in several instances. The approach of establishing industry-recognized Green Racing Protocols through SAE is sound and will provide a clearer and defensible mechanism for objective recognition levels. The reviewer added that efforts to introduce cellulosic ethanol into International Motor Sports Association (IMSA) will expand visibility for biofuels, which often face unique challenges. The reviewer indicated one thing that is not completely clear and questioned exactly how these Green Racing recognition levels will be utilized. The reviewer asked whether teams that achieve a certain number of points (based on the Recommended Green Racing Protocols) will be given an award or recognition of some sort, or is it possible to conceptualize a method whereby the team's final placement in races would be a combination of actual racing times and their level of Green Racing Protocol achievement. In other words, the reviewer asked if there are additional innovative ways to combine the Green Racing Protocols and the actual racing times to develop a hybrid scoring approach that may entice broader participation and involvement.

Reviewer 5:

The reviewer stated that the goal is admirable, but the ultimate success of the project depends on the linkage between improved consumer acceptance of green vehicle technology and green racing that seems difficult to test.

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

Reviewer 1:

The reviewer indicated that the accomplishments meet the objectives of the program. The SAE Standard is a good step. The tie-in with IMSA is also excellent.

Reviewer 2:

The reviewer believed that the approach to have protocols and standards is critical. The reviewer likes to see how the generation and agreement process of the protocols is being achieved.

Reviewer 3:

The reviewer noted the publication of revised SAE Recommended Practice J2880, "Recommended Green Racing Protocols." Early green racing protocols were more subjective; the new protocols are more objective. The reviewer mentioned an established memorandum of understanding (MOU) with IMSA. Green Racing Simulator has returned to outreach activities. The reviewer stated that over 4,000 people have driven the Green Racing Simulator, which is not only entertaining but educational as well. The reviewer stated a supply of cellulosic ethanol (E85) has been arranged. NASCAR has received 500,000 hits on its E15 page (it was not clear how many of those hits are directly attributable to this project). The reviewer indicated that no milestone chart was provided; just a short table.

Reviewer 4:

The reviewer stated that the technical accomplishments have been solid including the successful balloting of revised SAE J2880 "Recommended Green Racing Protocols" and establishment of objective new recognition levels, introduction of cellulosic ethanol supply for IMSA, reintroduction of the Green Racing Simulator, and

the re-launch of GreenRacingCup.org. The reviewer believed it is definitely important to push hard to expand the Green Racing Partnership to include new sanctioning bodies and try to further expand the reach of Green Racing. Additionally, the reviewer asked if there is a way to establish a system to measure the success/growth rate of introducing new technologies/partnerships through Green Racing. For example, it is somewhat difficult to gauge whether the progress of Green Racing has remained steady, been on an upward growth trajectory, or declined in its value proposition over the last several years. If there was a process/or more information to assess, this it would be beneficial.

Reviewer 5:

The reviewer stated that the completion of the protocols constitutes a significant advance. It creates a step-by-step progression to a race series becoming environmentally sustainable. The reviewer believed that certain questions remain though and asked how sanctioning bodies are convinced to use the protocols, and whether they were involved in their development and in how to apply them. Regarding technologies other than fuels, the economic constraints in racing can limit the application of these new sub-systems. The reviewer noted that it seems that a major partner (like an auto company or interested supplier) would have to be involved for widespread application to offset the development costs. This is more difficult nowadays because the development processes for new hardware are much faster and computer-based, whereas in the past racing was more widely used for initial concept prove-out when development was empirical. The reviewer believed that alternative fuel uses would be easier to implement than allowing expensive concept technologies in this era.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:

The reviewer stated that overall, the project has a good breadth of collaboration including IMSA, EPA, SAE, and ANL, with each taking on different roles. There are no large gaps here, although it would be good to increase collaboration with other motors sports associations/authorities to widen and deepen the commitment to Green Racing. The reviewer believed it may also be beneficial to explore additional communication strategies and further expand media support and outreach through additional entities besides just EPA.

Reviewer 2:

The reviewer mentioned the MOU with IMSA. The reviewer stated getting assistance from ANL on the website and with the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) well-to-wheels modeling. The reviewer indicated collaborating with EPA (including on-site support at races) and SAE. Partnering with Harvard Kennedy School Belfer Center, Motorsport Engineering Conference, CAPE, and Purdue University. Interestingly, the project team is not working with Formula-E. The project team said it is because the rules of that series do not allow enough innovation. The reviewer recommended the team explore changing this situation.

Reviewer 3:

The reviewer questioned how the different collaboration partners are engaged to help leverage an agreement on protocols and standards. In addition, the reviewer asked if there are any opportunities to involve the OEMs with this activity so they can learn and participate toward a production path.

Reviewer 4:

The reviewer indicated many collaborations with the major players in racing are in place or in development. Without this there is no chance of implementing change. The reviewer added that while budget constraints are clear, under no circumstances would DOE ever become a team sponsor. But there is no reason why good, technically competent teams could not form CRADA with DOE units (or laboratories) to leverage the pot of knowledge in that broad technology system. The reviewer believed it would be a good idea to try to do just one of these in the next year to see how it can work.

Reviewer 5:

The reviewer said that it is not for lack of trying, but the absence of NASCAR as a partner hurts the main aim of the project.

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

Reviewer 1:
The reviewer stated extends the current work in an appropriate way.

Reviewer 2:
The reviewer stated that the team is working to develop partnerships with two additional race sanctioning organizations. An audience member suggested that the Green Racing Program reach out to better involve small and mid-sized teams.

Reviewer 3:
The reviewer noted that while funding limits the effectiveness of the effort, it has had good success. Keeping in mind that this is a great outreach project and could open the door for some limited future technical collaborations, the effort must continue; stopping it may create a reversion to a past condition. The reviewer believed it is funny how racing has so many players that enter for a short time, create a stir and then disappear. Their impact is often discarded and forgotten. The reviewer indicated that the emphasis should be on broadening the number of wins. Getting some substitute fuel that other levels in racing can drop in would be incredibly profound and make an incredible impact. Recommend exploring how and whether this can be pursued.

Reviewer 4:
The reviewer stated that the proposed future research is reasonable, covering a lot of ground. The reviewer recommended focusing especially hard on the completion of agreement for additional racing series into Green Racing framework and International series recognition for North American events performed in alignment with J2880. The reviewer also strongly recommended bringing into the fold new sanctioning bodies and racing partners. This is especially important as the project ends in September 2016 and a strategy for Green Racing to become self-sustaining needs to be identified and established.

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

Reviewer 1:
The reviewer noted that alternative fuels in racing vehicles directly substitute for petroleum fuels. Far more important, racing pushes alternative fuel technology, demonstrates the performance and reliability potential of alternative fuels, and builds awareness. All of these can lower barriers to introduction of alternative fuels by industry, and adoption of alternative fuels by users.

Reviewer 2:
The reviewer said the project advances use of alternative fuels in racing and hopefully increases consumer awareness.

Reviewer 3:
The reviewer indicated that the technologies being implemented or in use either substitute fuels or find ways to save fuel. That displaces petroleum.

Reviewer 4:
The reviewer stated that Green Racing supports DOE objectives of petroleum displacement by encouraging the implementation of advanced, efficient vehicular technologies and fuels into racing to enable technology evaluation and visibility to millions of potential vehicle purchasers. Green Racing helps serve as an evaluative transition point for technologies as they potentially make their way toward consumer vehicular applications.

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

Reviewer 1:
The reviewer stated that the team is achieving useful results from the modest funding they are receiving.

Reviewer 2:
The reviewer noted that resources appear to be sufficient.

Reviewer 3:
The reviewer indicated that resources for this project are sufficient.

Reviewer 4:
The reviewer indicated that this is a hard question to answer, but it is certainly not excessive. The project has limited funding which limits the promotion of the technologies broadly and potential application of DOE technical help to implement these petroleum displacing technologies sooner. As they say in racing circles: "speed costs money, how fast do you want to go?" But another old adage says: "Race only where you can afford to win," so recommend that the resources be focused on the biggest and broadest positive outcomes. The reviewer recommended focusing only on some quantifiable successes in achieving petroleum displacement and also finding a way to promote the effort so that awareness of the gains is more broadly known by race fans.

Technology Requirements for High-Power Applications of Wireless Power Transfer: Omer Onar (Oak Ridge National Laboratory) - vss152

Presenter

Omer Onar, Oak Ridge National Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that the approach taken is in line with the project objectives.

Reviewer 2:

The reviewer stated that the proposed work is well thought out. The reviewer said that it lacks partners that would use this technology. Need clarity on the project milestones/dates.

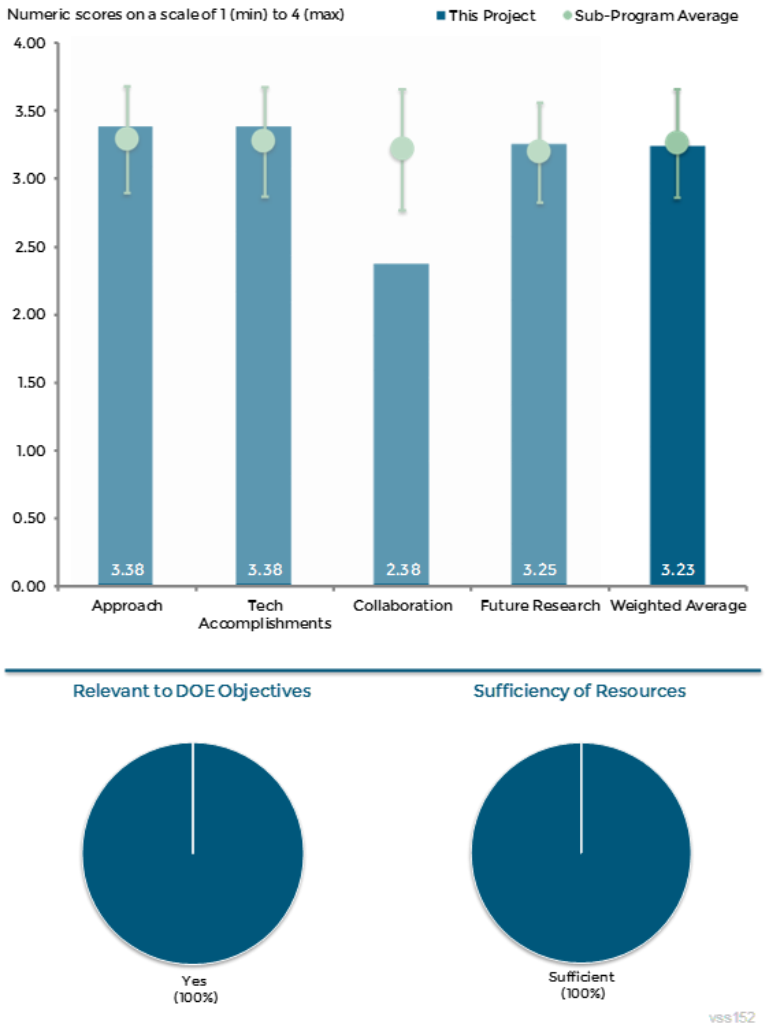

Figure 1-30 Technology Requirements for High-Power Applications of Wireless Power Transfer: Omer Onar (Oak Ridge National Laboratory) - Vehicle Systems

Reviewer 3:

The reviewer noted that although the objectives are well stated, the scope is not. Therefore, it is unclear if the anticipated application is to buses, light rail or other.

Reviewer 4:

The reviewer believed there needs to be clarification on what actually is part of this currently funded project, and what is aspirational and for future funded projects. The reviewers were all confused about the structure of this project based on the milestone slide. If future work is planned, that should be part of the Future Work slide, not part of the milestones listed for this project. Having said that, if the objective of the project was to produce a model, the project appears to be successful in achieving this objective.

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

Reviewer 1:

The reviewer indicated that the progress made and the technical achievements are in line with the project deliverables.

Reviewer 2:
The reviewer stated that the modeling appears to have evaluated a variety of designs and addressed the performance issues in current high-power wireless power transfer (WPT) designs.

Reviewer 3:
The reviewer stated that the technical work to date is well done. Needs to consider the practicalities of implementing this system. The reviewer questioned whether we want to do all of this technical work if it is not in fact economically practical.

Reviewer 4:
The reviewer stated that the work is sharply focused on system design outside of application environment, without taking into account simulations of effects that the operating environment may have.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer said that partners are needed that would apply this work.

Reviewer 2:
The reviewer noted that although it is understandable that this is still in the design phase, it is advisable to reach out to DOT/transit companies that have a stake in the technology to discuss future ramifications of mutual relevance.

Reviewer 3:
The reviewer indicated that there are no collaborators listed, making the lack of collaborations for this project noticeable. ORNL is no doubt a leader in R&D in this area, but the reviewer wondered if there are no industry collaborators that could be brought into this project. The reviewer asked if there are other research groups working on high-power WPT with which ORNL could collaborate. The reviewer also asked who will provide the integration with the bus in the same way Toyota and Evatran performed the integration in the light-duty vehicle (LDV) WPT system from a previous presentation.

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

Reviewer 1:
The reviewer stated that the steps to building a system once a design has been decided upon seem solid, as does the plan to work with a bus manufacturer to implement the system in an actual vehicle. If the funding comes through, the planning for these stages must be described more explicitly.

Reviewer 2:
The reviewer stated that the future work was not clearly articulated. The reviewer asked whether the project is just starting, or wrapping up.

Reviewer 3:
The reviewer urged consideration of simulation or empirical testing of operating environment variable anticipated in the appropriate application.

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

Reviewer 1:
The reviewer stated that electrification of heavy-duty transport could effectively displace petroleum. This project studies the enabling technology for this goal.

Reviewer 2:
The reviewer noted that high-power WPT is arguably the application that suits WPT most, and the presenter rightly points out in the presentation that buses are ideal candidates with set routes and low fuel economy. If high-power WPT can be made to work, the petroleum reduction possibilities are massive.

Reviewer 3:
The reviewer indicated it provides easy access to costly data and analysis tools that can be applied to future research and policy decisions that affect DOE, DOT, EPA and state GHG emission reduction targets.

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

Reviewer 1:
The reviewer stated for paper studies and limited test, the resources are sufficient. They would be insufficient to test on a larger scale.

Reviewer 2:
The reviewer noted that the funding for this project is adequate. The subsequent build and implementation steps will need careful consideration to achieve the same.

Reviewer 3:
The reviewer stated that, considering the scope is not defined in the presentation, it is difficult to determine whether the funding level is sufficient.

Accelerate the Development and Introduction of Advanced Technologies through Model-Based System Engineering: Aymeric Rousseau (Argonne National Laboratory) - vss153

Presenter

Aymeric Rousseau, Argonne National Laboratory.

Reviewer Sample Size

A total of five reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that the proposed approach to exploring new areas for the next generation of automotive simulation tools is a logical progress considering the advancement in technologies and need.

Reviewer 2:

The reviewer stated that the approach to this project is excellent, specifically its emphasis on positioning Autonomie for future use through large-scale simulations and integrating additional tools expanding the Autonomie ecosystem. This will provide the flexibility for Autonomie to adapt to expected and unforeseen future needs/requirements, while continuing to enhance user flexibility and convenience. Additionally, the reviewer noted that the strong emphasis on first gathering requirements from the broad user community is on the mark. Autonomie has proven its worth as evidenced by the large user community (over 175 companies worldwide) including domestic OEMs and broad applicability with VTO.

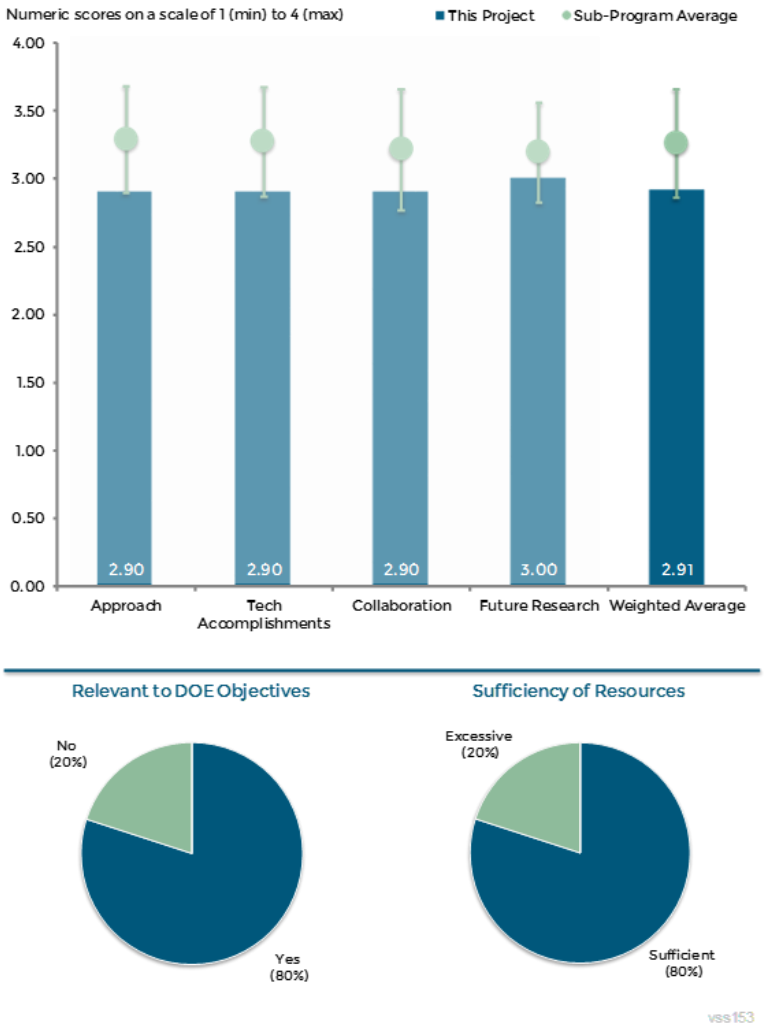

Figure 1-31 Accelerate the Development and Introduction of Advanced Technologies through Model-Based System Engineering: Aymeric Rousseau (Argonne National Laboratory) - Vehicle Systems

Reviewer 3:

The reviewer liked the fact that Autonomie is versatile and robust enough to be used on heavy-duty vehicles as well as light-duty vehicles. The reviewer did not like the fact that one must also purchases licenses to Matlab and Simulink to use Autonomie; calling this a distinct disadvantage.

Reviewer 4:

The reviewer said the project seems to have a good process to evaluate maintenance and improvement needs. Shows a process diagram of connecting with customers and stakeholders and talked about prioritization of needs. The reviewer believed it might be nice to see some evidence of the collection and prioritization of needs, maybe a selection matrix, for example. The reviewer stated a personal belief that moving into large-scale

simulation capability is a good direction and the approach seems sound, including simulation quality checks to flag potential issues when the user does not look at each simulation individually as in traditional single simulation.

Reviewer 5:

The reviewer indicated that the program still looks hard to use with so many technical features even though progress has been made for a large-scale simulation run. This may become more or less of an issue when it is integrated with so many other commercial codes. The reviewer believed that it may pay noticeable overhead time when it runs with other commercial codes. Also, use of Matlab/Simulink platform forces the user to have Matlab/Simulink commercial license when this program is largely funded by DOE or taxpayer dollars. Furthermore, the reviewer stated that Autonomie is a commercial product, meaning that the license fees can be significant in view of the over 175 users as stated. If that is the case, why taxpayer dollars would be used to support the large portion of this program development, which could create an unfair playing field for those commercial codes.

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

Reviewer 1:

The reviewer stated that the project shows progress in several areas including modeling, large-scale simulation, and software enhancement.

Reviewer 2:

The reviewer believed that good progress had been made on large-scale simulation. It is difficult to measure progress against goals. The reviewer could not quite tell if the progress shown is as expected and promised to DOE.

Reviewer 3:

The reviewer stated that the task has logged an extensive and impressive list of achievements including incorporation of physical modelling, release of new thermal models, model parallelization with a new message passing interface (MPI), incorporation of large-scale study capabilities (over100,000 runs), new graphical configuration builder, model-based system engineering (MBSE) enhancements, HTML report improvements, implementation of quick launch/developer mode, decoupling of vehicle mass, updated file import scripts, user interface usability enhancements, simulation speed upgrades, and others. .

Reviewer 4:

The reviewer indicated that making the program more user-friendly and faster with MPI are the features that are nice to have.

Reviewer 5:

The reviewer believed that the goals and objectives for this project as part of the DOE VTO R&D are too ambiguous and too general as stated to determine whether the project is meeting these goals and objectives. There is nothing specific, measurable, achievable, relevant, or timely about the goals or objectives. The reviewer believed it is not clear how this project helps DOE's mission of reducing petroleum dependence and improving energy conservation.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:

The reviewer stated that the project shows good collaboration from national laboratories and different sectors of the industry.

Reviewer 2:
The reviewer noted that the project works with an extensive list of well-established partners, including other model providers (national laboratories, ANL, export tool companies), and for process definition and direction, OEMs, Mathworks, Expert Tool Companies, and ANL. There are no glaring deficiencies here, although nothing was specifically mentioned with regard to universities and their specific modelling needs or potential contributions to the future direction of Autonomie.

Reviewer 3:
The reviewer stated it seems good, but felt it was unclear from the presentation what Gamma Technologies or Mathworks brought to the project.

Reviewer 4:
The reviewer believed that if Autonomie is being used on DOT- and U.S. Department of Defense-(DOD)-funded projects, then it is only reasonable to expect that DOT and DOD be made formal partners on this project.

Reviewer 5:
The reviewer was not sure how other partners are involved in this program.

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

Reviewer 1:
The reviewer had no significant issues in this area.

Reviewer 2:
The reviewer said that, as alluded to in the approach section above, the focus on expanding the Autonomie Ecosystem with linkages to additional tools and large-scale simulation capabilities is spot-on. Autonomie will also continue to serve its traditional role in providing guidance to DOE vehicular R&D activities, while expanding the use of Autonomie throughout DOE to promote MBSE approaches. The reviewer stated that upcoming tasks/milestones for the Autonomie Maintenance and MBSE enhancement components of the project are provided in sufficient detail.

Reviewer 3:
The reviewer stated that future plans to enhance the tools are a logical approach; however, finding ways to facilitate industry and user acceptance is important for the future of this project.

Reviewer 4:
The reviewer deemed future work to be in the right direction, driven by input from customers. Large-scale simulation is the right way to go. The reviewer noted that considering the bigger picture of the whole workflow and the range of needs is good thinking and could be an area where Autonomie could set itself apart from similar tools.

Reviewer 5:
The reviewer stated that all future work plans are good., but questioned whether this can be done without using DOE funding or taxpayer dollars, because large commercial license fees may be able to support the model development.

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

Reviewer 1:
The reviewer stated that the project covers areas that could benefit the objectives of DOE for fuel displacement in several ways.

Reviewer 2:
The reviewer noted that many OEMs have used this program to support their product needs as well as their future technology development. Therefore, this project supports the overall DOE objectives of petroleum displacement

Reviewer 3:
The reviewer stated that there is evidence that Autonomie is used a lot by DOE programs that are working on petroleum displacement. But the reviewer noted that other tools exist to do vehicle system simulation, so continued justification for Autonomie is needed beyond having projects purchase a commercial tool. To the reviewer it looked like the value is there and DOE is getting its money's worth.

Reviewer 4:
The reviewer stated that systems modeling, as opposed to actual hardware integration/testing, is increasingly used and essential to accelerate the design and implementation of advanced vehicular technologies. Systems modelling lowers costs and improves time-to-market which leads to significant competitive advantages. The reviewer added that Autonomie is a leading tool not only for guiding DOE VTO R&D activities but also industry design, engineering, and development. While industry has tools of its own, Autonomie provides a number of highly valuable and unique capabilities with regard to vehicle controllers and framework aspects.

Reviewer 5:
The reviewer stated that no explanation was provided about the relevance of this project to petroleum displacement.

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

Reviewer 1:
The reviewer stated there are sufficient resources for this project.

Reviewer 2:
The reviewer believed that $400,000 seems reasonable to keep the tool moving. The reviewer believed the team could do more with more money, but the considerations of purchasing a commercial tool should be considered as well. For whatever amount is spent on this tool development, consideration has to be given to how far that money would go in purchasing a commercial tool to use on the DOE projects.

Reviewer 3:
The reviewer indicated that the resources for this project are sufficient.

Reviewer 4:
The reviewer thought that $400,000 per year is outrageously excessive for maintenance of the software. The reviewer managed software projects before, none of which ever cost this much to maintain.

Fuel Displacement Potential of Advanced Technologies under Different Thermal Conditions: Aymeric Rousseau (Argonne National Laboratory) - vss154

Presenter

Aymeric Rousseau, Argonne National Laboratory.

Reviewer Sample Size

A total of five reviewers evaluated this project.

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

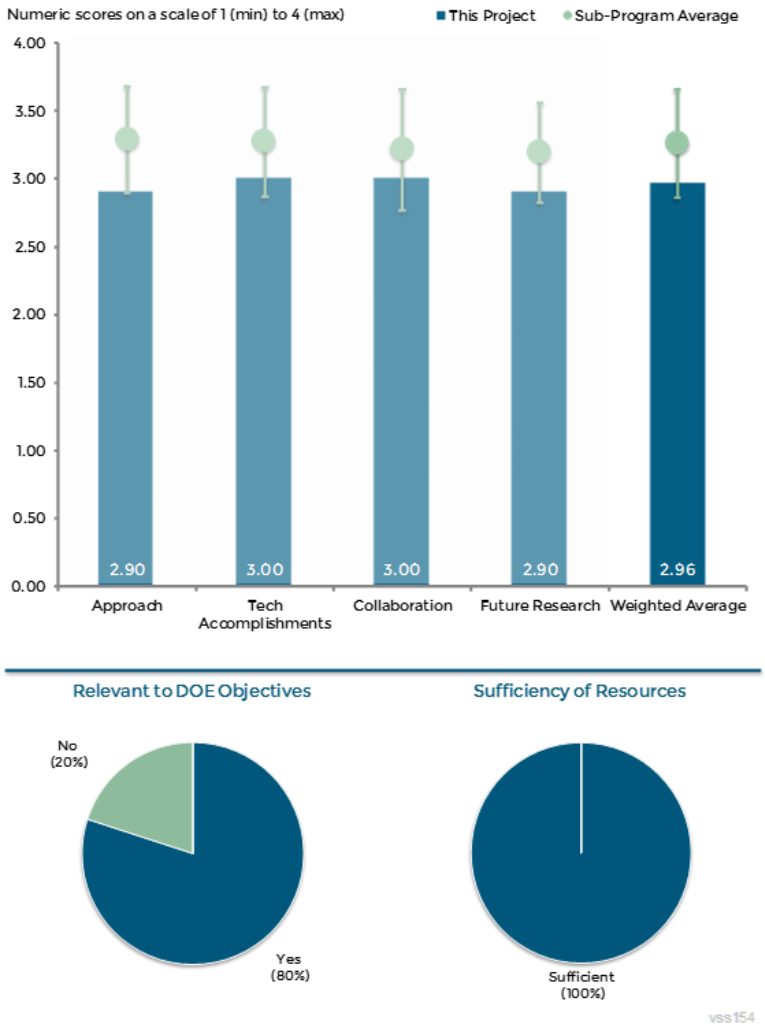

Figure 1-32 Fuel Displacement Potential of Advanced Technologies under Different Thermal Conditions: Aymeric Rousseau (Argonne National Laboratory) -Vehicle Systems

Reviewer 1:

The reviewer noted excellent overall project design. There is some inherent limitation on what can be accomplished with modeling if the intent is to move from the specific validated cases to more generic cases.

Reviewer 2:

The reviewer stated that the approach in this project follows standard procedures, because these areas have been very well covered in several studies, in particular, for conventional vehicles. Use of existing knowledge from component manufacturers, e.g., tires, can enhance the outcome of the project.

Reviewer 3:

The reviewer called the approach sound, especially using existing data and models. Using the simulation tool to evaluate temperature effects is a good approach as long as the sub-models respond to temperature with the main effects, which seems to be the case here.

Reviewer 4:

The reviewer stated that the approach is overall good except for the selection of vehicles. The selection of vehicles is solely dependent on Advanced Powertrain Research Facility (APRF) so that if a vehicle has been identified as having a thermal issue but has no APRF data, it will not be analyzed.

Reviewer 5:

The reviewer noted that the program does not detail how the approach is taken to tackle this thermal issue. Rather, it gives readers the impression that this is just an application program using Autonomie to perform the thermal analysis. The reviewer believed more description would be helpful.

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

Reviewer 1:
The reviewer cited excellent modeling work with very good use of experimental data to validate.

Reviewer 2:
The reviewer observed that the project has shown significant progress in modeling and simulation in several areas that are important for the development of accurate thermal models for EVs.

Reviewer 3:
The reviewer stated that there is evidence that new models are in place and test data is being analyzed to validate models. When models are chosen from literature and other sources to be implemented, it would be good to show that a number of models were investigated and the most appropriate one for the needs was used. The reviewer believed it was unclear if the project is on target for progress and questioned what technologies are expected to be evaluated by the end of the project and whether progress is on plan to cover all of those.

Reviewer 4:
The reviewer noted the excellent comparisons between simulations and testing demonstrated through Slides 19 and 20. Significant simulations have been done, all of which are very informative if used and explained properly. However, this presentation fails to capitalize on this momentum, explaining why the thermal conditions impact the vehicle fuel economy. The reviewer speculated that one of the reasons is that slides on technical accomplishment are too busy with too many figures with little explanation. For example, Slide 10 could be split into at least two slides to explain the physics behind the simulations. The reviewer asked what we can learned from Slide 16, which needs more description.

Reviewer 5:
The reviewer stated that the goals and objectives of this project are not specific, measurable, achievable, relevant, or timely. It is not clear how this project fits into DOE's mission of improving energy conservation and petroleum displacement. Thus, without clear goals and objectives, it is not possible to measure accomplishments and progress.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that the project leverages data from various sources including industry, making s good use of the APRF test capability.

Reviewer 2:
The reviewer noted good collaboration with national laboratories and industry.

Reviewer 3:
The reviewer stated using test data already collected, and u sing NREL model.

Reviewer 4:
The reviewer believed it is not clear how the partners are involved in the program.

Reviewer 5:
The reviewer questioned whether the results showed that ambient temperature has a significant impact on EVs. If not, the reviewer inquired about why EV manufacturers are not made partners.

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

Reviewer 1:
The reviewer stated that the future plan is excellent because this program will be tested using real-world conditions.

Reviewer 2:
The reviewer stated that no more work is planned; this is the last year.

Reviewer 3:
The reviewer noted that the future work is very ambitious and questioned if the scope is becoming too wide.

Reviewer 4:
The reviewer stated that the project explained that the future plans include evaluation of energy consumption with the vehicle thermal management system (VTMS) using real-world conditions, use of new modeling technologies, and optimizing energy management strategy. However, more details on these approaches should be added. The reviewer noted that the project can use this knowledge to expand to other vehicle types.

Reviewer 5:
The reviewer stated it is generally clear where it is going but light on specifics of what technology evaluations are really critical. The reviewer noted that the tire thermal model was implemented, but asked whether that was because it was available or because it really matters. The reviewer asked what the next most critical thermally sensitive model is.

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

Reviewer 1:
The reviewer noted that improved model fidelity helps to ensure DOE objectives are realistic with regard to technology options.

Reviewer 2:
The reviewer stated because this study reviews a template that has significant impact on EV energy consumption.

Reviewer 3:
The reviewer stated that moving into the area of temperature effects is a good place to go. There really is no average day so starting to understand the sensitivity of new technologies to ambient temperatures is a good direction to help fuel efficiency improvement projects.

Reviewer 4:
The reviewer noted that the model developed under this program helps developers understand why thermal conditions are important, thus developing solutions to those potential barriers. The reviewer believed this would aid development of more efficient components. Therefore, this project supports the overall DOE objectives of petroleum displacement.

Reviewer 5:
The reviewer found it unclear how this project supports or relates to petroleum displacement.

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

Reviewer 1:
The reviewer stated that the resources seem to be sufficient for this project. The team is getting a lot done.

Reviewer 2:
The reviewer indicated that this is the last year of funding for this project.

Reviewer 3:
The reviewer stated that sufficient funds are available for this project.

Analyzing Real-World Light-Duty Vehicle Efficiency Benefits: Jeff Gonder (National Renewable Energy Laboratory) - vss155

Presenter

Jeff Gonder, National Renewable Energy Laboratory.

Reviewer Sample Size

A total of five reviewers evaluated this project.

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

Reviewer 1:

The reviewer noted that the comprehensive approach taken to consider a variety of drive cycles will help assess the potential benefits.

Reviewer 2:

The reviewer believed that the approach is comprehensive and fully leverages all the tools and data at the disposal of the team. Well-developed methods are successfully applied from previous projects.

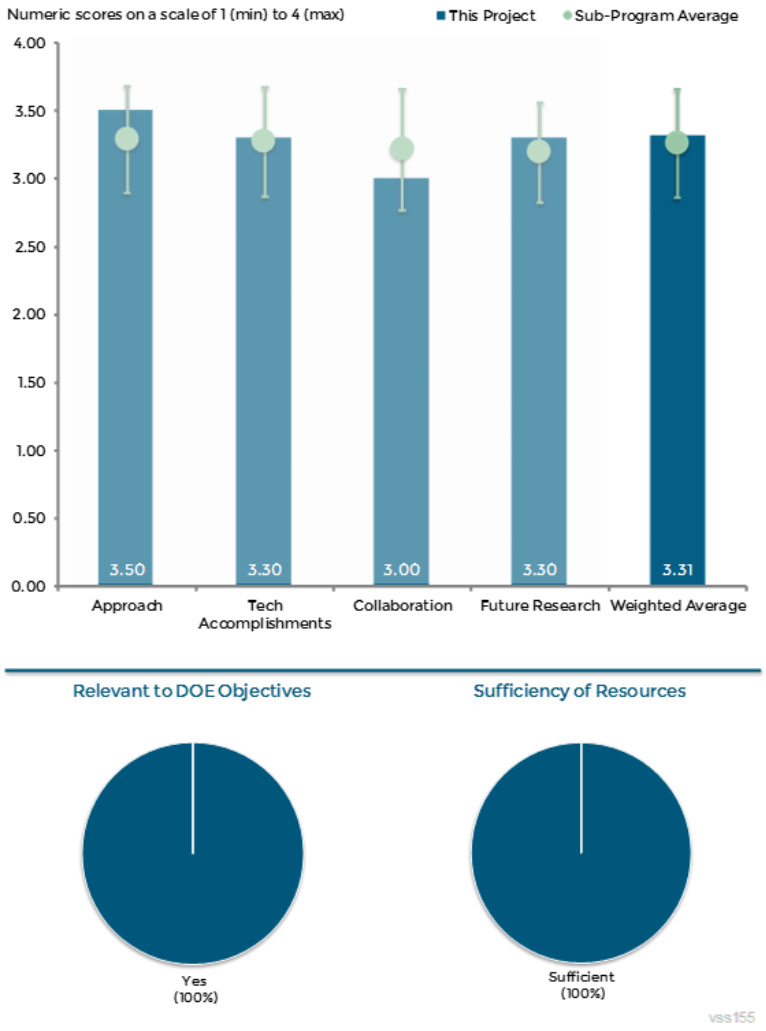

Figure 1-33 Analyzing Real-World Light-Duty Vehicle Efficiency Benefits: Jeff Gonder (National Renewable Energy Laboratory) - Vehicle Systems

Reviewer 3:

The reviewer stated that the evaluation of the benefits of new technologies under real-world application provides more accurate data than standard cycles.

Reviewer 4:

The reviewer believed that modeling should include mass trade-off to fuel efficiency gains.

Reviewer 5:

The reviewer stated that the approach taken is good if it can be proved, but the big question remains how such a simplified tool model can evaluate complicated technologies and their benefits. Calibration against one vehicle or technology can be good with tuning model constants, but the reviewer questioned if these model constants would be applied to other similar cases.

The model needs to demonstrate the relative comparisons between A and B in many scenarios as opposed to testing data.

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

Reviewer 1:
The reviewer stated that the progress and results to date are excellent. Useful findings that leverage the available resources of the DOE laboratories to the fullest extent possible.

Reviewer 2:
The reviewer stated very useful information for the auto industry and research community

Reviewer 3:
The reviewer stated that extrapolation of the Real World Benefit Estimate to the current and anticipated national LDV fleet may provide a more compelling illustration of the value of the research to both vehicle manufacturers and policy makers.

Reviewer 4:
The reviewer believed that involving more sets of real-world data from vehicles, with identified features for fuel economy improvements, will aid in the A/B technology comparisons.

Reviewer 5:
The reviewer stated that it is important that the model is calibrated against testing in absolute values. However, it is more important to compare the relative comparisons between A and B technologies against the experimental data in A and B, because this kind of tool is not designed for high-accuracy simulations. The reviewer indicated that Slide 15 only shows simulations between A and B. The reviewer asked about testing data in A and B.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer noted excellent collaboration between ANL, OEMs and NREL. The reviewer asked if EPA should also be involved.

Reviewer 2:
The reviewer believed that more opportunities could be realized by involving OEMs directly in this effort, as well as the EPA, by providing vehicles for testing and technical support that can possibly leverage a change in EPA rulings.

Reviewer 3:
The reviewer believed that more OEMs should be involved.

Reviewer 4:
The reviewer indicated that coordination with DOT and State Highway Agencies (SHAs) could provide data that would provide a more robust model.

Reviewer 5:
The reviewer believed that it is not clear how partners are involved in the program.

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

Reviewer 1:
The reviewer stated that the proposed work is on-target.

Reviewer 2:
The reviewer indicated that incorporating roadway condition information from SHAs should be considered to strengthen conclusions concerning the impact of pavement smoothness.

Reviewer 3:
The reviewer questioned if the team considered testing vehicles equipped with map-based features that learn the same route, and determine the potential benefits toward additional credits.

Reviewer 4:
The reviewer noted that the future work should at least includes two parts - improve the model fidelity (not mentioned), and A/B comparisons (not clear whether it was only simulations with A and B or benchmark against testing in A and B or combination of both).

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

Reviewer 1:
The reviewer believed this is a good, methodical way to try to capture the benefits of technologies that can provide off-cycle fuel economy improvements. This can encourage OEMs to have greater confidence in implementing these technologies if sufficient off-cycle credits are allowed.

Reviewer 2:
The reviewer stated that this research will help to better understand the real-world operation characteristics of light-duty vehicles, which provide very useful input to OEMs in vehicle design and powertrain calibration.

Reviewer 3:
The reviewer noted that if this work can be calibrated in a reliable way, this model can play an important role in achieving the objective the program states. Continuing work on this goal will support the overall DOE objectives of petroleum displacement.

Reviewer 4:
The reviewer indicated that this not only supports DOE objectives, but also the DOT Clean Transportation Sector Initiative goals of 80% GHG emissions reductions by 2050, as well as EPA objectives. Consider potential for incorporating PV on surfaces to provide power-assist to vehicle accessories.

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

Reviewer 1:
The reviewer considered that the resources are sufficient for the current work stream.

Smart Grid Requirements Study: Tony Markel (National Renewable Energy Laboratory) - vss156

Presenter

Tony Markel, National Renewable Energy Laboratory.

Reviewer Sample Size

A total of three reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that the technical approach of the project shows good planning and steps. Also, involving several national laboratories adds strength to the project but should be focused. However, assessing battery life and vehicle performance should have high priority in the project.

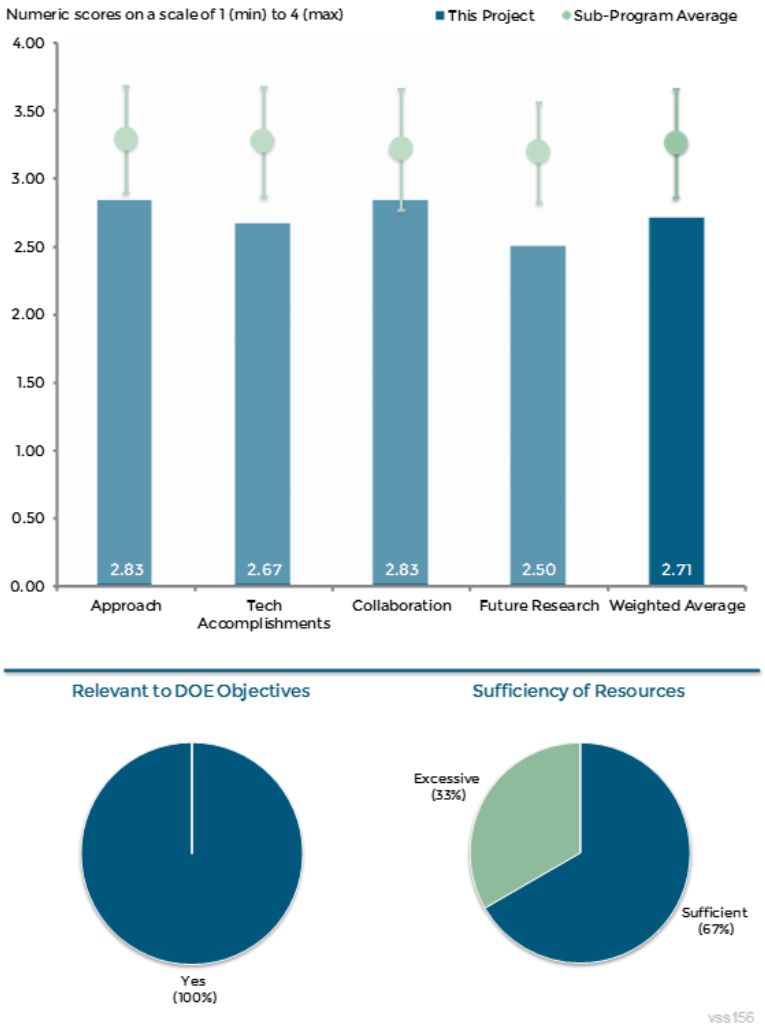

Figure 1-34 Smart Grid Requirements Study: Tony Markel (National Renewable Energy Laboratory) - Vehicle Systems

Reviewer 2:

The reviewer noted that the project was titled "requirements study" but it was not clear how the work presented flowed from that. The outline of deliverables is impressive and seems solid, but the presentation did not talk much about the approach to these various tasks.

Reviewer 3:

The reviewer indicated that the project approach was inappropriate for defining requirements for PEV integration with a smart electric grid. The study should have defined a hierarchy of goals and objectives, key performance parameters, value metrics, and requirements scenarios. To the reviewer it appeared that the approach taken was inappropriately focused on implementation approaches for performing pet investigations that are focused on a very narrow set of PEV-grid interaction concepts (e.g., vehicle to grid [V2G]).

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

Reviewer 1:

The reviewer stated that the project shows good progress in technical areas similar to system integration, characterization, and test procedures. However, work on battery life and cost needs to show more results.

Reviewer 2:
The reviewer noted that the presentation did not present the results of the various task outlined. It was difficult to judge the value of the accomplishments because most of them were not presented. In general, the concepts discussed seem very valuable. The reviewer believed it would have been helpful to see more of the details of the accomplishments.

Reviewer 3:
The reviewer indicated that the lack of requirements for PEV-smart grid integration from the PEV system perspective is the critical barrier that this study was intended to address. The work performed was too narrowly focused to overcome the critical barrier.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer noted good collaboration with national labs. However, more involvement of industry could speed and enhance project results.

Reviewer 2:
The reviewer noted that there appears to have been copious collaboration between the laboratory participants but the objectives/statement of work for those collaborations were off target. In general, a key component of collaboration that appears to be missing from the project is inputs and feedback from a broad range of stakeholders.

Reviewer 3:
The reviewer indicated that conceptually the collaboration among laboratories seemed strong. However, it was not clear from the presentation how the various tasks highlighted for each laboratory support the requirements of the study of requirements.

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

Reviewer 1:
The reviewer stated that the goals spelled out in the future plans are reasonable. However, more details about the approach should have been explained here.

Reviewer 2:
The reviewer stated that there needs to be a much clearer strategy for how the joint laboratory efforts support overall requirements for grid integration for DOE. If this exists, it was not presented. The reviewer recommended a much clearer active involvement from industry to guide the requirements.

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

Reviewer 1:
The reviewer stated that the goal of defining requirements for PEV-grid integration is critical to the opportunities for transportation electrification to contribute to DOE objectives of petroleum displacement. Proper design of PEV-to-grid interactions will increase the ability of the U.S. transportation sector to employ a broad range of energy sources to power its vehicles.

Reviewer 2:
The reviewer noted that it could support DOE objectives of petroleum displacement, if the project can solve battery life and cost issues.

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

Reviewer 1:
The reviewer noted that the rating of sufficient assumes that the project is a three-year project with level funding each year.

Reviewer 2:
The reviewer indicated that the project has sufficient funding.

Reviewer 3:
The reviewer stated that the amount of funding focused on requirements seems very excessive, but it appears other things are being done with the funding than just requirements.

Unitary Thermal Energy Management for Propulsion Range Augmentation (UTEMPRA): Sourav Chowdhury (Delphi Automotive Systems LLC) - vss157

Presenter

Sourav Chowdhury, Delphi Automotive Systems LLC.

Reviewer Sample Size

A total of three reviewers evaluated this project.

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

Reviewer 1:

The reviewer indicated that this is an excellent example of innovation and concept development which may have, if successful, significant future benefit.

Reviewer 2:

The reviewer stated that the basic level design and packaging work is very good, though the subsystems are not novel. Identification of the commercial-level barriers did not seem clear, tough system level requirements are well defined.

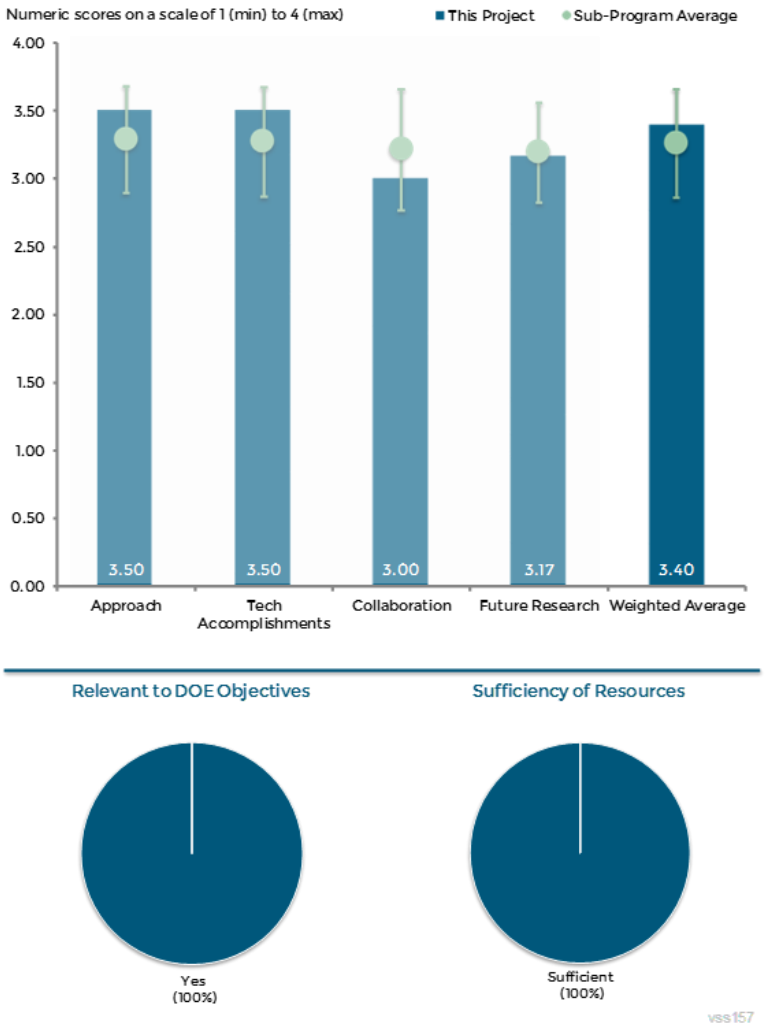

Figure 1-35 Unitary Thermal Energy Management for Propulsion Range Augmentation (UTEMPRA): Sourav Chowdhury (Delphi Automotive Systems LLC) - Vehicle Systems

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

Reviewer 1:

The reviewer stated that this type of program is essentially an enabling technology development and if a multi-mode flow controller (MMFC) can be demonstrated with production issues addressed there will be real benefit in thermal design.

Reviewer 2:

The reviewer stated that this project is well within the first year of work. Packaging, design, layout work, and baseline tests complete.

Reviewer 3:
The reviewer noted that though percentage of the work completed seems low, the amount of completed project requirements, packaging and other system requirements is very good, and shows complete understanding of the system level required.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer noted an appropriate blend of suppliers, OEMs, and national laboratories.

Reviewer 2:
The reviewer believed that the collaboration is okay, but could be improved upon with additional OEM input.

Reviewer 3:
The reviewer stated that the required partners are included, but commercial viability may require additional information about regional benefits and sensitivity to actual consumer usage profiles.

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

Reviewer 1:
The reviewer stated that test evaluation with hardware integration of the new HVAC system will be welcome in the next review. Standardized drive cycles in the evaluation stage are important for comparison to other systems; it will be interesting to see what EPA suggests for this project.

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

Reviewer 1:
The reviewer indicated that increasing the range of EVs in cold environments would increase their adoption and reduce petroleum consumption.

Reviewer 2:
The reviewer stated this project goal is identical to the other EV heating projects; cold-weather EV heating range reduction must be addressed in order to advance the technology in the marketplace. This work will demonstrate one approach to finding range improvement under such conditions.

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

Reviewer 1:
The reviewer indicated that though the progress is good and the plan is sound, the lack of novel technologies indicates that the systems integration and packaging study are the main deliverables. If there are specific goals that will be obtained in development that will be novel, like the layered heat exchanger and unique brazing process.

Zero-Emission Cargo Transport Projects (ZECT): Nancy Cole (SCAQMD) - vss158

Presenter

Joseph Impullitti, SCAQMD.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that this is an excellent project in what is widely viewed as an optimum application of zero emission technology. That is in effect short-range heavy transportation of goods in a seaport environment (drayage truck).

Reviewer 2:

The reviewer stated that the project and project support appear to be well coordinated (year 1 project).

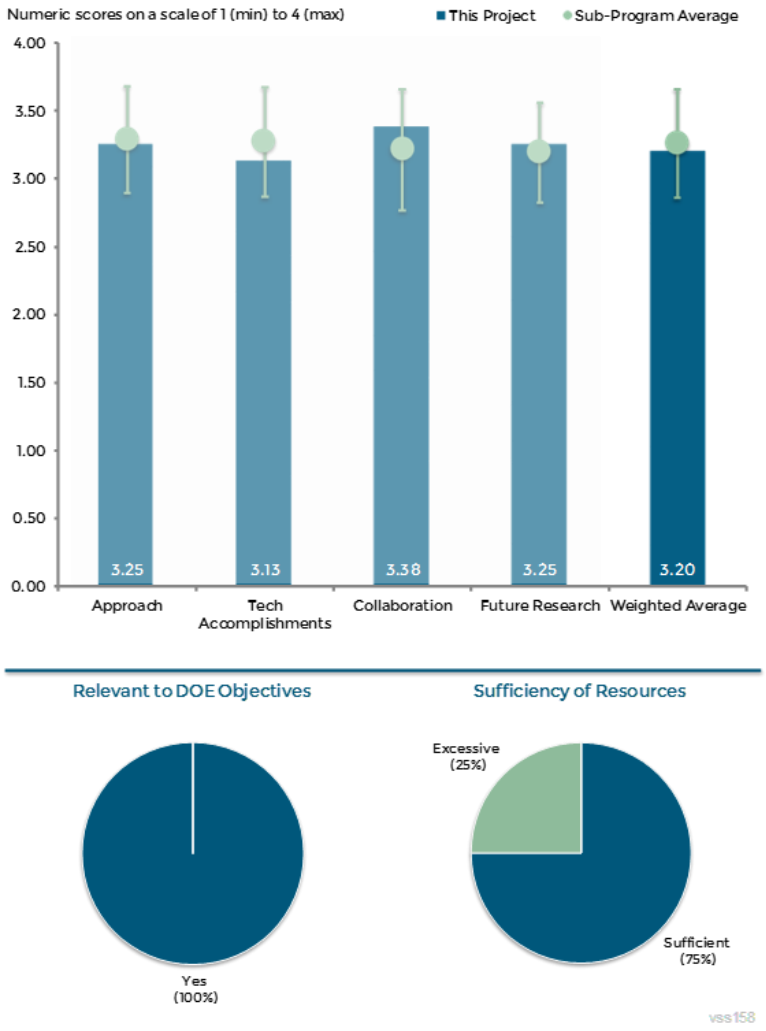

Figure 1-36 Zero-Emission Cargo Transport Projects (ZECT): Nancy Cole (SCAQMD) - Vehicle Systems

Reviewer 3:

The reviewer indicated that the stated approach has several strong elements including building off previous and ongoing projects' vehicle technologies and infrastructure; requiring contractors to have experience with fuel cell or battery electric truck and bus development (which will hopefully minimize the likelihood that particular contractors will be unable to deliver); selecting a variety of contractors to pursue multiple, different truck configurations (minimizing risk should one of the contractors run into trouble); and requiring contractors to partner with a major OEM and design for manufacturability (maximizing the potential for long-term commercial viability of the developed systems). The reviewer noted that the presentation did not explicitly mention plans for a rigorous cost/benefit analysis of the price point that the vehicles will need to reach in order to have their fuel displacement achieve economic payback relative to conventional vehicle alternatives (without necessarily relying on subsidies), but the presenter indicated that an analysis of this sort is planned and will also quantify infrastructure costs. The reviewer noted that it will be important to include such an analysis—ideally with the participating manufacturers assessing and reporting what will be required to achieve these costs, and with state agencies quantifying the value of individual Zero Emission Cargo Transport (ZECT) vehicle contributions to air quality improvements in order to evaluate the reasonableness of any long-term incentive needs.

Reviewer 4:
The reviewer indicated that there seems to be a large number of different architectures to be evaluated in this project. No mention of vehicle simulation and modeling was made in the vehicle selection text, though the presenter commented on the capabilities of the partners. The reviewer noted that comparison of the results/performance related to each architecture will be difficult given the great variation in infrastructure investment that may be required in connection with some of the architectures.

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

Reviewer 1:
The reviewer stated that, if successful in overcoming fueling infrastructure and costs, this project can demonstrate a game-changer in similar applications.

Reviewer 2:
The reviewer indicated that the project appears to be well managed at this point.

Reviewer 3:
The reviewer stated that the project was awarded in October and is not scheduled to kick off with its contractors until later this month, so accomplishments to date were limited to the vehicle concepts that have been proposed/selected. The presentation described a number of these concepts and included enough detail to convey that a reasonable level of rigor went into their development, and that the selected contractors should be expected to succeed on their development plans. The reviewer indicated that the approach section included good qualitative criteria for contractor selection, but as this selection process represents the entirety of project accomplishments thus far, it would have been good to see more details/specifics about how the winning contractors demonstrated convincing long-term commercialization plans, and to get a sense of the number of proposals received relative to the number of awards granted.

Reviewer 4:
The reviewer stated that many of the partners have made good progress on their particular deliverables, but the true test of the deliverables will be when the vehicles are in field test or validation dyno testing.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer noted a large group of integrators, each with appropriate deliverables and responsibility for system evaluations.

Reviewer 2:
The reviewer noted that the presentation did not include a comprehensive collaboration and coordination summary slide. By its nature, the project includes multiple collaborators in the form of the contractors awarded to design, build and deliver the ZECT vehicles. The reviewer indicated that as the kickoff has yet to occur with the contractors it is difficult to assess how effective the coordination with these contractors will be, but there has at least been enough coordination so far for South Coast Air Quality Management District (SCAQMD) to select the awardees and include details on the vehicle designs in the presentation. The overview slide indicated $7 million contributed by funding partners as a separate item from the $3 million contractor cost-share but the reviewer did not catch who those funding partners include. The reviewer expressed the opinion that it would be good to have these partners called out as collaborators in the presentation.

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

Reviewer 1:

The reviewer indicated that the future work is to include design, integration and delivery of the vehicles by the contractors, then a 24-month on-road demonstration period for each. It is good that these future plans include a rigorous comparison to 2012 or newer baseline vehicles in order to accurately benchmark the benefits and challenges of the ZECT vehicles with respect to costs, performance, reliability, effectiveness and needed refinements. The reviewer stated that the future work should also maintain a sharp focus on long-term commercial viability, and ask the contractors to detail their strategy and likely timing to transfer technologies supported through this project award into successful commercial products.

Reviewer 2:

The reviewer stated that in today's environment, economic impact of technology on increased costs to the shippers or OEMs must be taken into account. In this case, the aggregate economic impact on either the increased cost of tonnage of shipping (ultimately trickling down to the consumer), or the taxpayer, should be included.

Reviewer 3:

The reviewer stated that as the team is early in the project there is much opportunity for future work, perhaps too much, as there are so many system architectures. Future work to align specific architectures with specific duty cycles would be a great additional effort.

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

Reviewer 1:

The reviewer noted that the project stands to deliver a small amount of petroleum displacement from the individual demonstration vehicles, and a much larger level of displacement if the project makes possible long-term commercialization of the supported technologies in larger numbers.

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

Reviewer 1:

The reviewer stated that the significant cost of developing and delivering zero emission cargo transport vehicles makes the cost of this project understandably large. However, in comparison to other demonstration programs (such as those supported under ARRA that required roughly 50% contractor cost share), the 15% contractor cost share ($3 million/$20 million) seems a bit low. The reviewer felt that requiring contractors to put up a larger percentage of the required funds would increase their incentive to get the technologies integrated into future product offerings and thus achieve a return on their internal investments.

Medium-Duty ARRA Data Reporting and Analysis: Ken Kelly (National Renewable Energy Laboratory) - vss159

Presenter

Bob Prohaska, National Renewable Energy Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer noted great work on collecting data on various technology deployment projects for advanced technologies in commercial vehicles. The projects are well structured and the data is methodically and rigorously handled, and can be retrieved and analyzed in subsequent projects.

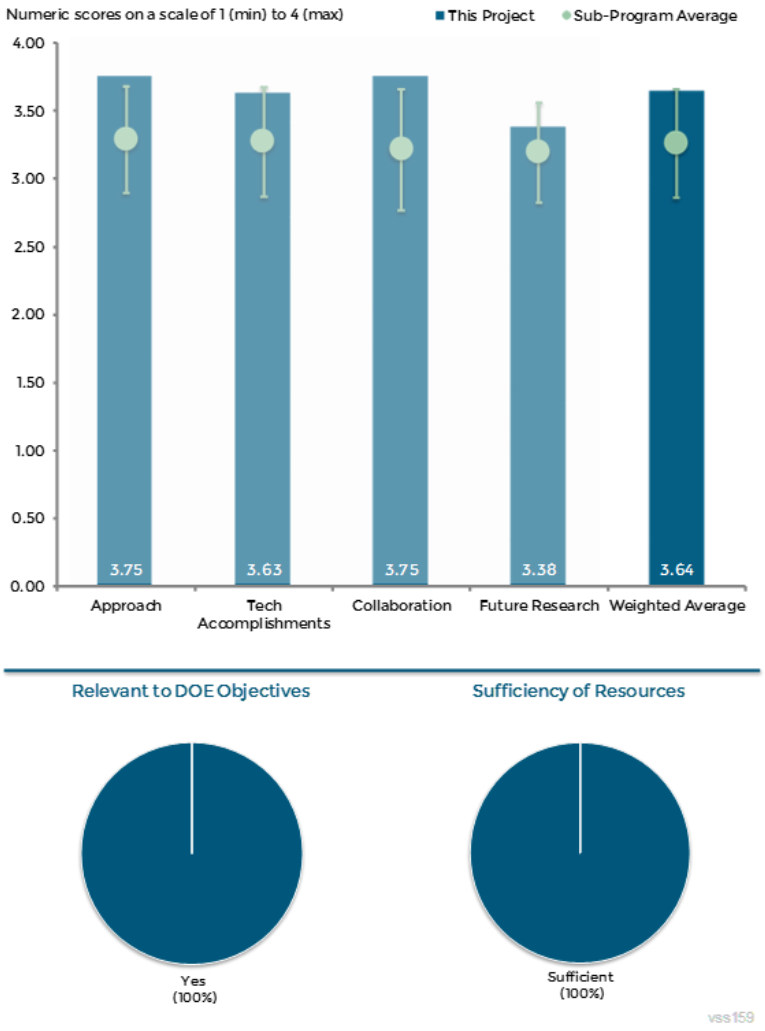

Figure 1-37 Medium-Duty ARRA Data Reporting and Analysis: Ken Kelly (National Renewable Energy Laboratory) - Vehicle Systems

The reviewer stated that there are apparently several, similar NREL project relating to collecting and analyzing data for fleets (on various levels). It would be good to have an overview of how these projects relate to each other and to see whether any overlap or gaps exist in the overall data collection and analysis efforts.

Reviewer 2:

The reviewer stated that this effort is right on target with shaping the industry perceptions of these new technologies. The barrier related to the long-term viability of the OEMs may need more attention and support. The reviewer noted that collecting and reporting on operational availability, amount of maintenance and parts consumed, and logistics downtime could bolster the first barrier.

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

Reviewer 1:

The reviewer stated that three completed deployment projects, along with reports, in addition to two ongoing projects are a respectable output for the reporting period.

Reviewer 2:

The reviewer noted being unaware of an automotive data collection effort superior to this.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer indicated that it is apparent that close collaboration with fleet and technology partners is required to achieve these results. Good work.

Reviewer 2:
The reviewer stated that this project has to achieve a wide range of collaboration in order to execute.

Reviewer 3:
The reviewer stated that some coordination with SHAs or other site owners for charging stations should be sought to obtain feedback on the impact on their operations or utility costs. The SHAs may also provide road condition data by road network or region that would be relevant to the outcome of this study.

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

Reviewer 1:
The reviewer noted that the proposed future work is on target. The potential for identifying optimal truck configurations of payload, power, and energy capacity for different vocations could really change the industry for the consumers and the OEMs. The reviewer stated there was great potential to drive down costs through volume production.

Reviewer 2:
The reviewer stated that it would be good to present what specific technologies will be priorities in the coming years to be able to assess whether the most relevant technologies are being evaluated and the right emphasis is being placed (e.g., HEV, BEV, PHEV, hydraulic hybrid).

Otherwise the future work is a little opaque.

Reviewer 3:
The reviewer noted that there appears to be an inconsistency between the timeline presented in the overview and the proposed future research on Slide 22. Although there is no scope identified on the slide, future research considerations of interest to fleets would be maintenance trade-offs and the availability of charging stations. The reviewer stated that DOE should coordinate with DOT/SHAs for future investments in charging facilities as the next Surface Transportation Legislation is finalized.

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

Reviewer 1:
The reviewer stated that this project will identify areas in which the technology performs best by vocation. Good project.

Reviewer 2:
The reviewer indicated that this not only supports DOE objectives, but also the DOT Clean Transportation Sector Initiative goals of 80% GHG emissions reductions by 2050, as well as EPA objectives.

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

No comments were received in response to this question.

Fleet DNA Phase 1 Refinement and Phase 2 Implementation: Ken Kelly (National Renewable Energy Laboratory) - vss160

Presenter

Adam Duran, National Renewable Energy Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that this is the Manhattan Project for advanced powertrains/systems for commercial vehicles. The only potential area of improvement is to work with the users of this capability with the intent to refine the products.

Reviewer 2:

The reviewer stated that this is an excellent attempt to replace a dead system, VIUS, with a much less cumbersome process to get field data for developers of new technologies. The reviewer emphasized that this can be done without bothering people with a survey document. This level of data collection seems appropriate.

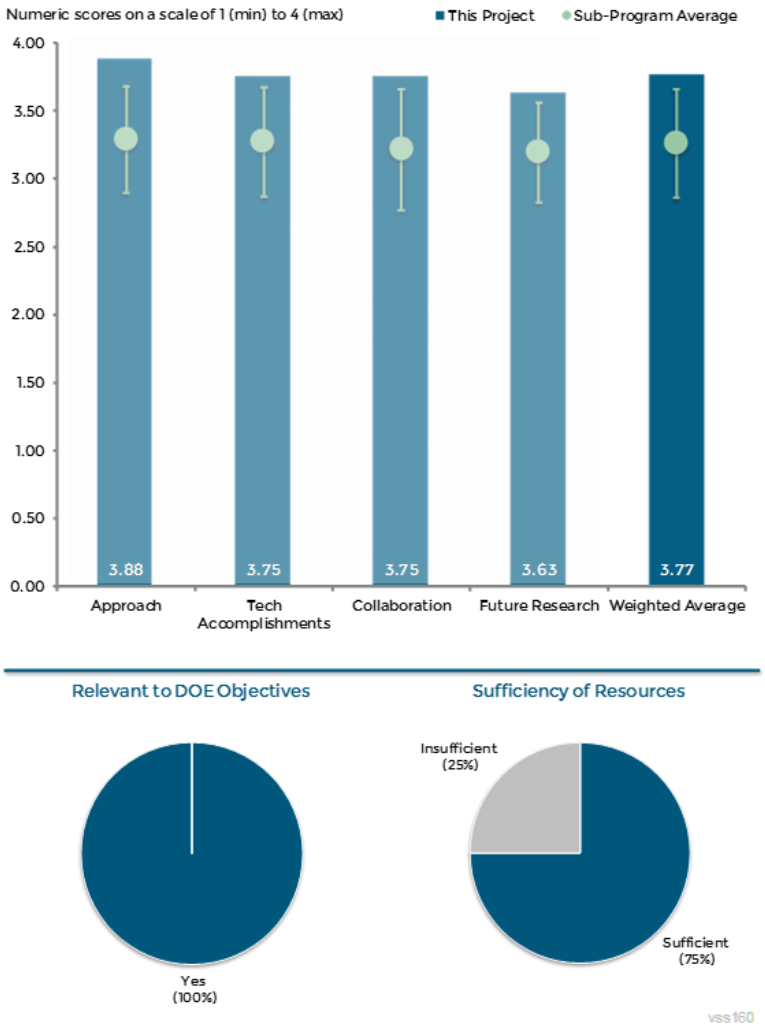

Figure 1-38 Fleet DNA Phase 1 Refinement and Phase 2 Implementation: Ken Kelly (National Renewable Energy Laboratory) - Vehicle Systems

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

Reviewer 1:

The reviewer stated that this effort is very difficult to improve at this point. Now that this information is available it will take some time to see how the outside world will use it. The reviewer would expect that the desire for new types of analyses will emerge over time.

Reviewer 2:

The reviewer stated that the project seems on scope and completing the data collection on a timely basis. It also seems from the examples shown that this tool is desired and being used already. The reviewer remarked that the team was doing a good job.

Reviewer 3:
The reviewer noted an excellent portal for ease of data access and visualization tools.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that this project sets the bar for collaboration and coordination.

Reviewer 2:
The reviewer emphasized an excellent list of manufacturers, end-users and governments/non-governmental organizations (NGOs) on the lists. It definitely seemed to the reviewer that the team is engaged and interested in using this data for their efforts to match up with other customer quality deployment data collection.

Reviewer 3:
The reviewer stated that some value may be found in collaborating with SHAs and metropolitan planning agencies that may have symbiotic interests.

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

Reviewer 1:
The reviewer stated that the plan to start collecting and storing laboratory data is excellent. Additionally, the future plan to fold in the simulation capability will really open the door for optimizing vocation-specific platforms.

Reviewer 2:
The reviewer indicated that getting additional data per the plan is critical and continuing to test the tools with interested parties will ensure their ongoing use by an increasing number of stakeholders. The reviewer questioned how this tool will be further marketed for understanding, noting that this is not readily discussed. The reviewer hears more about how unfortunate it is that VIUS is gone and appreciates trying to promote this more, but does not see the results in the industry yet. This is important work now and down the road as the database matures.

Reviewer 3:
The reviewer noted that additional value may be found by incorporating data sets such as traffic congestion, road condition and weigh-in-motion data to see what effect it has on the fleet performance by vehicle class, road network and/or region.

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

Reviewer 1:
The reviewer deemed this one of the most significant projects in these sessions. Field data is critical to developers, integrators and fleets. The project should have a huge benefit in technologies being available and on accelerating their adoption in the real world.

Reviewer 2:
The reviewer called this very important information for future development of propulsion technologies.

Reviewer 3:
The reviewer stated that the project provides easy access to costly data and analysis tools that can be applied to future research and policy decisions that affect DOE, DOT, EPA and State GHG emission reduction targets.

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

Reviewer 1:
The reviewer indicated that given the massive amount of data collection, coordination, processing, quality assurance (QA), storage, security, analytics and dissemination, the funding available appears to be modest.

Reviewer 2:
The reviewer said resources seem appropriate.

Multi-Speed Gearbox for Commercial Delivery Medium-Duty Plug-In Electric Drive Vehicles: Bulent Chavdar (Eaton Corporation) - vss161

Presenter

Bulent Chavdar, Eaton Corporation.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer noted that the approach and strategy in Slide 5 is comprehensive. Because application of this technology can be extremely expensive, which may prohibit its acceptance by the market, this issue must be addressed, specifically with potential payback time.

Reviewer 2:

The reviewer noted that it was building on the strengths of ORNL and NREL. Good comparisons to baselines. The reviewer believed it had strong business case development, which is not always seen on these types of DOE programs.

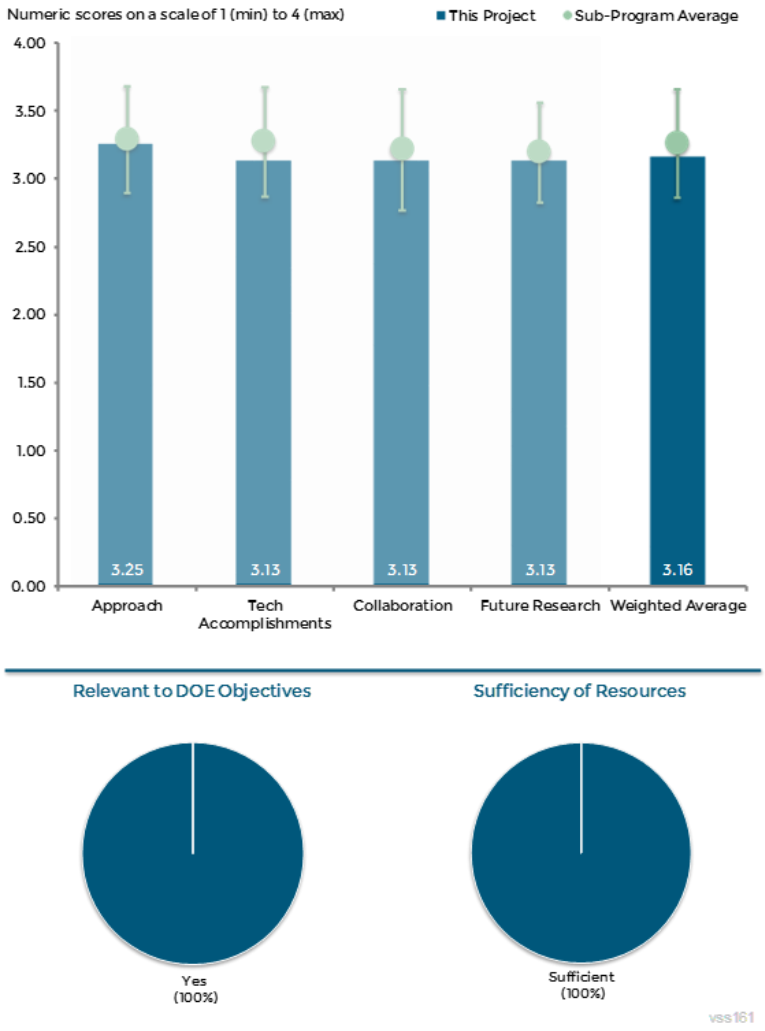

Figure 1-39 Multi-Speed Gearbox for Commercial Delivery Medium-Duty Plug-In Electric Drive Vehicles: Bulent Chavdar (Eaton Corporation) - Vehicle Systems

Reviewer 3:

The reviewer stated that the project objectives and how they relate to DOE goals are not stated in the presentation, therefore it is unclear whether the approach is adequate and what the scope of the project is.

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

Reviewer 1:

The reviewer stated that deliverable goals are being met. This is a good topic, but the reviewer questioned the EV volumes in this space and the contribution of such a transmission. The reviewer appreciated Eaton and DOE working on this. The reviewer asked if benefits in acceleration and top speed are really needed. The reviewer understood the increase in gradeability and fuel economy, but questioned the results from voice of customer work shared in Slide 11, and suggested this might be validated a bit more.

Reviewer 2:
The reviewer indicated that performance metrics are not provided, so found it difficult to determine whether the progress is sufficient.

Reviewer 3:
The reviewer noted that the approach taken to analyzing EV transmission volume is misleading because one of the keys to see market penetration is the payback period and cost. Only presenting projection on volume is not enough. The reviewer asked what the y axis for the figures in Slide 10 is and what DFSS (Design for Six Sigma) means. The reviewer said do not assume that all readers can understand all acronyms.

The reviewer said if capital cost and price of transmission would be overwhelmingly important (Slide 11), the cost should have been addressed. However, this has not been done yet.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that having two national laboratories plus Smith is good.

Reviewer 2:
The reviewer stated that collaboration, communication with other fleet owners, such as SHAs, who often have GHG emission reduction targets, may be valuable to provide information for future equipment purchase decisions.

Reviewer 3:
The reviewer did not see end–users as partners; the reviewer thought that might really help here with inputs to the business case and to help with tradeoffs in the design.

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

Reviewer 1:
The reviewer indicated that a good plan seems to be in place.

Reviewer 2:
The reviewer noted that some analysis on return on investment should be provided and also related to existing technologies.

Reviewer 3:
The reviewer indicated that in BP1, capital cost of the system, price of the transmission, and total operation with payback time should be included. Without this plan, this program provides less value to public.

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

Reviewer 1:
The reviewer stated that this not only supports DOE objectives, but also the DOT Clean Transportation Sector Initiative goals of 80% GHG emissions reductions by 2050, as well as EPA objectives.

Reviewer 2:
The reviewer stated that the system will use less energy.

Reviewer 3:
The reviewer agreed that the project supports DOE objectives somewhat, but with the low uptake of EVs the reviewer was unsure this is essential to investigate.

Reviewer 4:
The reviewer was unsure because of the extremely high cost and its payback time in the medium-duty (MD) world. Customers may not accept this approach unless payback and cost issues can be addressed in this program.

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

There were no reviewer comments on resources.

Integrated Boosting and Hybridization for Extreme Fuel Economy and Downsizing: Vasilios Tsourapas (Eaton Corporation) - vss162

Presenter

Vasilios Tsourapas, Eaton Corporation.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer considered this an interesting technology application and a good plan for initial development and technology evaluation

Reviewer 2:

The reviewer stated that the project approach is generally effective. The plan should address the main issues with this system in regard to durability and electric power compatibility in the early stage of the project.

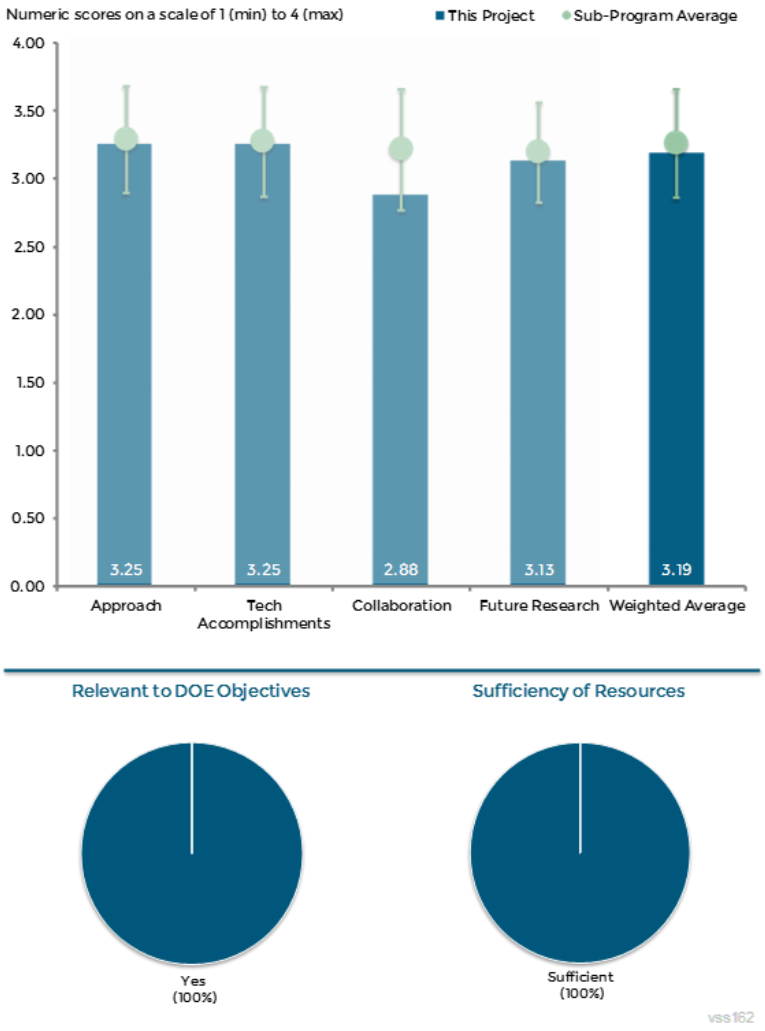

Figure 1-40 Integrated Boosting and Hybridization for Extreme Fuel Economy and Downsizing: Vasilios Tsourapas (Eaton Corporation) - Vehicle Systems

Reviewer 3:

The reviewer stated that it would be nice to have a comparison of how these technologies compare in cost to other alternatives for improving fuel economy. The Roots expander and hybrid supercharger are interesting technologies. The reviewer indicated that a comparison with other technologies might help justify the selection of these technologies for application on an engine (and could help answer any potential questions about whether Eaton has selected off-the-shelf technologies for this project).

Reviewer 4:

The reviewer stated that the first project year is difficult to judge properly. Some packaging and base design work has been completed. Next year will prove more telling.

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

Reviewer 1:

The reviewer stated that the project shows good progress in the areas of simulation and material and component development.

Reviewer 2:
The reviewer noted that though the team is early on in the project, the schedule is clearly defined, and being ahead of schedule on the modeling allows additional evaluation time for waste heat and engine integration.

Reviewer 3:
The reviewer stated that the packaging and base design has some work completed. Difficult to properly gauge the project as it has only been working for a few months.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that this is the proper mix required for such a demonstration.

Reviewer 2:
The reviewer stated that collaboration seems reasonable. Addition of a partner that actually manufactures engines might improve the project (not clear if that is possible).

Reviewer 3:
The reviewer noted a good group of collaborative partners that encompass the systems immediately impacted by these two systems, but there remains a question in overall vehicle-related requirements.

Reviewer 4:
The reviewer stated that the project could improve collaboration by using partners from national laboratories and industry.

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

Reviewer 1:
The reviewer indicated that modeling, design, development and in-vehicle demonstration is the proper plan for such a technology.

Reviewer 2:
The reviewer stated that it will be very interesting to following this leading-edge application of these technologies.

Reviewer 3:
The reviewer stated that the project uses a standard project development plan that covers all requirements for having a final product.

Reviewer 4:
The reviewer indicated that one area for potential future research is further exploration of the interactions of these systems with engine calibration. The reviewer questioned how the engine calibration might be optimized to help improve overall system performance. It was not clear how much work in the future will be focused on engine calibration development, but it seems this would be an important area to get the best performance from the powertrain system as a whole. The reviewer stated that understanding the impact of the Roots system on backpressure, and how the backpressure impacts peak cylinder pressure constraints, engine durability, and efficiency will be important to understanding the potential impact of the system.

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

Reviewer 1:
The reviewer indicated that hybrid supercharging should enable downsizing, start/stop, and some energy capture, all of which save fuel. The Roots expander saves fuel by capturing waste exhaust energy.

Reviewer 2:
The reviewer stated that the predicted 20% improvement over turbocharged baseline is an aggressive target. If the target is met, it will demonstrate an effective and cost-effective technology.

Reviewer 3:
The reviewer noted that the obvious impact of 20% improvement of fuel economy would align with DOE goals, as well as taking advanced technology into deployment for transportation efficiency

Reviewer 4:
The reviewer stated that if successful it could make significant improvement for engine downsizing and thus fuel consumption savings.

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

Reviewer 1:
The reviewer noted an interesting combination of systems into one project; the controls required to balance these two systems to achieve optimization may require additional vehicle-related tuning

Reviewer 2:
The reviewer stated that the project has sufficient resources.

Advanced Bus and Truck Radial Materials for Fuel Efficiency: Justin Martin (PPG Industries, Inc.) - vss163

Presenter

Justin Martin, PPG Industries, Inc.

Reviewer Sample Size

A total of three reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that it seems like a good approach. There is lots of background experience to draw on and the tools and plans are in place to proceed and be successful.

Reviewer 2:

The reviewer stated that the objective of this task is to design, develop, and demonstrate fuel efficient and safety regulation-compliant tire filler technologies with the expected outcome to achieve natural rubber truck and bus radial tires with an overall fuel efficiency improvement of 4-6%, while maintaining or improving tear strength and tread wear. The focus is to develop a method to controllably and uniformly disperse silica fibers into rubber formulas, develop a new, surface-modified silica technology that reduces rolling resistance by at least 60% in the lab compared to current carbon black technology, and the development of new rubber blends optimized for rolling resistance, tear strength, and tread wear performance. The reviewer noted that a significant challenge for truck and bus tires is that natural rubber contaminants are believed to interfere with in situ coupling required to effectively disperse silica, thereby yielding poor filler dispersion, tire performance, and processing. The approach involves investigating the ability of Agilon passenger tire products to overcome the natural rubber contaminant problem which has been researched and published. The reviewer indicated that the overall approach includes controlling dispersion (understanding how different silica surface chemistries and surface areas or linked to performance), development of new tread compounds (using previous results to reduce rolling resistance by at least 60% with no degradation in hardness, tear strength, and tread wear), and ultimately optimizing formulas for on-tire performance (select final rubber compound formulations for tire builds for independent testing by DOE). This is a very sound and logical approach to achieving the project objective and addressing associated challenges.

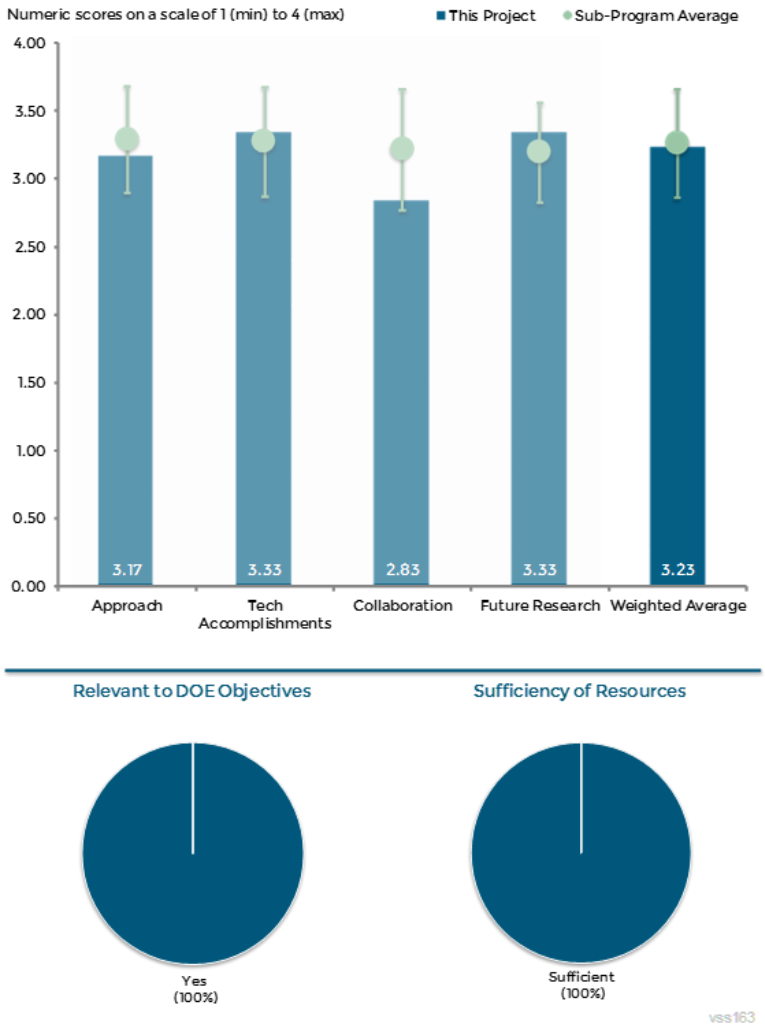

Figure 1-41 Advanced Bus and Truck Radial Materials for Fuel Efficiency: Justin Martin (PPG Industries, Inc.) - Vehicle Systems

Reviewer 3:
The reviewer stated that the approach of trying new filler materials is sensible. The reviewer indicated some uneasiness about the target being truck tires. Even if the team means only Class 8 trucks (very unclear), tires for different uses-- high speed versus low, cold versus hot climate, heavy load versus lighter, are likely to require different properties. Perhaps the budget was too small to address a variety, but the primary target should have been identified.

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

Reviewer 1:
The reviewer indicated that several appropriate compounds were fabricated and examined. Adequate dispersion of silica in natural rubber blends was observed.

Reviewer 2:
The reviewer noted that the project is a recent start (October 2014) but has already achieved some key accomplishments. Specifically, surface energies of key rubber compounds have been calculated where the surface energy/polarity measurement is critical to understanding how to disperse fillers in polymer compounds. The reviewer stated that 12 silica materials have been synthesized to date and a variety of surface energies created. Most important, early rubber compound testing shows promising results with improvements of 47% in rolling resistance, 18% in wear resistance, and equivalence in hardness for treated silica versus the silica control. The reviewer stated that overall, strong technical accomplishments were achieved early in the project.

Reviewer 3:
The reviewer stated that the project is showing good progress toward the 60% rolling resistance (RR) target. The reviewer suggested having an intermediate metric to track progress on RR reduction.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer indicated that the project partners are PPG Industries, Bridgestone Americas Tire Operations, and Augustine Scientific – a lean, but sufficient team. It may be good to consider other project partners should intransigent technical issues arise and confound resolution.

Reviewer 2:
The reviewer stated that the key collaborator is, of course, the tire manufacturer. The analytic lab is also important. The reviewer noted that it would have been desirable to add a trucking company that might have been able to advise on the different types of use conditions the final tires would need to handle. The reviewer stated being convinced that one size does not fit all trucks and buses.

Reviewer 3:
The reviewer stated that it was not completely clear what Bridgestone brings besides consulting, but perhaps that is enough.

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

Reviewer 1:
The reviewer stated that it looks like a good plan with intermediate measures and tests to filter choices and show progress.

Reviewer 2:
The reviewer indicated that the proposed future work is very well detailed at the higher levels (optimizing silica materials and development of compatible rubber compounds) and identifying key tasks with associated milestones. Additionally, a discussion of the key remaining challenges and potential solutions is provided. The reviewer stated that this provides a sense that the project is well planned and thought out, with potential future obstacles already identified and solution pathways identified.

Reviewer 3:
The reviewer stated that the future work will basically optimize what the project team has already done and try to understand how processing and formulations change the results.

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

Reviewer 1:
The reviewer indicated excellent relevance, if this project delivers production-capable technology, fuel consumption will be directly reduced.

Reviewer 2:
The reviewer stated that this project supports overall DOE objectives of petroleum displacement because heavy-duty trucks and buses account for a large portion of petroleum use in the country and the contribution of tire RR to petroleum usage is significant, second only to aerodynamic effects.

Reviewer 3:
The reviewer stated that obviously if truck efficiency can be improved 4-6%, petroleum is saved. It is unclear how this work will actually demonstrate these savings.

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

Reviewer 1:
The reviewer stated that this project is 25% cost shared. Resources for the project are sufficient.

Reviewer 2:
The reviewer emphasized that is was hard to evaluate from information provided.

Reviewer 3:
The reviewer stated that it was hard to comment, but noted that DOE is funding a very large portion (75%) of the overall project and asked why the partners are not contributing more.

Evaluate VTO Benefits (BaSce): Neeraj Shidore (Argonne National Laboratory) - vss164

Presenter

Aymeric Rousseau, Argonne National Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that the simulation approach presented is outstanding in examining the fuel consumption and vehicle cost in coming decades.

Reviewer 2:

The reviewer noted an interesting project that will eventually grow with time. Adding new PT combinations/new technologies and then simulating benefits of all the combinations to determine which make sense and which do not, is a computational nightmare but assuming no limitation on computing power - is achievable.

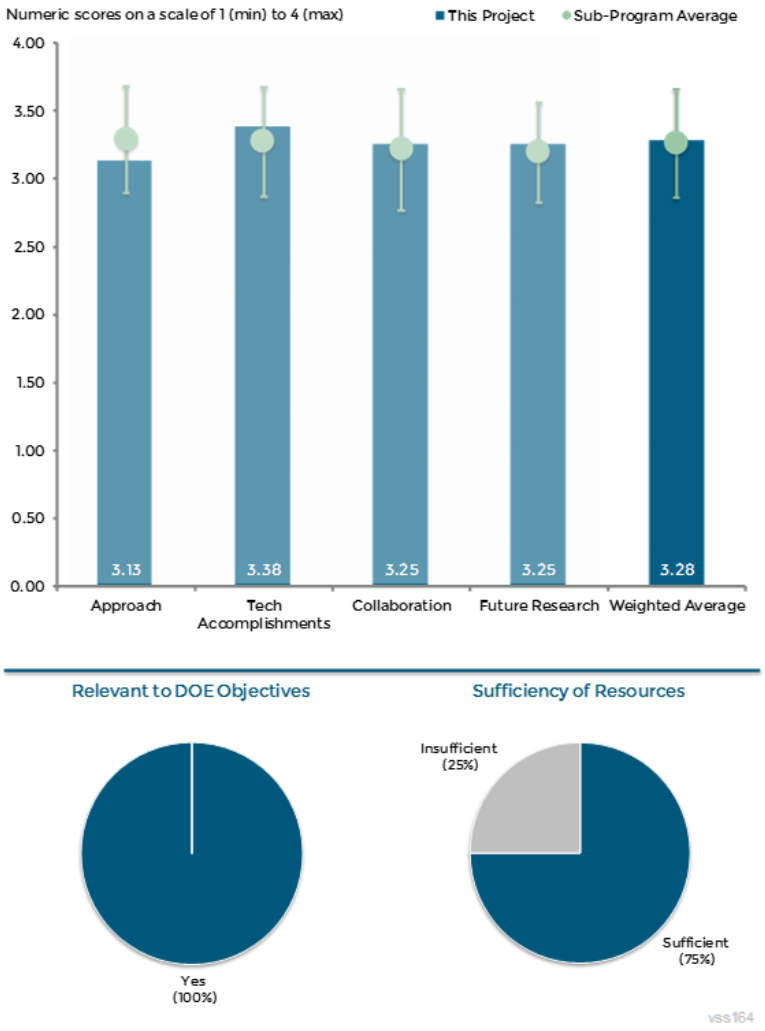

Figure 1-42 Evaluate VTO Benefits (BaSce): Neeraj Shidore (Argonne National Laboratory) - Vehicle Systems

Reviewer 3:

The reviewer stated that scaling up the number of simulations by an order of magnitude or more appears to have been accomplished quite effectively. As the authors point out in the presentation, dealing with the large quantity of data requires very robust quality assurance (QA)/quality control (QC), and in such cases, usually, one can only account for problems that have been encountered before. The reviewer questioned how to address problems that have never been seen before in an automated QA/QC process. The reviewer also questioned, on a separate note, how to separate out the benefits of VTO funding, as distinct from advances that might have taken place even without VTO funding.

Reviewer 4:

The reviewer stated that the information was pertinent, but poorly displayed.

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

Reviewer 1:
The reviewer stated that the results obtained help to overcome the critical barriers to reducing consumption of petroleum fuels and promoting commercialization of innovative vehicle technologies.

Reviewer 2:
The reviewer indicated that the novelty of using IAV to determine the baseline and then variance from this point is a useful way of normalizing technologies so that their true benefit can be assessed. The component sizing versus cost benefit is a strong achievement.

Reviewer 3:
The reviewer indicated that good progress appears to have been made in developing methods for handling large quantities of results; however, this remains the Achilles heel - see previous comment. The reviewer stated that the graphs on Slide 11 are confusing and the probability in the two graphs should add up to one. The reviewer indicated that Slide 14 is confusing as well - the second graph shows diesel HEVs having lower fuel consumption than gasoline HEVs, but the statement above the graphs makes the opposite claim. The reviewer said that in the technical accomplishments slides, a short explanation of why the results are what they are, would be very helpful. The reviewer stated that significant amounts of data are being processed to generate these graphs, and putting a reasonable amount of effort into understanding and explaining the reasons for the trends (even the slightest variation from expected behavior) would lessen the likelihood of bad results slipping through the QA/QC process.

Reviewer 4:
The reviewer stated that it was somewhat difficult to follow the flow and solutions. Once it was explained it made more sense, needed verbal guidance.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer saw no problem here.

Reviewer 2:
The reviewer stated that the partners still appear to be predominantly from within DOE. The strength of this program should be shared and made available for others to use. The reviewer discussed with the presenter that while the information and data from this project is available, one unfortunately must know that it is there, and then go look, as it is not publicized in any way that the reviewer could determine.

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

Reviewer 1:
The reviewer would like to see this project reach into the MD and HD environment. Here the complexities are much greater and a tool like this could be of significant benefit to both OEMs and Tier 1 suppliers. The reviewer would be interested to see if a slimmed-down version of this could be used as an ordering tool to assist customers in their technology selection, recognizing the complexity of the MD/HD world.

Reviewer 2:

The reviewer stated that life-cycle cost is one of the most important factors for the customer in selecting future vehicle technologies. The principal investigator (PI) should consider the cost of home charging systems for EVs and PHEVs as most customers will have in-house charging systems in the future.

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

Reviewer 1:

The reviewer stated that the study has supporting information to show the relevance.

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

Reviewer 1:

The reviewer remarked resources were poorly displayed.

Design and Implementation of a Thermal Load Reduction System in a Hyundai PHEV to Improve Range: John Rugh (National Renewable Energy Laboratory) - vss165

Presenter

John Rugh, National Renewable Energy Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer noted a well-organized follow-on to previous work

Reviewer 2:

The reviewer was excited to see the results of this project. Approach looks long, strong and two phases seem appropriate for planning. The reviewer stated that it builds on the strong skill set NREL has on this after completing the truck project.

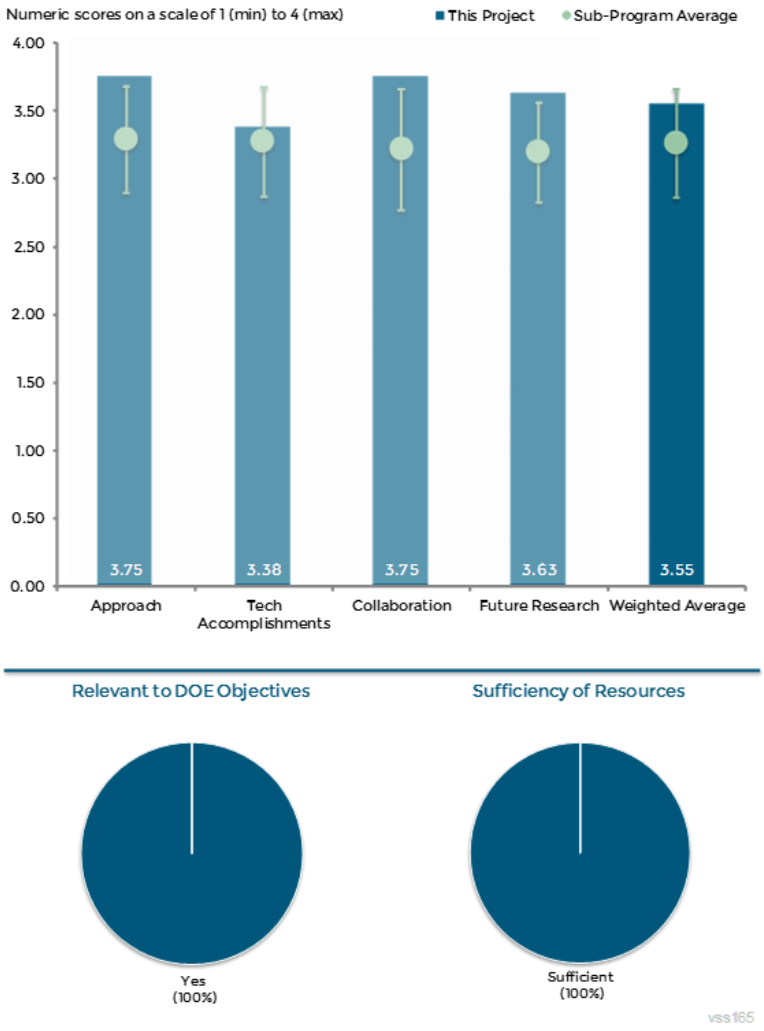

Figure 1-43 Design and Implementation of a Thermal Load Reduction System in a Hyundai PHEV to Improve Range: John Rugh (National Renewable Energy Laboratory) - Vehicle Systems

Reviewer 3:

The reviewer stated that the goal of the project is to increase the grid-connected electric drive vehicle range by 20% during operation of the climate control system over the standard vehicle configuration by reducing vehicle thermal loads. The reviewer stated that thermal loads can be highly detrimental to the range of EVs in cold (especially) and hot ambient temperatures. The two-phase approach of this task with Phase 1 being led by NREL and Phase 2 by Hyundai America including design and development under phase 1 and integration and validation under phase 2 is sound. The reviewer noted that both phases include testing and analysis. Phase 1 will be conducted on a prototype and Phase 2 on production Hyundai Sonata PHEVs. The reviewer stated that a broad cross section of technologies (often leveraging previous work) are being examined including insulation, solar reflective paint, solar control glass and films, heated and cooled seats, door glass defrosters/ defoggers, and grid-connected preconditioning. It is not clear whether advanced HVAC systems are being considered as part of this project, probably not. The overall approach and sequencing including the hand-off after phase 1, as well as the scope of technology considerations is well considered.

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

Reviewer 1:
The reviewer indicated it is early in project and looks forward to Phase 2 results.

Reviewer 2:
The reviewer stated that the project seems to have a good start and a good team in place.

Reviewer 3:
The reviewer stated that the project is new start for fiscal year (FY) 2015 and as such has a relatively limited number of accomplishments. Business/legal agreements with partners have progressed, a vehicle platform (Hyundai Sonata) has been chosen, and a preliminary summer test plan/approach has been identified. The reviewer indicated that this summer's test plan includes splitting the effort into a two-phase air conditioning test (pull-down and steady state) which is expected to increase repeatability and improve determination of technology impact on HVAC loads. Overall, given the early stage of the project, an acceptable list of accomplishments.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that having Hyundai as a partner in the project will prove concepts once in the demonstration phase.

Reviewer 2:
The reviewer indicated good work getting OEM involvement.

Reviewer 3:
The reviewer noted a good set of collaborators.

Reviewer 4:
The reviewer stated that the extent of collaboration and coordination with other entities is excellent, including a vehicle OEM (Hyundai), a well-regarded climate control system supplier (Halla Visteon), and a technology supplier for each specific technology area. The reviewer stated that there are no obvious gaps in the overall team structure.

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

Reviewer 1:
The reviewer stated that quantifiable results from actual test will be very valuable. Should consider hot weather testing in a desert environment rather than at NREL.

Reviewer 2:
The reviewer stated that the proposed future work is covered adequately at a high level outlining the general task activities to be conducted. It would be beneficial if additional detail were provided as to specific task activities, especially ones which may be more critical (go/no-go milestone determinative) or challenging. Additionally, the reviewer stated that it would be beneficial to provide some insights into alternative strategies/options should current ones being considered not pan out either technologically or from an economic standpoint.

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

Reviewer 1:
The reviewer stated that the energy required for ancillary systems needs to minimize to provide more energy for propulsion.

Reviewer 2:
The reviewer noted excellent support to EV range achievement per EV Everywhere goals.

Reviewer 3:
The reviewer believed the project does support DOE goals. EVs and PHEVs need new understanding of these types of analyses, heat loading and the associated solutions, and using electric power as much as possible to propel the car.

Reviewer 4:
The reviewer stated that this project supports DOE objectives of petroleum displacement, as a significant barrier to continue market expansion of PHEVs is range reduction resulting from climate control loads, especially in cold weather. By reducing the impacts of climate control loads, the size of the battery and climate control system can be reduced (lowering cost) or kept the same achieving greater driving ranges and consumer acceptance.

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

Reviewer 1:
The reviewer stated that this project has a 20% cost share, which indicates respectable industry commitment. Resources for this project are sufficient.

Advanced Transmission Selection to Provide Accurate VTO Benefits: Neeraj Shidore (Argonne National Laboratory) - vss166

Presenter

Neeraj Shidore, Argonne National Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer noted that the approach to enhancing transmission selection to merge with control optimization and vehicle sizing process is very good. Previous work of updating automatic transmission and shifting algorithms in Autonomie and development of detailed dual-clutch transmission (DCT) and continuously variable transmission (CVT) models have provided a good basis for accomplishing this year's and future activities.

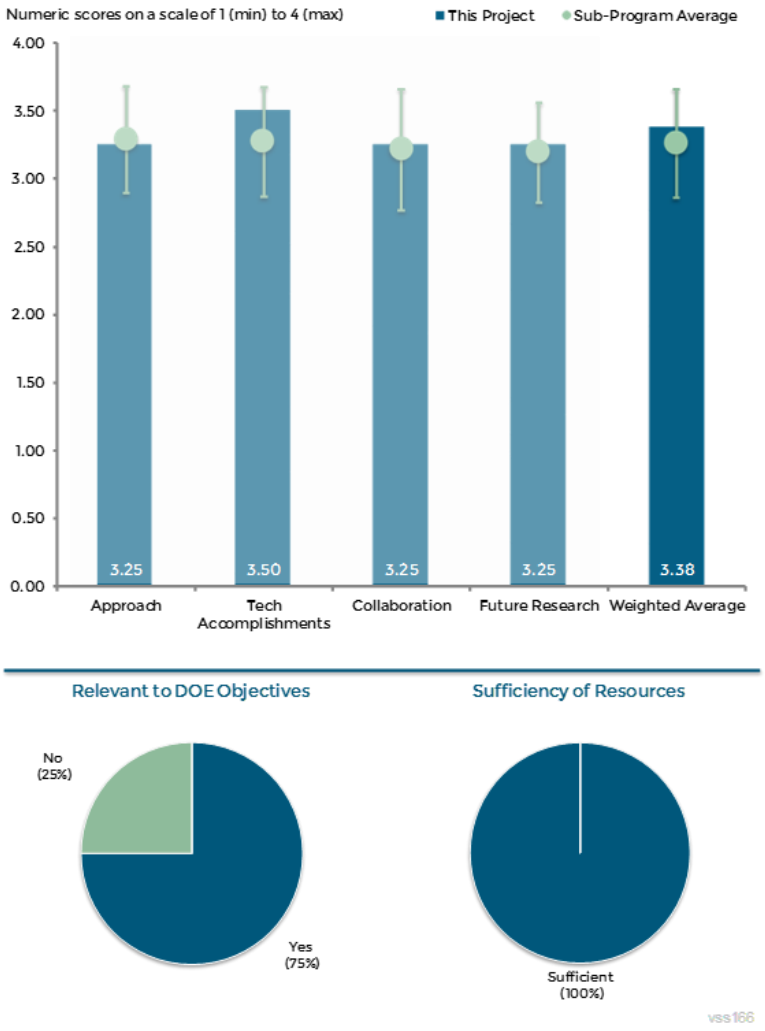

Figure 1-44 Advanced Transmission Selection to Provide Accurate VTO Benefits: Neeraj Shidore (Argonne National Laboratory) - Vehicle Systems

Reviewer 2:

The reviewer stated that the modeling and validation approach for implementing transmission models in Autonomie is well done. There are some inherent modeling limitations in capturing characteristics of these complex systems.

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

Reviewer 1:

The reviewer noted that the progress has been excellent. Models are very reasonable in results produced.

Reviewer 2:

The reviewer stated that the technical accomplishments have been very good, including the development and validation of advanced transmission models and showing that shift parameter optimization can result in significant fuel economy improvements in conventional powertrains.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that the project leverages data from various sources where available. Inherent limitations are imposed by industry reluctance to share information.

Reviewer 2:
The reviewer stated that the collaboration and coordination in this project are very good. Technical guidance provided by the automotive manufacturers is very useful to the success of the project. The reviewer indicated that the data from Argonne's APRF is essential to the success of the project.

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

Reviewer 1:
The reviewer noted that the proposed future work is directionally correct. Co-optimization may yield some incremental benefits.

Reviewer 2:
The reviewer stated that the plan of future activities to expand optimization techniques to evaluate benefits of VTO technologies is very good. Including real-world driving cycles in the evaluation VTO technologies will provide needed additional insight into the technologies.

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

Reviewer 1:
The reviewer indicated that it enables better modeling of systems for DOE technology assessments. This allows a more accurate picture of what is needed to achieve DOE objectives.

Reviewer 2:
The reviewer stated that this project definitely supports the overall DOE objectives of petroleum displacement. The development of algorithms for proper transmission selection is essential to evaluate the impact of vehicle technologies on fuel displacement and cost of advanced vehicles. The reviewer stated that the evaluation of VTO technologies requires a proper transmission selection and optimization which this project provides.

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

Reviewer 1:
The reviewer indicated that resources appear adequate.

Reviewer 2:
The reviewer stated that resources appear adequate to complete the project.

Integrated Network Testbed for Energy Grid Research and Technology Experimentation (INTEGRATE): Brian Hunter (National Renewable Energy Laboratory) - vss167

Presenter

Brian Hunter, National Renewable Energy Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer noted an excellent technical approach to establish operational feasibility and standards. Future work should consider regulatory and social changes required to support adoption.

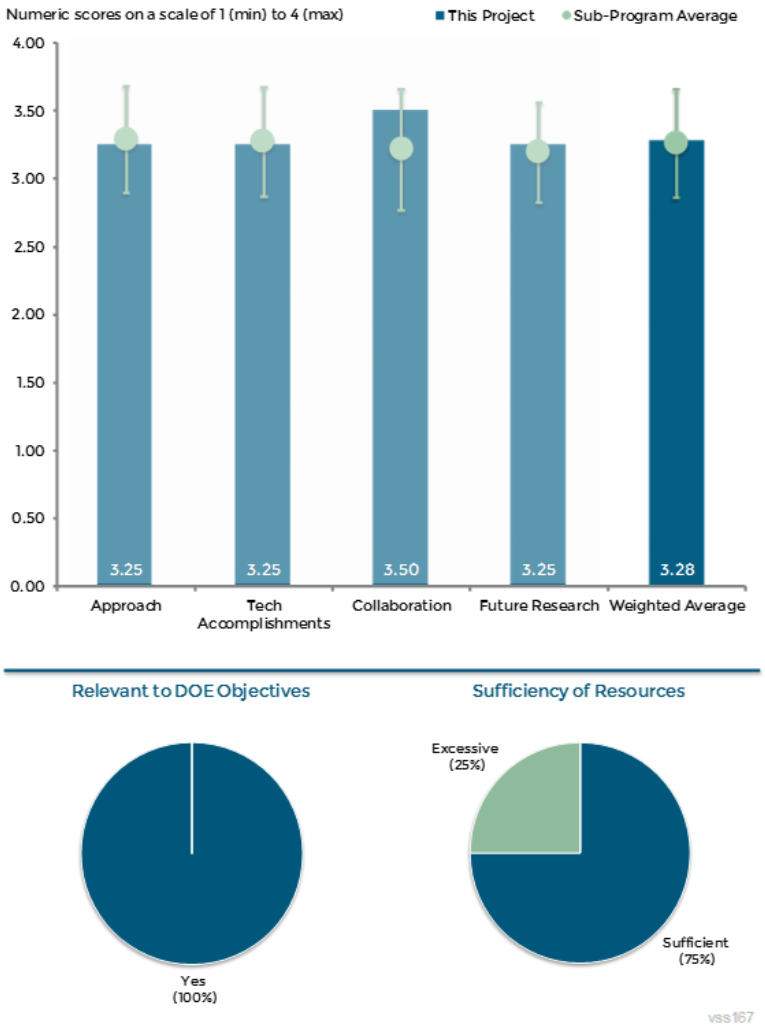

Figure 1-45 Integrated Network Testbed for Energy Grid Research and Technology Experimentation (INTEGRATE): Brian Hunter (National Renewable Energy Laboratory) - Vehicle Systems

Reviewer 2:

The reviewer stated that it was initially unclear how NREL is participating on the INTEGRATE project according to the presentation; however, after speaking with the presenter, it became clear that NREL is offering their facilities to the project. The reviewer concluded that INTEGRATE as a project is an appropriate activity to test out standards issued as part of the Grid Integration Initiative to evaluate how thorough and complete existing standards are, as well as to shine a light on gaps in these standards.

Reviewer 3:

The reviewer stated that it appears that 90% or more of the work done to date is in reviewing proposals and selecting the awardees. Very little information was provided about the selection process although the reviewer was told that more than 40 proposals were reviewed, a massive effort. The reviewer emphasized that it is not clear if reviewers are reviewing the selection process or the awarded projects. Most of the projects have not started yet, so it is difficult to review them and not enough information on the individual projects was provided to evaluate.

Reviewer 4:

The reviewer stated that this project has three primary components: connected devices, communication and control systems, and integrated systems with a focus on ensuring the seamless integration of clean energy technologies into the electrical grid. The reviewer said that on the surface this approach seems reasonable, but what seems to be missing is a clear vision (or at least presentation thereof) on how all this comes together at the

end of the project and fits into the realities of the marketplace and existing standards and codes environment. For example, under Approach/Strategy topic area 2, it says "INTEGRATE projects will design, build, and test a flexible, open-source, consensus standards-based communications, information, and communication (CIC) infrastructure ...." The reviewer stated that it is not clear exactly what this means and how an open-source, consensus standards-based system would be established given the proposed 18-month project duration juxtaposed with the notoriously slow standards development process and that some related standards are only currently in progress. Additional information elucidating the processes and pathways of how all the project pieces come together at the end, more detailed information with regard to the role of standards development organizations, and the final project outcomes would be very helpful.

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

Reviewer 1:
The reviewer noted good progress in team selection and integration. Early in project.

Reviewer 2:
The reviewer stated that the project is 5% complete and is in the planning stage. That said, it would be good to see a proposed timeline, activities and deliverables for each topic area.

Reviewer 3:
The reviewer stated that this project is a relatively new start (2014) with essentially all the accomplishments being contractual in nature; reasonable progress has been achieved in this regard.

Reviewer 4:
The reviewer indicated that most of the work has not yet begun. The process of selecting and putting contracts in place is difficult but not enough information was provided on the selection process to determine its quality.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer noted that a large consortium of partners is involved in the INTEGRATE project in order to evaluate these standards. We will see in the future how the collaboration pans out.

Reviewer 2:
The reviewer stated that the new facilities at NREL support all project requirements. Should consider coordination with INL to address cyber security of systems.

Reviewer 3:
The reviewer stated that although not all of the 40+ proposals were included, it is clear that a very high level of collaboration is being done. The reviewer expressed disappointment that no utilities were selected for award.

Reviewer 4:
The reviewer stated that so far, there is a respectable number and broad cross section of collaborators in the project areas in which awards have been made. The collaborators identified appear appropriate to the tasks at hand. The reviewer indicated that it is important to stay in close contact and coordination with the codes and standards development community. A very strong element is the high level of cost share for the project, nearly 50% indicating strong commercial interest.

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

Reviewer 1:
The reviewer stated that most of the work is yet to be done. The reviewer is expecting significant accomplishments to be reported next year. The reviewer suggested that each of the awarded projects are reviewed individually and not as a group.

Reviewer 2:
The reviewer stated that 95% percent of the project lies ahead. The execution of the three topic areas appear to cover the important aspects of testing out the connected grid.

Reviewer 3:
The reviewer stated that for future project scope, consider business model required to support adoption.

Reviewer 4:
The reviewer stated that the proposed future research does not clearly identify the strategy and activities moving forward. Technologies will be installed and evaluated at the Energy Systems Integration Facility (ESIF) location at NREL, but with the exception of the University of Delaware project, little specific technical detail is given as to what the large task activities will be within each area. The reviewer questioned how all these activities coalesce at the end and fit seamlessly into the realities of an evolving grid and transitioning marketplace.

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

Reviewer 1:
The reviewer stated, yes, this project contributes to the operations of the connected grid, in which renewable energy sources are harmonized with smart appliances and consumers, also including EVs.

Reviewer 2:
The reviewer noted that the project is relevant to DOE objectives of petroleum displacement as the use of electric-drive vehicles will reduce petroleum use and the ability to synergistically tie EVs to the grid (both as V2X services and coordinating with load curves of renewable energy resources) is important to expanding the value proposition of EVs to the consumer.

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

Reviewer 1:
The reviewer suggested consider adding a cyber-security resource.

Reviewer 2:
The reviewer stated that the resources for the vehicular element of this project seem somewhat excessive. The two main project elements for vehicles include “characterizing the ability of V2X assets to increase hosting capacity of the grid and provide grid services” and “support open, practical, interoperable platforms in a way that enables renewable power and sustainable transportation technologies.” The reviewer indicated that other entities are looking at similar things (such as ANL and SDOs) and it is important to be fully cognizant of and coordinate with them upfront and on an ongoing basis to eliminate duplication/overlap of activities. It may be a good idea (it is not clear whether this is intended) to look at the services that could be provided to the home by EVs as part of this project (such as during emergency power outages), as in some ways this may be a more viable and tangible attribute in the minds of potential EV consumers.

Accessory Loads Analysis: Richard Carlson (Idaho National Laboratory) - vss168

Presenter

Richard Carlson, Idaho National Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that the project follows standard test procedure. The approach could be updated as the project progress.

Reviewer 2:

The reviewer stated that the approach taken is good, but desired to see additional vehicles included, along with measuring individual loads for a given common feature.

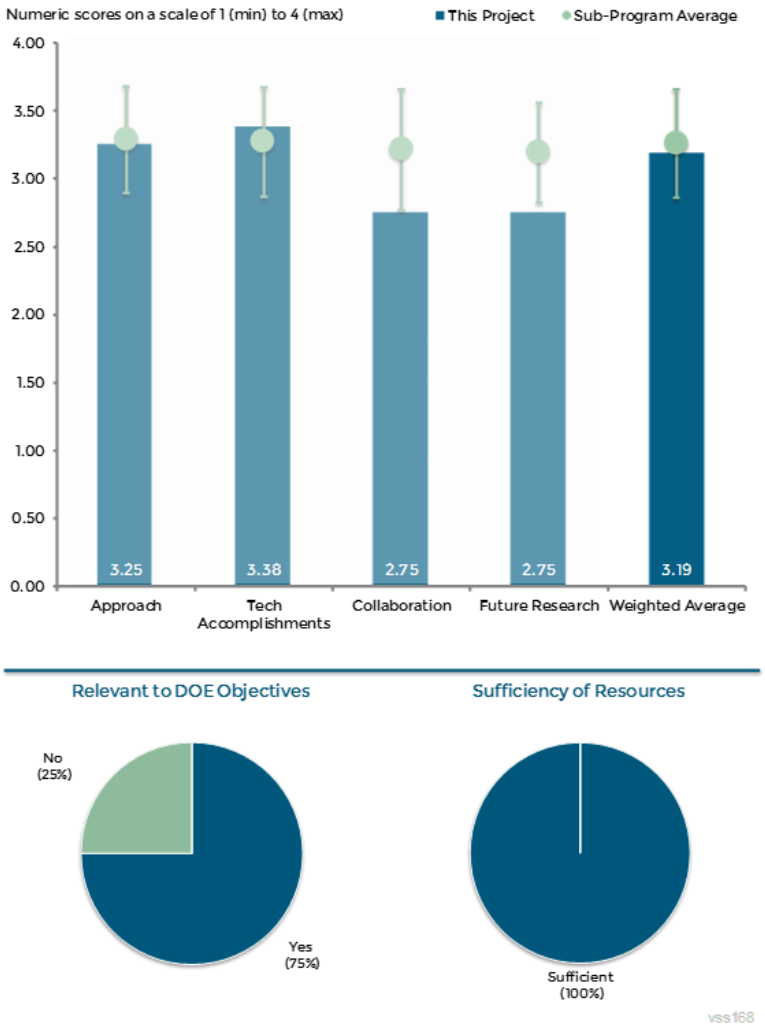

Figure 1-46 Accessory Loads Analysis: Richard Carlson (Idaho National Laboratory) - Vehicle Systems

Reviewer 3:

The reviewer suggested the PI might want to consider the distance-specific energy consumption of auxiliary systems, which will help research community to better understand the percentage of energy consumed by auxiliary systems.

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

Reviewer 1:

The reviewer noted that the project is on track. This could be a starting point for other data generation, collection, and analysis to further evaluate this area. Also, it could expand to other types of vehicles.

Reviewer 2:

The reviewer stated that the accomplishments and progress are good, but wanted to see data broken down by features and not the total aggregate.

Reviewer 3:

The reviewer stated that the data are important for industry and research community in evaluating the auxiliary load of LDVs.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer stated that additional vehicles and involvement from OEMs with technical support will enhance the data resolution and accuracy.

Reviewer 2:
The reviewer noted that more OEMs should be involved. Larger vehicles such as full-size U.S. cars should be evaluated.

Reviewer 3:
The reviewer indicated that the role of partners in this report is not explained.

Reviewer 4:
The reviewer noted that this information appears to lack relevance to anyone other than the OEMs. Even if this is exclusively funded by industry, some explanation of how the outcome will be beneficial to consumers should be provided.

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

Reviewer 1:
The reviewer stated that there is more potential for future work in this area.

Reviewer 2:
The reviewer stated that future relevant research may be the impact HEVs and EVs.

Reviewer 3:
The reviewer would like to see data at the component and feature level; and not just the aggregate vehicle level. This will allow comparison of the relative loads.

Reviewer 4:
The reviewer stated that distance-specific auxiliary load consumption should be reported in the future.

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

Reviewer 1:
The reviewer noted this project will help to better understand the energy consumption of auxiliary system.

Reviewer 2:
The reviewer stated that this work could have impact in an area that is important for the development of advanced technology systems that could improve vehicle fuel economy,

Reviewer 3:
The reviewer noted that this research appears to be in the interest of the OEMs alone.

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

Reviewer 1:
The reviewer stated that the project has sufficient resources.

PEV-EVSE Interoperability Project: Richard Jacobson (Intertek) - vss169

Presenter

Jeffrey Wishart, Intertek.

Reviewer Sample Size

A total of five reviewers evaluated this project.

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

Reviewer 1:

The reviewer indicated that the one year project was on target and under budget, EVSE evaluations complete.

Reviewer 2:

The reviewer indicated a systematic vehicle testing approach that tested a large number of combinations and EVSE equipment in a controlled setting. The reviewer stated that this type of effort is critical as second-generation EVSEs are being developed and new standards are being created regarding this equipment.

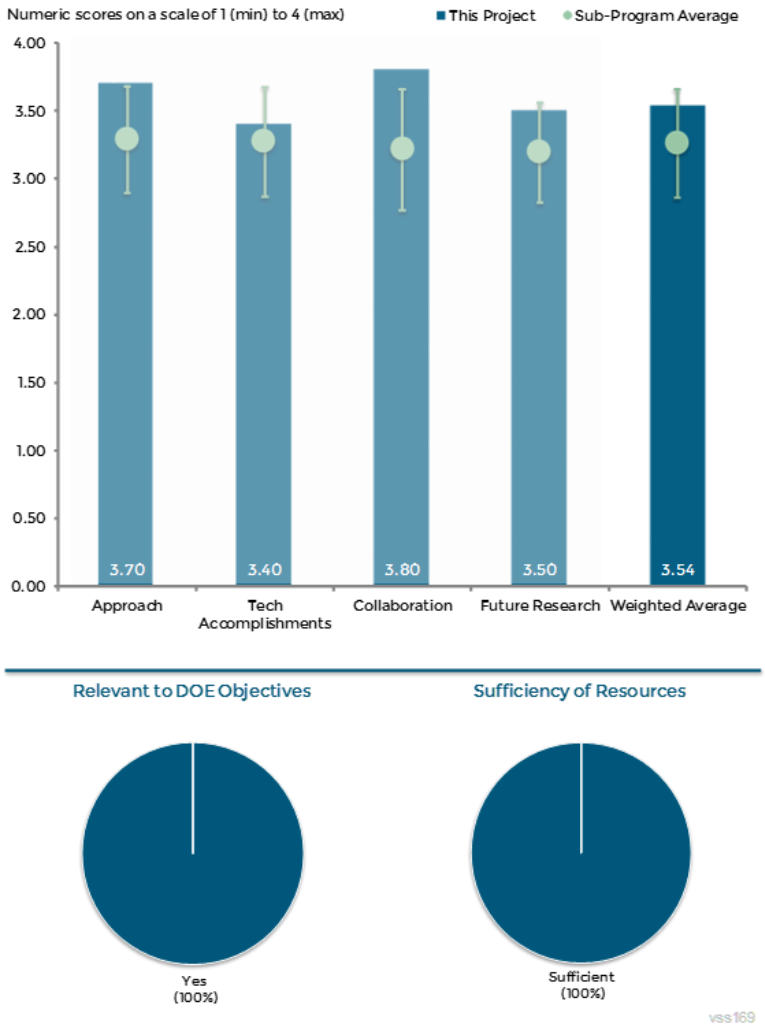

Figure 1-47 PEV-EVSE Interoperability Project: Richard Jacobson (Intertek) - Vehicle Systems

Reviewer 3:

The reviewer indicated that the overall approach was straightforward and logical. In order to see how the standard worked, the team tried to use it on as many vehicle and EVSE pairs as possible. The reviewer emphasized that it makes perfect sense to try out the standard under real conditions before promulgating it.

Reviewer 4:

The reviewer stated that the approach involved testing a matrix of PEVs and EVSE charging infrastructure, which seems like the most effective way to evaluate interoperability and inform refinement of the J2953 testing standard. Anecdotal comments shared by the presenter on project experience include observations of break-in/wear on the components as well as an experience curve for the technician conducting the testing that were not necessarily anticipated. So perhaps planning for how to address such a break-in period could be one minor way to improve the approach were this project to be repeated.

Reviewer 5:

The reviewer stated that the approach is sound and is a comprehensive approach to testing the interoperability between EV and EVSE. The project expands upon J2953 test protocols to further define failure modes and provides a better understanding of failure mechanisms.

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

Reviewer 1:
The reviewer stated that the project was brought to completion highlighting both successful EVSE communication and failures.

Reviewer 2:
The reviewer stated that over 2,500 EVSE/vehicle pairs were tested on a uniform basis. The testing method and software were evaluated and provided to equipment/vehicle manufacturers as appropriate. The reviewer stated that the results were interesting, in that not all pairs worked, so changes in the testing procedure and/or hardware had to be developed.

Reviewer 3:
The reviewer stated that initial results have identified vehicle, equipment and test procedure issues that could not have been discovered without this effort. If electrified mobility is the long-term goal, this type of effort should precede next-gen e-mobility infrastructure development.

Reviewer 4:
The reviewer stated that work was completed on time and under budget. The technical accomplishments of this project will help further the research of EVs within DOE's VTO.

Reviewer 5:
The reviewer noted that the presented accomplishments focused on completion of alternating current (AC) Level 2 compatibility testing between the range of vehicles and charging equipment. This testing revealed some issues, which were shared with the individual manufacturers whose equipment was involved, and an aggregate, anonymized report was created and published. The reviewer noted that it would have been nice to have the presentation include some additional details and findings from the test report.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer indicated that the collaboration included the most important players in the field, both from the national laboratory side and industry.

Reviewer 2:
The reviewer noted a very good mix of vehicles and hardware represented in this study.

Reviewer 3:
The reviewer stated that collaboration with ANL on the automated test procedure was excellent. Collaboration with SAE J2953 was good and supplemented ongoing work within that standards committee.

Reviewer 4:
The project involved extensive collaboration and coordination with manufacturers of the vehicles and charging equipment, with SAE and particularly the J2953 test procedure development committee, with ANL for testing automation software development and equipment, and with INL for overall AVTE program management and publication of the project report. The reviewer stated it is unfortunate that the results are only published in an anonymized format, but understandable if that was what the various manufacturers required in order to participate.

Reviewer 5:
The reviewer emphasized that sufficient laboratory and organizations; would have been nice to have more OE involvement.

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

Reviewer 1:
The reviewer stated that the team proposes to expand the scope to include fast charging and Tesla systems, which is important because of Tesla's pivotal market position and influence. It will be key to making sure there is compatibility among EVSE types. The reviewer emphasized that it will be necessary and challenging to develop a standard for testing these products.

Reviewer 2:
The reviewer stated that the proposed future work focuses on direct current (DC) charger interoperability testing, which represents a natural extension of the Phase 1 work.

Reviewer 3:
The reviewer stated that the focus on DC fast charging was appropriate and clear. Project could also add some MD/HD and/or commercial focus to look at these users/systems.

Reviewer 4:
The reviewer questioned whether the number of high-power level chargers warranted a similar test effort, or tighter equipment standards.

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

Reviewer 1:
The reviewer noted that it directly supports EV infrastructure development, and consumer acceptance of technology.

Reviewer 2:
The reviewer stated again, it is pretty simple. EVs are never going to gain significant market share if you cannot charge them reliably everywhere, so having standard, reliable chargers are key to petroleum displacement via electrification.

Reviewer 3:
The reviewer stated, yes, it helps develop and advance the state of the art for electric-drive vehicles.

Reviewer 4:
The reviewer stated that interoperability of vehicles and charging infrastructure will be critical to achieving reliability and positive consumer experiences with the technology. This seems like a very appropriate role for government support to ensure that interoperability is successful, that the testing standard is as robust and effective as possible, and that individual manufacturers need not incur the redundant expense of each conducting this testing separately.

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

Reviewer 1:
The reviewer noted that it appears that the project team has accomplished its work quite well within the allocated modest budget, so the funding was sufficient. The reviewer is confident that the next phase will also be appropriately budgeted.

Reviewer 2:
The reviewer indicated that the resources seem sufficient for conducting the testing described.

Reviewer 3:

The reviewer said project was completed with sufficient budget.

Lessons Learned about Workplace Charging in The EV Project: John Smart (Idaho National Laboratory) - vss170

Presenter

John Smart, Idaho National Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer noted great work on a very small budget. The approach is solid.

Reviewer 2:

The reviewer stated that the project seeks to shed light on any existing barriers to EV adoption and starts to identify policies that employers can implement to improve EV charging usage at workplaces. The reviewer indicated that the Phase II revisions led to a more actionable deliverable targeted to employers to use when designing and deploying their EV charging infrastructure.

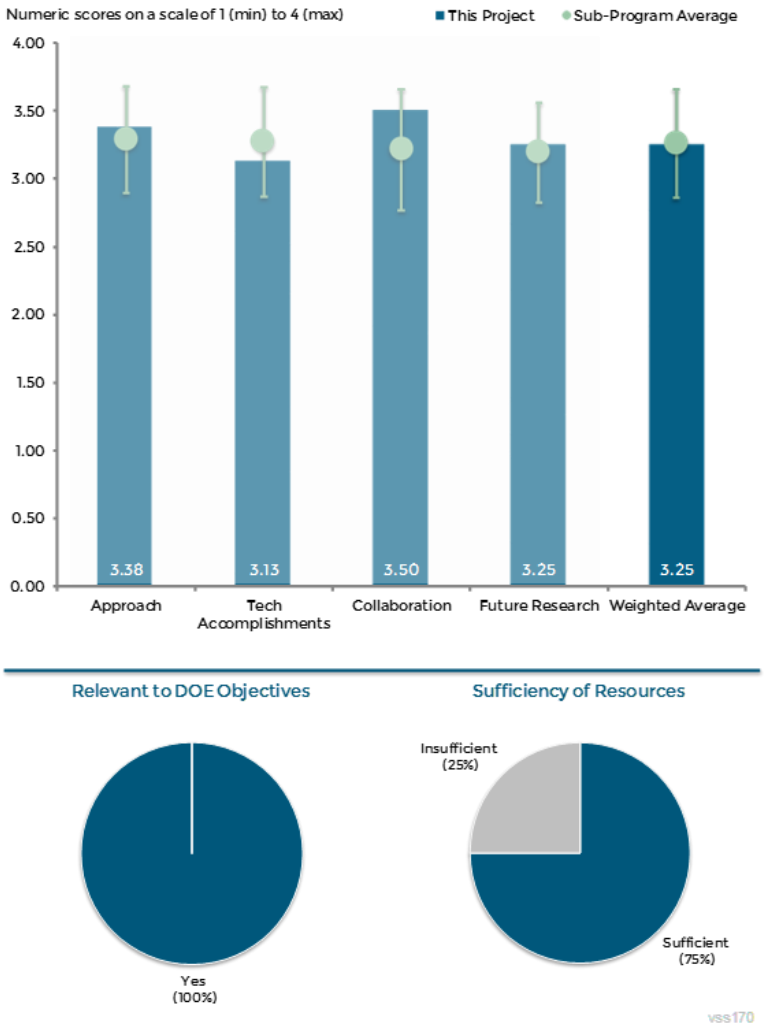

Figure 1-48 Lessons Learned about Workplace Charging in The EV Project: John Smart (Idaho National Laboratory) - Vehicle Systems

Reviewer 3:

The reviewer stated that while the original project as conceived was good, there appears to have been insufficient data to carry through and complete the original scope of the project. The accomplishment slides appear to indicate that at least some of the data were acquired as answers to survey questions, and as with all surveys, the reviewer questioned what measures were taken to improve the accuracy of the collected data. The reviewer also asked if the drivers were asked to maintain detailed logs.

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

Reviewer 1:

The reviewer stated that this is a very important issue for DOE to understand. The implications are very broad as utilities and others look at the business viability for workplace charging.

Reviewer 2:
The reviewer noted that the project is well positioned to deliver the lessons learned document by mid-2015. Some of the data analyzed is inconclusive, such as which policy factors lead to higher EV charging (Slide 18) as well as which types of drivers would be most likely to make use of charging infrastructure (Slide 17). The reviewer indicated that it seems more investigation is needed to be able to make concrete solutions regarding lessons learned.

Reviewer 3:
The reviewer stated that the PI appears not to have had access to key pieces of information that could have helped improve the quality of the results – the cost of electricity, when users had to pay for the charging, for instance.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer noted a very impressive list of companies that were involved. The information will be very valuable to them.

Reviewer 2:
The reviewer questioned if it would have helped to leverage the research done in some of the universities or other national laboratories (LBNL, for instance), and leverage their expertise in these areas.

Reviewer 3:
The reviewer stated that the project seems to have good collaboration with EV project partners to support the data collection. The reviewer would like to see collaboration with partners who will be customers of the lessons learned document and how this report will be disseminated.

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

Reviewer 1:
The reviewer stated that the completion of the lessons learned document wraps up this project. It would be recommended to continue this investigation to dive deeper into an analysis on the effectiveness of policy choices at employers, including the designing of experiments to see how the absence or presence of a specific policy option impacts charging usage.

Reviewer 2:
The reviewer stated that larger sample sizes are needed for the studies, and as the author notes, the study only looked at early adopters. The reviewer stated that one important question to answer would be how we can extrapolate the results of studies that include (perhaps) only the EV-believers to the general public. It seems that this study may need to step beyond just a purely statistical analysis and venture into human behavioral aspects as well.

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

Reviewer 1:
The reviewer stated that this is a critical issue to understand the impact on the grid and climate change.

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

Reviewer 1:
The reviewer noted that the data collection phase appears to be complete, and the only remaining tasks appear to be documentation.

Reviewer 2:
The reviewer noted that this issue should get much more attention.

eVMT (Electric Vehicle Miles Traveled): Richard Carlson (Idaho National Laboratory) - vss171

Presenter

Richard Carlson, Idaho National Laboratory.

Reviewer Sample Size

A total of four reviewers evaluated this project.

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

Reviewer 1:

The reviewer stated that the approach of analyzing data of 21,600 vehicles across a wide region of the U.S. for electric vehicle miles traveled (eVMT) based on fuel economy label and vehicle average charge sustaining fuel consumption is very good and will help eliminate the barrier of the lack of real-world data from electric-drive vehicles.

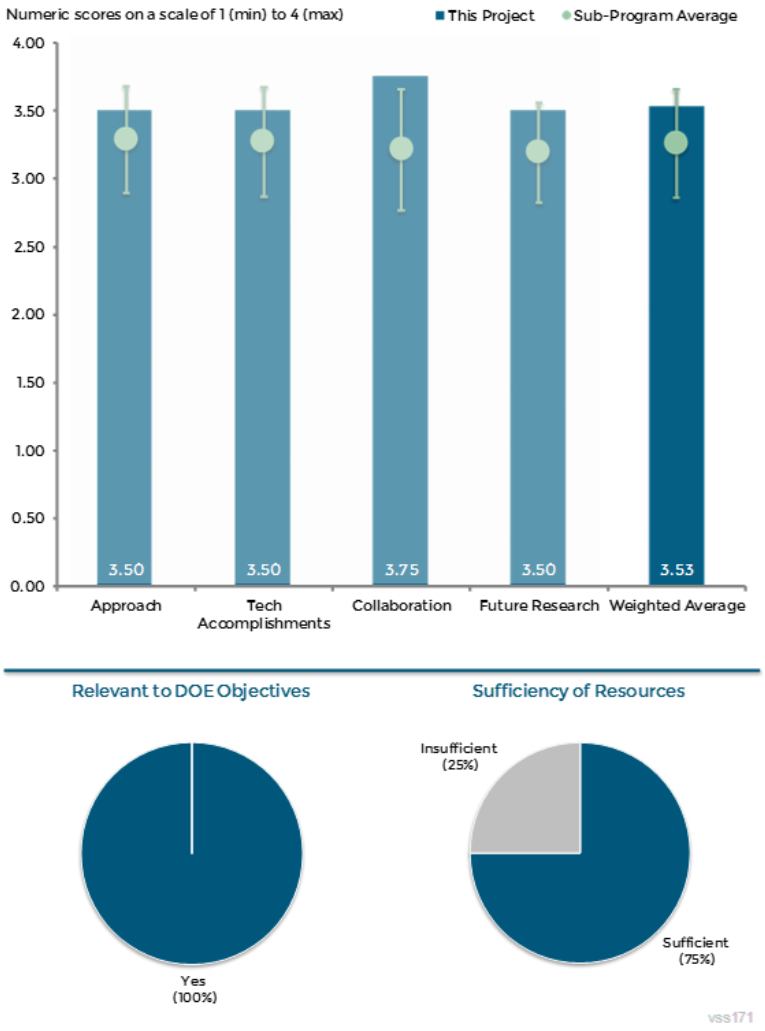

Figure 1-49 eVMT (Electric Vehicle Miles Traveled): Richard Carlson (Idaho National Laboratory) - Vehicle Systems

Reviewer 2:

The reviewer noted that this is a relatively small project, but given the very limited resource constraints, the approach was sound. The interaction with companies and car makers gave it a very high credibility. The reviewer emphasized that the results were very clear and widely applicable.

Reviewer 3:

The reviewer stated that energy consumption should be examined.

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

Reviewer 1:

The reviewer indicated that technical accomplishments have been very good. Analyses has been completed on over 21,000 vehicles showing the total calculated eVMT and vehicle average monthly eVMT and have been presented to the California Air Resources Board with respect to the zero emissions vehicle (ZEV) credit regulations.

Reviewer 2:

The reviewer stated again that the relative contributions of this project to DOE's goals given the resource constraints was very high.

Reviewer 3:
The reviewer stated that the eVMT obtained in this research help OEMs to better understand the operation characteristics of EVs and PHEVs.

Question 3: Collaboration and coordination with other institutions.

Reviewer 1:
The reviewer indicated that the four automotive partners in this project have provided excellent collaboration and coordination. This is a unique project because the partners actually approached INL and asked for the analysis to be performed on their data.

Reviewer 2:
The reviewer stated that the project clearly worked with a number of important organizations to collect data and understand applicability.

Reviewer 3:
The reviewer indicated that the PI has done an excellent job in collaborating with industry partners.

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

Reviewer 1:
The reviewer stated that the proposed future work to analyze the impact of eVMT on seasonal and regional variation should provide good information. Understanding vehicle utilization when a second vehicle is used in the same household for trips greater than EV range will be a very useful analysis.

Reviewer 2:
The reviewer stated that the PI should explore the vehicle miles traveled in each trip and if the variability of charging facility in workplace will affect the vehicle miles travelled in each trip.

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

Reviewer 1:
The reviewer stated that this project is relevant to DOE goals because the analysis results may be used by the California Air Resources Board for consideration of amendments to the Zero Emissions Vehicle credit regulations, which could provide for more benefit to using BEVs and PHEVs, which will create more petroleum displacement.

Reviewer 2:
The reviewer noted that the VMT issue is still not well understood but is a very important issue to understand the impact on DOE goals.

Reviewer 3:
The reviewer stated, yes, the application of EVs and PHEVs help to decrease the consumption of traditional gasoline and diesel fuels derived from crude oil.

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

Reviewer 1:
The reviewer suggested that DOE add more funding to this project so that the PIs can make more efforts in evaluating the energy consumption each trip.

Reviewer 2:
The reviewer stated that resources are adequate to complete the project in a timely fashion.

Acronyms and Abbreviations

AC	Alternating Current
A/C	Air-Conditioning
ACEC	Advanced Combustion & Emissions Control
AMR	Annual Merit Review
ANL	Argonne National Laboratory
ARPA-E	Advanced Research Projects Agency - Energy
APRF	Advanced Powertrain Research Facility (ANL)
APU	Auxiliary Power Unit
ARRA	American Recovery and Reinvestment Act
AVTA	Advanced Vehicle Testing Activity
AVTE	Advanced Vehicle Testing & Evaluation
BEV	Battery Electric Vehicle
BMS	Battery Management System
BP	Budget period
BTE	Brake thermal efficiency
CAE	Computer-aided engineering
CAFE	Corporate Average Fuel Economy
CARB	California Air Resources Board
CDC	Conventional diesel combustion
CEC	California Energy Commission
CFD	Computational Fluid Dynamics
CIC	Communications, information, and communication
CLEERS	Cross-Cut Lean Exhaust Emission Reduction Simulation
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CRADA	Cooperative Research and Development Agreement
CVT	Continuously variable transmission
DC	Direct Current
DCT	Dual-clutch transmission
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DTNA	Daimler Trucks North America
ECU	Engine control unit

EDLC	Electrochemical double-layer capacitors
EG	Ethylene glycol
EGR	Exhaust Gas Recirculation
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
EREV	Extended Range Electric Vehicle
ESIF	Energy Systems Integration Facility
ESS	Energy Storage Systems
EV	Electric Vehicle
EVSE	Electric Vehicle Supplemental (Supply) Equipment
FE	Fuel economy
FHWA	Federal Highway Administration
FOA	Funding Opportunity Announcement
FTMPG	Freight ton-miles per gallon
FTP	Federal Test Procedure
FY	Fiscal Year
GDI	Gasoline direct injection
GHG	Greenhouse Gas
GREET	Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation
GSF	Generic Speed Form
GTR	Global Technical Regulation
H_2	Hydrogen
HC	Hydrocarbons
HD	Heavy-Duty
HEV	Hybrid electric vehicle
HHDDT	Heavy heavy-duty diesel truck
HHV	Hydraulic hybrid vehicle
HIL	Hardware in the Loop
HV	High voltage
HVAC	Heating, Ventilating and Air Conditioning
ICE	Internal Combustion Engine
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEC	International Electrochemical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMSA	International Motor Sports Association
INL	Idaho National Laboratory

ISO	International Organization for Standardization
ITS JPO	Intelligent Transportation Systems Joint Program Office
kHz	Kilohertz
kW	Kilowatt
kWh	Kilowatt Hour
Li-ion	Lithium Ion
LD	Light-Duty
LDV	light-duty vehicle
LEESS	Lower-energy energy storage system
LIC	Lithium ion capacitor
LLNL	Lawrence Livermore National Laboratory
MBSE	Model-based system engineering
MD	Medium-Duty
MMFC	Multi-mode flow controller
MOU	Memorandum of understanding
MPG	Miles per gallon
MPGe	Miles per gallon equivalent
MPI	Message passing interface
MY	Model year
NGO	Non-governmental organization
NGV	Natural gas vehicle
NHTSA	National Highway Traffic Safety Administration
NIST	National Institute of Standards and Technology
NOx	Nitrogen Oxides
NREL	National Renewable Energy Laboratory
O_2	Oxygen
OBD	On-board diagnostics
OEM	Original Equipment Manufacturer
ORNL	Oak Ridge National Laboratory
PCM	Phase change material
PEV	Plug-in Electric Vehicle
PHEV	Plug-In Hybrid Electric Vehicle
PI	Principal Investigator
PTC	Positive temperature coefficient
QA	Quality assurance
QC	Quality control

R&D	Research and Development
RCCI	Reactivity controlled compression ignition
ROI	Return on Investment
RR	Rolling resistance
SAE	Society of Automotive Engineers
SCAQMD	South Coast Air Quality Management District
SDO	Standards definition organizations
SGIP	Smart Grid Interoperability Panel
SHA	State Highway Agency
SI	Spark Ignition
SOC	State Of Charge
SS	Steady state
TIM	Thermal interface materials
TOU	Time of use
UPS	United Parcel Service
U.S. DRIVE	U.S. Driving Research and Innovation for Vehicle efficiency and Energy sustainability
V2G	Vehicle-to-Grid
V2I	Vehicle-to-Infrastructure
V2V	Vehicle-to-Vehicle
V2X	Vehicle-to-Grid, Infrastructure, and/or Vehicle
VMT	Vehicle miles traveled
VSS	Vehicle & System Simulation
VSST	Vehicle systems safety technology
VTMS	Vehicle thermal management system
VTO	Vehicle Technologies Office
WHR	Waste Heat Recovery
WPT	Wireless Power Transfer
ZECT	Zero Emission Cargo Transport