1. Hybrid and Vehicle Systems Technologies

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

In August 2009, the Department announced the selection of ten projects totaling $425 million for development, deployment, and validation of hybrid vehicles, and deployment of charging stations across the nation. 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.

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 to 4)*. In the pages that follow, the reviewer responses to each question for each project will be summarized: the multiple choice and numeric score questions will be presented in graph form for each project, and the expository text responses will be summarized in paragraph form for each question. A table presenting the average numeric score for each question for each project is presented below.

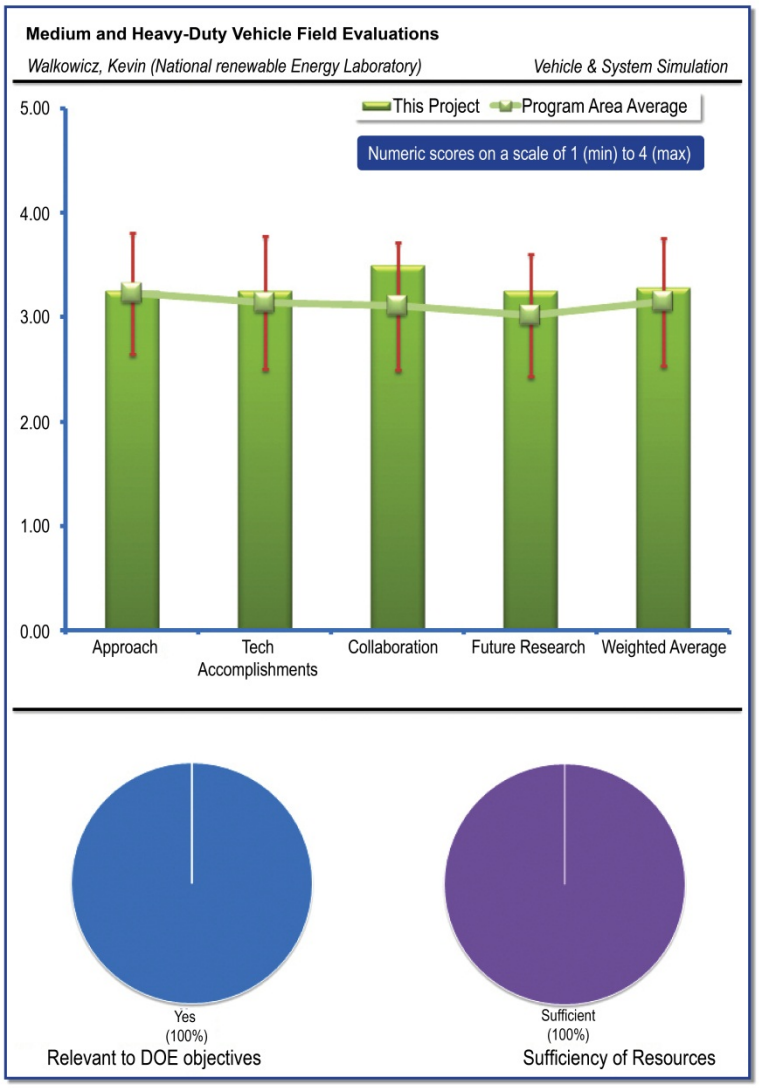
Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Medium and Heavy-Duty Vehicle Field Evaluations	Walkowicz, Kevin (National Renewable Energy Laboratory)	1-4	3.25	3.25	3.50	3.25	3.28
Truck Duty Cycle and Performance Data Collection and Analysis Program	Knee, Bill (Oak Ridge National Laboratory)	1-6	3.25	3.25	3.00	3.00	3.19
Boundary Layer Lubrication Mechanisms	Fenske, George (Argonne National Laboratory)	1-8	3.25	3.50	3.00	3.25	3.34
DOE/DOD Parasitic Energy Loss Collaboration	Fenske, George (Argonne National Laboratory)	1-11	3.50	3.25	3.50	3.25	3.34
DOE's Effort to Reduce Truck Aerodynamic Drag through Joint Experiments and Computations	Salari, Kambiz (Lawrence Livermore National Laboratory)	1-14	3.25	3.25	3.50	3.50	3.31
Analyzing Fuel Saving Opportunities through Driver Feedback Mechanisms	*Gonder, Jeffrey (National Renewable Energy Laboratory)*	*1-17*	*2.67*	*2.33*	*2.33*	*2.67*	*2.46*
Autonomie Large Scale Deployment	Rousseau, Aymeric (Argonne National Laboratory)	1-19	3.60	3.60	3.80	3.20	3.58
PHEV Engine Control and Energy Management Strategy	Chambon, Paul (Oak Ridge National Laboratory)	1-22	2.50	2.50	2.75	2.50	2.53
Plug-in Hybrid (PHEV) Vehicle Technology Advancement and Demonstration Activity	Cesiel, Greg (General Motors)	1-24	2.80	2.40	2.60	2.40	2.53
Ford Plug-In Project: Bringing PHEVs to Market	D'Annunzio, Julie (Ford Motor Company)	1-26	4.00	3.80	3.80	3.40	3.80
Idaho National Laboratory Testing of Advanced Technology Vehicles	Francfort, Jim (Idaho National Laboratory)	1-28	3.75	3.75	3.00	3.00	3.56

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Development and Deployment of Generation 3 Plug-In Hybrid Electric School Buses	Friesner, Jan (Navistar, Inc.)	1-31	3.25	2.50	3.00	2.75	2.78
Advanced Vehicle Testing Activity	Karner, Don (ecoTality North America)	1-33	3.25	3.00	3.25	2.25	3.00
Advanced Technology Vehicle Lab Benchmarking - Level 1	Lohse-Busch, Henning (Argonne National Laboratory)	1-35	3.33	3.33	2.67	3.00	3.21
Advanced Technology Vehicle Lab Benchmarking - Level 2 (in-depth)	Rask, Erik (Argonne National Laboratory)	1-37	3.75	3.50	3.25	3.25	3.50
Electric Drive and Advanced Battery and Components Testbed (EDAB)	Carleson, Barney (Idaho National Laboratory)	1-39	3.00	3.00	2.75	3.00	2.97
Vehicle Systems Integration (VSI) Research Laboratory at ORNL	Smith, David (Oak Ridge National Laboratory)	1-42	3.25	3.00	3.00	2.75	3.03
Analysis of maximizing the Synergy between PHEVs/EVs and PV	*Kinter-Meyer, Michael (Pacific Northwest National Laboratory)*	*1-44*	*2.67*	*2.50*	*2.67*	*2.67*	*2.58*
CoolCab Test and Evaluation	Rugh, John (National Renewable Energy Laboratory)	1-46	3.67	3.33	3.67	3.33	3.46
Advanced PHEV Engine Systems and Emissions Control Modeling and Analysis	Daw, Stuart (Oak Ridge National Laboratory)	1-47	3.00	3.67	3.67	3.67	3.50
Plug-In Electric Vehicle Integration with Renewables	*Markel, Tony (National Renewable Energy Laboratory)*	*1-49*	*3.00*	*3.67*	*3.00*	*2.33*	*3.25*
Medium- and Heavy-Duty Electric Drive Vehicle Simulation and Analysis	Barnitt, Robb (National Renewable Energy Laboratory)	1-51	3.20	3.20	3.40	3.20	3.23
Analysis of Battery Wear and V2G Benefits Using Real-world Drive Cycles and Ambient Data	*Barnitt, Robb (National Renewable Energy Laboratory)*	*1-53*	*3.00*	*1.50*	*1.67*	*2.00*	*1.96*
LDV HVAC Model Development and Validation	Rugh, John (National Renewable Energy Laboratory)	1-55	2.50	3.25	2.25	3.00	2.91
Integrated Thermal Management for Electric Drive Vehicles	Rugh, John (National Renewable Energy Laboratory)	1-58	2.80	3.00	2.80	3.00	2.93
Real-World PHEV Fuel Economy Prediction	Gonder, Jeffrey (National Renewable Energy Laboratory)	1-61	3.00	3.25	3.25	2.50	3.09
Evaluation of Powertrain Options and Component Sizing for MD and HD Applications on Real World Drive Cycles	Rousseau, Aymeric (Argonne National Laboratory)	1-64	3.33	3.00	3.33	3.00	3.13
Evaluation of Ethanol Blends for PHEVs using Simulation and Engine-in-the-Loop	Shidore, Neeraj (Argonne National Laboratory)	1-66	3.00	3.00	2.75	3.00	2.97
Data Collection for Improved Cold Temperature Thermal Modeling and Strategy Development	Jehlik, Forrest (Argonne National Laboratory)	1-68	3.25	3.00	2.75	3.00	3.03
Advanced HEV/PHEV Concepts	*Gonder, Jeffrey (National Renewable Energy Laboratory)*	*1-70*	*3.67*	*3.00*	*3.67*	*2.67*	*3.21*
HEV, PHEV, BEV Test Standard Validation	Duoba, Mike (Argonne National Laboratory)	1-73	3.50	3.50	2.75	2.50	3.28
Codes and Standards to Support Vehicle Electrification	Bohn, Ted (Argonne National Laboratory)	1-76	3.50	3.25	3.50	3.00	3.31

Presentation Title	Principal Investigator and Organization	Page Number	Approach	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Green Racing Initiative: Accelerating the Use of Advanced Technologies & Renewable Fuels	Larsen, Bob (Argonne National Laboratory)	1-78	3.00	2.75	3.25	3.00	2.91
Testing and Validation of Vehicle to Grid Communication Standards	*Gowri, Krishnan (Pacific Northwest National Laboratory)*	*1-81*	*3.33*	*3.33*	*3.33*	*3.00*	*3.29*
CRADA with PACCAR Experimental Investigation in Coolant Boiling in a Half-Heated Circular Tube	*Yu, Wen (Argonne National Laboratory)*	*1-84*	*3.75*	*3.25*	*2.75*	*3.50*	*3.34*
Development of High Power Density Driveline for Vehicles	Fenske, George (Argonne National Laboratory)	1-87	2.40	2.40	1.80	2.60	2.35
Grid Interaction Tech Team	Hardy, Keith (Argonne National Laboratory)	1-90	3.50	3.75	3.25	3.50	3.59
Dynamometer Testing of USPS EV Conversions	Jones, Perry (Oak Ridge National Laboratory)	1-93	3.00	3.00	3.25	3.00	3.03
Wireless Plug-in Electric Vehicle (PEV) Charging	Miller, John (Oak Ridge National Laboratory)	1-96	4.00	3.75	3.50	3.75	3.78
The ArvinMeritor Dual Mode Hybrid Powertrain (DMHP): Opportunities and Potential for Systems Optimization	*Smith, David (Oak Ridge National Laboratory)*	*1-98*	*3.33*	*3.00*	*3.33*	*3.67*	*3.21*
Advancing Plug In Hybrid Technology and Flex Fuel Application on a Chrysler Mini-Van PHEV DOE Funded Project	Bazzi, Abdullah (Chrysler LLC)	1-100	3.67	3.33	3.33	3.17	3.40
SuperTruck - Development and Demonstration of a Fuel-Efficient Class 8 Tractor & Trailer	Jadin, Dennis (Navistar, Inc.)	1-102	3.50	3.25	3.50	3.00	3.31
*Electric Drive Vehicle Demonstration and Vehicle Infrastructure Evaluation	Karner, Don (Electric Transportation Engineering Corp.)	1-104	3.75	3.50	3.75	3.50	3.59
*Advancing Transportation Through Vehicle Electrification - PHEV	Bazzi, Abdullah (Chrysler LLC)	1-107	3.75	3.50	3.50	3.50	3.56
*Plug-In Hybrid Electric Medium Duty Commercial Fleet Demonstration and Evaluation	Miyasato, Matt (South Coast Air Quality Management District)	1-109	2.75	3.00	3.25	3.00	2.97
*Advanced Vehicle Electrification	Gosbee, Darren (Navistar, Inc.)	1-112	3.00	3.67	3.33	3.33	3.42
*Cascade Sierra Solutions: Transportation Sector Electrification	Lau, Sandor (Cascade Sierra Solutions)	1-114	3.00	3.00	3.00	3.00	3.00
*Advanced Vehicle Electrification and Transportation Sector Electrification	Cesiel, Greg (General Motors)	1-116	3.00	3.00	3.00	3.25	3.03
*Smith Electric Vehicles: Advanced Vehicle Electrification + Transportation Sector Electrification	Mackie, Robin (Smith Electric Vehicles)	1-118	3.50	3.75	2.50	3.25	3.47
* Electric Drive Vehicle Infrastructure Deployment	Carleson, Marc (Coulomb)	1-120	3.00	2.67	2.67	2.67	2.75
*Class 8 Truck Freight Efficiency Improvement Project	Rotz, Derek (DTNA)	1-122	2.75	2.75	3.50	2.75	2.84
* Demonstration of Highly Efficient and Clean Class 8 Trucks	Lawyer, Bruce (Peterbilt)	1-124	3.25	3.50	4.00	3.25	3.47
Overall Average			3.23	3.14	3.11	3.02	3.15

Note: Italics denote poster presentations. * Denotes ARRA-funded projects.

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



Reviewer Sample Size

This project had a total of four reviewers.

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

The first reviewer noted that team had very precise measurement on MPG by technology. The second reviewer pointed out that prospective buyers benefited from unbiased evaluations so they can make informed choices to maximize fuel economy. The reviewer added that OEMs also have a learning opportunity, getting honest feedback from an external source, which allows them to improve their designs and maximize fuel economy. The final reviewer asserted that this work progresses the understanding of performance improvements for Hybrid vehicles in the various vocations.

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

The first reviewer indicated that this is an ongoing project and that historic progress and recent progress both seem appropriate. The first reviewer added that it is good to see they are trying to incorporate more grade and load information which is useful information and should be captured. The mix of in-field data with some more detailed dyno testing is also nice. The second reviewer asserted that the approach is fleet specific so the use of the data is constrained by proprietary data within those companies. Other similar fleets would have to "just buy a couple and run them" to get real an understanding of benefit. This reviewer added that a way to reduce this work to a vocation type specific benefit range to provide to the "second" adopters would create more benefit toward petroleum reduction. The final respondent called the work interesting, but noted that it is perhaps regionally limited and with very few test case vehicles. The final reviewer questioned how these data could be widely translated to national fleet.

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

The first respondent pointed out that this is a fairly long running program and that the basic idea seems solid as does the implementation. The first reviewer added that the results seem consistent (each year) and useful. Another respondent noted that when measured against the reported objectives, the project is complete

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

The first reviewer indicated that the project is working with a number of alternative propulsion system developers and with fleet operators. Another reviewer added that long term relationships exist and are well coordinated for the project.

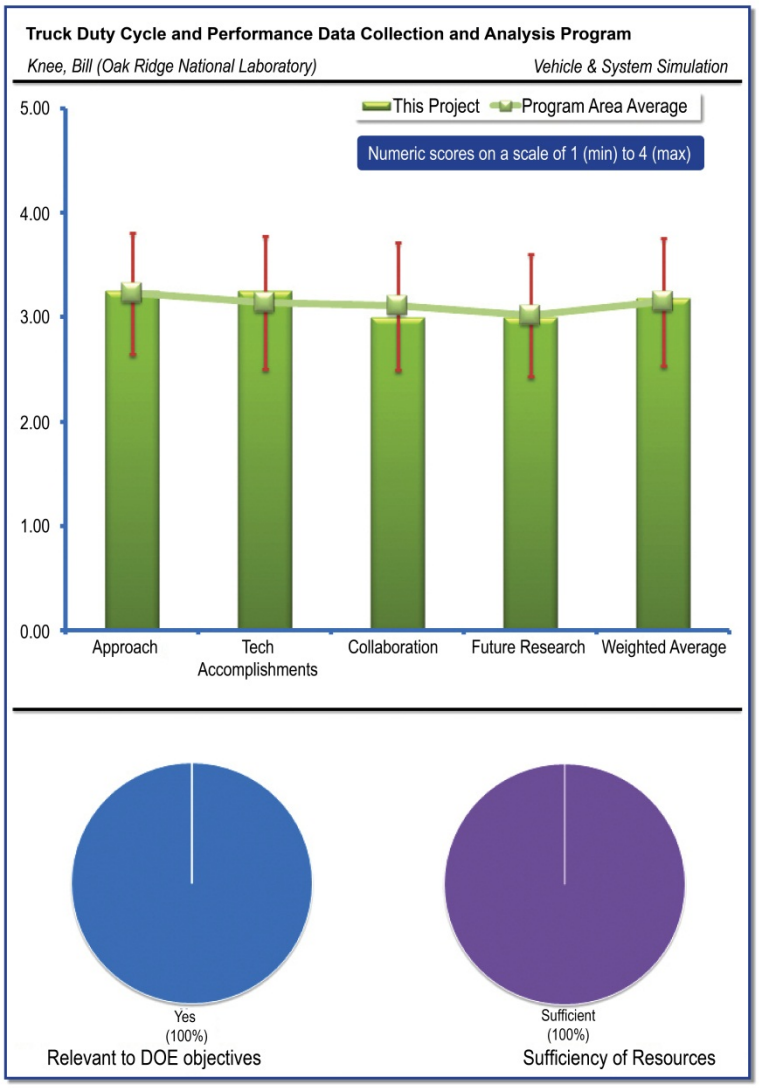
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

The first respondent included generally the same comments here as for accomplishments and indicated that the program output seems fairly consistent and appropriate. The reviewer noted that the data sharing mechanism is of particular interest and hopefully this will be publicly accessible, or at least some portions of the fleet data will be publicly accessible. The reviewer was also interested in the proposal to look at some off-road vehicles. The final reviewer added that the future proposals may be better than good.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

The respondent indicated that this again is a fairly well established program and the resources needs seem to be well understood, leading to appropriate planned efforts.

Truck Duty Cycle and Performance Data Collection and Analysis Program: Knee, Bill (Oak Ridge National Laboratory) – vss002



Reviewer Sample Size

This project had a total of four reviewers.

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

Four panelists reviewed this presentation. A first reviewer stated that the information being developed is suitable to show industry the FE benefits of various technologies. A second reviewer stated that to make informed decisions, designers and decision makers need to understand how vehicles are used and where the energy actually gets used. A third panelist said that the project has a very good validation processes.

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

One reviewer thought that no real hard barriers seemed to exist. Another concluded that there are a number of tradeoffs that need to be made in deciding whether to get a more rich data set on a more limited number of vehicles/applications or a more restricted data set (per vehicle) across a much richer array of vehicles/applications. All in all, this reviewer agreed with the large scale approach; however, it seemed like there are still some missing details regarding various accessory loads. These type of data should be present in the data collected as part of the MTDC (richer data on a more limited number of vehicles). Pending the outcome of the final review of all the MTDC data, maybe some additional MTDC efforts are necessary. (However, having said that, this reviewer recognized that tradeoffs are needed. It would always be nice to have everything, it is rarely possible.)

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

The first reviewer noted that progress to date seemed to be consistent with funding received to date. A second reviewer thought this project was definitely aligned and progressing according to plan, in line with the funding being delivered. The reviewer also suggested that this type of project could provide more benefit if it were expanded.

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

A first commenter saw lots of collaboration that seemed to be well coordinated. A second reviewer had detailed thoughts on specific research goals, having seen this presentation which included claims such as: "...driving tractive force, based on relatively simple assumptions, predicts total engine power quite well"; and "Fuel consumption during periods of positive tractive force correlates very well with the tractive force itself, even under very different driving conditions." The reviewer felt both of these statements suggested

that accessories are a small part of the puzzle. Further, the plans for the LSDC do not include any information regarding accessories. The reviewer recognized the need to limit bandwidth, but again the underlying statement is accessories are a small part of the picture. The reviewer said that immediately following this presentation this reviewer saw studies aimed at reducing consumption from heating, ventilating, and air conditioning (HVAC) accessories. This reviewer was unsure if there is an issue with this particular research, or the overarching research program. However, this would seem to be the program most targeted at discovering how operators really use their vehicles and there are a number of programs that look at reducing accessories. This reviewer did not know if some additional efforts are needed with the more complete data collection efforts. It would also seem that Idaho National Laboratory (INL) researchers might have some insights for the data collection.

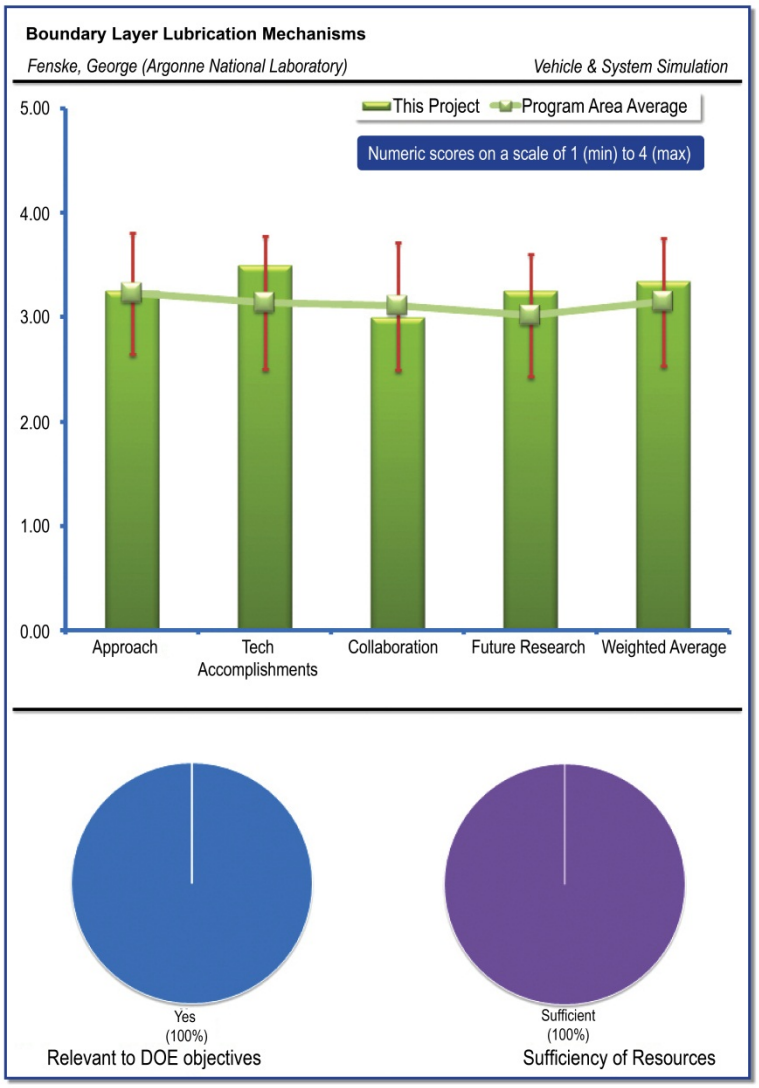
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

A first panelist stated that this long term project has an ongoing plan, but could possibly be expanded to create more benefit. A second reviewer thought the general roll out of LSDC pilot seems to be fairly deliberate. Perhaps things could be accelerated slightly by leveraging INL's experience. This reviewer remarked that data buses are presumably much different between heavy duty vehicles and those on which INL typically collects data, but they do seem to have a lot of experience with a fairly large number of vehicles.

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

One reviewer saw pilot testing of large scale data collection as an FY11 target, but did not see any mention of pilot hardware.

Boundary Layer Lubrication Mechanisms: Fenske, George (Argonne National Laboratory) – vss003



Reviewer Sample Size

This project had a total of four reviewers.

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

Four panelists reviewed this presentation. A first reviewer thought this project is in alignment with DOE objectives because improvements in lubrication will result in fuel efficiencies and overall reduction in fuel usage. A second reviewer believed that improving efficiency will clearly reduce energy/petroleum use, and friction reduction methods can offer improvements in virtually any powertrain configurations (newer configurations are not required). A third reviewer responded that this project clearly addresses the issue. Efficiency gain is largest possible gain for source of energy. Engine, transmission, axles can each cut fuel consumption by 2% to 4% by reducing friction. The fourth reviewer stated that high friction and high power density failures may occur in poorly understood boundary lubrication regime. The work directly contributes to our understanding of how to use lubricants to effectively displace petroleum usage, and as such, correlates 100% with the DOE mission. The Vehicle Technologies Program (VTP) facilitates environmental responsibility by advancing technologies to reduce passenger and freight emissions. A primary responsibility concomitant with oil dependence is reducing greenhouse gas emissions (primarily carbon emissions) from man-made activities such as use of oil for our vehicles. Neither petroleum reduction goals nor carbon emissions reduction goals can be achieved without new and more efficient vehicle technologies. More advanced fuels and lubricants as being studied in this project directly advance our understanding and responsibilities to reduce potential GHG emission and develop more efficient vehicle technology systems.

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

A first reviewer found the approach, which utilizes two parallel paths, interesting. The combination of both material and chemical film developments should result in a comprehensive prediction methodology. A second panelist thought that this project has a good technical approach, since the boundary lubrication regime is poorly understood. New tools and methods should enable new insights. ANL has unique tools (beam line X-ray analysis with minimal surface cleaning, electron micrographs for the film layers) that should help understanding of both materials and chemical films. Specifically, help understanding of boundary layer and film structures that build up on the surface, and tribochemical reaction layer analysis. A third panelist declared that the project addresses fuel savings by understanding and reducing frictional boundary layers in vehicle components and systems. There are constant advances in technology that may be contributing or averting frictional performance and impact. The third panelist commended ANL for using a basic research approach that includes computational models, design and simulation methodologies to understand tribological layers in various vehicle components. The work takes a components level and full complex systems approach. The work also considers test protocols in

this important area of research. The third panelist thought the experimental approach is a nice complement to the modeling and simulation work, and is nicely supported by basic materials science characterization of tribo films. The detailed information between with crystalline versus amorphous phases and their impact on friction is important to this field. The work may lead to a sustainable systems understanding for full vehicle friction management and reduction. This same panelist was thrilled to see the use of grazing incidence diffraction at APS. Nice example of power of photons. The final reviewer responded that all in all this is a worthwhile project and the progress seems good and appropriate with the budget. It is fundamentally a basic research program, so the lofty end goals that get discussed (2% improvement from axle, 3% from transmission, 4-5% from engine) more or less have to be ignored; at the end of this basic research effort no efficiency improvements should be expected. Rather the purpose is to understand the underlying mechanism so that a path to the improvements can be developed. The final reviewer thought this would be appropriate—basic research is important (although sometimes as a reviewer it is hard to reconcile the end goals with the program). However, this reviewer thought that any program does need to have some end goals defined/stated. It would be nice to see exactly what the end goals of this project really are (under questioning it seemed the 90% complete statement might have been a little optimistic).

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

A first evaluator thought that researchers seem to have made good progress in understanding boundary film and using this understanding to modify boundary lubrication. This reviewer commented that it would be nice to have some specification of end goals. A second evaluator acknowledged a novel idea to explore nature and use these theories in order to better understand how boundary layers are defined and characterized. The development of extremely low boundary frictions through modification of chemical film structure is an exciting find. A third reviewer considered this an excellent technical accomplishment. This reviewer remarked new scuffing model joining film and materials and design tools made available to OEMs are an excellent use of funds. Specific materials identified as well as pathways for future research. Use of crater created to expose film layers without damaging the layers is excellent experimental work. Understanding composition and structural changes in nm range of these layers is a solid advance. The final reviewer pointed out that the project began in 2004 and is 90% complete. This reviewer thought the project demonstrated significant development in sustainable friction reduction under boundary lubrication regime. The project also looked at temperature effects during sliding, and also failure/performance prediction methodology for lubricated components. The final reviewer described the project. The objective of the work this year included determining the mechanisms of boundary layer formation and loss rates as well as the film properties; determining the mechanisms of catastrophic failure by scuffing; developing integrated low-friction high power density interfaces; and determining the mechanisms of boundary layer formation and loss rates as well as the film properties. Technical accomplishments included the analysis of about a dozen tribochemical films, to establish a firm connection between the structure and friction behavior of the films. Further modeling and simulation is required. Findings: All crystalline films exhibits consistently higher friction; amorphous or mixture films consistently showed lower friction; produced tribochemical films enable boundary friction as low 0.03 instead of the usual 0.1 to 0.13 values.

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

The first reviewer cheered good work with collaborators! Good hand off to commercialization! The second reviewer stated that interactions and collaborations include Eaton Corporation, Castrol-BP and Oakland University, but it was not exactly clear to the reviewer why these particular collaborators were chosen. A third panelist commented that the list of collaborators is comprehensive and includes representatives from all the main areas Engine, Transmission, Axle and Oil manufacturers as well as academia. The final reviewer felt that most of the collaborations seem to have been loose. This reviewer did not remember hearing much about the results of the academic (Oakland University) collaboration. The CAT collaboration does seem to have transitioned knowledge into industry, but it also seems like this was a few years ago.

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

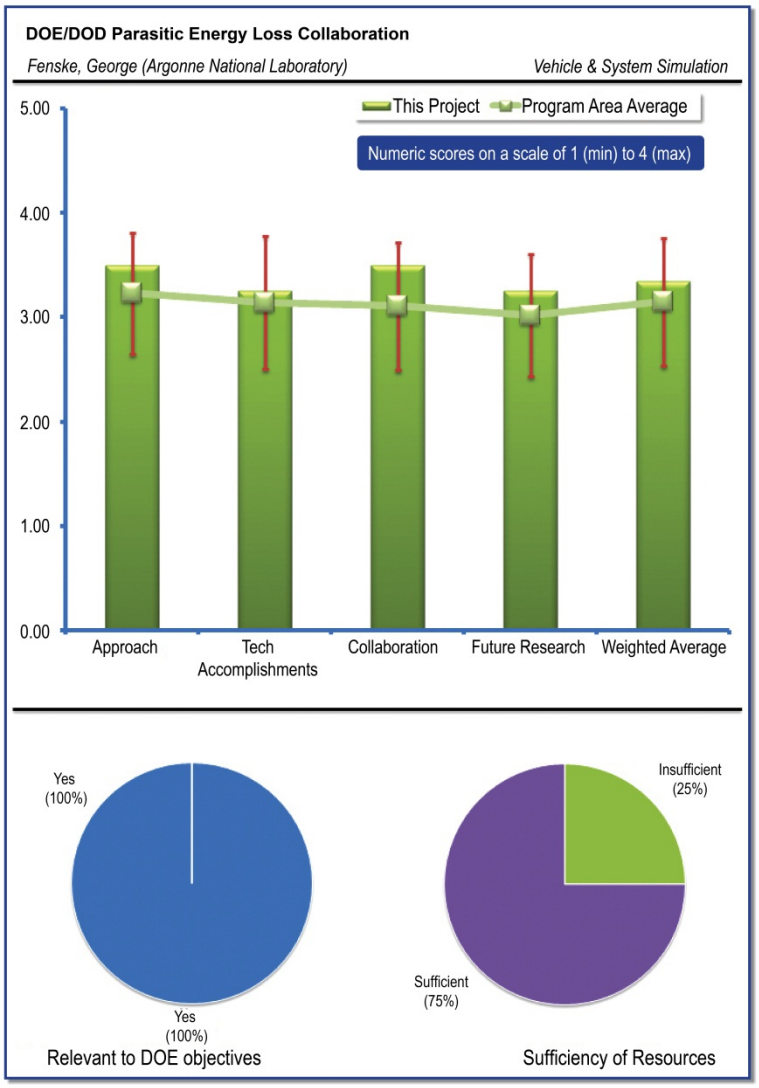
The first commenter found that future work appears to continue the exploration of friction reduction through material and film investigation. There has been some commercialization from work on this project but the reviewer believes that more opportunities

should be investigated. The reviewer is of the opinion that a follow on project is a must as the objective of turning this study in practical use must be achieved. A second commenter highly emphasized that work is needed on development of constitutive equation for the tibo-film mechanical behavior for input to the compressive friction modeling effort. The second reviewer said that future work should also include evaluation of the role of surface coatings on the behavior of tribochemical films, especially the low-friction ones, and continued development of compressive friction model. This panelist further suggested refining and optimizing the methodology for formulation and fabrication of the low-friction tribochemical surface films; conducting more work on real contact temperature; continuing nanomechanical and frictional properties of structurally different boundary films using a nanomechanical probe system; and providing a pathway for structure-properties relationship formulation for boundary layer films. The second reviewer pointed out that the presenter claimed that the "Potential for 5 -15 % fuel savings via efficiency gain is increasingly achievable," and further opined that the 15% was overly optimistic. A third evaluator felt that they all seem very good. The only thing holding this back from "outstanding" is that the evaluator was not fully clear on what parts of the "future efforts" represent future works under this program and what parts represent more general future efforts. Again, a clear statement of goals from this project would be useful. The fourth panelist stated that this project's goal is to design tribochemical film that gives optimum properties. The mechanism discussed was the sum of shear forces, ignoring wetting, flow viscous pressure in film layer and thermal. Scuffing initiation causes temperature rise not the reverse. Only shear force mechanism? Shear force increase of film layer is claimed as the dominant mechanism when in boundary layer contact regime. This is a logical explanation but further investigation to verify the assumptions may be fruitful. Crystalline versus amorphous analysis work coupled to nanoindentation is great, though the explanation should have been more thorough.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

A first respondent thought that for the remaining scope, budget and timing the resources are sufficient. This respondent believes that project scope may have to be reduced to complete the project in the defined timeline, and that a follow on project is essential. A second reviewer thought that funding is sufficient to wrap up the project and elucidate the questions for a next stage of funding. The third reviewer requested a little more clarity as to what the milestones are in order to make a definitive assessment. This reviewer recognized this is more difficult with basic research, but a plan always exists—and it could have been a little more clearly stated.

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



Reviewer Sample Size

This project had a total of four reviewers.

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

Reviewers generally perceived that the project supports DOE objectives. The first evaluator concluded that this project directly contributes to DOE objective of petroleum displacement. The project targets specific VTP performance goals to achieve petroleum reduction, and supports the 21st Century Truck Initiative and both light duty and heavy duty vehicle technology goals by addressing details of parasitic losses in both commercial and ground vehicles. To achieve petroleum and GHG reduction goals, this project offers a strong support to the challenges and represent a unique opportunity for the U.S. to continue to evaluate, test and understand parasitic losses in VTP, to establish a sustainable energy infrastructure. A second evaluator claimed that improving efficiency will reduce petroleum used and reducing friction is broadly applicable to most powertrains. A third stated this project directly addresses fuel efficiency. Good use of resources. Friction consumes 10% to 15% of fuel in commercial vehicles. Reduced fuel use saves cost, reduces logistics and increases safety for military. Parasitic losses are large component of vehicle energy consumption. Good pulling together of resources and search for range of new technologies. There is a clear need for this type of work. New fuels and environmental regulations bring new challenges. The fourth reviewer thought that reduction in fuel usage for the military has a many benefits, from savings in overall cost associated with fuel delivery (due to lower demand), to reduction in convoys, is significant. This is aligned with the DOE objectives.

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

The first respondent commented that the modeling of parasitic losses to identify the magnitude and then identify pathways to improve fuel consumption is a logical approach. A second commenter deemed this type of DOD-DOE collaboration critical to accelerating VTP and VSS investments. The project should formally establish DOE/DOD collaboration that utilizes key facilities and expertise to investigate, model, and understand fundamental tribological phenomena that impact fuel efficiency, reliability, and durability. This particular project will develop and implement advanced tribological solutions (lubricant, materials/coatings, and surface texturing) to reduce fuel consumption, and will identify critical barriers related to parasitic friction losses, reliability, and durability common to commercial and military vehicles. The goal of the work is to improve vehicle fuel efficiency while maintaining/improving reliability and durability. The third respondent liked the rather detailed modeling of the engine losses showing the impact of changes in viscosity and reductions in boundary layer/asperity friction. This helped justify the focus on improving boundary layer friction by providing some grounded numbers that give some rigor to claims on what improved boundary layer friction can provide. The final respondent concluded that collaboration with DOD is an interesting approach to obtain severe environment data that is useful, but scarcer for

industry. Modeling parasitic losses to identify goals is well thought out as is use of bench top lab techniques to explore solutions: materials, textures, operating conditions. Are model validation phase and confirming testing on in use parts to come as later steps? or another project? Clarity here may improve the approach. There was one sentence on slide 20 "Establish test program ...". More depth here would be helpful.

QUESTION 3: CHARACTERIZE YOUR UNDERSTANDING OF THE TECHNICAL ACCOMPLISHMENTS AND PROGRESS TOWARD OVERALL PROJECT AND DOE GOALS.

The first reviewer stated that the project is 25% complete. FY 2010 accomplishments included establishment of the MOU between DOD and DOE on this collaborative project on parasitic losses with DOD/TARDEC. Such an MOU may be considered a tremendous victory. The project is really just getting started. Preliminary work across agency needs and sampling was performed and acquiring driving schedules. Technically a small project on compression ring and oil control ring at low loads –to focus on simulating hydrodynamic regime where viscous losses are greatest was started. A second reviewer thought there was good progress on organization and building the approach. With oil on off testing, new work is just beginning. The presenter showed some of the same slides as previous presentation. Nice illustration but it was unclear what was the new bench work for this project. New slide hone results are getting the project off to a good start. A third reviewer thought that FMEP modeled as a function of boundary lubrication and viscosity is interesting, and that the use of both military and commercial drive cycles with real hardware and additives and then exploring the friction mechanisms under different load conditions should yield some interesting results. The fourth reviewer thought the presentation was a nice review of different driving conditions and impacts of friction reduction.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

The first panelist strongly stressed the excellence of the collaboration. Collaborators include TARDEC, Mahle, DOD Vehicle OEMS (NDA –protected) and Additive and Lubricant OEMs (NDA). Stakeholder breadth is commendable and appropriate. The second panelist thought that all aspects appear to be included and well covered. A third was impressed by the good outreach to DOD. The fourth panelist considered the project is in its early stages, and needs more work to expand partners to ensure commercialization of the results. This should be easy to pull in more industrial partners as the project gears up. The link to Mahle is a good start.

QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

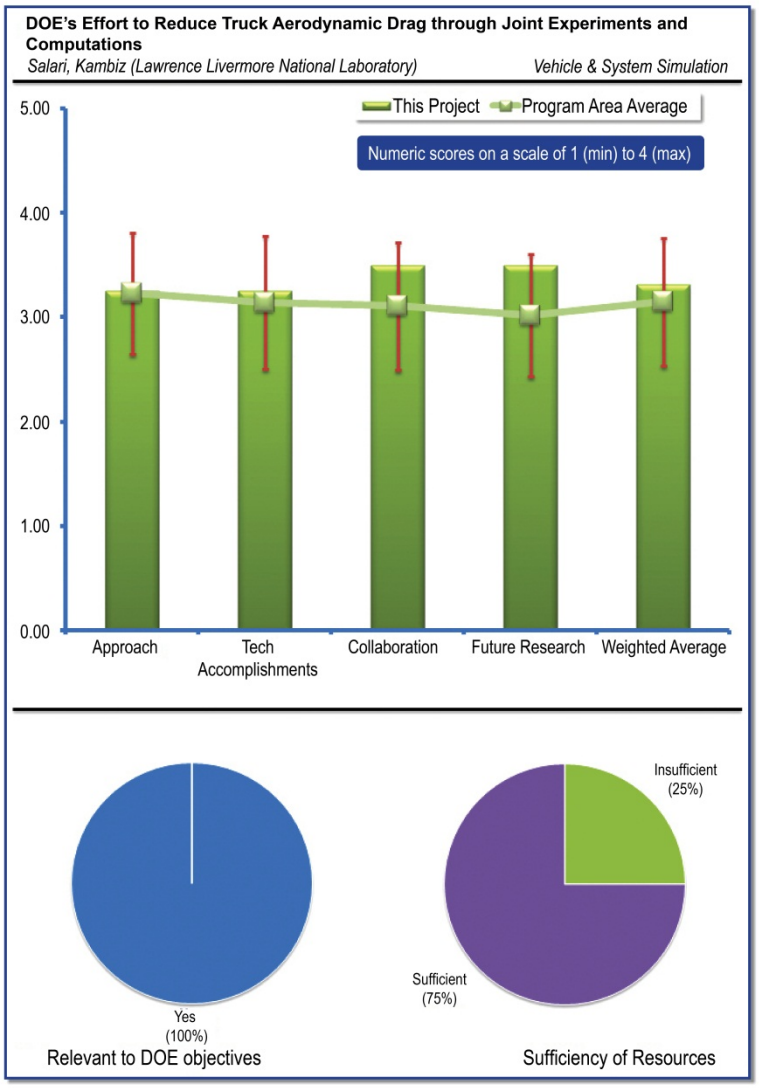
The first respondent thought the modeling efforts for diesel and gas engine work were clear, but asked, What is the new experimental work? This was less clear. A second respondent expected to see some good results from the modeling as well as the developments on engine and powertrain rigs. Alternative fuels were not covered in this project, but there is a follow on project that will explore this. A third respondent thought the next steps should include modeling the impact of low-friction strategies on vehicle efficiency – commercial and military ground vehicles, based on driving schedules (commercial vs. military). FY 2011 work should include: Applying driving schedules (engine maps) to predict changes in friction mean effective pressure (FMEP); scaling fuel economy to indicated mean effective pressure (IMEP); and initiating/extending studies on impact of additives and materials on vehicle efficiency (friction) and reliability/durability(wear and scuffing) –in progress. Findings to date include: Durability/Reliability–Maximum forces occur near top-dead-center where boundary/mixed regimes dominate –focus on high loads (˜50 N/mm). A fourth respondent appreciated the difficulties, but it would have been nice to see some efforts to look at the impacts on transmissions/gearboxes. The slide showing the impacts of friction reduction on net engine losses is very nice. It showed how reduced boundary friction enables lower viscosities and these two together give the some significant benefits and it puts some rigor behind the claims. It would be very useful to see something similar on the transmission side; otherwise the claims about potential reductions really do not seem to have a firm basis. Having said all that, given the funding level, this respondent thought the proposed work seemed very reasonable.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

A first evaluator would increase this budget. The MOU has accelerated ROI when managed appropriately. When ANL works with DOE HQ VSS, this management and its results may work very well. A second evaluator concluded that more resources on more experimental work would be worthwhile. How will the work on the engine / drive train simulation rigs be funded? The FY 2011

funding is small compared to the goals. A third evaluator said resources appear sufficient. The final evaluator thought the first two items seem reasonable. The final item (test program with original equipment manufacturer [OEM]//Tardec) will rely on getting external support.

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



Reviewer Sample Size

This project had a total of four reviewers.

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

The first evaluator was of the opinion that this project directly contributes to the overall DOE goal to reduce our dependency on petroleum for Class 8 tractor- trailer vehicles. The project objective includes reducing aerodynamic drag in Class 8 tractor-trailers by approximately 25% leading to a 10-15% increase in fuel efficiency at 64 mph. Class 8 tractor-trailers are responsible for 12-13% of the total US consumption of petroleum. A second evaluator acknowledged that aerodynamic losses on heavy trucks represent a significant amount of petroleum consumption. Moreover, some "add-on" devices and other enhancements can be implemented in the very near term. A third evaluator thought that a 25% drag reduction is aggressive and highly needed. The project directly addressed a key parasitic loss. Aero plus single tires seem to be a large near term impact. The third evaluator thought this project was producing great work to get solutions on the road in large volumes. The final evaluator stated that reduced aero drag improves fuel efficiency of tractors and trucks which take a large amount of the fuel used in the U.S.

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

A first respondent thought that this project's approach is sound. Full scale wind tunnel testing was matched with science-based AE modeling and road testing. Wind tunnel testing is expensive, but sound, and the industry collaboration is useful. The first respondent was not clear what the university contribution was, and thought that it could be easily expanded. A second panelist claimed that this year involved a lot of testing to help validate various claims and (presumably) to support CFD modeling efforts. Good focus on near term technologies that haulers would be likely to adopt (if the tests show merit). A third panelist thought that there was a great blend of pulling forward existing or proposed solutions and sorting them out to prioritize resources to accelerate to the market and in developing new solutions. This panelist also thought extending solutions from box trailers to tankers is a good step. A fourth respondent concluded that although the 2010 presentation did break down the drag by area of the tractor-trailer, and a drill down analysis was not given to show the aerodynamic drag currently on the tractor/truck vs. the cost to improve them. If that was done, it was not made clear this year. Even though both technologies help with fuel economy, wide base tires and aero improvements are pretty different topics. These technologies might be better served in separate projects. Analysis of the rolling resistance and how to reduce it (besides using Super Singles) was not shown.

QUESTION 3: CHARACTERIZE YOUR UNDERSTANDING OF THE TECHNICAL ACCOMPLISHMENTS AND PROGRESS TOWARD OVERALL PROJECT AND DOE GOALS.

Reviewers had positive feedback about the technical accomplishments achieved thus far. A first reviewer commented that drag reduction estimations of the corrugated trailer drag, tanker trailer, and add on devices for van trailer are all valuable. LLNL's virtual testing environment should minimize wind tunnel costs. The non-proprietary results should be made as public as possible so drivers and fleets can use the information to make purchasing decisions. A second reviewer reported that identification of tankers was nice; a good opportunity for improvement and nice summary showing the influence of the gap. The second reviewer also liked the review of a broad range of offerings and efforts to summarize findings. The third reviewer thought that the ability to run full scale wind tunnel tests on tractor trailer was amazing. The work on corrugated trailers to identify low hanging fruit is a great result. Design guidance to trailer tails. The reviewer thought this project displayed great work with Navistar and extended team, resulting in really amazing progress over several years. This is an outstanding example of great use of DOE resources to really deliver advances important to the nation. The fourth reviewer stated that FY10 Accomplishments include full-scale wind tunnel test of Class 8 tractor-trailer combinations at NASA Ames Research Center, National Full-Scale Aerodynamics Complex (NFAC) facility. FY 11 accomplishments will include a focus on improving design/performance of existing drag reduction devices based the FY 2011 full-scale wind tunnel tests, and performing scaled experiments to validate the improved performance of redesigned aero devices. The ultimate goal of the work will be to design new aerodynamic drag reduction fairings for tanker trailers. The fourth reviewer concluded that the wind tunnel work is a strong accomplishment. What the team does with this date in the next assessment and design steps will be telling. Suggestions are trailer skirts, tail devices, and other AE devices. Findings include 405% FEI with wide base single tires.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

The first panelist thought that it was good to see interactions with haulers (Frito Lay and Praxair) in addition to manufacturers. A second panelist reported that partners include Navistar, Inc, Michelin, Freight Wing Inc., ATDynamics, Kentucky Trailer and Wabash National, Frito-Lay and Safeway and Praxair. A third panelist felt there was outstanding collaboration with a strong group including LLNL, Navistar, Michelin, NASA Ames, Wabash, Praxair, and Safeway. This panelist thought that communication through conferences and international outreach was outstanding, and that combining work on tires and aero to attack the two big parasitic losses is a unique approach. A fourth panelist believes that the collaboration with Navistar should ensure the devices are used, and that the collaboration with Praxair should allow improvements to be more easily adopted. The fourth panelist also stated that the guidance document referenced in the presentation should be easier to access for people who want to read it that are not on the project. LLNL took more than 10 days to be able to locate and send out the document upon request.

QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

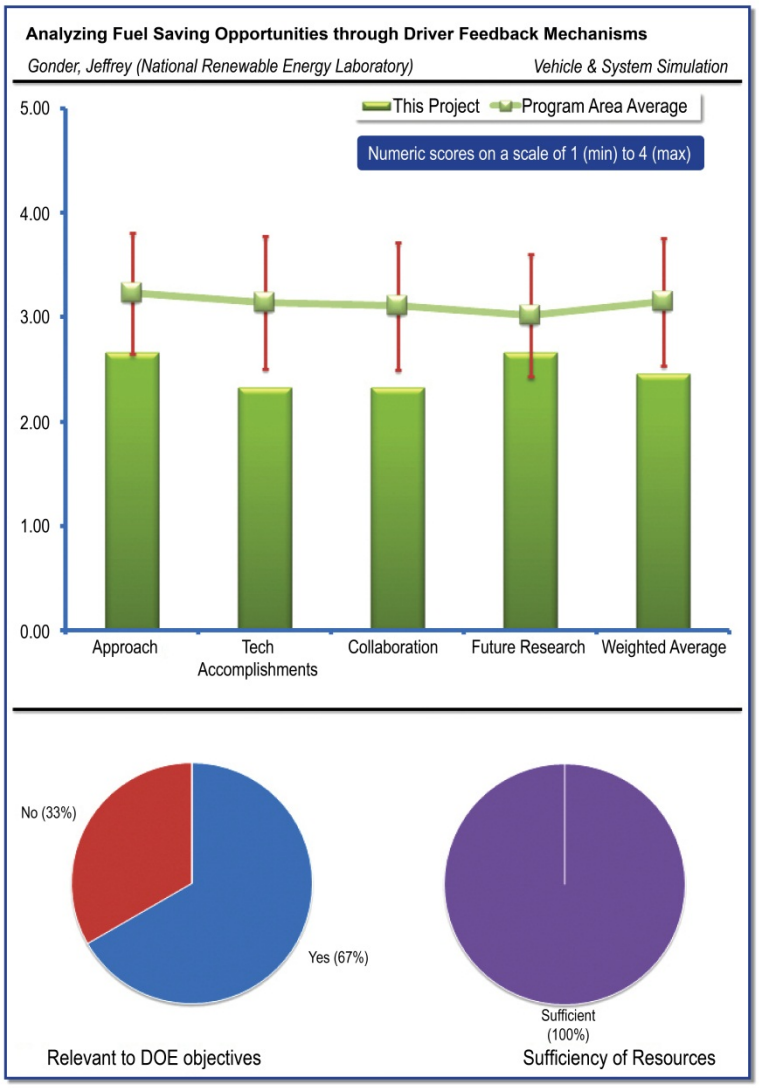
The first evaluator considered there to be potential for gains in efficiency for tanker trailers. Efforts to incorporate thermal (cooling system) aspects into aerodynamic studies seem nice. A second evaluator encouraged work to continue on tankers, aerodynamic devices, aerodynamic surface optimization, and integrated vehicle approach. This reviewer asked, what about through the engine aero losses? Is this a big next area? Will there be more types of trucks analyzed? Now that work is well advanced for long haul box rigs, should an analysis be done to identify next big areas to attack? A third evaluator reported that future work will include continued track work on AE devices and performance validation, and work with Praxair to design new aerodynamic drag reduction devices. Expanded work will include investigation of benefits of tractor-trailer integration for drag reduction (geometry, flow, and therma). This integration is the most compelling aspect of future work. A fourth evaluator thought the improvement on the tanker truck (to be measured) will be a key bit of information that would encourage use of aero devices in that application.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

The first reviewer thought that the money remaining in 2011 may not be sufficient to achieve all the future goals of the program for 2011. The team may need to prioritize which part of the plans should be funded. A second reviewer stated there was a great use of resources, that the project was an excellent value for the money, and that this project appears to have delivered more energy savings

for the money than any other DOE project they had seen recently. A third reviewer thought this program seemed to be fairly well established, with good coordination between various institutions.

Analyzing Fuel Saving Opportunities through Driver Feedback Mechanisms: Gonder, Jeffrey (National Renewable Energy Laboratory) – vss007



Reviewer Sample Size

This project had a total of three reviewers.

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

Two reviewers watched this presentation, and the third reviewed written materials. The first reviewer agreed that it is likely that providing the right feedback should effect some improvement in driving behavior, leading to lower fuel consumption. The question is, how much can be gained by this approach? The fundamental assumption is that it will take a long time to replace older lower technology vehicles, and significant reduction in fuel consumption can be had by trying to modify driver behavior. The second reviewer felt that modification of personal driving behavior has the potential to lead to roughly 5-10% improvement on average over the U.S. vehicle fleet. One the biggest problems facing improvement in vehicular fuel economy is the very large pool of legacy vehicles in the U.S. Fleet. These vehicles take 13-15 years to turn over and when coupled with the relatively slow penetration rates of new vehicular fuel efficiency technologies, the end result is a very slow improvement over time in the overall U.S. vehicle fuel economy. Technologies or fuel efficiency approaches that can improve the fuel economy of existing vehicles already on the road (more than 200 million), even only modestly per vehicle, can lead to dramatic savings when applied over the entire U.S. vehicle fleet. A third reviewer could not attend the session, so only reviewed the written presentation. This reviewer noted that this project has not yet enacted any of its planned tasks.

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

The first evaluator saw a good combination of driver behavioral research and engineering aspects. Previous work from the National Renewable Energy Laboratory (NREL) has introduced the concept of kinetic intensity to evaluate different drive cycles. It may help to leverage some of that work and look at the derived benefit as a function of kinetic intensity. While it is not directly related to the project objective, it does bring some level of objectivity to the evaluation. The second evaluator stated that the approach is solid, consisting basically of quantifying fuel savings opportunities, identifying/understanding behavioral influences, and assessing various feedback mechanisms. Respectable and appropriate partners have been leveraged to appropriately assist with the task, with the possible exception of the lack upfront of automotive OEM participation. This reviewer expressed concern with the task becoming somewhat divergent. If work continues in the future, it may be beneficial to narrow and focus down to a few very promising implementation pathways with partners with the potential to be broadly implemented commercially. The third reviewer concluded the approach was not clear from written material.

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

The first evaluator reported some interesting results from the study - even the negative results (only incremental cycle improvements achievable) provide valuable information. The second reviewer stated that this task has generated a respectable amount of technical progress and accomplishments, including analysis of and adjustment to real world driving samples, insights from literature reviews, identification of driving cycle considerations, and approach assessments. Several sound recommendations from the task have been made. The accomplishments basically make the case that a significant amount of petroleum displacement potential exists through modification of driving behavior. But, as always, modification of personal behavior can be extremely difficult unless there are strong incentives to change. The third evaluator concluded that there were no accomplishments shown in the written presentation.

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

The first respondent thought that the task had respectable collaboration with several other entities including the Institute of Behavioral Science, Gloworm, Navistar, and Progressive Insurance. It would be beneficial to further expand collaborations with these entities, others like them especially on the commercial side, as well as with automotive OEMs. A second respondent stated that it was not clear from the presentation whether there had been any collaboration up to this point in the project. The slides on future work clearly indicate a list of collaborators. A third respondent surmised that collaboration and coordination was not clear from the written presentation.

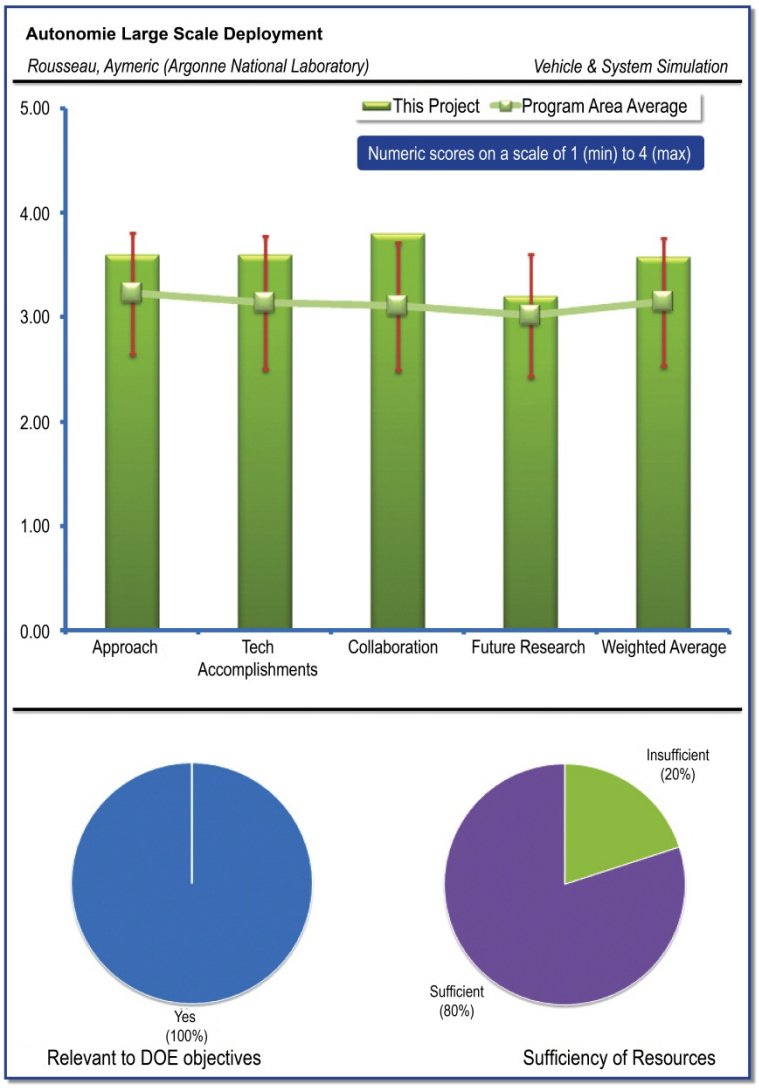
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first panelist commented that the project is largely coming to an end, but does appear to have the potential for continued follow-on benefits. For example, following up further on the idea of leveraging applications with enhanced incentives through commercial vehicle fleets and usage based insurance is promising. These areas could be taken further. It would probably be beneficial to get an automotive OEM involved from the standpoint of determining the feasibility of different driver feedback mechanisms from a driver receptiveness and cost standpoint. In the presentation, Recommendation 3 to "make it automatic" holds the promise for bigger gains but only much further in the future. A second panelist reported that the project's presented future work includes several recommendations along with collaborative work that is planned. It is not clear what the purpose of these recommendations is (with specific reference to future work). Is there anything planned that will study the impact of implementing these recommendations? The third panelist thought that the written presentation did not really clearly explain future research.

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

A first commentator thought resources have been sufficient for the task. A second reviewer was unsure.

Autonomie Large Scale Deployment: Rousseau, Aymeric (Argonne National Laboratory) - vss009



Reviewer Sample Size

This project had a total of five reviewers.

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

The first reviewer stated that this project provides software tools for vehicle manufacturers to be able to develop and field optimized vehicle systems architectures more quickly and cost effectively. Although this tool will not directly deliver petroleum displacing technologies to market, it will be an enabler to help automotive companies develop products more quickly. It is likely that the larger vehicle manufacturers who do not use Autonomie will already have alternative tools/methods that can achieve the same objective, but this package will be useful to the smaller manufacturers and ancillary companies and will help provide consistency in the marketplace. A second reviewer reported that Autonomie is the primary tool used by all the labs to evaluate fuel consumption of new powertrains or new control strategies, and it appears to have found significant use across many of the labs. A third felt that this project is highly relevant to accelerate the modeling of vehicle systems core to DOE objectives. Unknown overlap with other commercial off-the-shelf (COTS) solutions but availability without for-profit license fees can be key to labs, universities, etc. A fourth reviewer affirmed that the large scale deployment of Autonomie will accelerate HEV, plug-in hybrid electric vehicle (PHEV) and electric vehicle (EV) technology development and evaluation. It is easy to see that the program will have a high impact on work at both government agencies and industry. The fifth reviewer thought that a software program that provides plug and play integration of various engine and vehicle simulations program will be a valuable tool for the design of fuel-efficient vehicle and vehicle technologies.

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

A first panelist relayed that one of the stated goals in to have a commercial partner, which brought to their mind the ADVISOR experience. This panelist hopes the lessons learned from ADVISOR are kept in mind when seeking a commercial partner to work with on this project. A second panelist hoped that the approach will lead to a successful launch for the expanded user base, by commercializing the software package and taking significant efforts to ensure that the product will be robust and well supported in the market. This activity will be key to transitioning the software from a narrow range of “beta” users into the wider market. The wider market may be much less tolerant of developmental issues. The second panelist also thought the approach of bringing in a commercialization partner to manage those tasks, while leaving the government the responsibility for continuing produce development, looked very wise. A third panelist believed that the approach for the large-scale deployment of Autonomie to date has followed a systematic and well-thought out plan. Progress on automating software testing and distribution appeared to be working well. A fourth panelist is of the opinion that a virtual engineering approach, using tools for CIL and SIL are clearly the future. The

new website, links for entering and tracking issues, and other support activities are very useful for the large scale deployment effort. Establishing partnerships with industry is also commendable, as is automatic release generation process. Generation of public component libraries would enhance impact on work at academia and other agencies. A fifth panelist thought that perhaps the search for a commercial partner (for 24/7 support, etc.) was a little late starting, in that companies/users are already ramping up without the support contracted. From one question answered in review it sounds like there are easy migrations from Powertrain Systems Analysis Toolkit (PSAT) for models... these are key. So far there is no central "device" model library to enable efficient sharing without model reconstruction or extensive manual networking to other researchers/developers. A virtual tool (device) library should be strongly considered as an enhancement.

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

Reviewers generally perceived that the project is making progress. A first commentator said that it was good to see that Autonomie is being deployed for several DOE funded projects (quite successfully), many of which include HiL, PiL, and other configurations. This actually indicates the level of accomplishment and progress more than some of the slides in the presentation that address this specific issue. A second commentator thought that the commercialization effort appears to be progressing well, in a well thought out manner, and has hit several key milestones with respect to bringing in a commercialization partner. The package also appears to have added some key functionality over the last few years which has expanded its usefulness for the commercial customers. A third commentator judged that all critical tasks seem to be on target, the industry collaboration is very strong and attests to success in deployment. A reviewer concluded that the relatively large number of users suggests the product is well-received and useful. It would, however, be more valuable to track usage hours as opposed to the number of users to better evaluate Autonomie market penetration. A fifth commentator affirmed that the adoption and co-funding of the software by major OEMs and integration in a number of existing DOE projects are indications of its accomplishment/progress.

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

Reviewers had positive remarks about the project's level of collaboration. The first respondent reported that it looks like there is excellent cooperation between ANL and GM, and ANL and the different software vendors that are involved. A second respondent thought that the great relationship with GM will help convince other companies including other manufacturers, GM suppliers, and other companies to use this package. This collaboration with a very critical user will have positively influenced the matureness and feature content of the product. A third respondent thought the collaboration to be, in short, outstanding. Other DOE entities, software companies, and OEMs are all involved…and the sheer number of users is impressive. A fourth respondent reported that there is good exchange between labs, OEMs, and Autonomie users. A fifth respondent thought that the project looks to be very well networked both with industry (co-developed with GM) and with other modeling system providers. Seems some additional commercial collaboration (OEMs/ suppliers) would be on-board and noted here unless agreement with GM restricted other commercial collaborators. "Marketing" or awareness to others should be proactive...maybe just not noted here.

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

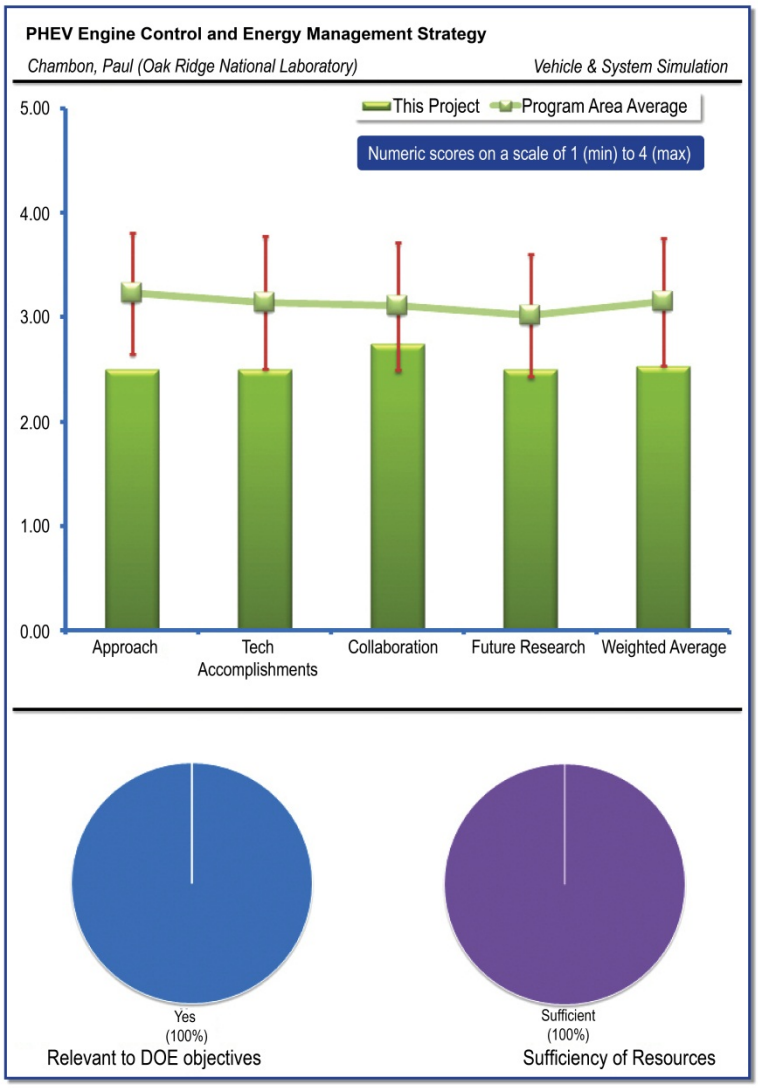
The first evaluator cautions careful selection of a commercial partner, based on the evaluator's experience with ADVISOR, related in the response on project approach. A second evaluator thought the additional feature content looks reasonable. Reducing simulation times for co-sim events may be key in making the adoption of the package a success - it was unclear from the briefing whether the current run times are acceptable or excessive - from experience this can often be a trouble area and should be looked at thoroughly. A third evaluator concluded the key element to future plans is to find a suitable commercial partner who could more effectively management the distribution and technical support of Autonomie. A fourth evaluator reported that the initial work on multi-controller optimization has been mentioned, and will be emphasized going forward. There will be a lot of important issues to address; this is an area that deserves a lot of attention. Industry standards for modeling and simulation (M&S) and support of simulation-based fuel consumption labeling and regulation for medium-duty (MD) and HD are both very relevant goals. A fifth evaluator thought the project did not provide much description of specific research/development areas to improve or enhance...a little of "it will be continuously

improved" based on feedback. However, the developers should have some more ideas of technically what is on the frontier. Maybe they do, just not communicated in presentation.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

A first reviewer said that it seems like milestones are being met, and that planned future leveraging of a commercialization partner will be key to accelerate deployment. A second commented that the scale of the effort, impact, and further development of partnerships may merit increase in funding. Leveraging of GM funds helps achieve this at the moment and is commendable. A third reviewer thought that there appeared to be sufficient given progress and plans. No note of resource constraints in the project material and several partners engaged as well.

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



Reviewer Sample Size

This project had a total of four reviewers.

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

The first reviewer thought that this project supports overall DOE objectives indirectly, by addressing the cold-start emissions in PHEVs. Solutions will remove or reduce the constraints related to cold-start while optimizing the PHEV for minimum fuel consumption. A second panelist reasoned that increased penetration of PHEV can provide significant displacement of petroleum fuels. A third stated that the project does support DOE objectives but the relevance (compared to other initiatives) does not seem too strong. Cold start strategies are worked extensively through efforts with the U.S. Environmental Protection Agency (EPA),, the OEMs and tier suppliers to manage this transient event. It is not clear that there is a specific problem tied to PHEV that would not be addressed in the non-PHEV configuration. Yes, there could be more than one engine start event per drive cycle. However, the overall goal of DOE would be to avoid engine starts completely; or, if necessary, it would be to extend the range of the vehicle after the EV range is exceeded. This reviewer remarked that there are some configurations, modes, and duty cycles that may require multiple starts but is it a primary-enough expectation to put specific development funding into? How much more optimization would really occur above and beyond the baseline work already done for cold start?

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

The first respondent thought the approach looked good overall but had one question: Does the PHEV set up include a motor/generator that could be used for stop-start? It is not clear from the presentation if that is so. Since the claim is that is expected to come from system optimization, it would seem that the motor/generator would play a big part in the system optimization. This would have a significant impact on emissions as well. A second respondent reported that the approach includes several tasks, four main tasks to be exact, and the planned activities are well defined in the context of stated objectives. However, the respondent's concern is whether the planned scale of the effort is realistic, particularly building the hardware setup and plans to carry out proposed experimentation. So far the engine testing has been completed, using a complete vehicle and chassis dynamometer. The on-going effort is developing engine-in-the loop capability at UT Knoxville, while there a planned parallel engine experimental effort at Oak Ridge National Laboratory (ORNL) on emissions and control system development. In short, the second reviewer was supportive of the effort, as long as the team keeps the focus on the main goal and initiates work on cold-start strategies on time. A third respondent asked: How would adding the hybrid controller into the loop really affect the cold-start performance? The material/presentation did not get specific enough regarding what control parameters/actions may enable optimization. The approach seems to be heavily dependent on tapping into the

tight control loop of the ECM (having an open controller). Without answering the question of a novel approach to cold start emissions, this effort seems redundant to every OEMs current activities. A fourth respondent criticized that establishing a partnership with Bosch (or similar) should have been a primary goal from the onset of the project as opposed to developing an open controller. In addition, there has been much research investigating various strategies to mitigate cold start emissions but the approach used in the present project does not seem to build off previous research, instead it reads as if "various strategies will be tried."

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

The first reviewer stated that many of the issues that came up in 2010 have been well addressed. A second thought that since the partnership with Bosch had been established it appeared that the progress made on developing an open controller was diminished. A third commentator said that they understand the difficulty in getting the engine setup and then switching based on the new collaboration with Bosch. Again, is the potential benefit and available control levers actually worth all this time trying to directly control the engine? Perhaps the most valuable effort to the broader community is experience in modeling an engine system and PHEV vehicle level model in Autonomie. This should be well documented to benefit other initiatives. A final commentator concluded that engine characterization on ORNL chassis rolls facilities has been completed. The open source controller has been developed, to overcome the setback caused by lack of technical support from the OEM. The latter obviously caused delays, but the team seems to be in a better position after engaging Bosch as a new partner. The progress at UTK and ORNL related to engine test setups seems to be good, but effort so far has mostly provided enablers in terms of methodologies and experimental capabilities. Transition to actually pursuing main objectives will need to happen soon.

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

Reviewers had a mixed assessment of collaborations, with three commending the collaborations and a fourth expressing concern. The first evaluator found significant improvement compared to last year, where the project appeared to be foundering. This evaluator also thought it was good to see Autonomie being put to use. A second evaluator concluded that collaboration with UTK and ANL good, engaging Bosch as the new partner should be very useful for controller development. A third evaluator reasoned that the partnership with Bosch should prove valuable to determine effective strategies to mitigate PHEV cold start emissions. The final evaluator said that it seems the project should have been suspended until a known collaboration partner giving desired control access was in place. Not at all clear if efforts are well-coordinated with EPA efforts at a project objective level...understanding that specific expert(s) with experience in cold start transient emissions are being leveraged. With this project there may be a high risk of redundant objectives.

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

All four reviewers questioned future plans. A first stated that the details are lacking as to building a systematic test plan to determine the optimal strategy to reduce PHEV cold start emissions. A second thought that the list of strategies to be investigated seemed to be broad, and will require decisions soon. What will be the balance between work on vehicle level strategies (supervisory control) and engine-level strategies, e.g., air-fuel ratio (AFR) optimization or VVT retard? A third reviewer said that for FY12 the objectives included supervisory strategies and system optimization. The third reviewer asked: How is the sizing of components itself addressed here? Is there a trade-off involving vehicle performance as well? Battery capacity? What drive cycles will be used? A fourth reviewer deemed that the future work does not seem well connected to a future mainstream DOE effort. If future goals are realized (e.g., all-electric vehicles) will this problem be eclipsed/obsolete? Is this really a PHEV project or looking at approaches to improving engine cold starts in general. The FY12 proposed work of "Iterative concurrent emissions optimization of engine control strategies and hybrid supervisory strategies" would be very helpful to give examples of HOW this would be approached...what example "levers" specific to PHEV?

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

One respondent answered that resources appear sufficient for stated scope.

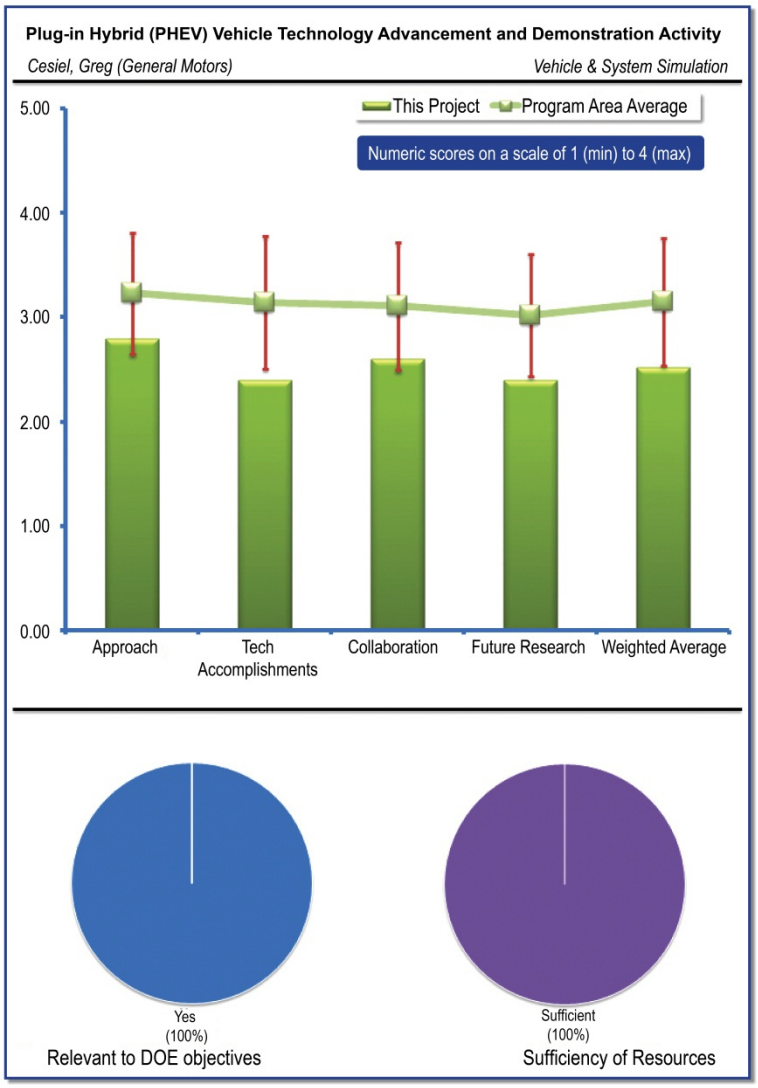
Plug-in Hybrid (PHEV) Vehicle Technology Advancement and Demonstration Activity: Cesiel, Greg (General Motors) – vss018

Reviewer Sample Size

This project had a total of five reviewers.

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

The first reviewer described developing and demonstrating advanced PHEV technologies as being very relevant to DOE's mission statement. A second commentator concluded that PHEVs are a proven way of reducing fuel consumption. Therefore, developing PHEVs and bringing PHEV to production is an obvious means to achieve petroleum displacement. A third commentator affirmed that PHEVs can be very effective in petroleum displacement. This project helps OEMs perform risky new development and deployment of PHEVs in the future. Real world usage and results are an important and expensive endeavor. Leveraging costs with OEMs is a wise choice. A fourth commentator acknowledged that introduction of advanced plug in technology (blended mode) will have significant impact on increasing fuel economy. A fifth commentator had a fundamental programmatic question, and doubted the program's ability to accelerate the penetration of plug-in hybrids into the U.S. fleet.



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

The first respondent offered that the presentation materials offer minimal technical details. The respondent could only guess that GM is addressing the barriers appropriately. The second respondent thought the approach was not very detailed, but that lack of detail made sense at this stage of the development process. A third respondent thought the approach was great, building off of previous 2-mode technology and expertise; is there plan for on-road fleet operation besides the development testing? The fourth respondent thought the presentation did not have much in the way of data, and was more of a high level overview. The fourth respondent would like to see specific data to understand petroleum displacement potential. The project is stated at 65% complete, but needed some data for review. A fifth respondent did not feel that this project was leveraging the Volt. Since it appears a project goal is to accelerate PHEV penetration into the national fleet, it seems maximized leveraging of the Volt would be logical.

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

The first evaluator thought that good progress had been made. This evaluator thought that the presentation could have provided more details, graphs, figures, or results on progress. A second evaluator thought it hard to gage the level of progress since last year. Few details were given, and accomplishments seemed similar to last year. No measures were given to support refinement. A third evaluator

thought that, based on the presentation material, it seemed like very little progress has been made over last year (slide is identical to last year's presentation). Some of that can be explained by the change to a new vehicle platform that required porting the powertrain from the Saturn Vue. Still it was not made clear by the presentation material. DOE reviews were mentioned to assure us that milestones were achieved and demonstrated during those reviews but no evidence was provided during AMR. Are they being too secretive? A fourth evaluator reported that the project has been shown to function in cold and high altitude, and was said to be 65% complete; however, no data was shown to validate this claim. The fifth and final reviewer thought this project seemed to be behind Ford and Chrysler. There were no technical accomplishments or data presented. It appears the switch of vehicle platforms significantly impacted this project.

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

A first reviewer found good collaboration with the University of Michigan, the Battery Coalition, UMTRI, and Argonne with testing. More collaboration with component and battery suppliers could help to strengthen PHEV development for the U.S. market. A second reviewer reported that partners were listed but no concrete evidence of by-products from those collaborations (except for ANL, but they are not listed as a partner). A third reviewer found that University and DOE lab collaborations were evident. A fourth thought the project had appropriate collaborations with government and educational institutions. A fifth reviewer only noted University of Michigan collaboration, and understood that the ANL test was required. Ford and Chrysler had municipality and utility partners on their teams, and this reviewer was expecting the same on this project.

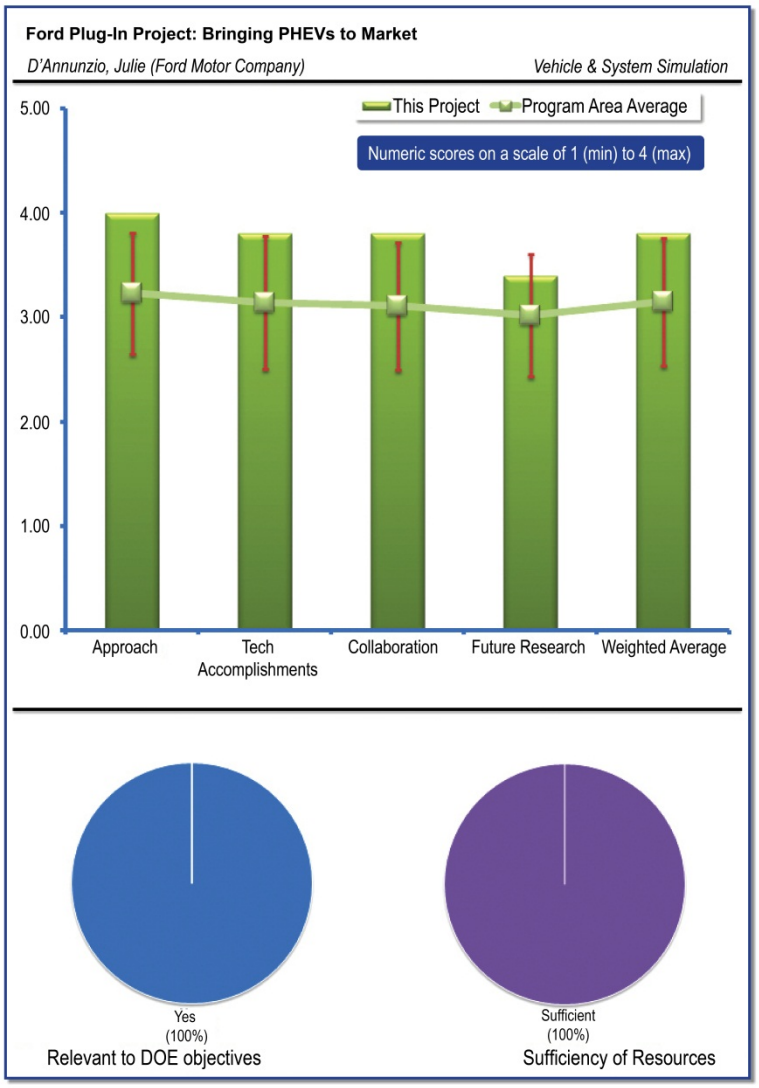
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first panelist saw good plans for continued development and demonstration through testing and on-road demonstration; including various charging power levels and charge / drive patterns. It would be interesting to include controlled charging studies (day of day control and/ or charge power level control through Smart Grid tech.) A second panelist thought the plan was fairly generic, but seemed reasonable. A third said the plan was adequate for the future year, but that it was hard to gauge if enhancements would be implemented. A fourth panelist agreed that there were no detailed specifics on the program in the presentation, but that the general idea was very good. A fifth panelist reported that program steps were presented, but it was not clear where GM is in the phases. A schedule would have been helpful and suggested for future AMRs.

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

The first evaluator suggested leveraging previous 2-mode technologies to enable low investment costs for this project in order to reach the goals of development and demonstration. A second evaluator was not able to assess the project based on presentation material. The second reviewer asked: Is this staffed appropriately, judging by the lack of (evidence of) progress? A third evaluator thought the resources to be sufficient, with the exception that in switching platform, there may be more expense than originally planned.

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



Reviewer Sample Size

This project had a total of five reviewers.

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

Reviewers saw that this project supports DOE's objectives. The first evaluator thought that demonstration and deployment of more than 20 PHEVs from an OEM is very relevant to DOE's mission statement. A second claimed that plug in hybrid technology has high potential for drastically increasing fuel economy. This technology coupled with renewable fuel flex fuel capability furthers the potential for petroleum displacement. A third evaluator stated that flex fuel and improved mileage will support DOE's goals. A fourth said use of advanced technologies may enable electrified (GRID connected energy) transportation.

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

Commenting reviewers remarked that the project has a very good design. The first reviewer thought this project had a great approach: multiple vehicles were deployed to a dozen utilities for on-road demonstration as well as dynamometer testing for baseline evaluation and data correlation. A second reviewer felt the design approach was very good, and should yield good results and insight into capabilities of PHEVs. A third reviewer said that this was a well phased program that allows for evaluation of systems and production likelihood, and proper in-use durability planned. A fourth reviewer affirmed that the approach seems solid. The next generation of improvements is being implemented in EU and China vehicles.

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

A first panelist thought that deployment activity looked very good. A lot is being accomplished. The panelist was interested in seeing the results after the 57 MPH calibration enhancement (a smart decision). A second panelist reported that there was good data thus far on over 500k miles for fleet, and that the data acquisition system and vehicles seem to be sufficient and effective enough to move forward. A third panelist stated that particular data not shown, only a high level overview. Progress and mileage accumulation is good (fleet ~400,000 miles); however, fuel economy potential not shown. The panelist thought there were interesting results on fleet driving behavior that was unexpected (higher rates of daily charging- fleet drivers not wanting to pay for charging at home). A fourth panelist confirmed that more than 20 PHEVs were deployed for on-road operation, accumulating nearly 400,000 miles, and serving as an outstanding demonstration of PHEV technologies. These increased EV operating region, and successfully demonstrated vehicle to grid communication (Smart Grid). A fifth panelist reported good technical progress, which identified status and issues, including program changes. The project identified changes in technology within partner community, including charging EVSE partners, and J1772 plug

upgrade. Key barriers to be addressed included energy storage system (ESS) controls improvements. Specific performance related to vehicle goals not reported.

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

Reviewers has positive feedback on collaborations. A first commentator stated that collaboration with a dozen utilities was great. They wondered if any portion of demonstration planned for private drivers as compared to business fleet usage since the driving, charging, and utilization patterns are quite different from business fleets to private drivers. A second commentator pointed out that of course the OEMs would be collaborating with its suppliers, but this project is exceptional because collaborating with utilities is a very important relationship. A third commentator was of the opinion that in addition to the technical partners in the development of the vehicle, the fleet/driver network they have created enabled a quick mileage accumulation, and outreach opportunity. INL data gathering and distribution was useful for proper information sharing. A fourth commentator thought utility collaboration is good, but that future partners could include private individuals to capture non-fleet application. A fifth commentator saw good collaboration with a number of regional energy authorities, government, and industry partners.

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

A first respondent said to continue the great work, and that any plans for further development, improvements, etc. should use lessons learned. A second respondent saw a solid project drawing to a close. A third thought that continuing field testing and evaluation of technology changes and controls changes is good plan, but no specific details were listed in the presentation as future work. A fourth respondent considered next generation technology planning to be logical (electric AC, higher speed EV). Battery life predictions based on improved EV usage could be added.

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

A first evaluator thought that more than 20 PHEVs provided a large enough sample to demonstrate the technology on-road while still being small enough to keep costs down. A second evaluator found it hard to judge; it appeared that this project has not been slowed by funding. A third evaluator concluded that appropriate resources have been applied in this project, especially, and very importantly the outreach.

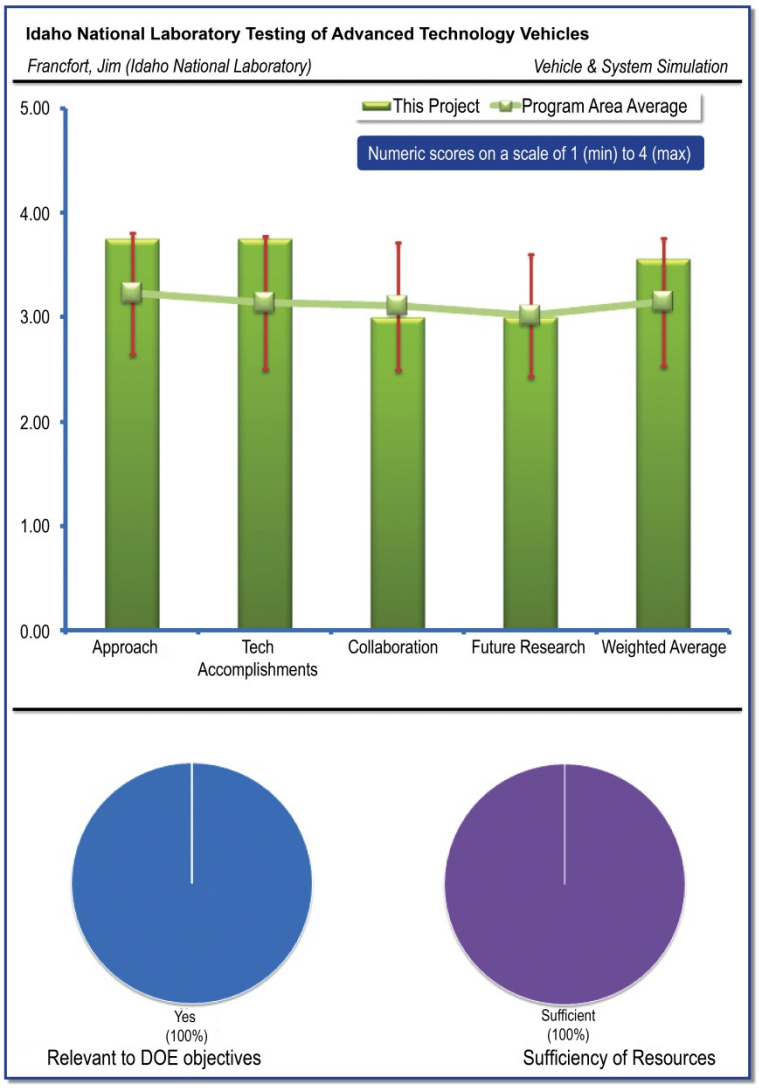
Idaho National Laboratory Testing of Advanced Technology Vehicles: Francfort, Jim (Idaho National Laboratory) – vss021

Reviewer Sample Size

This project had a total of four reviewers.

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

The first reviewer felt that unbiased 3rd party vehicle testing helps to overcome end-user hesitance to acquire advanced vehicles, and helps manufacturers and suppliers improve the performance and reliability of advanced vehicles. A second stated that it is important to have some actual in use testing to provide a basis for all the modeling and projections. A third reviewer confirmed that independent, unbiased, and credible real world evaluation of advanced vehicles and fuels is essential for market acceptance of these technologies and to achieve significant petroleum displacement. Without broad, real world confirmation of advanced vehicle technology performance and costs, potential end-users—be they fleets or individual consumers—are not likely to consider their use. The final reviewer held that the U.S. needs real world testing of hybrid and electric vehicles to understand how much they are reducing fuel use and what some barriers for their use might be.



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

The first panelist commented that, all in all, the data collection seems to be well done, providing some real feedback to decision makers. A second agreed that there is a lot of data being obtained by this project for little government investment. A third panelist reported that INL, in collaboration with other entities, has been performing the function of an independent real world tester of advanced light-duty vehicle technologies and fuels for nearly two decades. INL has developed a comprehensive and proven approach to need including development of test methods for each technology; conduct of actual testing on closed tracks, dynamometers, in the laboratory, and accelerated and fleet testing. INL analyzes and evaluates a number of vehicle and component parameters and infrastructure related elements under a broad range of environmental and driving conditions. The focus is to accurately and consistently document real world technical, maintenance, and cost parameters and to convey them in applicable formats to a broad range of users. The processes have been refined and honed consistently throughout the years. More recently, a significant emphasis has been placed on evaluation of electric drive vehicle infrastructure including charging equipment, charging/driving patterns, and interactions with the grid. A fourth summarized the approach and made suggestions on the presentation. This panelist listed: Collecting real-world and life cycle data on advanced vehicles; DOE program doing field testing of LD advanced vehicles; multiple testing approaches used depending on technology state and need; data review and cleaning; very clear graphical summaries in reports; and a battery testing mule vehicle. The fourth panelist thought that advanced vehicle testing activity (AVTA) is a very low-cost

project for the number of test miles and data accumulated, and the number of reports published, as all funding is highly leveraged via testing partnerships to provide maximum benefits to DOE and taxpayers. =Every testing regime has at least 20% cost share, and most testing cost-share is typically 50% or higher. Taxpayers receive independent information on emerging technologies and the associated amounts of petroleum used or avoided. The final panelist also advised that slide 14 is potentially confusing—although the color scales look to be the same, the numerical values the colors signify are quite different so the two graphs are not comparable to each other. Although some resolution could be lost, it would probably be best to use the same color scale for both graphs.

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

A first evaluator thought the accomplishments generally good, as this was mostly about data collection, and this is a long running program that seems to be fairly well established. A second concluded that a lot of useful data are being obtained. The findings (such as the positive effects of the microhybrids) appear from the presentation to be given back to stakeholders for them to act on through reports. Hopefully feedback is obtained from the stakeholders on the format and content of those reports. How are data accumulated into larger groups, then analyzed and used? This is a huge amount of valuable data but it must be challenging to get analyze and then use it. The reports by vehicle were clear and helpful. A third evaluator agreed that the task achieves an impressive level of overall productivity, not just in the sheer number/variety of vehicles which have been tested over millions of miles, but the success to which a broad range of partners have been engaged, and contributed through a variety of means including most impressively the very high levels of cost share. Technical accomplishments also include battery specific testing, support for the United States Postal Service (USPS) electric long life vehicle effort, and the electric drive and advanced battery test bed vehicle project. The level of automation achieved in the data collection and reporting functions is also very impressive and undoubtedly contributes to high overall of efficiency of the project. A fourth evaluator summarized the accomplishments, including: Dyno testing of USPS conversions; testing li-battery PHEVs from 10 manufacturers (and one Pb-battery); publishing/presenting 3,000+ fact sheets, 26 formal reports, web-accessible reports; 22 HEV models (56 units) tested to date; 5 million HEV testing miles; and 12 H2 vehicles tested.

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

A first respondent thought that collaboration with researchers developing the models seemed like it could be a little tighter. The respondent also noticed mention of standards (two accomplishments) but no discussions of collaboration with ANL - who is also working on these standards. A second respondent concluded that it would help to explain more ways that the partners have used the data. The power companies' use of charging data makes sense, but it is a good idea to continue to look for how to provide value to OEM's just as it is beneficial to provide data for Autonomie. A third respondent reported that the project has extensive collaborations with other labs, EPA, multiple governmental fleets, and broad testing partners including utilities, county/city governments, automotive OEMs, military bases, universities, conversion companies, advocacy groups, and clean air agencies. Again, most impressively is the success to which these broad collaborators have been engaged and contributed through various in-kind and financial cost-sharing arrangements. A fourth respondent listed the collaborations as: Testing by INL and ECOtality; collaborating with USPS, major automotive OEMs, ANL, ORNL, NETL, EPA. The respondent noted that "Consumers" or "General Public" were conspicuously absent from the list of collaborations. While the last respondent would not expect the AVTA to truly collaborate with consumers, this reviewer felt there should at least be strong efforts at direct outreach.

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

The first commentator felt that future research should continue to focus on how data are analyzed and shared. A second commentator thought that charging infrastructure reports (not just vehicle) seem to be a newer focus and are a good idea. A third commentator stated that proposed future activities center on continuation of the testing, data collection, and analysis of electric drive vehicle technologies, energy storage systems, and supporting infrastructure in response to DOE's goal to reduce petroleum consumption in the transportation sector. Plans also are to continue to test as appropriate other advanced vehicle technologies such as hydrogen internal combustion engine vehicles. Plans are to end PHEV conversion data collection as increasing numbers of OEM PHEVs become available. A fourth commentator concluded that future plans to test electric vehicle supplemental equipment (EVSE)//charging

infrastructure are good, but presentation implies that this (rather than vehicle testing) will be the future focus of the program. Is it wise to de-emphasize vehicle testing? The last commentator also noted that NDAs and agreements in place to test Volt, Escape, Ram, LEAF, Coulomb (EVSE).

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

The first evaluator thought that, given the AVTA's numerous accomplishments over several years, the resources are at least adequate. Given the efficiency of the AVTA, the return on investment from increasing the program's resources might be significant. A second evaluator noticed total DOE share increases ($4.0M compared to $2.5M), and assumed the extra work for infrastructure reporting drives this. A third evaluator thought resources appeared sufficient and appropriate for the current activity given the very high level of cost share achieved. A fourth evaluator thought it looked like resources could be a constraint to do the quality control on the data. Does more of this function need to be done on the government side if the companies are having trouble with it?

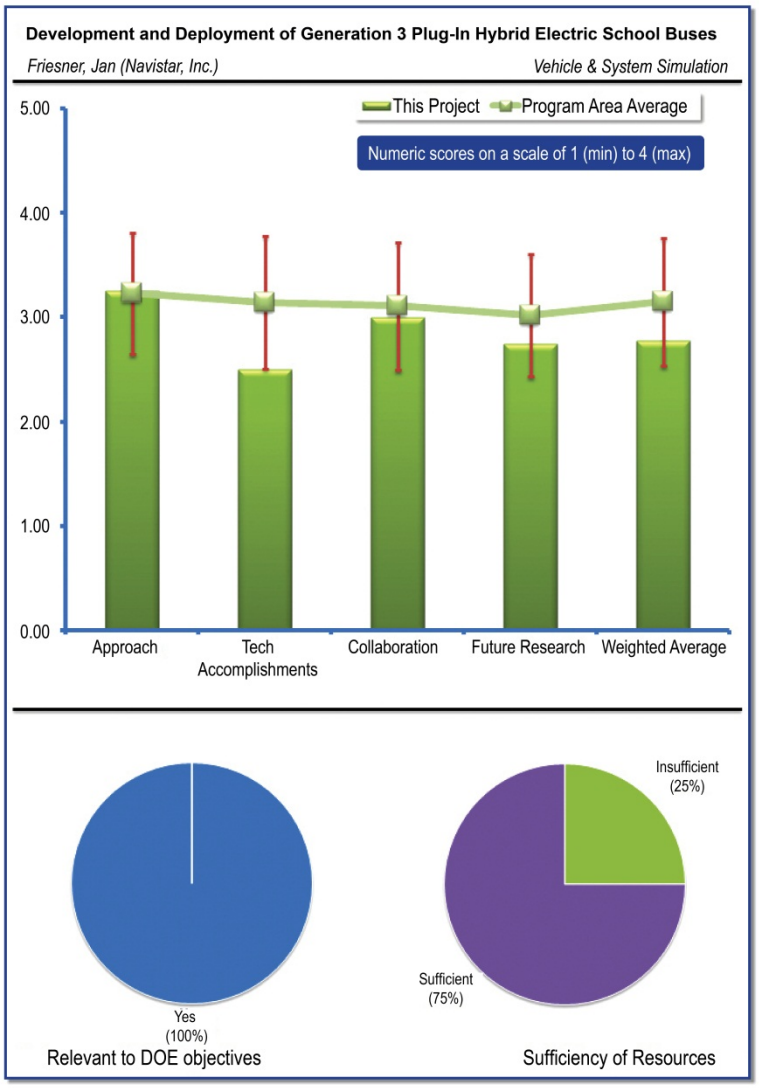
Development and Deployment of Generation 3 Plug-In Hybrid Electric School Buses: Friesner, Jan (Navistar, Inc.) – vss023

Reviewer Sample Size

This project had a total of four reviewers.

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

The first reviewer stated that school buses are great candidates for PHEVs and PHEVs can achieve good petroleum displacement. A second panelist thought that the technology could be leveraged for other heavy duty class applications aside from bus usage, which could be very beneficial relative to large scale transportation. The project exhibited an interesting application of PHEV for busses, with two opportunities for charge and a transient operation—and benefits for air quality at schools. If seen to be successful, this could serve as a model for future school bus fleet decisions. A third panelist concluded that hybrid buses will displace fuel, but it will be small compared to light vehicle consumption. The presenter said there are 200,000 buses in the U.S. The LV fleet is ~ 240 million. Buses amount to less than 0.1 % of the LV fleet.



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

The first reviewer thought that this project had the right approach: performing upfront simulation work to identify the correct powertrain configuration as well as to size components before building the two best candidate platforms for real world evaluation. This will save iteration time and get a better end product. A second reviewer said there was a good approach and applauded the decision to adjust requirements based upon field data collection. A third reviewer felt it was unfortunate the original targets were unable to be attained. They stated the investigator's rationale for backing off on the targets was a little vague. A fourth reviewer considered the upfront analysis with cost benefit included to be appropriate for the market. The big question will remain the additional cost of battery storage and high power electronics being acceptable within the market (the biggest barrier).

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

A first respondent thought that it was unclear what portion of the work was performed by Navistar: DOE seems to have requested ORNL to perform simulations and NREL to do route analysis. Navistar seems to have done their own simulations but no results are available. The current progress does not line up with the February 2012 target to get running PHEV bus prototypes. A second respondent concluded that perhaps the project got a late start, but believed that doing the simulations (ORNL) and collecting the data (NREL) will provide a better design in the end. A third responded that after two years, modeling and simulation complete, but the

project has no hardware and much work to complete over next couple of years. A fourth reviewer affirmed that it seemed like progress was being made, but questioned if they were on schedule.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

The first commentator thought that there seems to have been some good interactions with ORNL and NREL. On the simulation side, no information was available to compare Navistar and ORNL results and to assess the coordination during that task. It would be good to have that information to learn what works and what does not. A second commentator felt that getting the help for initial design was a very good decision to take. A third said that to complete complex integration, relationships with other industry partners on the electrical powertrain/controls side would be beneficial (battery suppliers, high power electronics, motor suppliers, controls, etc.). A fourth commentator concluded that it seemed like ORNL and NREL have done a majority of the work thus far.

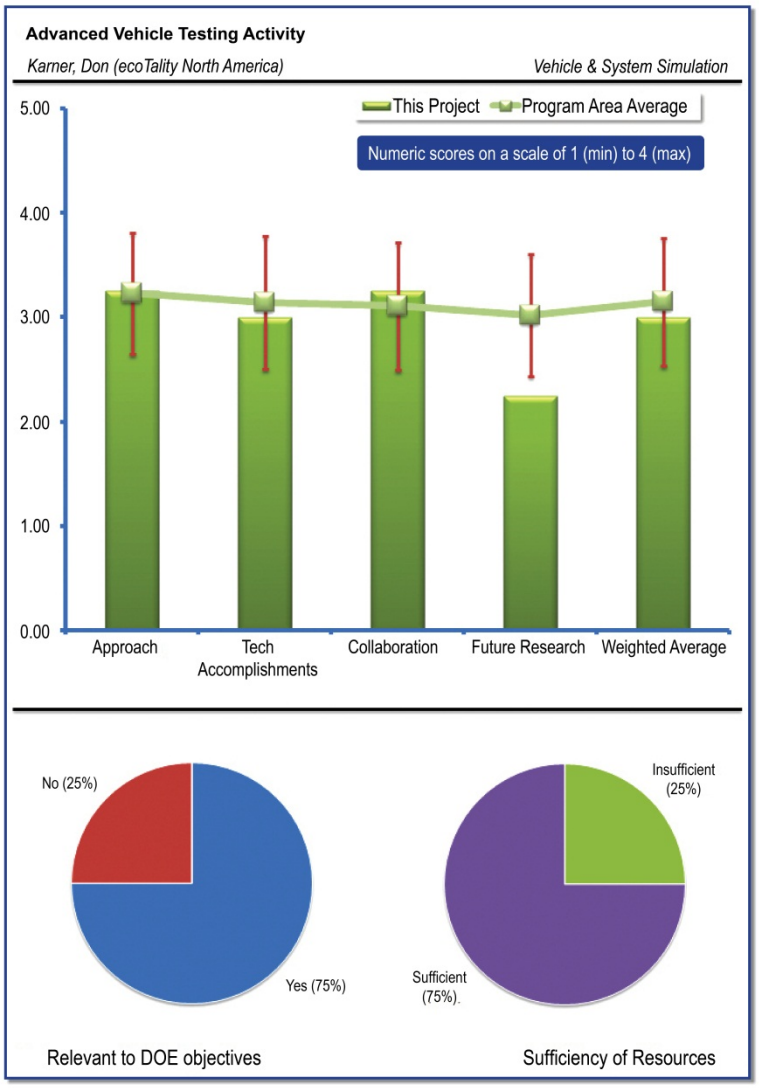
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

A first evaluator thought that once completed, the testbesds should yield very valuable data. A second was of the opinion that it was still very early in the project. Once the first prototype is built, then it will be interesting to see what direction the program will take and how close the vehicle performance is to the targets. A third evaluator concluded that the timeline listed to deliver prototype buses in February 2012 seems unrealistic. It is lacking components and powertrain dynamometer testing: currently the powertrain component go right into the bus after procurement. Without testing the engine, hybrid transmission and battery pack first in a safe, controlled environment to iron out most integration issues and validate control strategies, the debugging on the vehicle might be difficult and time consuming with no guarantee to cover the whole operating envelope. The plan does not mention controls and integration tasks, they should not be overlooked, and the vehicle will not be built in one week as currently planned.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

The first panelist thought the budget appeared to be sound. A second felt there was not much detail on resources, but deeper collaboration with electric powertrain industry suppliers would be beneficial on a tight deadline. A third panelist reported that resources were not mentioned in the presentation but the aggressive timeline will require a very large, qualified team to deliver those buses.

Advanced Vehicle Testing Activity: Karner, Don (ECOtality North America) – vss029



Reviewer Sample Size

This project had a total of four reviewers.

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

The first reviewer felt that this project has been helpful in characterizing vehicle performance, and in providing objective data with which to compare new technology vehicles to conventionally equipped vehicles. This reviewer noted that the accelerated testing has been particularly effective in that vehicle energy consumption trends can be evaluated over a number of duty cycles to result in a composite fuel economy. The same reviewer commented that the vehicle fleet testing accumulates 160,000 miles of service in less than two years and that this provides real world fuel economy data in a relatively short time frame. They feel that a lifetime of testing can be completed in less than two years' time. The availability of such data can guide OEM's and component and system suppliers with information to improve efficiency and durability of new technology vehicles, which will lead to greater market acceptance, and ultimately, reduced consumption of petroleum. The second reviewer felt that the work provides real world evaluation in a controlled environment to understand new technology effect on petroleum displacement. While the third reviewer said that this work directly evaluates energy use and petroleum displacement of advanced vehicles in real world testing. In contrast to three of the reviewers, the fourth reviewer commented that fuel displacement was not measured.

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

A single reviewer felt that the performance testing, which included vehicle acceleration, maximum speed, driving cycle range, braking, and gradeability, can be used to compare "new technology" vehicles to conventionally equipped units, and also provides an A to B comparison amongst new technology vehicles. This reviewer also felt that using the same driver over the same routes to eliminate the driver as a variable would allow the remaining variables to only pertain to the environment. This reviewer felt that it provides information on efficiency of such vehicles over the equivalent of a vehicle's lifetime. This reviewer also noted that it is important that total cost of ownership is calculated at conclusion of test program and felt that actual failure rates are very low as most testing is performed on production released vehicles. This reviewer also felt that with respect to component and sub system testing, battery tests are perhaps the most significant and that it provides invaluable information concerning degradation of battery performance over time.

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

One reviewer stated that the program has taken available specifications and combined them to form meaningful, comprehensive test procedures. This reviewer felt that one of the stated objectives, to develop lifecycle cost data for the vehicles which may have been developed during the course of fleet testing vehicles, had little information presented concerning this portion of the evaluation. During 2010, ten vehicle baseline tests were completed, and eight series of fleet tests began, with completion scheduled for the end of calendar year 2011. The reviewer said that the "most significant finding" according to presenter, is the excellent performance of batteries, which has been a large "unknown" for electric vehicles. The reviewer commented that batteries should last for the life of the vehicles, based on the experience of this program, and noted that looking at the total program since its beginning, 175 testing tasks were completed, with 10 million test miles accumulated to date. Six different fuels were evaluated. According to the reviewer one of the stated objectives was to develop lifecycle cost data for the vehicles. This may have been developed during the course of fleet testing vehicles, but little information was presented concerning this portion of the evaluation. Overall the first reviewer felt this program has provided a significant volume of data that can be used to rate production available vehicles and can also serve as a basis for identifying and exploring technical improvement opportunities. A second reviewer said that because this is a testing program over 5 years it seems to be well conducted and has had ongoing improvements. This reviewer felt that the number of vehicles over this time period seems to be quite efficient. The third reviewer commented that the fleet testing has a very limited in scope.

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

The first reviewer commented that the project team has worked closely with Idaho National Labs (procedure development and data analysis) as well as Argonne (procedure development and dynamometer testing) and that the project team has also worked with Roush Industries on vehicle development and regulatory compliance, as well as special testing. The same reviewer also felt that EZ Messenger, a courier service, is ideally suited for mileage accumulation and variation of routes. They stated that EZ Messenger has been a willing partner for conducting fleet tests and designing test routes. A second commenter said the work is very tightly tied to ANL and INL. This reviewer was not sure about how partnering has worked.

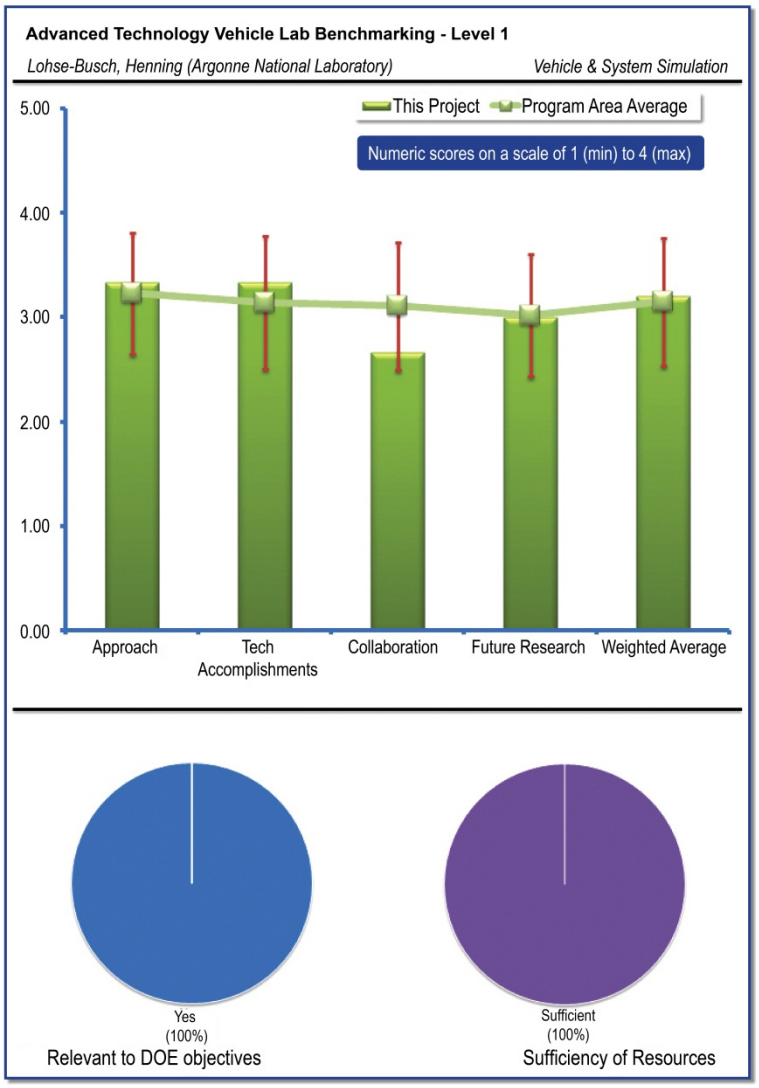
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer stated testing will be winding down by end of calendar 2011. Fleet testing and report completion will follow (presumably during the first half of 2012). The program is scheduled to end at that point. The reviewer also stated that one of the presented objectives was to develop lifecycle cost data for the vehicles. They thought that this may have been developed during the course of fleet testing vehicles, but little information was presented concerning this portion of the evaluation. The reviewer recommended that total life cycle costs be a prominent portion of the final report, and that all costs (fuel, electricity, routine maintenance, necessary repairs) be delineated. The buying public will be most interested in a so-called "cost of ownership." A second and third reviewer said that work was scheduled to continue on the 5 year program according to the schedule and that the program ends in December 2011. It was their understanding that no future work was been described. The third reviewer assumed that the project would be proposing for follow-on work.

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

One reviewer stated that the resources appear to have been appropriate as all project objectives have been or will be accomplished.

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



Reviewer Sample Size

This project had a total of three reviewers.

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

One reviewer stated that the program has taken available specifications and combined them to form meaningful, comprehensive test procedures. This reviewer felt that one of the stated objectives, to develop lifecycle cost data for the vehicles which may have been developed during the course of fleet testing vehicles, had little information presented concerning this portion of the evaluation. During 2010, ten vehicle baseline tests were completed, and eight series of fleet tests began, with completion scheduled for the end of calendar year 2011. The reviewer said that the "most significant finding" according to presenter, is the excellent performance of batteries, which has been a large "unknown" for electric vehicles. The reviewer commented that batteries should last for the life of the vehicles, based on the experience of this program, and noted that looking at the total program since its beginning, 175 testing tasks were completed, with 10 million test miles accumulated to date. Six different fuels were evaluated. According to the reviewer one of the stated objectives was to develop lifecycle cost data for the vehicles. This may have been developed during the course of fleet testing vehicles, but little information was presented concerning this portion of the evaluation. Overall the first reviewer felt this program has provided a significant volume of data that can be used to rate production available vehicles and can also serve as a basis for identifying and exploring technical improvement opportunities. A second reviewer said that because this is a testing program over 5 years it seems to be well conducted and has had ongoing improvements. This reviewer felt that the number of vehicles over this time period seems to be quite efficient. The third reviewer commented that the fleet testing has a very limited in scope.

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

A reviewer stated that the general approach is to use chassis dynamometers for controlled evaluation of hybrid and electric vehicles, as well as major components and systems. They point out that this testing is supplemented by track testing and coast down testing performed by INL. Following dynamometer testing, vehicles may subsequently be subjected to accelerated fleet testing. The reviewer said that the project scope is continuous improvement of test capabilities and instrumentation and that this contributes to Argonne's reputation as a leader in vehicle and drivetrain evaluation capabilities. The same reviewer also said that both Level 1 (basic) and Level 2 (more extensive instrumentation) are performed. While this project covers Level 1 activity, the reviewer felt that much information can be garnished from this Level 1 testing in a short period of time, including analysis of parameters such as driver aggressiveness and accessory loads. A second reviewer said that improvements would be to develop an understanding of driver behavior range so that the

real world performance range can be mapped via a straightforward set of drive cycles. The reviewer elaborated by saying standard test cycles run for FE or emissions are not adequate to define real world performance range

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

According to the first reviewer among the accomplishments sited for this period were: (1) Quantified effects of driver intensity (aggressiveness) on fuel economy. (2) Quantified effects of air conditioning on fuel economy. (A/C has a major impact on fuel usage). (3) Studied effects of idle stop on fuel economy, and showed that this feature is far more significant in city based start-stop driving (which would be expected). Also studied and quantified benefits of idle stop feature. (4) Examined in-vehicle battery performance. The reviewer felt that the findings are significant because they were conducted on several different brands of vehicles. Thus, the general conclusions and observed trends should be applicable to other vehicle types. A second reviewer said that in the areas and on the cycles tested, this is very good. See question 2 for improvements.

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

The first reviewer stated that collaborations include INL, SAE, and cooperation with several other DOE funded programs, including: (1) HEV, PHEV, and EV Test Standards Development, (2) Codes and Standards Support, (3) Data Collection for Improved Cold Temperature Thermal Modeling, (4) Autonomie Development, (5) Vehicle Demonstrations conducted at INL, (6) Integrated Thermal Management of Electric Drive Vehicles. The reviewer also remarked that the recent evaluation of an EV was discussed, in which testing identified significant technology improvement opportunities that were subsequently shared with the OEM. The reviewer felt that this feedback and close collaboration with OEM's is deemed to be particularly important, as the OEM is in the best position to use this data to drive improvement in these advanced technology drivetrains. The reviewer suggested that to ensure that such close collaboration and working relationships are carried out on a consistent basis. It was not clear that this sited example was "typical" of OEM/Lab interface. The reviewer also noted that collaboration with SAE is occurring regularly to facilitate standards development (based on some of the test results achieved). A second reviewer recommended that the project seek further collaborations with fleets for new drive behavior information. The final reviewer felt that more standardization on battery systems should take place. In particular connections should be standardized between battery management systems and the controllers.

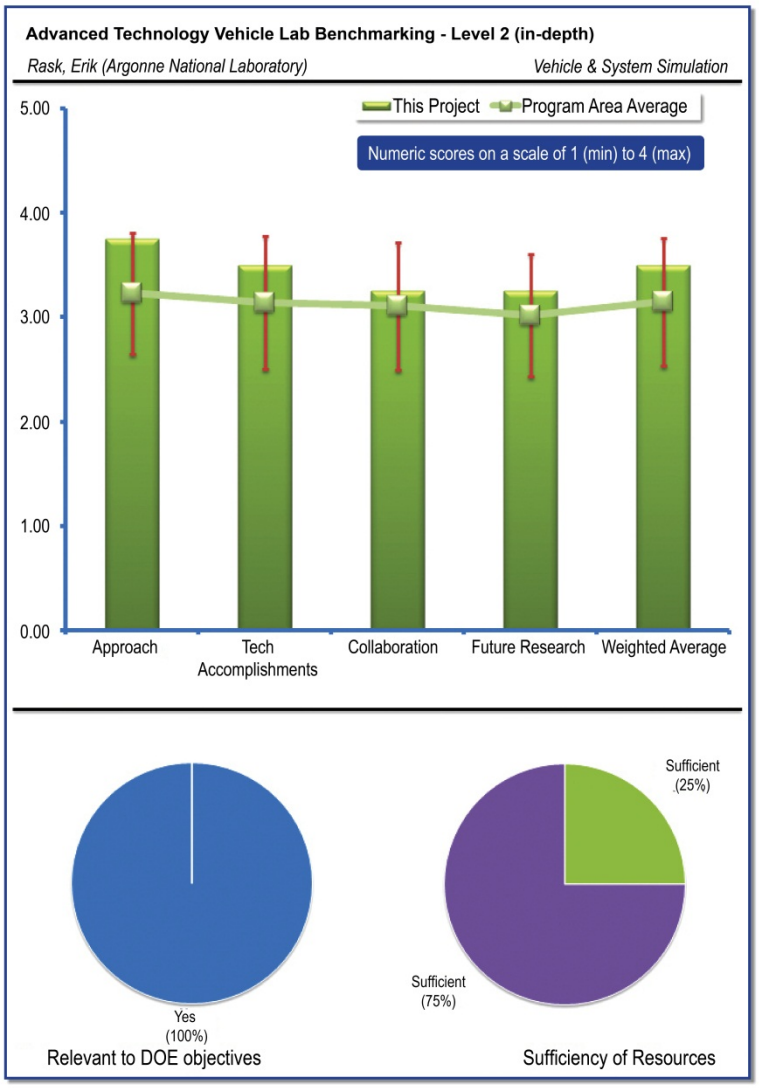
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One reviewer commented that the projected activity includes evaluations of Nissan Leaf, Toyota Prius, Hyundai Sonata and that it is unclear how vehicles are selected for evaluation or how work is prioritized. The reviewer felt that it would be helpful to better understand this process. The reviewer also noted that the project will perform Level 2 analysis on DOE selected vehicles and will continue support of standards development. They have also planned a facility upgrade to the 4WD test cell (installation of climate control for testing under extreme conditions). The second reviewer felt that the project should include new tasks for question 2 comments.

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

One reviewer said that resources appear to be sufficient and that current and future work seems to have been planned based on resources available, so there is a good match. Another reviewer simply stated that the project is getting by.

Advanced Technology Vehicle Lab Benchmarking - Level 2: Rask, Erik (Argonne National Laboratory) – vss031



Reviewer Sample Size

This project had a total of four reviewers.

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

Reviewers generally commented that the project supports DOE objectives. The first reviewer said that there was a very in depth testing on thermal effects of the systems. The second reviewer felt that the project is helping government and industry to understand current state of technology and that the information learned is fed into simulation programs, which facilitates design and spec'ing of hybrid and electric systems. The reviewer said the information can also be used by OEM's and suppliers to identify and act upon improvement opportunities and that the result is more efficient cars that will be more in demand, and result in a reduction of U.S. petroleum consumption. According to the reviewer the information is often times more detailed and comprehensive data than the OEM's themselves might generate. The third reviewer commented that this benchmarking work directly evaluates the potential for advanced vehicles to displace petroleum energy in controlled, repeatable conditions.

The final reviewer said the relevance will show better after some other vehicles are evaluated and felt that a sample of 1 is very hard to evaluate.

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

The first reviewer said that the level 2 testing involves more comprehensive measurement of vehicle operating parameters, including complete power flow assessment. This is extremely helpful in understanding current state of hybrids and EV's and may identify opportunities to reduce wasted power. This reviewer said that this is clearly "systems level" testing, understanding how all components and systems function together. Examples include EGR, waste heat recovery, and electrification of accessories. The reviewer also said that this testing also seeks to evaluate individual component performance, understand component duty cycles, and evaluate component operating temperatures. Furthermore the reviewer said that the instrumentation and parameter measurement is extensive (more than 100 parameters measured in each test). Detailed thermal data are obtained (understanding coolant temperature at all points of the engine). The second reviewer said that there may be already in place but getting real evaluation methods from OEM's and creating a number of evaluations against varying evaluation protocols would provide a greater value to industry.

QUESTION 3: CHARACTERIZE YOUR UNDERSTANDING OF THE TECHNICAL ACCOMPLISHMENTS AND PROGRESS TOWARD OVERALL PROJECT AND DOE GOALS.

One reviewer remarked fuel economy results were obtained that compared a 2010 Prius versus the 2004 version. Among the notable differences: there is a significant improvement in "engine off" time in 2010 version in the city. The reviewer also said that cold start strategy features controlled fuel flow rate during warm up (not warming up as quickly as possible, but as efficiently as possible). Another feature evaluated is the coolant warm-up using exhaust heat. They also noted that the project evaluated usage of exhaust gas recirculation (EGR) valve, traction motor characterization, and generator characterization. They noted that obtaining data that can provide insight into brake blending strategy. Sounds like this will be given more attention in the future. The reviewer stated that testing showed battery de-rate versus temperature. The reviewer concluded that such detailed testing as this can provide invaluable information to both OEM's and component system suppliers. The data help to define duty cycles, operating requirements, and effects of component or system design on fuel efficiency. The reviewer said that this kind of detailed understanding is an enabler for initiatives to improve performance while lowering cost. The second reviewer said that the project is still learning but on a good track and felt that outcomes so far are very good.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

The first reviewer noted that collaborations include: (1) Advanced Vehicle Testing Activities with INL and DOE, (2) SAE (testing procedure development), (3) Cooperation on DOE technology evaluation requests, with NREL, ORNL, and INL, (4) United States Council for Automotive Research (USCAR) and OEM's (sharing of test plans, data and analysis), (5) Developers of Autonomie (also located at Argonne). The reviewer felt that the extent to which data are reviewed with OEM's is not completely understood. This reviewer strongly encourages Argonne to work closely with OEM's as a means of fostering and accelerating identification and implementation of improvement opportunities. The second reviewer said that the project provides great to support internal DOE initiatives like Autonomy, but is not really sure how good the industry collaborations are.

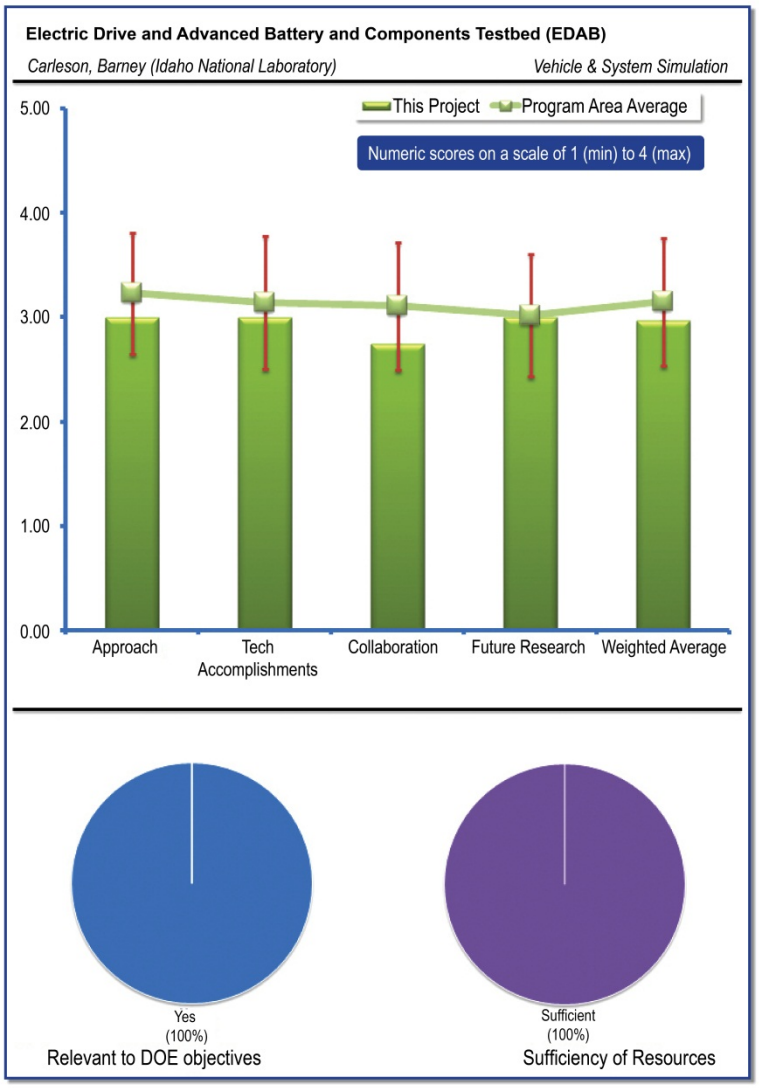
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

One reviewer said that short term projected activity is to continue Prius evaluation, including hot and cold temperature performance. Upcoming work includes Level 2 evaluations of the Volkswagen Jetta, Hyundai Sonata, Chevy Volt (2011).The reviewer pointed out that the means of selecting vehicle candidates for evaluation was not provided in the presentation and the project should consider providing information on this process in the future. The second reviewer felt that adding more vehicles will solidify the approach and add to outcomes.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

The first reviewer commented that resources appear to be adequate for planned testing and that the lab facilities and technical expertise at the Argonne Labs appears to be outstanding. The reviewer felt that the labs are very well equipped to handle this comprehensive Level 2 vehicle testing. The second reviewer said that from what is being done, the project may need more resources to expand collaborations. The third reviewer pointed out that 5-cycle testing will require more resources, and that it is important to evaluate hot and cold performance for advanced vehicles. This reviewer felt that data and testing from APRF supports many other important areas, including standards.

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



Reviewer Sample Size

This project had a total of four reviewers.

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

Reviewers generally saw that the project directly support DOE objectives. The first reviewer commented that testing energy storage systems (ESS) in realistic environments will help identify and resolve ESS performance, reliability, and durability issues to facilitate deployment of petroleum-displacing PHEVs and EVs. The second reviewer commented that battery technology is essential to successful implementation of electric drive vehicles on a broad commercial scale. While advances are being continually made, much still needs to be understood about the way various battery technologies behave under different driving and environmental conditions. This reviewer felt that in order to further develop battery technologies, prioritize resource allocation for R&D, and gain additional insights it is important to have a reliable base of real-world performance data from a broad cross section of advanced battery technologies. Similar to the first two reviewers the third reviewer said that hybrid electric and electric vehicles are often discussed as one way to reduce petroleum consumption and energy storage systems represent a major technological hurdle to be overcome if EVs and HEVs are to more widely penetrate the market. This reviewer felt that the project's efforts to understand how energy storage systems are used and the impacts this has on the systems directly support the overall goal of petroleum displacement. The fourth reviewer points out that this presentation covers two projects - Electric Drive and Advanced Battery and Components Testbed (EDAB), and Baseline Testing and Fleet Data Collection and Analysis of USPS eLLV (2nd project). This reviewer said that the score is only for EDAB but the comments cover both projects. If possible, the reviewer recommends against having two projects in one presentation in the future. The reviewer realizes that both projects needed review and there was probably only one timeslot. For EDAB, the fourth reviewer felt that industry and users need to know how electric vehicles and their storage systems perform to see how designs can be improved. For the USPS eLLV project the reviewer said that on-road testing is needed to see how various designs perform in real world conditions.

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

The first reviewer stated the project is developing an energy storage system (ESS) test "mule" vehicle and is focused on small blended "advanced" (i.e., - not yet commercially available) PHEV batteries to full-size EV batteries; not smaller batteries for mild hybrids. They also stated that the project is unseeing combination of chassis dynamometer, lab, and on-road testing. The reviewer wondered if it is premature to test all sorts of exploratory ESSs on-road and that perhaps it would be more effective to screen them first with hardware-in-the-loop testing in a more controlled (lab) environment. This reviewer felt that it was unclear if that has already been

done, or is being done separately. The first reviewer also mentioned that they did not hear a discussion of how the one ESS to be tested first was selected and that it is a topic reviewers might have liked to review and comment on, but in general, the level of detail of this presentation was a bit thin. The second reviewer also said that the presentation was in two parts: (1) one related to development of a battery test bed and (2) the other related to the data collection from a USPS fleet. The bulk of this will focus a little more on the first. For the EDAB project the second reviewer was not completely sure if a mule vehicle is really the best use of DOE's time/funds. The reviewer felt that building a mule is what OEMs do best and a dedicated hardware in the loop testing center is more what they would expect out of a National Labs. The second reviewer elaborated by saying that the addition of "real world" conditions is nice, but they did not know the value of one set of conditions, such as vibration seen in a custom configuration (which is not likely to be duplicated) and thermals seen with custom configuration in one environment. The reviewer recommends that perhaps additional instrumentation could be added to vehicles INL tests under other projects and that the collected data could be used to drive lab cycles (no need for mule vehicle). The second reviewer also commented that given the requirement of a vehicular test bed, the series electric seems a reasonable design decision. For the EDAB project, the third reviewer felt that this part of the project is needed to characterize the ESS. The reviewer recommended that the project may want to consider more than 3 years or 100K miles for end of the 1st life and asked, what is end of life criterion? While 30% was mentioned as a reason for 3 years or 100K miles the reviewer felt that it should be checked that the packs really have lost 30% at 3 years or 100K. The reviewer remarked that the packs may not have degraded that much and so could be tested longer if budget allows. The third reviewer said that the test cycle used is a valid cycle and noted that the environment will definitely factor into how the packs perform. The fourth reviewer said that the approach is sound, encompassing three overall components including chassis dynamometer testing, energy storage system testing in the Laboratory, and on road testing. They feel a good decision was made to base the ESS testing pattern on trends determined from previous PHEV household fleet data. A reviewer also said that it is confusing for reviewers to review the on-road USPS long-life vehicle (LLV) testing together with the EDAB mule vehicle. It seems this reviewer that the EDAB mule vehicle is different enough that it should have been the main focus of this presentation. For the second USPS project the third reviewer commented that the data for how ESS will perform is important to the learning gained from this project. The reviewer felt that the fact sheets are a good overview of the whole vehicle but hopefully there is more battery use data being given back to the companies that made each vehicle and to the public where allowed.

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

The first reviewer commented that the "First" ESS to be tested has been selected and purchased and the ESS control system developed. They also noted that the EDAB mule vehicle conversion nearing completion. One reviewer felt that the program seems to be on track. While the second reviewer felt that appropriate progress is being made for this stage of the work. The second reviewer stated that actual ESS testing needs to begin in July in order for significant results to be achieved before the end of the year. For the second USPS project, the second reviewer commented that it is good to look at charging effectiveness as this project is doing. The third reviewer said that technical progress has been good based on a FY10 project start date. The reviewer elaborates that the principal value of the project is that it provides in-depth real world information encompassing effects of vibration, temperature extremes, stop/start conditions and so fourth into the analysis of energy storage systems.

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

The reviewers saw a high-level of collaboration, and also suggested additional collaborators. One reviewer felt that the project team consisting of INL, ECOtality, ORNL, and AVL is certainly capable, but feels the project could be more effective if there was collaboration with battery manufacturers, component suppliers, and/or vehicle OEMs. Similarly, another reviewer felt that AVL and ORNL are good choices, but that it would be nice to see some more collaboration with potential end-users of this data (e.g., those modeling or designing the systems which will be tested). The third reviewer also commented that it should be examined who can use data from the ESS's and how it can be broadcast to those interested (keeping confidentiality where necessary). Another reviewer sated that the level of collaboration is largely reasonable and appropriate for this task. It included ECOtality for testing, ORNL for control system development, and AVL for vehicle integration. The reviewer questioned if any coordination with ANL or NREL would be in order and appropriate. Another reviewer remarked that getting five vehicles out of this project for the budget allotted is a good value. For the second USPS project, a reviewer commented that there is good coordination with an energy storage group that will facilitate the use of the packs in a 2nd life.

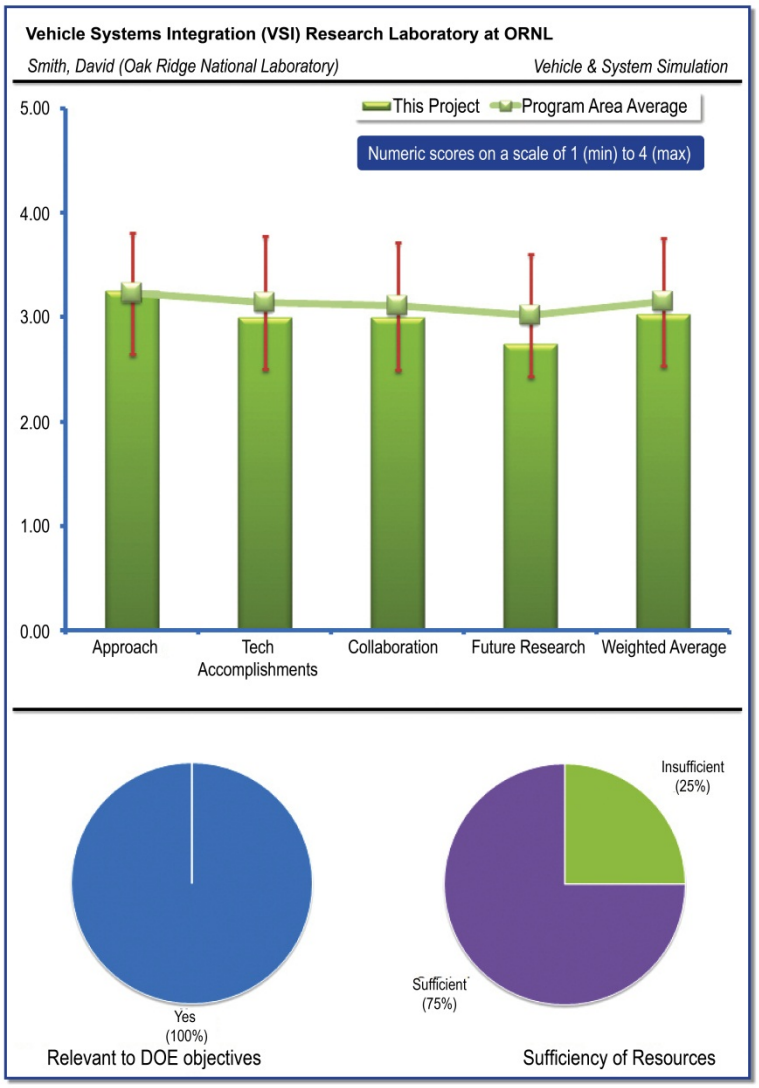
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

One reviewer commented that tracking of temperature with battery performance and life will be valuable and that for all the testing recommended, some 2012 budget would likely be necessary. Another reviewer said that sufficient information was provided on future work activities. Another reviewer was not completely convinced that a specialty vehicle is the best approach for "real world" data, as opposed to instrumenting a number of actual vehicles and then using the data to drive test cycles on variety of battery packs, so the reviewer is not convinced that four specialty vehicles are needed. A third reviewer said that sufficient information is provided on future work activities including testing various energy storage systems with various chemistries, testing of a variety of motor and power electronics technologies, as well the potential build of 2-4 additional test platforms to build after successfully demonstrating on-road testing capabilities and flexibilities of the current prototype. For the second USPS project the data for one year will be good on the postal vehicles but data for 2 or 3 years as packs could perform differently long term would be better.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

One reviewer felt that both projects will likely require funding in 2012. Similarly a second reviewer commented that the EDAB project may need funding in 2012 to complete testing and the second USPS project would benefit from longer term data on the ESS's than just 1 year. This reviewer felt that the USPS project should not need too much to continue testing - just resources to download and examine the data and possibly for maintenance. A third reviewer stated that resources appear sufficient for this task.

Vehicle Systems Integration (VSI) Research Laboratory at ORNL: Smith, David (Oak Ridge National Laboratory) – vss035



Reviewer Sample Size

This project had a total of four reviewers.

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

One reviewer said that this new facility described will bring state of the art testing capability for MD and HD trucks, which are very much needed. Another reviewer remarked that testing facilities that can support heavy duty powertrains are in short supply and having a good facility will help development efforts bringing better technologies to the market in less time. The third reviewer felt that the facility will provide the ability to understand integration effects of various technologies.

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

The first reviewer likes the expandable facility concept. The second reviewer said the lab seems to be a nice facility, including two dynamometers which can offer very large total torque capability when joined. The third reviewer pointed out that the facility is behind schedule and now expected to be commissioned in about a year.

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

One reviewer pointed out that the project seems to be a little behind schedule, but breaking ground and getting construction started is a real and significant step. The reviewer felt that the net summary for this project as a whole would seem to be that it will be a useful facility and construction is underway, albeit slightly behind schedule. The second reviewer said that the design of the site is good and constrained by funding and other limitations.

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

One reviewer pointed out that the facility already has one commercial system scheduled for testing. Another reviewer commented that there is not a lot of collaboration right now and that they only have one industry partner lined up.

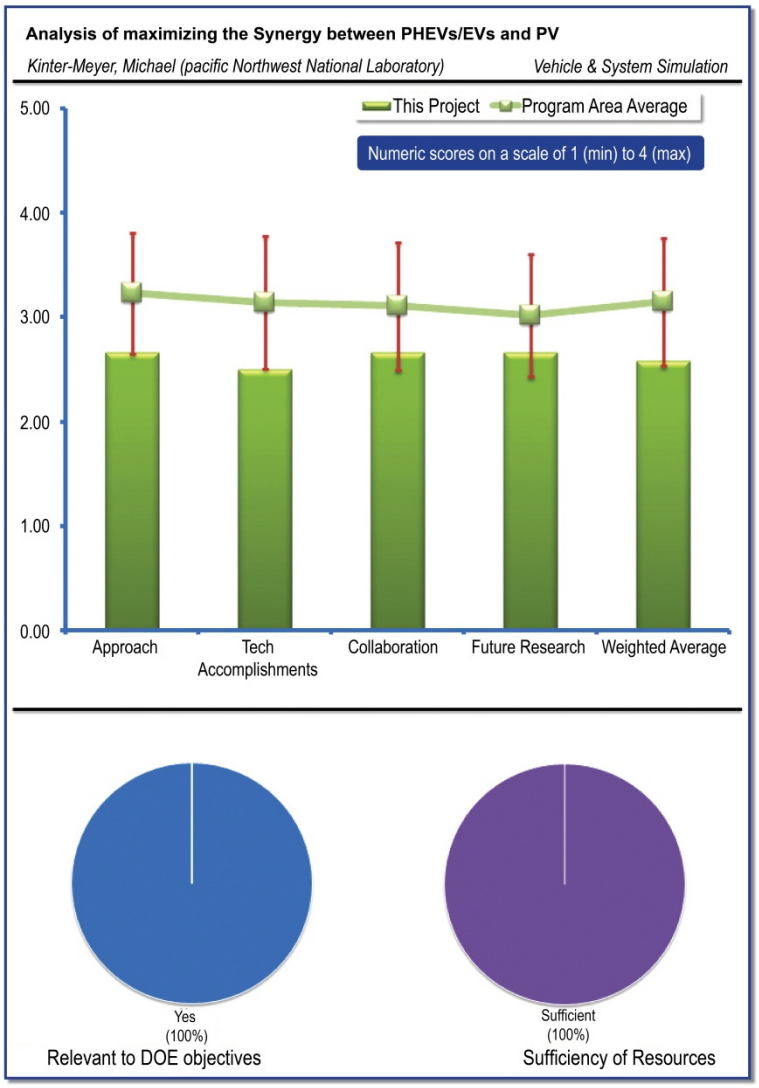
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One reviewer said that it is hard to say much about this, the facility is still under construction and will likely be in construction or development for a portion of next year. A second reviewer elaborated by stating that the facility needs to be built and commissioned before future work can be solicited and planned.

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

One reviewer again pointed out that things seem to be a little behind schedule. Another reviewer viewed the schedule lag as an indicator of insufficient resources.

Analysis of maximizing the Synergy between PHEVs/EVs and PV: Kinter-Meyer, Michael (Pacific Northwest National Laboratory) – vss036



Reviewer Sample Size

This project had a total of three reviewers.

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

One reviewer commented that PEVs and renewable energy have a strong synergistic potential to reduce petroleum consumption in the transportation sector. Advances in one area can enable further advances in the other. In order to capitalize on these opportunities, close coordination, communication, and harmony needs to be achieved between the demand scenarios of PEVs and supply profiles of renewable energy sources. The reviewer pointed out that the project is focused on the effectiveness of PEVs providing grid services as a function of public/private charging, as well as determining the market value of grid services that can be captured.

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

One reviewer pointed out that the technical approach explained in detail what needs to be done, but there is not a lot of information on how this will be done. Another reviewer remarked that this task is largely focused on the synergistic opportunities of coupling solar photovoltaic (PV) electricity generation with plug-in electric vehicle demand and that it will follow essentially the same approach previously conducted for wind energy by Pacific Northwest National Laboratory (PNNL). This targets overlaying solar insolation profiles onto vehicle driving patterns to determine the number of PEVs required to meet balancing services for grid friendly charging strategies, including as a function of public/private recharging stations.

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

Two reviewers noted that the project has not yet started and it is a new start for FY11. It was not clear what rating should be given.

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

One reviewer said that based on proposed plan it looks OK. This reviewer questioned, should collaborators include utility companies as well? A second reviewer stated that collaboration exists with NREL for PV arrays and plug-in electric vehicle (PEV) charging with smart charger controller and that collaboration also exists within PNNL with the Environmental Molecular Sciences Lab. The second reviewer said that it would be beneficial to broaden collaborative efforts to utilities and industry to gain additional insights, understanding of industry thinking and direction, and potentially lead to cost-sharing should concepts emanating from this project prove to be attractive.

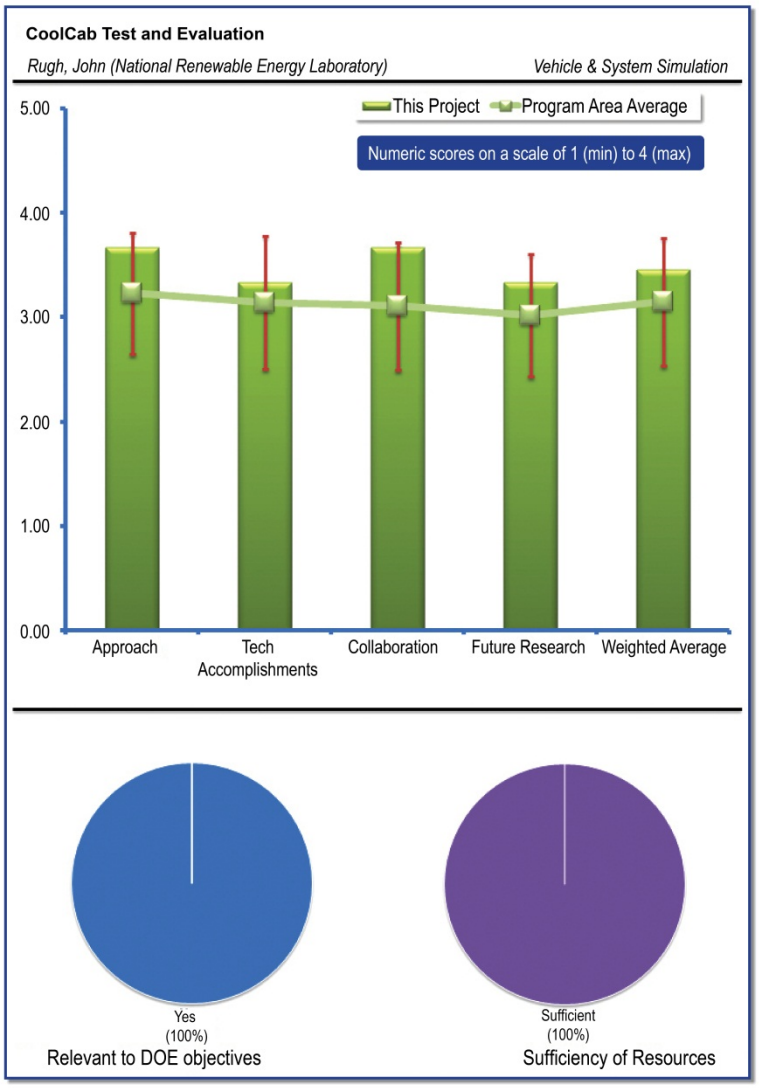
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

The first reviewer commented that it is a relatively short duration project. They felt that a time line of activities would help in understanding the scope of the work involved. Another reviewer said the proposed future research is somewhat undefined but appears to focus on concept demonstration in FY12. It would be beneficial to get industry involved in FY11 as a precursor to an FY12 demonstration.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

Based on one reviewer's understanding of the proposed work, it should be sufficient. Another reviewer said resources are sufficient for this task, especially as it is largely a follow-on to a very similar effort with wind energy.

CoolCab Test and Evaluation: Rugh, John (National Renewable Energy Laboratory) – vss037



Reviewer Sample Size

This project had a total of three reviewers.

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

A reviewer said that the project had an excellent approach to a very big problem of cabin temp control. A second reviewer stated that idle reduction saves fuel. Another reviewer felt that the project was relevant; however, more detailed fuel saving data must be presented.

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

A reviewer commented that the projects estimation of potential 30% reduction in idle fuel use by providing tools for design evaluation of alternative technologies fills a gap in the engineering process. This reviewer felt that this is an excellent way to attack the problem on a systematic basis.

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

A reviewer commented that how to take the tool to the next steps was shown to be clearly understood and that the collaboration with vehicle producers will enable early adoption and ongoing use.

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

One reviewer said this certainly seemed like it is a well-coordinated effort with industry and the Autonomy group.

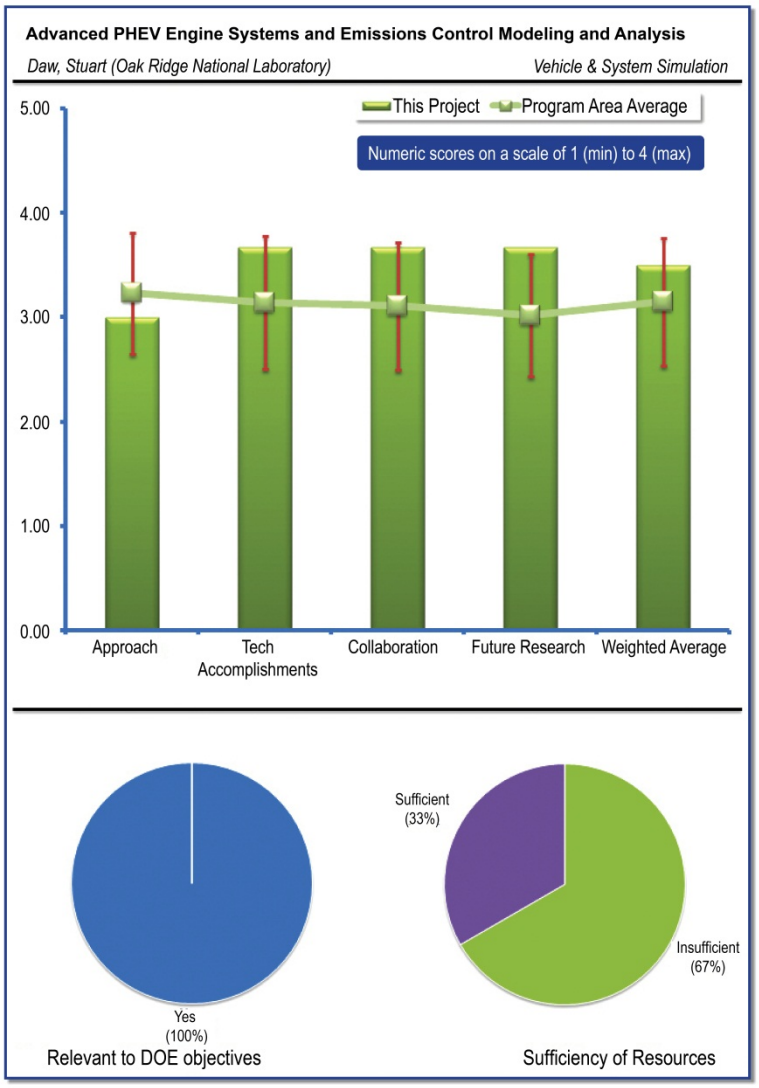
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One reviewer expressed that this project is a logical extension of current work and coordinated with the industry partners.

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

A reviewer said that the development to the next level may require more resources.

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



Reviewer Sample Size

This project had a total of three reviewers.

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

One reviewer felt that this project is definitely relative. They elaborated by saying modeling of powertrain emissions directly supports the development of high-efficiency powertrains. A second reviewer said the project is emissions related but to the extent it enables hybrids to meet emissions laws, it furthers the use of fuel saving hybrids. A third reviewer agreed by saying that topics are highly relevant to DOE objectives and enabling development in the industry. Publication to industry is understood to be essential.

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

The first reviewer commented that modeling transients is critical for PHEVs and HEVs that routinely operate their engines in start-stop modes. The reviewer said that emphasizing component models rather than maps along with low-order model can allow exploration of more concepts and tradeoffs within available time and project resources. The reviewer also remarked that promising concepts identified with the low-order model should then be verified with higher-order modeling. Furthermore the reviewer said that the project has been going for six years and finish is listed as "ongoing". The reviewer can believe there is still significant work to do, but is there really no end foreseen for this PHEV engine and emissions modeling effort? The third reviewer said there is still a lot to evaluate for one project. They also said that tying together various programs (as this project does) will help get usable results from the programs involved. Coordination will continue to be very important. The third reviewer said that the premise is that multiple engine on/off will generate higher emissions. The third reviewer questioned how do those emission spikes balance with engine off time when no emissions are generated? A fourth reviewer said that the approach appears very sound and communication of sequence of activity/priorities would be helpful...otherwise it appears as a bit of a shotgun of activity. They understood that this may not be the case, just the appearance.

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

Reviewers saw significant technical accomplishments. The first reviewer said the accomplishments appear extensive and address project objectives. Insulated selective catalytic reduction (SCR) shown to keep temperatures high enough to mitigate impact of cold starts, though it may accelerate aging. They also pointed out that the diesel oxidation catalyst (DOC) model appears to be closely predictive of actual component performance, as does cold-start three-way catalyst (TWC) model and data. The first reviewer also

commented on linking component models together to simulate aftertreatment systems. The second reviewer said that the transient hybrid drive cycle simulation results have been accepted for publication. Multiple entities should be able to use them. The second reviewer felt it would be good to know the tradeoff between start/stop emissions and keeping the engine running. A third reviewer remarked that significant results and publications have occurred given the funding level.

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

One reviewer felt that there were extensive collaborations with appropriate contributors and stakeholders. A second reviewer said that there is a lot of info coming into the project and then needs to be assimilated into the project results. The third reviewer said the results look to mostly be used by Arvin. The third reviewer also asked if there other companies that could benefit from the results, and how can the results be brought to them? The fourth reviewer said that major collaborations are obviously in place, both within national labs and industry. The fourth reviewer questioned if there were any comments back from industry on relevance and alignment with future work priorities?

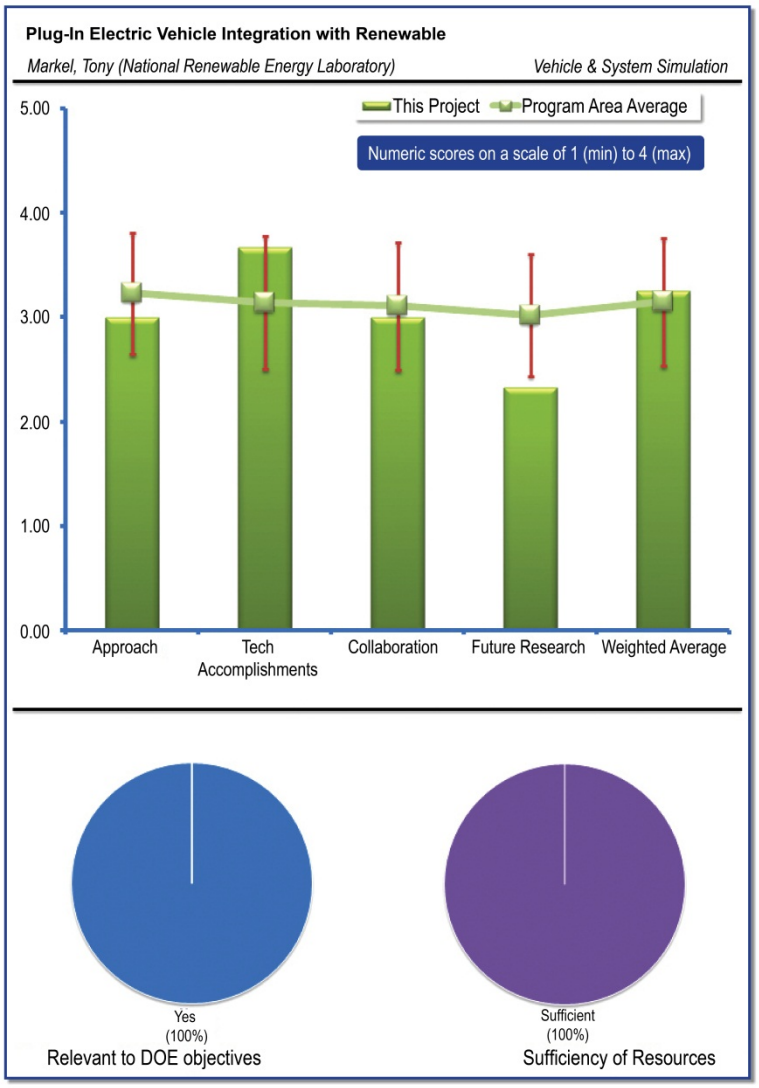
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer said that the presenter stated that this task will end this FY and the results will be migrated; the reviewer did not catch where they will be migrated to. Consequently, many of the "future activities" cited on the slide will not occur. Notwithstanding that, future modeling efforts should probably examine effects of using up to E15 fuel in gasoline engines, as is currently under consideration for nationwide approval. A second reviewer felt that it will be good to get the models into Autonomie for use by the Autonomie user community. A third reviewer said that the project had a good list of future activities and appreciate the comment of PRIORITIZED by category.

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

The first reviewer felt that this work appears very important and effective, yet resources shrank every year. The second reviewer commented that there still seems like a fair amount of work to be completed before the project is wrapped up this year. A third reviewer said that the project team has demonstrated successfully managing scope based on funding received. Will threshold future activities based on priority and funding level.

Plug-In Electric Vehicle Integration with Renewables: Markel, Tony (National Renewable Energy Laboratory) – vss042



Reviewer Sample Size

This project had a total of three reviewers.

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

One reviewer said that there is a high relevance to DOE objectives for integration to grid and potential load-leveling strategies through 2-way communications. A second reviewer said that the PEVs and renewable energy offer synergistic opportunities to reduce petroleum consumption in the vehicular sector. According to the second reviewer, working together, PEVs and renewable energy can help lower barriers to acceptance of respective technologies as they play to each other's strengths. This task aims to help with integration and synergistic growth between PEV's and renewable energy.

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

One reviewer questioned, Does the approach makes the work visible to industry and utilities directly? The reviewer felt that it was not obvious if progress/observations are distributed...last publication noted was one year ago at an MIT conference. The second reviewer said the objective is pretty clear: to identify opportunities for alternative value streams for PEVs through integration with renewables and support the definition of the infrastructure needed to enable these opportunities. The second reviewer felt the approach is reasonable within the overall objective framework of the project, but would be improved if it were more structured and quantitatively defined. Additionally, it may be beneficial to further assess the appropriate role for a National Lab (whether it be that of an integrator, convener, facilitator etc.) for the development of the concept of a "green signal".

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

The first reviewer said that based on stated objectives, very good progress has been made. A second reviewer said accomplishments appear to match plan. Noted participation in industry standards development (via SAE) is KEY! The second reviewer suggested referencing the publication frequency question in the Approach section. A third reviewer said that there has been solid progress specifically with regards to literature review and assessment, as well as published results of communication analysis scenarios. Delivery of the definition of "Green Signal" for charge and discharge management of PEVs is due in FY11. The third reviewer also commented that it would be beneficial if the project had quantified milestones within the context of the overall project objective.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

One reviewer said that the industry standards and National Labs were noted. The reviewer questioned direct connection to utilities (e.g., via the Electric Power Research Institute [EPRI]) and smart charger industry (e.g., General Electric)? A second reviewer said this project is collaborating with PNNL, SAE, and the NREL strategic energy analysis and distributed energy integration groups. They felt it may be beneficial to also include other industry and utility entities in collaboration on the "Green Signal". The concept of a "green signal" impacts multiple parties and the sooner everyone is brought on board the better.

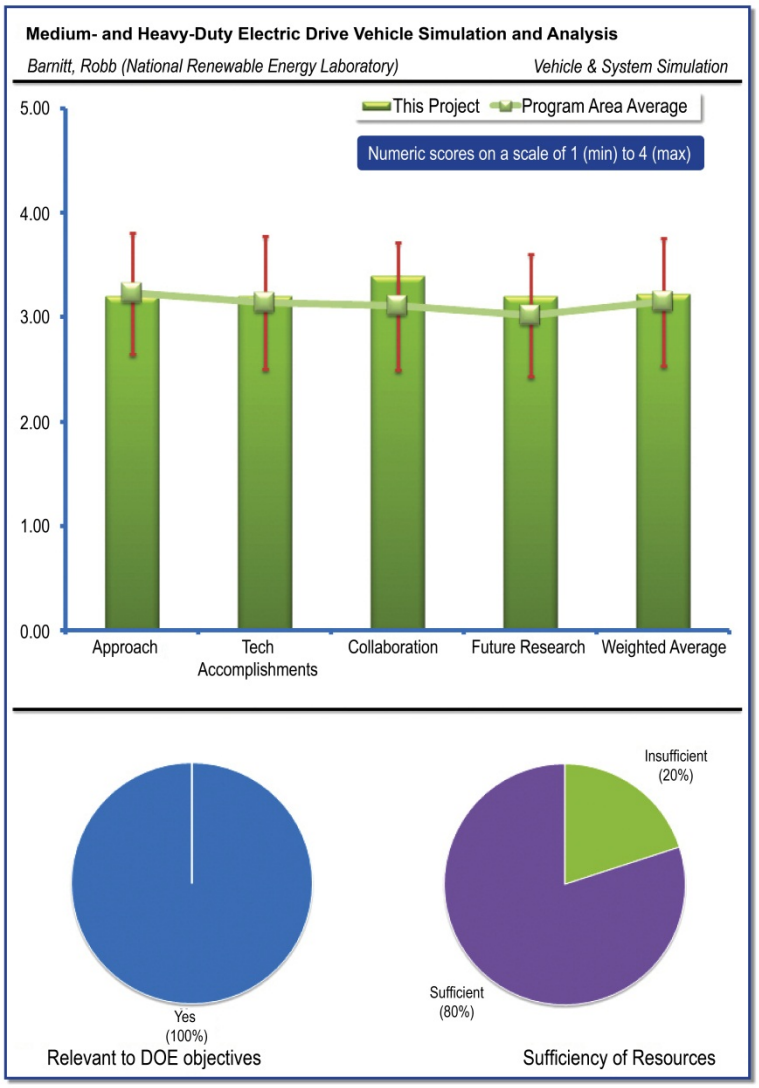
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

One reviewer said that nothing has been proposed, not clear what the rating should be. A second reviewer agreed, stating that the project was thin on description here as to what is intended to be done next, such as what is project specific barriers to address next. The third reviewer said that plans for FY12 include implementation of a field demonstration and analysis of results. Ostensibly, NREL is underway planning with an industry partner in this endeavor.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

One reviewer said that there are no budget disconnects apparent from description. A second reviewer said that the financial resources appear roughly appropriate for the scope of this task.

Medium- and Heavy-Duty Electric Drive Vehicle Simulation and Analysis: Barnitt, Robb (National Renewable Energy Laboratory) - vss043



Reviewer Sample Size

This project had a total of five reviewers.

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

One reviewer remarked that this is a good project topic with clear potential to positively (or negatively) influence fleet adoption of more efficient/petroleum displacing vehicles. They felt it was nice to see a medium duty project since this sector does not get that much attention. A second reviewer said that the project addresses questions pertaining to plug-in hybrid technology for an important vehicle segment, medium and heavy trucks. A third reviewer commented that the project is highly relevant analysis for industry consideration in matching applications to drive cycles. A fourth reviewer said that the methodologies to address industry and end-user expected benefit is extremely valuable to accelerate acceptance and deployment of PHEV vehicles.

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

The first reviewer said the overall approach looks good; however, there are concerns with the lack of grade information in the drive cycle. Grade imposes a higher demand on the battery output, and also allows for more regen during coast, and essentially changes the battery charge-discharge behavior. It may also change the trade-offs that are arrived at, based on drive cycles that do not involve grades. Another reviewer said that the simulation based approach with significant physical test data to build/correlate models should provide a very robust and defendable solution. Interesting "intensity" analysis approach for comparing driving cycles – it is absolutely correct to focus heavily on the driving cycle as this has a tremendous influence on whether technologies make commercial sense for a particular application. This reviewer felt that perhaps the commercial assumptions around future pricing for motors/batteries etc. could be developed in more detail - these will have a big impact on commercial viability, and they believe the government has invested more heavily in modeling/predictions of these items that has been adopted so far in this project. A third reviewer said that among the strengths are model validation with experimental measurements using the FedEx vehicle and the usage of a set of diverse driving cycles in the analysis. Also, the approach to considering battery and fuel cost support the main objective of providing the guidance to the MD and HD sector. The third reviewer felt that the weakness is a relatively crude battery modeling with two arbitrary selected max power levels. A fourth reviewer remarked that there was a good sequence of combining real-world data, dynamometer data and correlating analytical tools for broader use case application. Title including "Heavy-Duty" seems confusing with specifically medium duty package delivery being current scope. The fourth reviewer also felt that the questions asked in Project Relevance section also seem broader than intended activities would address (e.g., warranty implications). The fifth reviewer commented that utilizing "real" drive cycle data as model data input is an excellent approach. It would have been useful to conduct parametric studies of model assumption to assess different scenarios, e.g.,

increase in battery power density, varying cost of electricity, etc.

QUESTION 3: CHARACTERIZE YOUR UNDERSTANDING OF THE TECHNICAL ACCOMPLISHMENTS AND PROGRESS TOWARD OVERALL PROJECT AND DOE GOALS.

One reviewer said that the results of the research have allowed a better understanding of economics of electric drive vehicles and the relation to the drive cycle. It would be good if the grade information could be incorporated. A second reviewer commented that the project appears to have achieved significant amounts of progress within relatively limited funding limitations. The third reviewer said that the analysis of the fuel and ESS cost for the FedEx vehicle, for a set of daily distances and various PHEV system configurations, has been completed, and that is good. However, it is hard to judge the rate of progress since the planned timeline was not available to them. The milestone of publishing one paper is not sufficient for judging progress. The third reviewer did note that plans for future include a much more extensive list of tasks. A fourth reviewer simply stated that there were good and clear presentation of results. The fifth reviewer said that the model results provided a very valuable tool to assess long-term (15 years) economic input. As stated above, a parametric study of model assumption would have strengthened the results.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

One reviewer said that there are great partners, particularly the fleet partner who will be able to implement recommendations. A second reviewer also felt that there was a good selection of partners. The third reviewer remarked that the collaboration with direct participants is good. To gain perspective on the OEM questions (and approach to answer), perhaps an OEM should be a collaborator. Another reviewer said that the collaboration with FedEx to acquire "real" drive cycle data was extremely valuable.

QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

The first reviewer said it may be worthwhile to explore the CARLOS “real world” cycle that was developed by a consortium of auto companies and suppliers in Europe to represent passenger car and truck usage. While this is meant primarily for durability studies, it should be applicable for fuel economy studies as well, especially if it is truly designed to represent “real world”. A second reviewer said that the reporting out of the currently available findings and recommendations was quite confusing - in order to meet DOE's aim of displacing petroleum, the results and recommendations will have to be clearly and concisely described for fleet customers to interpret and be able to make purchasing decisions. Reviewer three would be keen to see a very clear message that could be presented at commercial truck conventions to fleet owners, as well as to product developers. It appears that there are already enough data available to tell this story, although the future planned effort certainly will help mature the fidelity of the results. This reviewer said that if the results are not easy to interpret in these types of forums, the government may consider implementing a “fleet advisory service” to meet with fleet owners and review their drive cycles against the data results to provide them one-on-one guidance for various investment scenarios. If budget can be found for this it could be a great method to accelerate adoption in the right areas so that fleets find good financial return on investment and implement wider adoption. A third reviewer said that the proposed future task form an extensive list, and answers will be relevant to the MD and HD sector. The equality of results will depend on some of the new models, such as the battery life model. Real-world driving is also important. The fourth reviewer remarked that the proposed future work is specific and seems a logic extension of current results.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

One reviewer said that good progress seems to have been made, although the split of task completion over time was not clear in the briefing. Another reviewer said that the funding level is not excessive, but increase for FY11 is not explained. A third reviewer said that the budget appears light to wrap up project with intended future work scope in FY11. This reviewer questioned, perhaps future work partially spills into a future request for FY12?

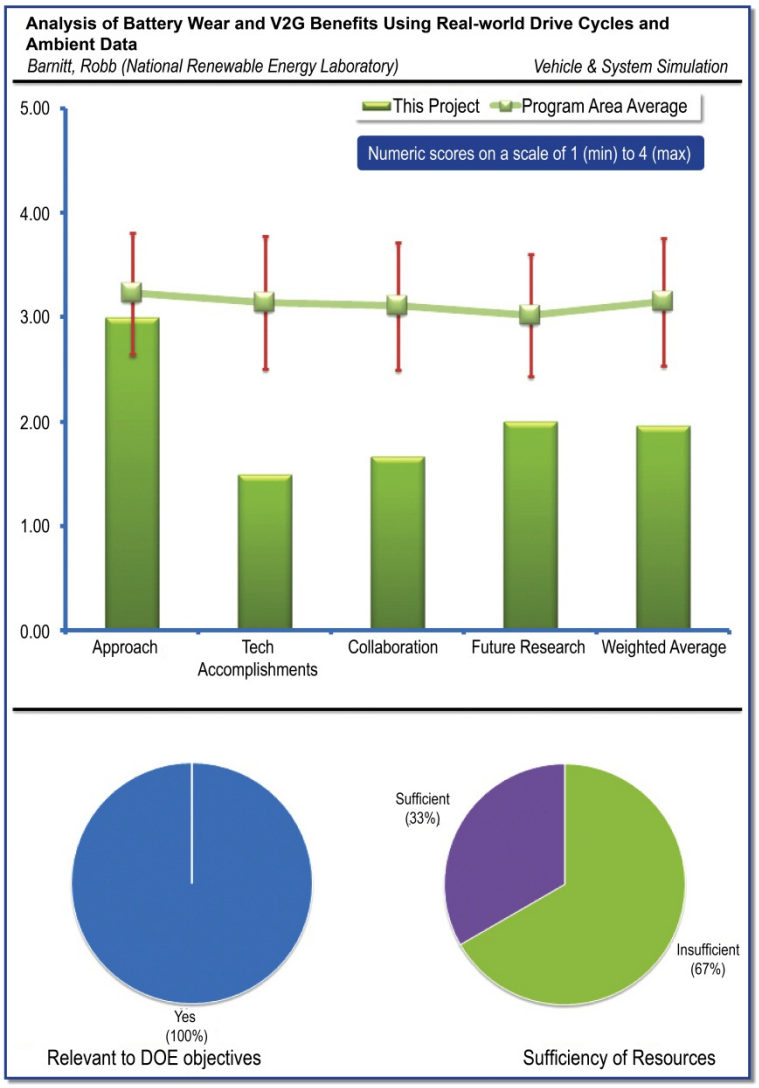
Analysis of Battery Wear and V2G Benefits Using Real-world Drive Cycles and Ambient Data: Barnitt, Robb (National Renewable Energy Laboratory) – vss044

Reviewer Sample Size

This project had a total of three reviewers.

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

Reviewers were generally of the opinion that the project supports DOE objectives. The first reviewer said the potential for saving fuel, especially when the drive cycles are repeating (as in school bus routes) is quite significant, and this project addresses some of the ways of achieving this. Another reviewer said that ambient temperature effects on battery wear/life is a major industry commercial risk element, thus a clear barrier to faster adoption of EVs/PEVs. A third reviewer felt that the plug-in electric vehicles offer the potential to displace significant amounts of petroleum. The principal barriers to plug-ins are range and cost which are largely governed by battery technology. The third reviewer said that these challenges can be mitigated somewhat through improved battery life and vehicle battery applications in support of peak grid demands. A better understanding of factors determining battery life (operating and ambient temperature) and exploration of vehicle-to-grid applications for vehicular batteries can lower life cycle cost barriers.



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

In general, the first reviewer felt the approach that is being used to evaluate battery life etc., is good. An issue that appears in all of the projects that involve simulating "real world" cycles is the lack of grade information in the drive cycle. Grade imposes a higher demand on the battery output, and also allows for more regen during coast, and essentially changes the battery charge-discharge behavior. However, the reviewer felt that it looks like incorporating grade information in the description of the real world drive cycles is a much harder task that they imagined, because of unreliable GPS elevation data and several other issues. Another reviewer said that the approach is sound for scope of project. A third reviewer remarked that the objective of this project is to ascertain holistically the value/utility of large energy capacity PEV school buses with usage profiles that may be conducive to vehicle-to-grid services. The third reviewer notated that this project follows a three layer approach: (1) Use of an existing NREL simulation tool determining battery life as a function of depth of discharge, temperature, and voltage, (2) Overlaying ambient temperature profiles, (3) Followed by overlaying driving and vehicle-to-grid usage profiles. This reviewer felt that the focus of this task should be more narrow and targeted such as focusing on a specific PEV school bus application in a targeted area that is fertile and has qualified industry and fleet partners and attractive local vehicle-to-grid applications. The overall approach is too broad and diffuse and has no upfront industry/commercial/private sector pull.

QUESTION 3: CHARACTERIZE YOUR UNDERSTANDING OF THE TECHNICAL ACCOMPLISHMENTS AND PROGRESS TOWARD OVERALL PROJECT AND DOE GOALS.

One reviewer said they cannot say much here, since no funds have been allocated. This reviewer was unsure if a fair rating is appropriate either. Two other reviewers noted that this is a new start project and the question is not applicable, the funding only recently confirmed.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

The first reviewer said that the presentation does not list any collaborators, though this could very well be because of a lack of funding. This reviewer also mentioned that on the lack of road grade data that was discussed earlier in the presentation, they will look into it at their company and see if it can offer any ways of measuring the relative elevation changes. This reviewer felt that is should help make the "real world" cycles more real. The second reviewer said that no collaboration was noted outside NREL; however, short term of project may be reason for less collaboration. Seems this project would have a battery supplier involved (and possibly EPRI?). A third reviewer felt that this project is currently only coordinating with other NREL activities including the NREL energy storage team and electric vehicle grid integration team. As alluded to under question two, this effort should be working upfront with several local fleets, industry, and utility partners to maximize synergies, and to ensure that project objectives are salient, and the approach and results are useful for the private and public sectors.

QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

The first reviewer said that since nothing has actually been accomplished yet, this reviewer assumes that everything outlined in the presentation is actually future work. The approach looks good. The second reviewer said that this question was not applicable as the current work is still being planned and aligned to budget, there was no future work framed. A third reviewer said that in discussions with the Principal Investigator, future work is to include climate control studies, which may be apropos given the significant impact of ancillary loads on PEV range, battery discharge profiles and by extension battery life, and ultimately life cycle costs.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

One reviewer stated that the PI indicated funded at 50% of scope; re-evaluation of scope and approach required. Another reviewer said that resources are sufficient for the proposed task. If the task is more narrowly defined and targeted, the current resources may be excessive. Another reviewer commented, No funding??

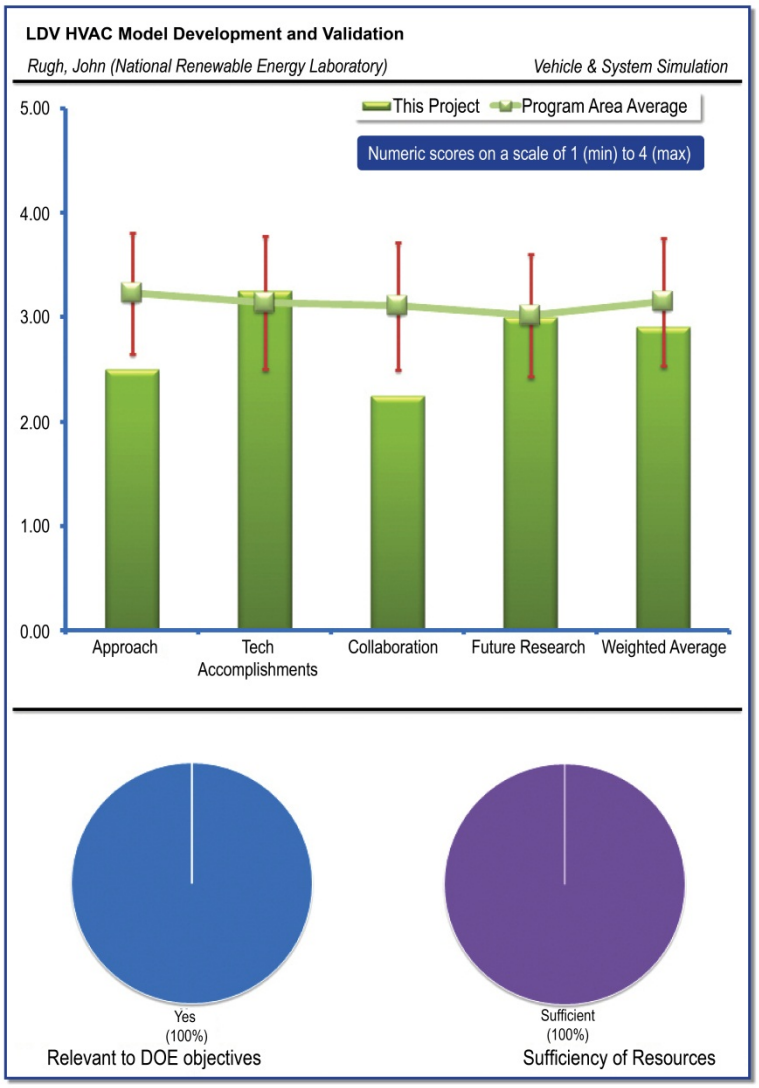
LDV HVAC Model Development and Validation: Rugh, John (National Renewable Energy Laboratory) – vss045

Reviewer Sample Size

This project had a total of four reviewers.

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

Reviewers generally saw that the project supported DOE objectives. One reviewer said understanding and reducing HVAC loads, often the largest accessory load, is a key enabler for greater acceptability of battery-dominant vehicles. Another reviewer remarked that air conditioning power demands can substantially affect fuel economy and the range of electric vehicles. Five percent of all fuel consumed by light duty vehicles is attributable to the A/C system operation. This reviewer said that creating a modeling approach that can lead to improvements in the efficiency of air conditioning systems can provide a significant fuel efficiency benefit to all vehicles, but particularly electric vehicles. This program seeks to create a modeling approach and to validate that methodology. The third reviewer stated that HVAC takes a large share of the fuel for light duty and even a sizable part of the HD and MD trucks. Also it drastically affects the fuel efficiency of hybrids. The fourth reviewer commented that it is important to have the Autonomie model available for numerous energy modeling activities. As such a high parasitic loss factor, every modeling activity should account for HVAC losses (both A/C and heater use).



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

The first reviewer said that this project builds on previous development of CoolCalc and that there was good attention to detail with including the momentum equation (for the flowing refrigerant) in the model. They also feel that Matlab/Simulink-based HVAC model interfaces with Autonomie, enhancing the model's power and usefulness. 1-D model is probably fine for refrigerant lines; however, it may be an oversimplification for heat exchangers. For example, multiphase flow and cooling fins do not appear to be considered in the model; presumably the cylindrical heat exchanger model elements use an average coefficient for the heat transfer to the air. The "Future Work" slide suggests that validating and "adding detail" to the model may be addressed in FY12. A reviewer asked a good question during the presentation—how does this work not duplicate modeling that Visteon and other AC suppliers or EPA must be doing already? Answer: Integration with Autonomie is new and valuable; NREL is not aware of any EPA models. This reviewer did not find these answers totally convincing. The second reviewer said that Matlab/Simulink will be used to model the A/C system. This makes the model easily interfaced with Autonomie, commonly used for overall vehicle simulations. Compatibility with Autonomie is apparently a primary objective of this program, since it is believed that a number of models already exist for conventional vehicle air conditioning systems. The reviewer stated that components will be modeled and built up to form a complete system and that this model will subsequently be used to build a model for heavy duty vehicles. According to the reviewer, the presentation did not provide

details of the experimental verification of simulation results. This is obviously a key element of the program. A third reviewer felt that the approach of integrating with Autonomie is excellent. It seems like models of HVAC systems should be pre-existing (especially when working with a partner like Visteon), even if they are not in Simulink. Can they not be translated or transferred manually into Simulink? The deriving of the models appears to have taken resources and time. For something like microtubes perhaps new models have to be developed since Visteon is likely not using them. A fourth reviewer felt that the model appears very simplistic versus state-of-the art tools already in use by Tier 1 suppliers and OEMs. Presentation seemed to frame a fundamental vehicle system routinely modeled as if it were leading edge development. The reviewer pointed out that fidelity/usefulness of the model may later be called into question if key decisions on overall vehicle efficiencies or target setting hinges on its use. This reviewer suggests a high level of commenting by HVAC experts at OEMs and suppliers before going too far with this project. The reviewer also pointed out that only A/C is modeled but title of project is HVAC…should heater loop be supplemented to the modeling effort?

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

The first reviewer said that this is a brand new project this year and is about 25% complete. Progress appears reasonable so far, but noted that none of the modeling has been validated yet, but it is in the future plan. The second reviewer said that the work looks to be on track. The modeling for the system and components is done and now needs to be integrated into Autonomie. While the third reviewer stated that given the approach and framing, sufficient progress seems to have been made to date. The final reviewer commented: (1) Detailed component models developed, (2) Phase Diagrams developed, (3) Conservation equations developed and introduced into simulation, (4) A/C system performance was demonstrated. The reviewer acknowledged that the significance of this simulation is that it will be compatible with Autonomie program, which is used extensively to simulate advanced vehicles. Other simulation programs are currently available, but they are very expensive and are NOT easily integrated with Autonomie. The reviewer pointed out that missing to date is the experimental validation of modeling results. Apparently this will be included as part of the overall program and Visteon will assist in this effort.

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

The first reviewer pointed out that NREL is working with Argonne and Visteon, and commented that there was not much detail on the nature or extent of such collaborations. The second reviewer pointed out that this modeling approach is being developed in conjunction with Visteon. It is anticipated that Visteon will take the lead in experimental verification of the model. This reviewer suggests that Visteon be asked to provide simulation results obtained from the current Visteon analysis tool. This will provide additional confidence in the validity of this newly developed modeling approach. An open question is whether or not one of the other National Labs would be able to perform the experimental validation more effectively than Visteon. Another reviewer said that the project has strong partners. In the presentation it was not clear on what was being shared with them but from the Q&A it sounds like there are plans to share with them. It looks like Visteon has given parts and info on those parts. The reviewer commented that it would help if they would share their models if they can be convinced to do so. Model comparison would be valuable. The final reviewer encouraged a robust conversation with the National Highway Traffic Safety Administration (NHTSA) and EPA to determine any redundancies with fuel economy efforts tied to modeling this significant parasitic loss. Also, Visteon HVAC team is likely to already have more sophisticated models of this in use...granted, possibly not in Autonomie.

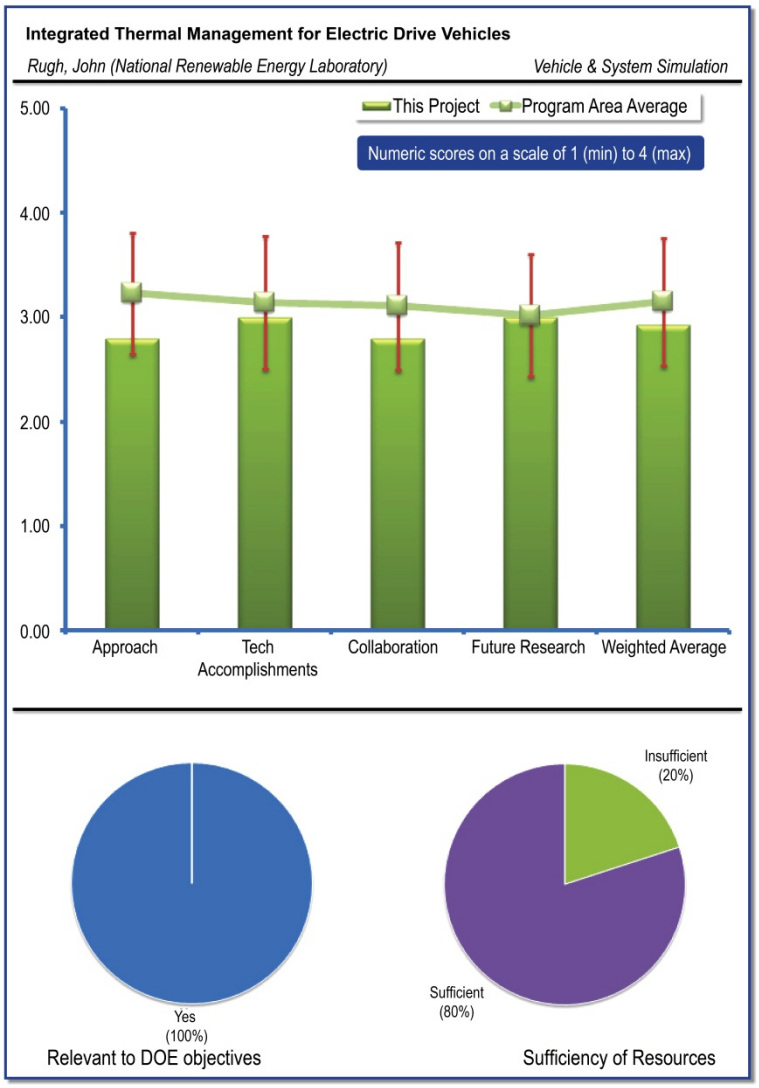
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One reviewer said that this project builds logically on prior work. Not much detail provided. Another reviewer said that it will be good to validate with the model with the system as built. The third reviewer said that future plans call for evaluating and modifying the simulation model as required, and to add additional detail to the simulation as required. Details of the experimental validation plan were not provided, but during Q&A, it was learned that Visteon will take responsibility for this. The idea to do the work for HD trucks in a follow up project is a good one since it accounts for 1% to 5% of the fuel use depending on the cycle. A fourth reviewer thinks the team should have a more definitive roadmap of whose work is benefiting from this model and what/when that work will be. This reviewer questioned, is this primarily a tool for the National Labs to have a vehicle HVAC Autonomie model or beyond that?

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

One reviewer noted that the resources appear to be sufficient. A second reviewer felt the same way given the relatively simple scope. As noted, Visteon will apparently provide resource for experimental validation of the simulation. Another reviewer commented that per the slides, budget in 2012 will be needed to complete the goals of the project.

Integrated Thermal Management for Electric Drive Vehicles: Rugh, John (National Renewable Energy Laboratory) - vss046



Reviewer Sample Size

This project had a total of five reviewers.

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

One reviewer said it is quite possible that integrated thermal management can offer some level of fuel economy benefits to even conventional vehicles by using smart warm-up strategies. So it should be able to offer more significant benefits in the case of PHEVs and EVs. A second reviewer said it is clear that thermal management systems have a significant influence over the range performance of electric vehicles, and therefore optimization of these systems from an energy perspective will be a key component of the consumer's willingness to adopt the technology. The second reviewer remarked that the effect will contribute to hybrid powertrain vehicles efficiency also, but the effects will be more pronounced on fully electric battery vehicles. A third reviewer remarked that the work examines opportunities for reducing energy consumption related to cooling and thermal management of a PHEV or EV; the goal is to improve range by reducing the losses related to cooling circuits for electric components. There may be indirect benefit in reduced complexity and cost of cooling circuits. A fourth reviewer said this is a very relevant topic to address barriers in industry. Thermal management has become a complex and costly subsystem within EV/PHEV vehicles. A fifth reviewer said that owing to a lack of waste heat, the energy required for heating and cooling of EV can represent a significant fraction of the overall energy input to the system. Therefore, the reviewer said optimizing the HVAC systems in EVs is critical to optimize energy efficiency.

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

The first reviewer felt the approach is good, with a focus on cost as well as increasing component (battery) life by using appropriate warm-up strategies. However, one piece of the petroleum displacement problem that should also be addressed is the effect of these warm-up strategies on reduced/increased parasitic losses in some of the components (e.g., bearing friction within the electric motors, increased electrical resistance in motor winding) which could lead to reduced/increased fuel consumption. The reviewer said this would be particularly true for conventional vehicles, where the dependence of parasitic losses on temperature is probably more significant, but it should have some effect on PHEVs as well. Additional simulations with temperature dependent parasitic loss maps should easily quantify this effect. A second reviewer said the definition around early stages of the project seems to be robust, however the maturity of the plan for the later stages of the effort seems like it still needs to be matured. For example: Key design operating points need to be defined so that any conclusions reached on combining cooling circuits with stand up to industry critique. An OEM partner willing to share system level requirements would be very helpful here. Selecting only “moderate” severity operating points (although they do represent a large proportion of the use profile) may undermine the credibility of the results—the performance of the

system during more severe load points should be confirmed, otherwise the system is not viable. Also the second reviewer recommend that the project team use a simple mass/energy and/or cost saving metric as a measure of success, rather than using those savings to "fund" a larger battery pack in the vehicle and predict the increased range; the latter, which was suggested to be the path forward during the questions, maybe confusing. The third reviewer commented that the approach is based on a 1-D modeling of the cooling circuits, and simulation of component (and cabin) temperatures and power required running ancillary systems. The reviewer noted that the project is in the early stage, nevertheless the direction needs better justification. Namely, it was repeatedly stated that the researchers will use the model to look for chances to combine cooling circuits in the EV or PHEV and reduce losses. However, the temperature setpoints for the battery, the motor, the power electronics, and finally the engine are typically very different, and that imposes fundamental constrains. The PI should use the preliminary results to address this and define the scope better. The fourth reviewer says that the approach looks sound to address assessment of combined cooling loops. Relevance charts (and title) indicate a broader "thermal management" scope which would imply cabin heating as well. Clarification that project is assessing A/C and Advanced Power Electronics and Electric Machines Program (APEEM) and ESS cooling would be helpful...assuming that is the case. If not, it was not obvious that approach addresses cabin heating work. In addition, this reviewer felt that declaring analysis ambient condition assumptions for analysis (based on typical industry extremes) and delta "T" rates for cabin cool-down would give more confidence that conclusions are linked to industry/customer expectations. The reviewer also noted that it is not clear what the Go/No Go Decision point in June 2011 is for. The fifth reviewer said that the 1-D thermal model using KULI is a good first approach to modeling HVAC systems in an EV. The leveraging of DOE tools is an efficient use of resources.

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

The first reviewer said that good progress has been made in developing component and subsystem models. Results showed good correlation with test data. The second reviewer commented that it is difficult to judge since the program is in such early stages. This item certainly could be a "3" if funding was only recently made available. Another evaluator said that there is good progress with development of the 1-D model for thermal/cooling analysis and a cabin thermal load model. The selection of the software package KULI was not elaborated enough, as there are other options. The reviewer wondered even more about the selection of FAST for vehicle simulations rather than Autonomie. Cabin thermal model is a strength and its impact will be interesting going forward. The fourth reviewer stated that there has been significant accomplishments setting up the necessary models and correlating to test data. The final reviewer said the results to date look reasonable though much works need to be done regarding optimizing the thermal management systems.

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

The majority of reviewers commented that the project may benefit from partnering with OEMs. The first reviewer said that Visteon and EE Tech team are named as collaborators on this project. Obviously, Visteon has been involved quite heavily in this project, providing component design data, etc. It was unclear from the presentation how much the EE Tech team is involved. In the future, the reviewer felt that it would perhaps be helpful to mention their part in the project as well. The second evaluator stated that it this program could really use an OEM partner who can provide full vehicle cooling/heating system requirements; while Visteon may be able to do this, the presentation suggested there may be some holes in the areas of design operating points (worst cases) and appropriate evaluation cycles. Another reviewer stated that the collaboration with Visteon and EE Tech is definitely a plus. The fourth reviewer remarked that the link to industry (Visteon) and coordination across DOE VTP areas is good. The reviewer felt the project may consider sooner link with OEM to best understand customer cabin comfort expectations (shown occurring in FY12). The final reviewer also said that the project could benefit by fostering strong partnerships with OEMs.

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

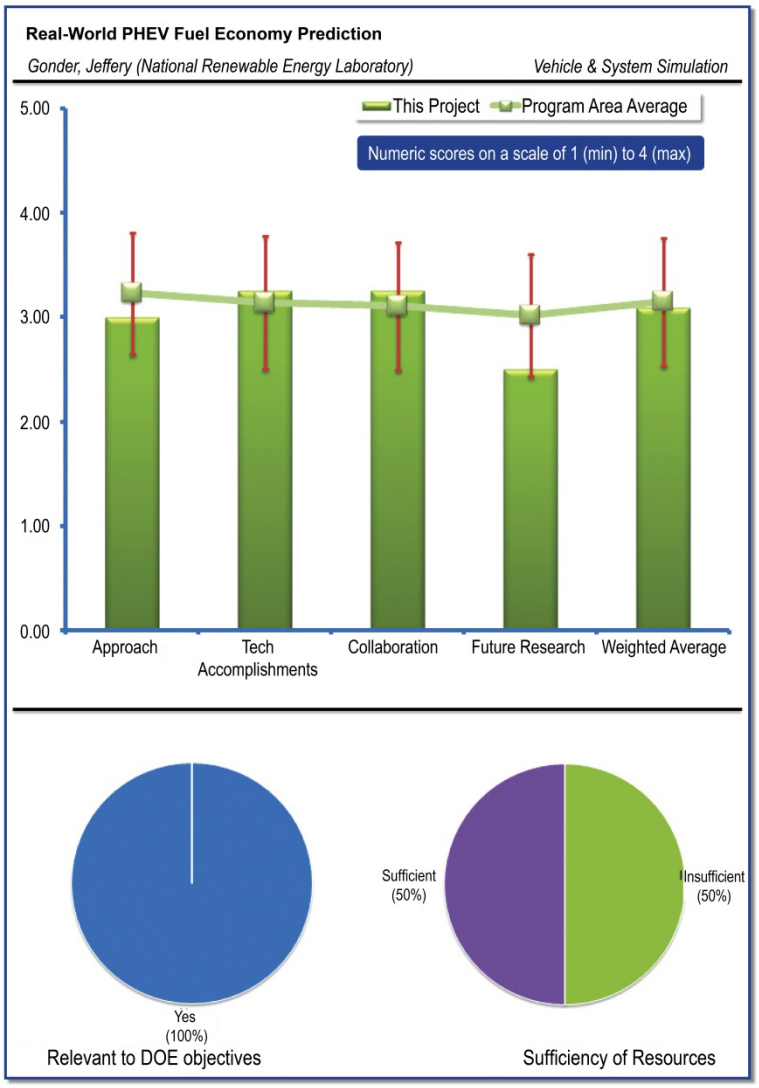
The first reviewer stated that the scope of the future work that has been outlined seems reasonable and achievable. A couple of considerations from the reviewer: Many of the other projects talk about evaluating fuel consumption benefits based on "real world" cycles. It appeared to this reviewer that only the federal test procedure (FTP) cycles are addressed in this project. It would be helpful

to understand the effect of these strategies on fuel consumption in "real world" cycles as well. A second reviewer said the project team may want to consider coupled 1D and 3D flow analysis (underhood airflow) to achieve a higher fidelity approach in later stages, after the initial direction is determined through the current approach. A third reviewer commented that including the battery cooling and examining the behavior of integrated system to detect opportunities for energy savings and reduction of system(s) complexity will be a critical next step. The project team should plan to evaluate the potential opportunities by looking at only a small section of certification driving schedules makes me worried though. Cooling systems and components have to be designed for critical conditions, hence extreme conditions or duty cycles should be considered too. A fourth reviewer said that the next steps on this project are outlined, perhaps expanding to include the cabin heating question in future work (as shown in relevance charts)? The final reviewer said that the planned work to quantify thermal challenges and to optimize (based on vehicle range) the thermal systems appear sound.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

A reviewer said that resources are sufficient based on the stated objectives. If some of the suggestions here are addressed, it may turn out that more resources are needed. Another reviewer said resources seem to be adequate, success in achieving the milestones will be determined by other factors. The third reviewer stated resources appear sufficient given current project scope. The final said this program is just in the very early stages, but it is presented as being completed in FY13 - in many ways the program should be fairly straightforward to execute, and therefore it seems like a great candidate to be significantly accelerated in order to reach conclusions more quickly and influence more products sooner. This reviewer would prefer to see this program executed in full and published within 12 months.

Real-World PHEV Fuel Economy Prediction: Gonder, Jeffrey (National Renewable Energy Laboratory) – vss047



Reviewer Sample Size

This project had a total of four reviewers.

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

All reviewers perceived that the project supports DOE objectives. One reviewer said that PHEVs have tremendous potential to reduce petroleum use and that this work is helpful because methodologies for determining PHEV fuel economy in blended driving are not as clearly defined as those for either conventional vehicles and charge-sustaining HEVs, or purely charge-depleting EVs. A second reviewer commented that the availability of an improved, standard approach for evaluating PHEV fuel economy will help industry project potential fuel economy improvements offered by new PHEV drivetrains, allow comparisons of various PHEV's, and provide a means of evaluating design changes made to PHEV drivetrains. This ability to project vehicle performance will accelerate improvements to PHEV technology, and ultimately make these vehicles more attractive. This in turn will promote greater petroleum displacement on a national level. The reviewer felt that the goals of this program are thus very appropriate: Evaluate the current means of projecting PHEV fuel economy, assess the pros and cons of each, and recommend a preferred approach. A third reviewer said the metrics for fuel economy that the public believes, will be key to them understanding the benefit to them in terms of fuel savings. A fourth reviewer remarked that the calibration of customer expectations to real-world fuel economy projections is relevant to advancing DOE objectives.

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

One reviewer said the real-world, GPS-derived driving cycles and the Transportation Secure Data Center where they are stored and can be accessed are both very useful. The reviewer did have a comment that was directed more at EPA than at DOE or NREL: The extreme sensitivity of PHEV fuel economy to use and driver behavior may make it less valuable (or potentially misleading) for EPA to state a single value as the official fuel economy for PHEVs. Rather, the reviewer felt it may be more useful for EPA to report (e.g., on the window sticker) several discrete efficiency values on separate driving cycles reflecting charge-depleting, charge-sustaining, and a few standardized representative blended cycles. The second reviewer felt the general approach has been described as follows: (1) Review and revise PHEV calculation methods for standard test cycles, (2) Identify currently available options for projecting fuel economy, (3) Confirm that simulations provide reasonable estimates, (4) Evaluate against available "real world data" (either from OEM's or from national labs), (5) Identify and summarize pros and cons of each approach, (6) Recommend preferred approach. The second reviewer commented that not all of the specific "calculation methods" under evaluation were identified. The "simplified" calculation method (which eliminates the need to conduct full 5-cycle tests) and the "blending" of charge sustaining and charge

depleting (CD) modes were discussed in some detail. A third reviewer stated that the approach to use simulation and then real world results to check current methods for determining fuel efficiency is a good one. A fourth reviewer commented that the approach indicates several scenarios for adjusting numbers from standard drive cycles and acknowledges the complexity from both standard cycles and predicting real-world fuel economy. This reviewer recommended that this would encourage a more specific analysis with regional variation given how extensive the impact on ambient temperature conditions are to real-world performance. The reviewer commented that it may be time to allow the consumer to understand how energy consumption for cabin comfort significantly impacts their EV efficiency/range. Attempting to converge on a singular approach across temperature regions may not provide much value to the consumer except in an "average" region which is not where many of the first EVs/PHEVs will be deployed.

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

The first reviewer noted two SAE standards and two reports, that the blended constant-depletion method appears to correlate well with actual PHEV data - in one case. The reviewer also noted that "Leverage on-road drive cycles for PHEV evaluation" (on the Technical Accomplishments slide #15) is valid, but it is more of an approach than an accomplishment. The second reviewer said it appears that some of the results included in the presentation are based on existing analysis methods, or based on previous work in other programs. The project may be in the early stages of evaluating current methods, and there has not been sufficient time or resource to complete improvements or down-select most promising approaches. This reviewer noted that there was information presented showing that actual fuel and electricity usage was similar to values projected by the "adjusted" estimation method. Based on one analysis, the simplified calculation method appears promising. In general, the reviewer felt that it appears the project is on the right track to yield more accurate and representative methodologies for energy usage prediction (fuel and electricity). A third reviewer remarked that progress on simulation has been good. Correlation with real world results may need some work to finish by the end of project. The fourth reviewer said that progress in understanding breadth of approaches, simplifying assumptions and performance drivers seems substantial.

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

One reviewer remarked that NREL is collaborating with ANL on procedures and dynamometer testing, the SAE J1711 task force on procedures, and with INL on field evaluation results. The reviewer also noted that the project is also providing feedback to EPA on proposed rulemaking. The second reviewer said that sited collaboration activities include: (1)Working with Argonne on procedure development and chassis dynamometer testing, (2) Participation on SAE J1711 task force, (3) Sharing proposed approaches with EPA and commenting on proposed rulemaking, and (4) Fleet evaluation data sharing. The reviewer said it was not mentioned whether the prediction methods use Autonomie or other simulation programs. There may be an opportunity to collaborate with Argonne personnel in modifying or refining simulation methods. Another reviewer commented that hopefully some more of the real world data coming in from other DOE projects can be utilized before the end of this project. The final reviewer also noted that extensive collaboration is evident from industry, national labs and EPA.

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

The first reviewer said that the project was a bit light on details. The reviewer recommended that DOE/NREL consider developing a user-friendly "app" that car dealers and/or individuals can use that would use NREL and/or EPA test data to allow prospective car buyers to input their actual typical driving patterns (e.g., 15-mile round-trip commute every weekday, 50 miles on weekend days, and a 150-mile trip once a month) and calculate the estimated fuel usage/economy they'd actually achieve with a particular PHEV (or any vehicle). Another reviewer said that the remaining work is described as "complete remainder of project plan", "deliver milestone to DOE" (report on "Real World PHEV Fuel Economy Prediction"?), and "recommend preferred prediction approach(es)". If the work plan had been described in more detail, this description of projected activity may have been adequate, but it is difficult to get a feel for what specific activities remain. A third questioned wondered if there is time to complete the remainder of the project plan, deliver the milestone and select the preferred prediction approach in 2011? The final reviewer said that the future work did not propose more

accurate predictions based on non-traditional parameters, one potential was previously mentioned as a regional-specific prediction due to ambient temperature variations. Seems there would be more future work potential in this space than reflected.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

One reviewer said that the project would likely need additional resources to develop the app discussed in #5 above. Another reviewer remarked that given the uncertainty of what actually remains to be completed, it is not obvious that resources are sufficient to meet the end of year targeted project completion date. The reviewer elaborated by saying this is not a criticism of the Principal Investigator necessarily, but the required resources originally projected for this effort may have been under-estimated. The work performed to date looks promising, but perhaps additional time and manpower will be required to bring the project to a successful completion. A third reviewer said that the time might be insufficient unless more resources are added to the project. The final reviewer said that funding appears on the lean side given scope. This reviewer senses that this may create constraints to exploring and documenting sufficient options on adjustment approaches.

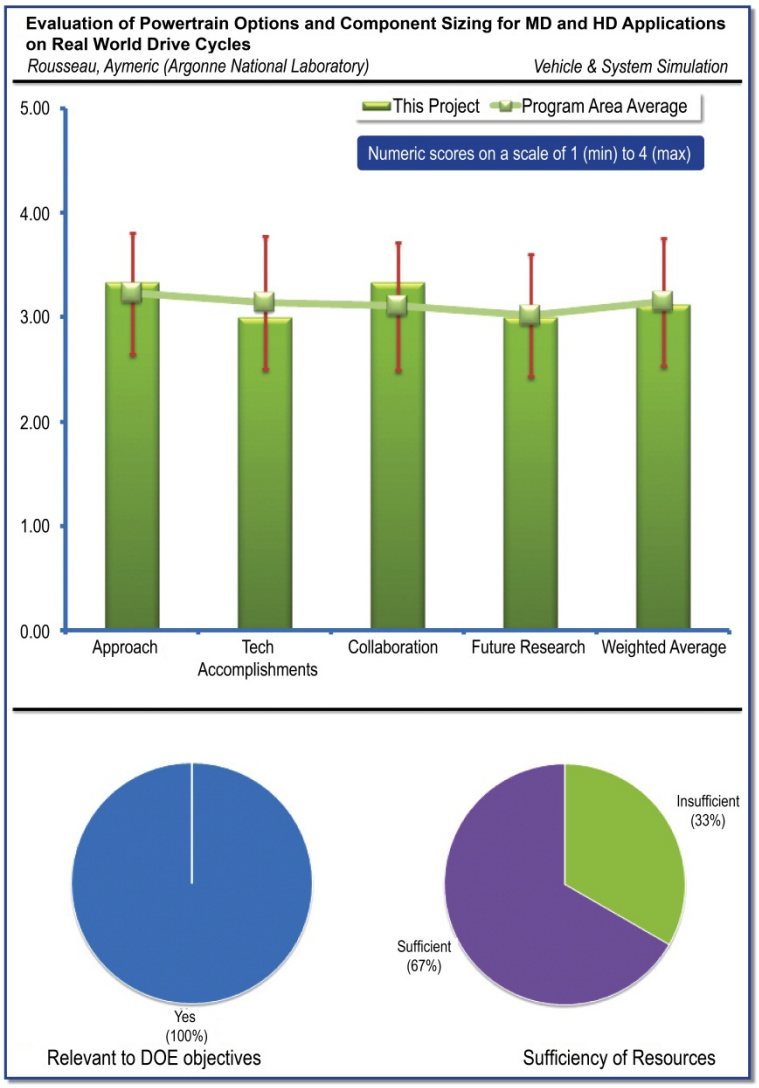
Evaluation of Powertrain Options and Component Sizing for MD and HD Applications on Real World Drive Cycles: Rousseau, Aymeric (Argonne National Laboratory) - vss048

Reviewer Sample Size

This project had a total of three reviewers.

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

The first reviewer noted that getting the size of components right will optimize efficiency. The first reviewer also said that transit bus manufacturers in particular, and probably truck manufacturers to some extent, tend to offer the engine size(s) specified by customers rather than an optimized engine size. The second reviewer said the right powertrains and component sizing are important for the cost of the systems and the benefit they provide. Lower cost systems (with optimized components) will help with implementation of fuel saving hybrids and quicker adoption of hybrids. The final reviewer said that the activity supports ability for DOE to see fuel consumption effects generically across vehicle segments in medium and heavy duty trucks through simulation.



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

One reviewer noted that there was good validation of models with actual vehicles (e.g., errors less than 2% for power). The reviewer also commented on the Q&A about constraining component size outputs to actual available products (e.g., engine hp) vs. identifying exactly what is needed. This reviewer suggested that the latter approach may be more valuable to the MD/HD vehicle OEMs because they tend to be less vertically integrated than LD auto manufacturers - some MD and most HD OEMs typically purchase their powertrains from a discrete list of supplier offerings rather than optimize and build them themselves. The second reviewer remarked that the approach of examining components and determining models for them to put into system models is a good one. It will allow engineers to see the effect on performance and fuel efficiency from different components. The third reviewer said that the general approach seems as good as it can be given complexity of product offerings across OEMs as current state. Discussion of attempting to factor specific engine existence, (near-term versus long-term) is not recommended. This reviewer commented that it is far too complex of an analysis and would be very difficult to maintain current data (also cannot account for production capacity constraints, etc.). For DOE directional guidance, the reviewer felt that fidelity of an "average" analysis across a segment should be sufficient.

QUESTION 3: CHARACTERIZE YOUR UNDERSTANDING OF THE TECHNICAL ACCOMPLISHMENTS AND PROGRESS TOWARD OVERALL PROJECT AND DOE GOALS.

One reviewer stated that the project is just ~15% complete, but it looks like the they have already made some progress in collecting drive cycles. A second reviewer commented that the development of component models has been done and that vehicle performance has been measured as well. The braking event histogram that was done will be helpful in sizing battery packs. The reviewer said it appears that a fair amount of work is still needed for the sizing algorithms and incorporating in the road data before the program is complete by the end of fiscal year 2011. The third reviewer commented that an example analysis was provided but the reviewer was unclear about how many classes of vehicle are now (and projected to be) complete by end-of-project. This appears to be a huge task to collect and manage the data but difficult to see exactly how far along the gathering and assessment of the data is currently.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

One reviewer said that ANL is partnering with OEMs (Navistar, Paccar, John Deere, Cummins, and more), NREL, ORNL, and West Virginia University. The reviewer said that the proposal cites "close relationship with truck manufacturers, suppliers, universities and national laboratory" and says "Value of data obtained through partnerships valued at several million dollars;" however, details of the collaborations are sparse. A second reviewer said there are many and varied partners that are giving data for the project and thought it will be good for the partners and other companies where possible to get the output (when it is available) as well. The third reviewer stated that this activity appears to have broad support and engagement in labs and OEMs.

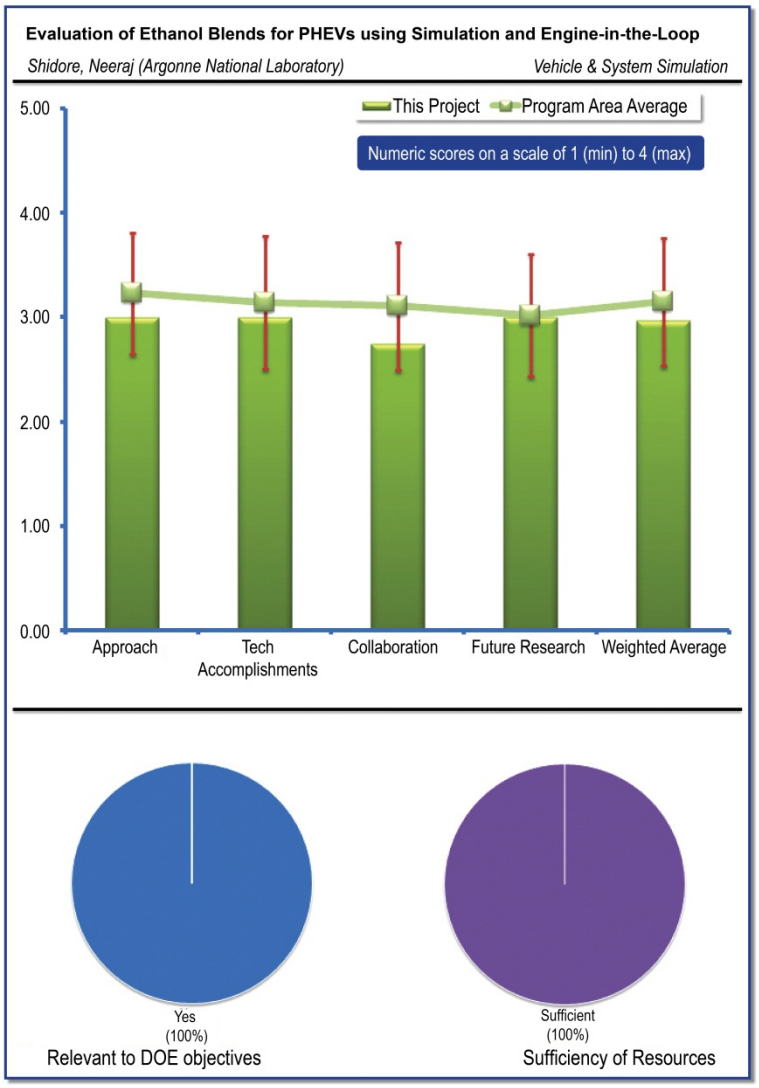
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

The first reviewer remarked that the future research is more of the same, plus ANL will "expand" collaborations and support future MD/HD labeling in Europe. The second reviewer commented that for this project, determining the improvement from hybrid systems is still a large task and for next projects, it makes sense to expand the scope to get into other improvements such as aero improvements. The final reviewer stated that much of the future activities seem to be a restatement of the current activities. They felt it was not clear what the future MD and HD labeling in Europe is for.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

One reviewer said it could be difficult to accomplish all the goals this fiscal year. The milestones are important ones for the truck industry so hopefully sufficient resources can be found to complete the program. Another reviewer felt it is difficult to judge scope relative to funding and that it appeared to be high potential for "ongoing" activity versus wrapping up a project at end of FY11. Wrapping up in FY11 would probably conclude insufficient resources.

Evaluation of Ethanol Blends for PHEVs using Simulation and Engine-in-the-Loop: Shidore, Neeraj (Argonne National Laboratory) – vss049



Reviewer Sample Size

This project had a total of four reviewers.

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

Commenting reviewers were unanimous that the project supports DOE objectives. The first reviewer felt that the project was relevant and that other fuels, such as ethanol, natural gas, electricity with storage, and biodiesel, can also provide attractive means for reducing oil use through fuel displacement. The project VSS49 seeks information to better understand use of ethanol – gasoline blended fuels for PHEVs. Barriers to ethanol blends include cold start issue and energy density/fuel consumption. A second reviewer said that the use of alcohol based fuels to displace petroleum fuels is in-line with the DOE objectives. Unfortunately, the challenges with ethanol blended fuels require further study and understanding before robust implementations can be deployed. The final reviewer stated that both PHEVs and ethanol have the potential to reduce petroleum consumption in the vehicle fleet.

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

The first reviewer explained that the project provided a very modest "seed" effort of $100K (started in FY 2011 and 50% complete) to start some simulation evaluations. The topics addressed- density, latent heat, knocks, and their impact on fuel/VSS-- are quite interesting and valuable data to have for those interested in alt fuels, and alt fuels engines, for example. The research objectives include data on optimization and areas of improvement, very interesting data to have for the community. The approach to the work is sound, and leverage existing resources at ANL Advanced Powertrain Research Facility (APRF). Approaches use appropriate fuel blends of interest (gas, E50, E85), standard drive cycles, and conventional and power split PHEV systems. This reviewer said that other reviewers have some load questions and presentation of data clarification is needed, but overall project (and such "seed") funding, is commendable. The second reviewer stated that the approach of pure gasoline (E0) through 50% (E50) and 85% (E85) ethanol blends is a good one as it covers the spectrum of ethanol based fuels currently available. The reviewer commented that with the addition of the Series Generator and Power Split device the reviewer would like to see the project investigate the use of E100 as the engine can now be run-up and started at much higher speeds than normal (idle vs. crank). The final reviewer said that this project makes very effective use of existing facilities and expertise to address a unique issue.

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

One reviewer remarked that the findings include important data for hybrid operation and load management. Fuel economy in ethanol blends may be optimized by vehicles control strategies. The data show an energy density penalty - in quantified detail of E50 and E 85 for conventional vehicles, and demonstrates the impact and improved comparative efficiency of hybrid operation, same fuel blends. The reviewer felt that continued work on PHEV operation will be interesting to follow. Another reviewer commented that the modeling of data appear to accurately capture the performance of the engine with the three fuels.

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

One reviewer said that the collaboration with OEM and EU could be improved. A second reviewer stated they would expect to see an OEM become more involved than just providing the ethanol fuel blend calibrations.

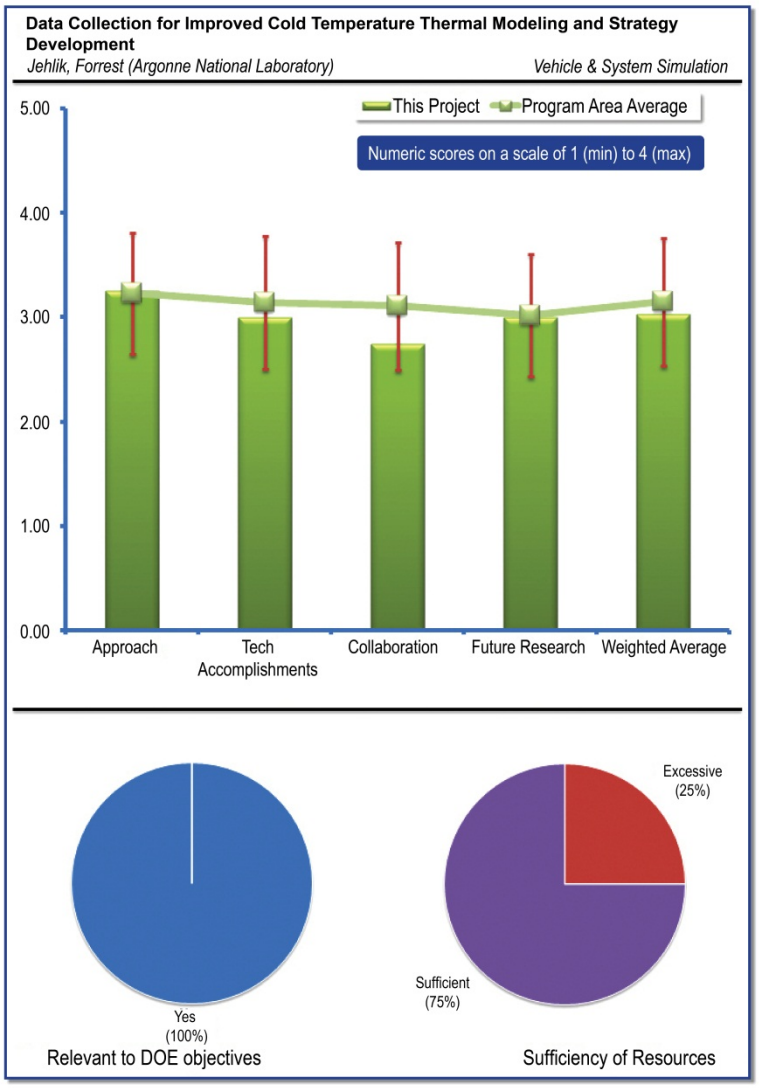
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One reviewer said the project is taking next appropriate data sets and plans more collaborations with OEMs. The reviewer also said that the project plans to share data with USCAR. Future work will take into account driver behavior, which is important for energy efficiency/density studies. Work has found energy density penalties because of NO_X properties; the reviewer felt there will be room for improvement and new data here. The reviewer pointed out the catalysts did not change or impact findings, this could be further exploded from a DOE Basic Energy Sciences (BES) perspective. The reviewer also commented that the team may consider looking at E100 and loading vs. exhaust temperatures. The second reviewer said that completing the project as defined is appropriate and an extension to the project to explore system level optimization opportunities for ethanol fuel blends in a PHEV/HEV application would be of interest. They also stated that a true flex-fuel PHEV/HEV would be logical progression of today's technology paths. The reviewer wonders who will be first.

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

The first reviewer remarked that the team has made some nice accomplishments and provided interesting data on a limited, seed funding. This reviewer commented that this is excellent work on the modest budget. The reviewer felt that if the project can continue the work based on the same modest budget, excellent. Before expanding the budget, the reviewer suggested bringing in a few other collaborators to strength the translation and impact of results, to other consultants or OEMs. Another reviewer stated that resources appear sufficient.

Data Collection for Improved Cold Temperature Thermal Modeling and Strategy Development: Jehlik, Forrest (Argonne National Laboratory) - vss050



Reviewer Sample Size

This project had a total of four reviewers.

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

All commenting reviewers agreed that the project supports DOE's objectives. The first reviewer remarked that this project is relevant and that it directly supports DOE's overarching mission "to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions." The work directly supports the overall DOE VTP goal to achieve petroleum displacement by investigating cold temp thermal modeling and mitigation for energy savings. The project is developing engineering solutions for petroleum use reduction. The second reviewer said that the project brings to the front, a void in analysis that represents the majority of our transportation climates. Another reviewer commented that cold starts and cold temperature operation have a significant impact on the quantity of fuel consumed by internal combustion engines. This reviewer said that finding a solution that minimizes this fuel consumption is directly in line with DOE objectives. The fourth reviewer felt that this work addresses cold engine fuel consumption for many different hybrid powertrains.

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

One reviewer felt the project team is looking at the impact of cold operation on vehicle operation and energy efficiency. Team developed a fuel map based on experimental load of Hymotion Prius, and matches it to an urban dynamometer driving schedule (a UDDS)/ / UD 60 model. The second reviewer said consideration of other temperature locations has been included in the approach but additional locations should also be explored (e.g., cylinder head and valve bridge) as these may offer a different perspective to oil and coolant.

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

One reviewer remarked that the work provided a focused data set for cold temp impact on fuel economy, but the data are limited with respect to its potential. They felt that the project demonstrates improved procedures for model development and testing UDDS, but the data and its results are modest with respect to potential implications. A second reviewer stated that progress appears to be as per the plan.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

One reviewer does not understand why Environment Canada is the only partner. However, this reviewer commented that the project is good use of ANL APRF, and future collaboration planned with NREL. The second reviewer was surprised to see that there was not an OEM involved. This particular reviewer was aware of previous OEM studies in the European Union that explored cold start fuelling and would have expected to see an OEM play a key role here.

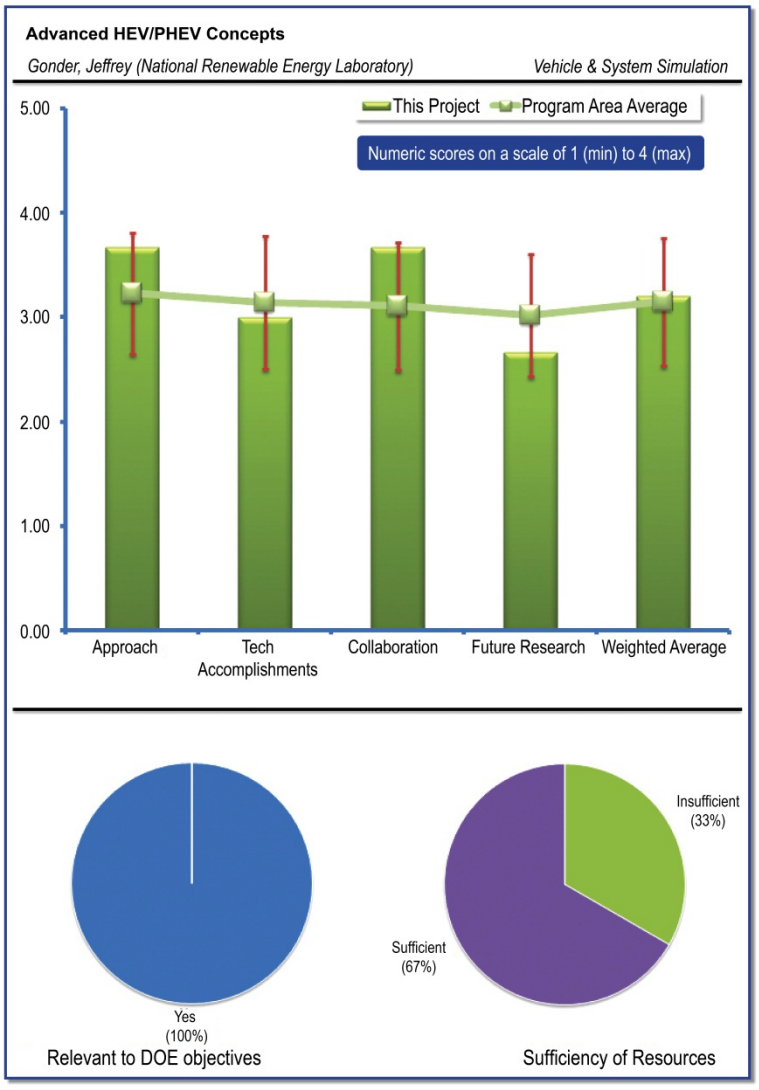
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

One reviewer remarked that this is an important project but funds are small and limited. Future work includes new collaborations that will help expand the work. The reviewer said that new proposed work may incorporate creature comfort features into modeling effort (NREL) or light off features into modeling effort (ORNL). The reviewer suggested working with EPA. The second reviewer stated that improving the response surface methodology (RSM) is important especially with the addition of alternative temperature signals. A third reviewer commented that a future project should take these results and apply them to a real engine in order to validate the overall fuel saving opportunity.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

A reviewer stated that funds are small, but so small they are not sure the impact of data are useful without a full blown comprehensive and coordinated effort. The reviewer felt that these very preliminary results show the study of cold temperature/thermal management with respect to the UDDS cycle, they thought it was important to study and has potentially significant impact on petroleum displacement. However, this reviewer also felt that data are sparse, so sparse that they are not sure about the investment, unless the project is truly managed and expanded and there is a strong relative return on investment. The reviewer stated that the current resources are a start, but not compelling as presented. Another reviewer stated that resources appear sufficient.

Advanced HEV/PHEV Concepts: Gonder, Jeffrey (National Renewable Energy Laboratory) – vss051



Reviewer Sample Size

This project had a total of three reviewers.

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

The first reviewer stated that this project explores three different approaches for enhancing the performance, efficiency, and cost effectiveness of hybrids and plug-in hybrid vehicles. Evaluation of these advanced concepts will help to decide whether major development programs should be undertaken. They also said that the project could lead to significant improvements in hybrid vehicles, thereby improving their market attractiveness and leading to increased market penetration. Putting a greater number of hybrids on the road clearly addresses the national goals of reducing emissions, and dependence on foreign oil. The second reviewer commented that all three thrusts are relevant. The first focuses more on reviewing whether some major barriers (the high costs of large battery packs) can be removed. The other two thrusts offer a preliminary review of potential fuel efficiency gains from advanced controls or infrastructure. The third reviewer remarked that the project includes three advanced concepts between lower energy ESS, Route-Based Control, and Drive-on charging. They also noted that route-based control (RBC) has enough substance to split-off as its own initiative. Lower energy ESS seems to be concluding and drive-on charging could also be split off. RBC should be fed now for good near-term feasibility to the DOE mission, the reviewer elaborated by stating that both for fixed routes (commercial) and for less-fixed (consumer) based on GPS/NAV. The reviewer also pointed out that DOC is longer-term R&D that may be eclipsed ultimately by fuel cell strategy. This reviewer commented that it is less obvious for DOE focus if MAJOR infrastructure investment required realizing nationwide benefits. Ability for vehicles to pick up charge may just offset battery size savings.

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

Reviewers provided extensive details and suggestions relating to all three areas included in the presentation. One reviewer commented that this project includes three different work streams so each are addressed separately: (1) Energy Storage Project – Using simulation, this project will evaluate the effect of storage capacity on fuel economy. The reviewer commented too small a capacity results in lost opportunities to capture regen braking energy and too large a capacity drives up the cost, a significant factor considering that batteries are the single most expensive component in an HEV or PHEV system. In addition, the project explores which duty cycles ultimately drive the battery size. If a smaller battery is acceptable for the overwhelming majority of duty cycles encountered, then a scaled down storage capacity may be an effective tradeoff between fuel economy and initial cost. The reviewer felt that the technical approach is sound, and should establish a methodology for selecting storage capacity that represents the best compromise between acquisition cost and weighted average fuel economy. (2) Route Based Control – This project seeks to understand the benefits of using duty cycle

information to "anticipate" the demands a particular route may place on the hybrid system, and then modify control strategy accordingly to optimize efficiency and/or performance. The reviewer stated that the approach calls for data collection along repeatable routes, then using this information to modify control strategy (one or more variants). These modified controls are then placed in the vehicles for performance and fuel economy testing. The units with modified controls are compared to baseline vehicles to determine benefits. The reviewer felt that the technical approach is sound, and can offer a significant benefit to hybrid vehicles that travel a particular route or group of routes on a recurring basis. (3) DOC Charging – The reviewer felt that this project appears to be a "technology search" to understand various options for charging the vehicle's battery while the vehicle is in motion. In essence, potential technologies will be identified, coasted out, and a calculation made of potential overall fuel savings. The reviewer remarked that the project will compare the total cost (vehicle, fuel, battery, battery replacement) of various charging options including drive-on charging, plugging in at home, plugging in at destination, etc. The second reviewer said that all three projects seem to be well organized with specific goals and a clear plan to meet the goals. (1) Energy storage system represents a big part of the hybrid system cost. Better defining the cost vs. benefit tradeoff can help lower barriers to implementation. (2) More advanced powertrains most likely can exploit the extra information which is available to further improve efficiency. The reviewer felt that it is good to understand the boundaries of these benefits and to review different implementations. (3) The reviewer felt that the high level modeling and simulation review of the potential gains from drive on charging is a useful step. Again, this has the potential to improve fuel efficiency; studies to better understand this is completely appropriate. The third reviewer remarked that it is difficult to understand allocation across three initiatives. They also felt that the research team seems well organized (internally) but scoping is complex for outside review. Lower Energy Energy Storage System (LEESS) approach and project seems pretty complete. For RBC, the reviewer recommended a broader approach to capture potential of consumer market (not just commercial fixed route). A scenario where GPS knowledge of consumer location and destination could optimize control, may create a larger petroleum savings as PHEVs rollout to consumer market and GPS-enabled vehicles and/or mobile smart phone device are commonplace. Approach to analysis of drive-on charging was least defined.

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

The first reviewer stated that this project includes three different work streams so each will be addressed separately: (1) Energy Storage Project –As might be expected, there are diminishing returns with regard to sizing the battery. Simulation results (UDDS duty cycle) suggest a decreasing rate of fuel economy improvement as the battery size gets larger. An analysis of regenerative energy captured shows that reducing the peak power requirements of the battery from 30kW to 20kW results in only a small loss of regen energy. The reviewer sated that battery manufacturers have indicated that peak power is one of the key cost and size drivers. The reviewer felt that good progress has been made so far in understanding and "quantifying" the tradeoffs in performance vs. cost. (2) Route Based Control – the reviewer pointed out that some simulations work has been conducted to understand effects of control strategy changes on fuel consumption and battery usage. The "New European Drive Cycle" was used for initial analysis work. In addition, runs have been made to understand how driving style can affect fuel usage and battery state. The reviewer remarked that it appears that driving type (not surprisingly) can affect how effective a particular control strategy is. The reviewer remarked that some good work has been done to date to understand interrelationships between control strategy, fuel usage, and battery condition; however, it is not clear that the vehicle data collection and subsequent creation of modified control strategies has yet been initiated. (3) DOC Charging – An analysis tool for comparing various technologies has been completed. This is an Excel-based, homegrown, easy to use tool. The reviewer said the analysis results show that "externally powered" hybrid electric vehicle has the lowest cost of operation, which seems to make a case for further evaluation of DOC concepts. The second reviewer commented that the conclusion that smaller battery pack could offer similar efficiency gains is interesting. The reviewer is also interested in the fast running excel model. The reviewer pointed out that recently the EPA has proposed their own simulation tool for medium/heavy duty regulations. The reviewer understands one of the concerns was that the model was perhaps too complicated or required too much data entry. This reviewer remarked that something along the lines of what seems to have been developed here might be appropriate. (The EPA seems to want to have a model that captures engine torque/speed-- not just power-- which might be beyond the simple excel model. However the level of detail the EPA wants seems consistent with a simple fast model. Regardless of this discussion, it might be too late for working with the EPA, but the tool would be useful to others.) The third reviewer said that LEESS had most progress as

principal activity to date and seemed pretty much done. RBC and DOC activity to mostly begin now and there are limited accomplishments to date.

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

Reviewers thought that collaborations were extensive, and also provided comment about opportunities for possible future collaboration. One reviewer stated that the Energy Storage Project collaborations and information exchange have occurred with Ford, Chrysler, and GM. In addition, NREL's recommendations have now been adopted by USABC. The first reviewer also noted that for the route based control the collaborations have been primarily with bus and component manufacturers, including ISE, Navistar, and Allison Transmission. Also for DOC charging the same reviewer said that significant interactions have occurred with a number of organizations, including the Partnership for Roadway Electrification & Automation (PREA),, University of Auckland, Korea Advanced Institute of Science and Technology (KAIST),, ORNL, University of California-Berkeley (Partners for Advanced Transportation Technology), Utah State University, and the Aerospace Corporation. The second reviewer remarked that there is a number of good collaborations, but it would be nice if another collaboration could validate the conclusions of the LEESS study (similar to the previous work with GM looking at ultracaps instead of a battery pack). The reviewer remarked that some OEM collaboration would be useful to confirm prototype devices deliver full HEV fuel savings. This reviewer believed that a lot of people would have use for a simple and fast fuel economy model, especially one that could run in Excel; this reviewer pointed out that Matlab is now fairly common in engineering circles, but almost all engineers have access to MS Excel. This reviewer mentioned the EPA above, but there might a wide range of other researchers. Another reviewer stated that the collaborations seemed extensive and sufficient.

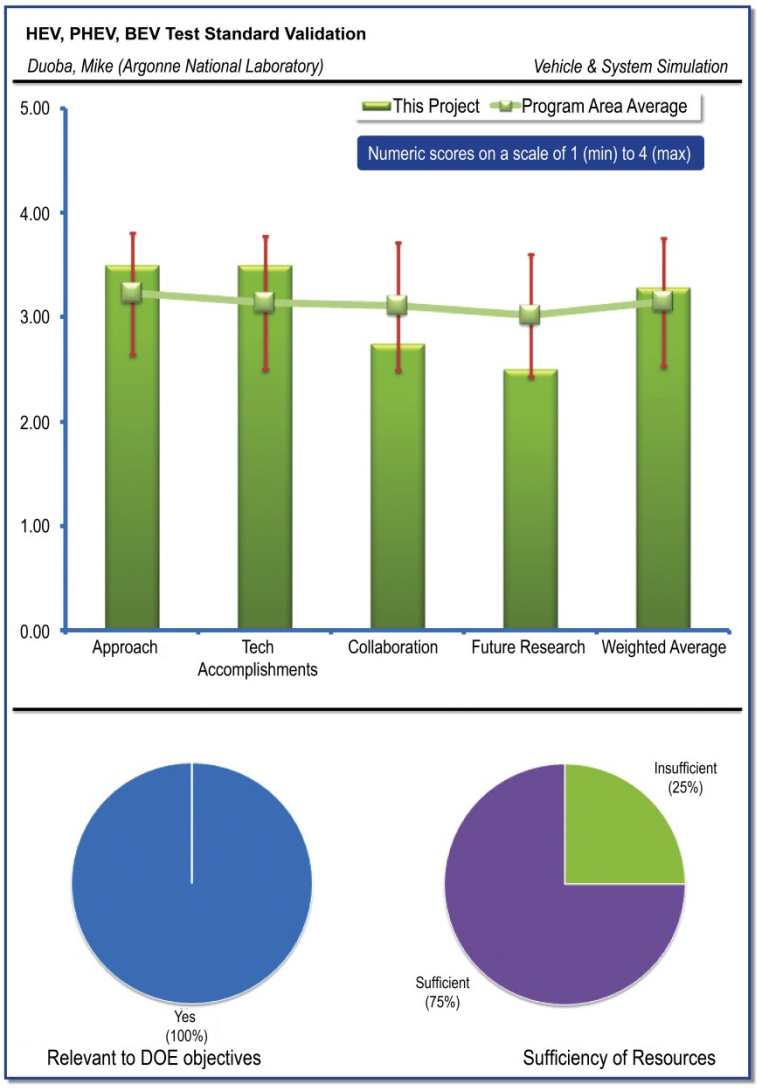
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One reviewer stated that for the energy storage project, the future activity is focused on assessing performance of newly specified equipment as it becomes available to determine if simulation results have accurately projected vehicle performance. The reviewer points out that this will be conducted over a wide variety of drive cycles. For the route based control the same reviewer points out that data collection and subsequent "tuning" of control system is yet to be completed. Actual vehicle results will be compared against baselines to determine the effectiveness of the control strategy changes. The reviewer also commented that further analysis work will go beyond fuel savings and also consider battery life and emissions. The reviewer also stated that this work was done on buses, but it is desirable to transfer methodology to light vehicles (more vehicles, more fuel savings potential). They point out that a light vehicle partner will be sought. For the DOC charging project the first reviewer stated that the project will continue evaluation of charging options including when parked, at stops, "on the move" on roads, or over designated "charging routes." Additionally, cost analysis program will be refined. The reviewer pointed out that a hardware demonstration is anticipated, although budget limitations may not permit this except on a scaled down level. A second reviewer said that all 3 fronts offer interesting and useful future efforts. The reviewer again repeated that a simple and fast fuel economy simulation could have a lot of use. The reviewer felt that some consideration of additional efforts to develop this tool for public release would be worthwhile. A final reviewer commented that overall scope seemed fragmented. It was not clear to the reviewer that next steps for RBC and DOC were very focused.

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

One reviewer said that it is somewhat difficult to assess the adequacy of resources and that this is really "three projects in one," so the $350K funding total seems light. In addition, the reviewer said the principal investigator seems to have a number of activities to track and coordinate. This all leads the reviewer to the impression that perhaps plans for all three programs are too ambitious to be covered with existing funding and resource levels. Another reviewer stated that Task 1 discusses confirming that prototype devices deliver full HEV fuel savings, but that his would seem to require physical testing, including in vehicle testing. The reviewer felt that it intended budgets will not support this. Similarly the reviewer points out that Task 2 would seem to be heavily dependent on collaborating with hybrid system developers and end system users (various transit authorities).

HEV, PHEV, BEV Test Standard Validation: Duoba, Mike (Argonne National Laboratory) – vss052



Reviewer Sample Size

This project had a total of four reviewers.

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

Reviewers remarked that the project supports DOE objectives. One reviewer said that standards are often underappreciated, but they are one of the most important pieces of the puzzle to commercializing complex systems like electric-drive vehicles. The second reviewer felt that this project is relevant. The reviewer also points out that project VS052, as will other standardization ANL projects (O59, 053, 052) directly support the DOE mission and the DOE VTP responsibility to develop new technologies to increase energy security in the transportation sector. The reviewer acknowledged that the project provides validation and testing of critical component for electric drive vehicles (EDV) including HEVs, PHEVs, and BEVs that will help reduce our national dependence on petroleum. Alternative non-petroleum based fueling options for ground transport vehicles – especially EDV—are critical to help support stable energy economy for the nation. Another reviewer stated that this work enables electrified transportation to displace petroleum energy. The final reviewer commented that the development of appropriate and timely standards is essential to the successful market adoption of electric drive vehicles. Procedures to test and validate standards during the development process are necessary to achieve robust and broadly applicable and accepted standards.

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

One reviewer remarked that it is a great idea to develop a quick version of SAE J1634 test procedures to enable faster development of extended-range EVs and PHEVs. This reviewer pointed out that the project will need to be careful if battery behavior at varying state of charges (SOCs) is significantly non-linear. This reviewer also felt that standardizing terms (J1715) is very helpful. Defining end-of-Charge-Sustaining (CS)-operation is very important for comparing PHEVs. This reviewer commented that developing and promoting standards is one of the most cost-effective and highly-leveraged investments DOE can make in bringing electric-drive vehicles to commercialization. The second reviewer commented that this project has been on-going since 2006. The reviewer said the approach is a nice complement to other VSS projects led by ANL and others DOE labs toward standardization. The project leverages the ANL Powertrain Research Facility resources and communicates results with INL AVTA appropriately. The final reviewer pointed out that this task involves leading and providing technical input to standards development largely with SAE, as well as performing supporting testing and validation activities primarily on the dynamometer. ANL's long history of vehicle and battery testing is being tapped to support this process. The reviewer said standards development and supporting validation procedures are by their very nature evolutionary and time consuming. They point out that one way to speed up the process somewhat is to have dedicated personnel who

cross the standards stakeholder boundaries and are in the position to provide important supporting technical information, while maintaining a neutral overall position. The reviewer felt that this appears to be largely the situation in this case. Another important aspect is efforts to simplify test procedures to lower costs to OEMs and accelerate the testing process once a standard is completed. The reviewer remarked that efforts to simplify and short cut test procedures (especially J1634) are in evidence here. Overall, the reviewer felt that the approach is sound and should be continued. However, given the high importance of the timeliness of standards development, the reviewer pointed out that continued efforts should always be made to further accelerate and simplify the standards development process, without of course compromising validity.

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

The first reviewer said that the project made important contributions to at least five significant SAE and International Organization for Standardization (ISO) standards. This reviewer remarked that the proposed vehicle technology map on slide 12 needs review. For example, "idle-stop" should overlap with PHEVs and CS-HEVs. This reviewer questioned if EREV should overlap with BEV. Furthermore, the first reviewer pointed out that on slide 14, title refers to "ISO 23274-2 Support Harmonization of PHEV Procedures" but the graphic shows a standard for "non-externally chargeable [hybrid electric] vehicles." The second reviewer said the scope of work for FY 2010/11 includes J1634 and is 90% complete. The reviewer also stated that the work focus is J1634 and includes dynamometer validation for BEV. The reviewer noted that the accomplishments include dynamometer test procedure “short cut” findings. The reviewer commented that test metrics for dynamometer tests seems critical; however, how likely is it to have such metrics fully accepted internationally and how fast? This reviewer questioned, ISO standards require years, yes? The reviewer concurred that you have to start somewhere. The third reviewer felt that the level of technical progress and accomplishments for this task are good. Progress has been made on a number of fronts including leading standards committees, development of supporting vehicle/component testing and validation on the dynamometer, and HEV terminology clarification.

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

Reviewers provided input about other possible collaborators. One reviewer stated the presenter mentioned numerous other labs, OEMs, suppliers and DOE. This reviewer was unable to hear or see DOT listed in collaborations; this reviewer remarked that slide 16 vaguely refers to "regulators," which may or may not include all relevant modes of DOT. The reviewer mentioned that work with MD/HD standard (J2711) just started and that the project should seek collaboration with DOT generally and the Federal Transit Administration in particular as this standard will likely be important to the transit bus industry. A second reviewer said that it would be nice to see other dynamometer experts engaged in this project, outside of ANL, such as SwRI. Another reviewer stated that this coordination can be a difficult proposition! The final reviewer felt that solid collaboration exists with SAE and foreign equivalents, automotive OEMs and suppliers, California Air Resources Board (CARB), and the Progressive Automotive X-Prize Competition (X-Prize) entities. This reviewer questioned as to whether other manufacturers (Chinese and Korean) should be coordinated with as well.

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

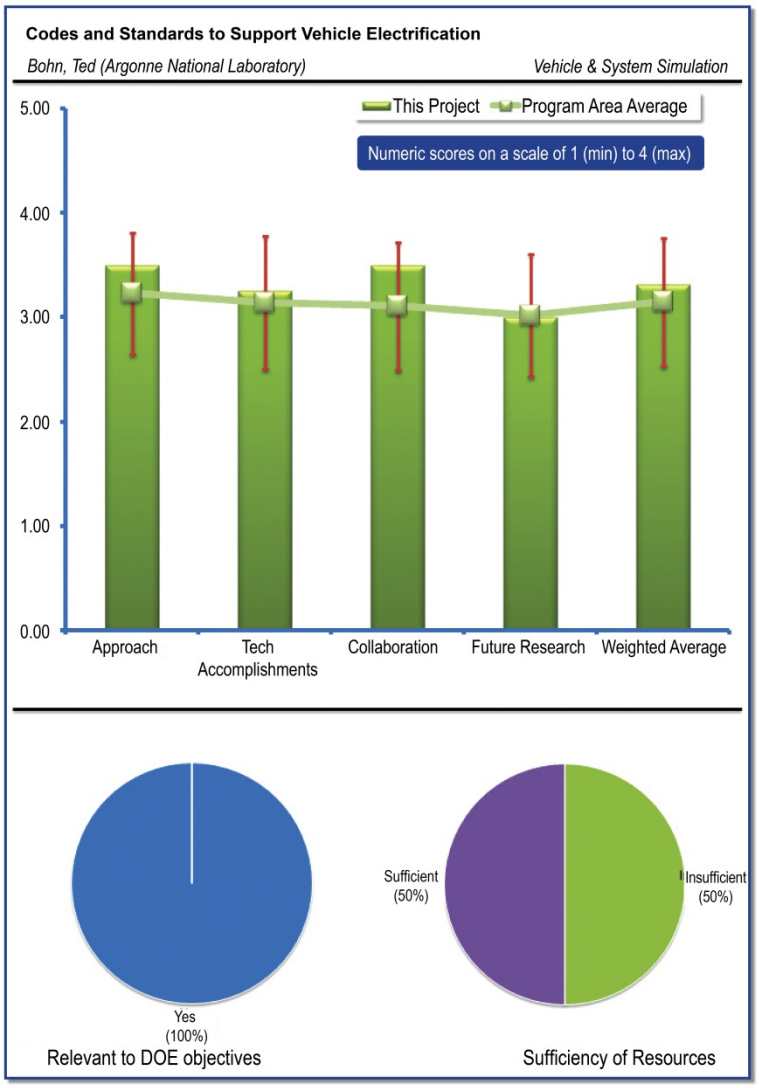
The first reviewer wondered if they missed part of the discussion, as they did not hear anything on proposed future research or see it in the slides; this reviewer gave this question a 3 out of 4 on the understanding that the important standards development coordination work will continue. The reviewer also commented that the project should ensure that the final standards include realistic assessments of accessory loads. These loads are even more important in vehicles with limited on-board energy reserves. The second reviewer said there was good use of APRF. The reviewer would like to see it expanded to other dynamometer test facilities for validation. The third reviewer felt that there was not much information provided on future efforts with the exception of J2711, but it is implicit that it would entail similar supporting activities for standards development as they arise and are prioritized.

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

The first reviewer said to continue funding at least the same level if not more. The second reviewer said that the budget is modest and that ANL uses OEMs resources well for vehicles testing. The third reviewer stated that currently, financial and human resources in

support of this task appear adequate and appropriate. The fourth reviewer went into more detail by saying the leveraging of APRF support means that the support of APRF must be maintained or expanded. In particular, the reviewer believed that 5-cycle evaluation of EVs and PHEVs will require much testing in APRF, and this testing will be required for standards.

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



Reviewer Sample Size

This project had a total of four reviewers.

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

Commenting reviewers agreed that this project supports the overall DOE objectives. One reviewer stated that this is important work on development and harmonization of standards to enable and facilitate wider deployment of grid-connected vehicles. The second reviewer felt that the project is relevant and that the project supports the DOE and VTP missions directly to reduce the nation's dependence on petroleum but enhancing the infrastructure for vehicle electrification. The reviewer felt with a modest budget (for multiple DOE lab collaborators), the project addresses a specific aspect of codes and standards related to PHEV-grid interaction that is necessary for EDV infrastructure, and SAE J2907 Motor ratings. The reviewer noted that at present there are not straight forward standard for HE and BEP systems. This reviewer remarked that this would be a nice contribution. A third reviewer commented that grid electric energy for transportation can displace significant petroleum fuel energy and that this work enables grid connected vehicles along with vehicle electrification components. The final reviewer said the establishment of timely codes and standards, including harmonization regionally and globally, are of critical importance to the successful implementation of plug-in electric vehicles. The reviewer remarked that codes and standards are essential to universal PEV connectivity and to maximize synergies with development of the unfolding smart grid.

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

The first reviewer commented that the project is providing support and leadership in standards development efforts and on applicable committees. The reviewer felt that given ANL and DOE are not in a position to impose standards, standards are more effective with full industry input and buy-in; it is hard to see how the approach could be made more broadly effective. The reviewer stated that the project is addressing codes and standards requirements to enable wide-spread adoption of electric-drive transportation with Smart Grid Interoperability. Developing and promoting standards are among the most cost-effective and highly leveraged investments DOE can make in advancing the commercialization of advanced vehicles. The reviewer noted that the project is pursuing worldwide harmonization of standards. A second reviewer felt that the approach to the work that includes the Institute of Electrical and Electronics Engineers (IEEE), National Fire Protection Association (, NFPA) and NIST is commendable. However, the reviewer wondered how much the National Institute of Standards and Technology (NIST) is actually participating? It appeared to the reviewer that that the NFPA collaboration is very active. The reviewer also remarked that the technical approach that uses four focus modes is good, (i.e., end use measurement device [EUMD]//energy management system [EMS]/home area network [HAN]/human machine

interface [/HMI]).). The third reviewer felt that it is somewhat difficult to assess the approach as this task covers a lot of ground over diverse areas including technical support for codes and standards, technology concept development, lab and verification experiments, benchmarking, and liaison and facilitative support across broad stakeholder groups. This reviewer felt that it may be beneficial to explore an alternative management approach, including delegation components, to lighten the load on the PI.

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

The first reviewer felt that there has been good progress. The reviewer heard some frustration with the "herding cats" nature of getting industry to agree on standards. The reviewer pointed out that some people on standards committees are much more motivated than others. The second reviewer commented that the defined accomplishments are sound here in this project, but in general, the work here in standardization and “harmonization” still has an enormous way to go. The reviewer noted that this project contributes a baby step, but there seem to be many baby steps ahead. The reviewer agreed that it has to start somewhere, and nice to see EU, China and Japan awareness and communication, but for example, Japan includes SAE J1772 AC charge system as standard, direct current faster charger for batteries (CHAdeMO) DC is still unique. However, the reviewer believed that it still seems there is a mountain of work ahead to standardize, with numerous political pulls that may be the biggest barriers. A third reviewer stated that the task has demonstrated significant technical progress on multiple fronts in support of codes and standards development, technology concept development, testing / benchmarking, harmonization, and overall coordination. The fourth reviewer felt that the project has a very significant bang for the buck.

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

The first reviewer mentioned that ANL is collaborating with an extensive and relevant set of stakeholders including SAE, IEEE, NFPA, Underwriters Laboratory (UL), National Electrical Code (NEC),UL, NEC, NIST, Utilities (DTE Energy, Southern California Edison, Communications technology vendors), EVSE suppliers (Clipper Creek, Coulomb, SPX, Leviton, ECOtality, General Electric, Schneider), Vehicle OEMs (Ford, General Motors, Chrysler, BMW, Fisker), and National Labs (INL, PNNL, ORNL). The second reviewer stated that most areas of the task appear to incorporate significant collaboration with other government and industry organizations. However, the reviewer pointed out the very broad and aggressive nature of the task along with the rapid evolution of the technology domain, dictates the need for a continual effort to reevaluate and assess the need for new/additional collaborative partners as efforts proceed. The reviewer felt that this is especially true on the technology vendor front. The final reviewer wondered how OEM collaborators were chosen as they seem to serve as “peer” reviewers.

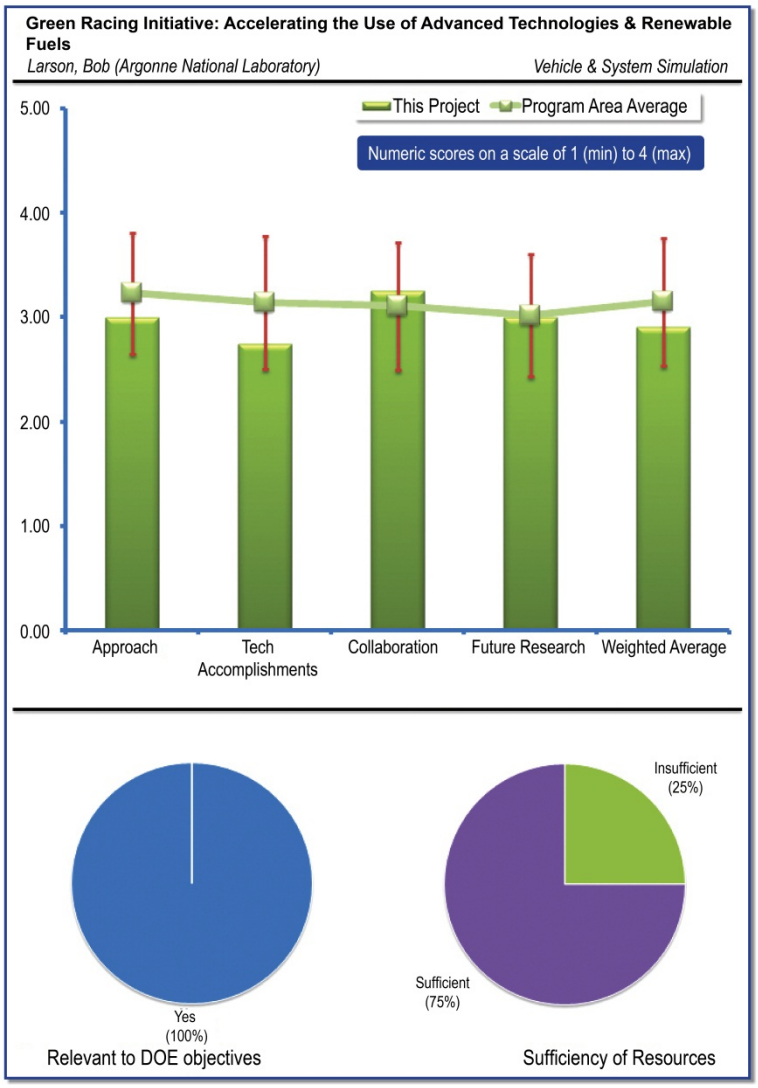
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer mentioned that the budget is $300K, modest but appropriate to provide standards data for this very defined scope of work. $400K is appropriate to achieve the FY 2011 goals. Another reviewer noted that benchmarking hardware to support codes and standards validation is planned for next year. A third reviewer said that the proposed future research is sound and in line with on-going activities. One reviewer was confused by the milestones slide as it implied the project is in year 3 of 3 and is nearing completion, yet the timeline on the second slide is silent on when the project will end (or be renewed), and then there was a slide listing several activities for next year.

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

One reviewer felt that this is a very important and broad task with timeliness considerations. The reviewer commented that strong consideration should be given to expanding funding resources to enable the addition of at least one more technical human resource. Another reviewer wondered if there are technical (as opposed to administrative) reasons why these standards are managed and reported separately from those under VSS052.

Green Racing Initiative: Accelerating the Use of Advanced Technologies & Renewable Fuels: Larsen, Bob (Argonne National Laboratory) – vss054



Reviewer Sample Size

This project had a total of four reviewers.

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

Reviewers commented that the project supports DOE's objectives. One reviewer remarked that this project is definitely supportive of DOE objectives. The reviewer pointed out that provided that the rules are structured to encourage it (which is generally true in this case), racing drives rapid innovation, serves as a showcase, and builds acceptance of advanced technologies. A second reviewer felt that project 054 is a unique complement to the VSS portfolio to support the DOE and DOE VTP missions in reducing our nation's dependency on petroleum. The project provides an outreach and education/training component for the nation, through an exciting and engaging venue, to increase awareness of alternative vehicle technologies. A third reviewer noted that besides the direct displacement of petroleum energy and component development in motor sports, the outreach effect from this project can have a much larger impact. The fourth reviewer stated that barriers facing widespread adoption of advanced vehicle technologies and fuels are not only technical in nature but often more so surround the issues of awareness and perception. The reviewer felt that broadly increasing general consumer understanding and acceptance of advanced vehicles and fuels can go a very long way with regards to achieving petroleum displacement.

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

Reviewers offered a very mixed evaluation of the project's approach. One reviewer said they were actually excited listening to the presentation of this project. This reviewer also felt that the presentation had a good intro, citing Secretary Chu's acknowledgement that racing pushes development much faster than development of production vehicles. The reviewer noted that the project is highly visible, especially to knowledgeable, enthusiastic, and often early-adopting consumers. This reviewer also pointed out that it encourages a historically resource-intensive sector to think about being "greener." Sponsoring racing leverages DOE investment very highly and the majority of actual investments are made by the racing teams and their sponsors. The reviewer remarked that the project cannot set, but can influence racing rules set by sanctioning organizations. Another reviewer said that Green Racing is an innovative way to greatly increase consumer awareness, understanding, and acceptance of advanced vehicle technologies and fuels. The reviewer felt that the racing industry offers the ideal venue to expose large numbers of people to the benefits of these technologies and dispel attitudes with regards to reliability, suboptimal performance, and costs, while providing a test bed if you will for automakers to performance test the technologies. The reviewer pointed out that through Green Racing a naturally vehicle-oriented audience can be

reached and dramatically leveraged. Additionally, since some alternative fuels are considerably cheaper than racing fuels, costs can be lowered opening the industry up to new entrants while saving further petroleum.

The first reviewer remarked that the slides comparing race car petroleum consumption on a track to passenger car petroleum consumption on the FTP were kind of pointless and could be misleading. The same reviewer also pointed out that the project needed to be careful of risk that the "bleeding edge" nature of racing innovation and the far more severe duty cycle than for highway vehicles could lead to failures of the green technologies that could inadvertently hamper their adoption. A second reviewer felt that this project is an important DOE VTP investment; however the initial investment of almost $500K for FY 2010 and $800K for FY 2011 may be managed more effectively. The reviewer stated that the approach to the work at present, and as presented, appears very POOR. While the reviewer acknowledged that it may simply have been the presentation as delivered to the reviewers, after multiple questions to the reviewer, it still was completely UNCLEAR, as to what DOE VTP VSS is actually supporting scope-wise in the Green Racing project. The reviewer stated that this needs to be defined for a comprehensive review. A third reviewer stated that it was not clear as presented orally or in PowerPoint form, which aspects of the Green Racing circuit DOE is actually funding. The reviewer felt it would it be better suited to find a stronger management team for this project. As presented, the ANL management team does appear to be managing the funds correctly or to their full potential. A fourth reviewer said that the project team at ANL stated the work is addressing barriers in technology risk and aversion, data collection and “constant technology development” but no data collection or risk aversion was presented. The reviewer stated that “Constant technology development” means nothing to them and that they need data. The reviewer felt that this presentation was VERY disappointing. Green Racing is an excellent topic that merges very well to VTP and VSS interests and would normally provide an exciting opportunity to unique engage the VSS players and stakeholders in community outreach and engagement through technology development, EV issues, and even standards, but this engagement was not presented. The reviewer felt that perhaps some of the information was not delivered as presented. The reviewer mentioned that the project slides state “enhance DOE image”. This reviewer highly recommended that DOE headquarters change the project manager if they wish to enhance, let alone maintain, the DOE image on this project. The project as presented does not enhance DOE’s reputation on the work. The reviewer stated that the project is not delivered with any oversight, management, accomplishments or goals and that this is a disappointment to the community. The reviewer felt without a management change, to one that understands spending tax payer money appropriately, with defined, specific goals, and demonstrating accomplishments, the reviewer would not support further budget on this scope of work.

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

Reviewers offered a range of opinions about the project’s technical accomplishments. One reviewer said there is good penetration and visibility of a variety of advanced powertrain and fuel technologies, including race wins by those cars. The reviewer also commented that the green racing simulator appears very effective at educating and engaging the general public. A second reviewer stated that solid progress has been made in advancing the use of biofuels (especially ethanol and biobutanol) into the American Le Mans Series, as well as the beginnings of introductions of HEV racing technologies. The reviewer noted that progress has also been made in advancing Green Racing to Circle Tracks which have enormous outreach potential, and developing a well-received Green Racing simulator. The third reviewer stated that the list of “Technical Accomplishments” under this budget do not make sense. The reviewer pointed out that as listed, DOE claims to have (1) Reduced American LeMans Series (ALMS) petroleum use by 42% at PLM with better competition; (2) Incentivized switch to E85 by all major OEMs in ALMS GT category; (3) Introduced Porsche 911 GT3 R Hybrid in DC; (4) raced at Road Atlanta; (5) Awarded second season-long ALMS Green Racing Championship Awards; (6) Green Racing Champions receive invitations to 24 Hours of Le Mans; (7) Deployed HEV E85 racing simulator at multiple ALMS events; (8) Circle Track Project GREEN car tested using E85, fuel injection, with catalysts; (9) Project GREEN car raced at national event and was competitive; (10) Revamped, improved web presence with expanded media outreach. This third reviewer asked how on earth the DOE budget was actually spent, specifically to ‘”accomplish” such grandiose goals? The reviewer also asked, what website? The reviewer stated that the technical “Progress” on advancing biofuels, as presented, seemed to take credit for the entire Green racing circuit. The reviewer remarked that this is not an appropriate presentation for DOE funding resources. The third reviewer also asked did DOE funds go to develop the Argonne National Laboratory (ANL) “simulator”, as the reviewer still does not know. However, the third reviewer did comment that there were VERY cool pictures of cars.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

A reviewer said there was a huge list of highly relevant collaborations. The reviewer also stated that supporting racing engages a large community of "collaborators" in ways that few other projects can. A second reviewer said that significant and ostensibly appropriate collaboration exists across the racing, automotive, and engineering communities. The reviewer felt that the sky is really the limit here, and as such continued strong efforts should be made to forge further collaborative activities and expand outreach and awareness. This reviewer remarked that it is important to continue and expand strong collaborative efforts with the media (TV, radio, and print) as force multipliers. The reviewer continued to point out that the entire concept of Green Racing has the potential to help "pull" into the market broad acceptance of advanced vehicle technologies and fuels. A third reviewer stated that the collaborations are expansive and felt that it may be better served to have DOE headquarters or another lab collaborator manage this project, if DOE VSS is to continue the investment.

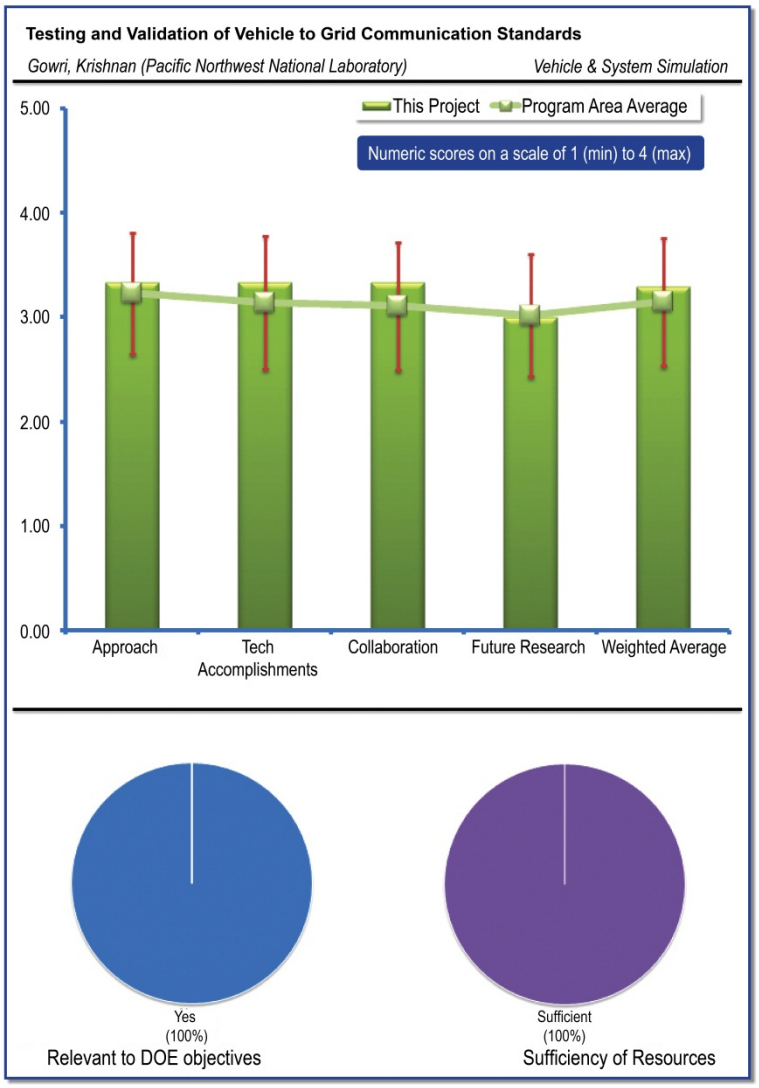
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

The first reviewer felt that the proposed future research was great. The reviewer stated that more of the same successful approach, plus increasing electrification, hybridization, use of biofuels, and possibly energy budgets (e.g., limiting fuel flow and/or quantity). The first reviewer remarked that they would have liked to hear more about the simulator. The second reviewer said the proposed future research is solid targeting further expansion of biofuels into Green Racing, development of new HEP ALMS prototypes in 2012 and beyond, and expansion of renewable fuels to Circle Track racing. This reviewer felt it is important to look hard to the media to maximize positive press coverage and dramatically expand exposure. As stated above, the third reviewer stated that the project slides state “enhance DOE image”. The third reviewer highly recommended that DOE headquarters change the project manager if they wish to enhance, let alone maintain, the DOE image on this project. This reviewer felt that the project as presented does not enhance DOE’s reputation on the work. The reviewer said that the project is not delivered with any oversight, management, accomplishments or goals and that it is a disappointment to the community. Without a management change, to one that understands spending tax payer money appropriately with defined, specific goals, and demonstrated accomplishments, the reviewer would not support further budget on this scope of work.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

One reviewer said that the project had great accomplishments and leveraging of the available resources. A second reviewer remarked that they could not evaluate because no clear milestones were demonstrated in the presentation either verbally or in PowerPoint form. A third reviewer felt that the resources are sufficient and appropriate for this task.

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



Reviewer Sample Size

This project had a total of three reviewers.

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

The first reviewer commented that this project directly supports the DOE objectives of petroleum displacement by advancing management of vehicle-to-grid (VtG) communication codes and standards. The reviewer felt that such management and optimization will enhance productiveness of the anticipated 1 million EDV on the road in the U.S. by 2015. A second reviewer said that as PHEV's become more accepted, a significant number of charging stations will be required, and a heavy demand will be placed on the grid. The reviewer felt that it is clear that an effective, and hopefully common communication methodology should be established to assist in billing for power, determining how much energy the vehicle requires, and providing information that could help the utility "level out" power requirements by managing the charging time and charging rate of vehicles. The second reviewer also commented that improving vehicle to grid communications makes the entire process more efficient, which will facilitate growth of PHEV sales, and reduce petroleum usage on a national level. The reviewer went on to say that this project is intended to develop prototype communication modules to determine what is possible and practical, and then to propose communication standards and validation procedures for these communications. The third reviewer felt that plug in hybrids and electric vehicles offer a strong potential to displace petroleum. However, to realize this potential, the charging infrastructure must be established. They feel that this work represents a key part of developing the charging infrastructure.

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

The first reviewer commented that the objectives of the work include development of testing and validation procedures for vehicle to grid communication (VGC) standards and technologies based on SAE Documents J2847 and J2931. The reviewer stated that to do this, the project team is building a "VGC Virtual Testbed" and prototype communication modules to establish performance requirements for vehicle and charging station OEM adoption. The reviewer noted that the approach to the bed takes into account an appropriate breadth of communication line options for vehicle to grid (VtG) and vehicle to charger (VTC). The reviewer remarked that the team has chosen communication pathways and architectures that support SAE standard development with the committee input and EPRI requirements documents. The reviewer felt that this is a logical approach to the task. Also, the reviewer remarked that this project leverages work funded by the DOE Office of Electricity Delivery and Energy Reliability (OE). The reviewer complimented that this project is excellent, it would be nice to see more OE-Office of Energy Efficiency and Renewable Energy (EERE) VTP joint projects in VSS. A second reviewer commented that the general approach was to set up a lab test bench procedure to evaluate data

transmission capabilities, using the battery, charger, and EVSE. The second reviewer noted that since currently available EVSE equipment does not include all the capabilities that are likely to be required/desired in the future, a prototype communication module was designed, built and tested. The reviewer pointed out that this was intended to demonstrate the potential communication capabilities that should be included in any future communication standards. The reviewer stated that based on the above test results, recommendations will be made to SAE regarding VGC communications. The third reviewer had a very hard time getting the full big picture view of this program. At the highest level, the reviewer understood the end goal and was in full agreement with it. At the low level the reviewer could see how the testing that was discussed would generate data that would help to achieve the end goal. However, the reviewer could not quite get a clear definition of what specific problem this work would solve or what part of the overall puzzle this work would provide. The third reviewer did note that the level of funding did not seem to be inconsistent with the work being done. However, this reviewer felt the level of funding is clearly not enough to achieve the end goal; this is appropriate, because the project in itself is not supposed to achieve the end goal. But again, the third reviewer could not determine exactly what part of the puzzle this work was supposed to provide.

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

The first reviewer said the project accomplishments leverage a matching project funded at OE and that it is fantastic. The reviewer also noted that technology development under this award included completion of the laboratory test bed, development of two programmable logic controller (PLC) module prototypes/tested and HMI tested with the PLC modules. The second evaluator remarked that given the relatively short duration of this program, good progress has been made. This reviewer stated that communication test and validation procedures have been developed, as well as the test bed for communication devices. The reviewer pointed out that several vehicle to grid (V2G) systems have been evaluated, and a prototype communication module has been developed to evaluate potential future communication capabilities. Throughout the program, SAE has been advised or progress, and a technical paper was co-authored with several members of the SAE committee that deals with communication standards development. Several sets of recommendations and inputs have been provided to SAE regarding communication standards. The third reviewer's understanding was that the net funding was $375K. For the level, the third reviewer felt that funding the results seemed appropriate. Given that the reviewer could not quite get an understanding of what specific end goal this project has, the reviewer cannot really assess progress towards that specific end goal.

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

Reviewers saw excellent collaborations, and also suggested possible future collaboratiors. One reviewer felt that the partners are appropriate and include SAE, Echelon, MAXIM and Hymotion. Considering the OE awards, partners also include Toyota and Coulomb. This reviewer felt it was outstanding to see OE EERE/VTP VSS "joint" effort funding and felt that there should be more of it. The second reviewer said that significant collaboration and communication has occurred with SAE, as related to V2G communications standards development. This reviewer pointed out that other industry organizations include NIST and EPRI. Furthermore, collaborative efforts have extended to two manufacturers of communication technology, Echelon and MAXIM, as well as a battery and charger manufacturer (Hymotion). The second reviewer remarked that although collaborative efforts have been effective, there appear to be several other DOE sponsored programs that at least touch on the subject of vehicle to grid communications. An improvement opportunity is for DOE to identify potential opportunities for collaboration amongst these various programs. DOE is in the best position to identify such opportunities as they have access to information on all such programs. The reviewer felt that this seems like a missed collaboration opportunity. The final reviewer simply stated that the project had a meeting with both SAE and EPRI.

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

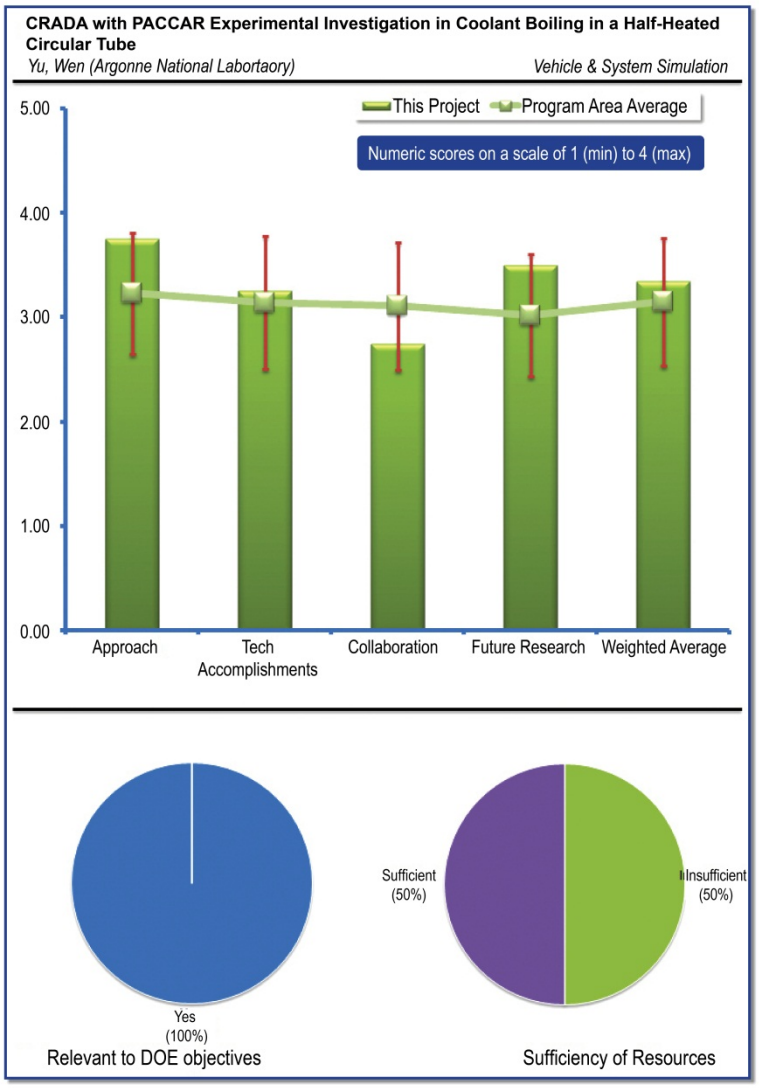
The first reviewer commented that the future work included work with SAE and contributing to J2931 document development. The reviewer pointed out that future experimental development work includes design and development of power line communication module prototypes for control pilot communication (three new modules will be developed based on SAE needs and EPRI

requirements documents). The reviewer said that the team will implement Smart Energy Profile (SEP) 2.0 application layers in the prototypes to test the latency, data rate and error rates. The work joins ANL and PNNL research teams and brings important communication VTG and VTC data to the public. The second reviewer stated that the project will be wrapping up in September 2011 and that the remaining effort will be involved primarily in summarizing work completed to date and continuing to assist SAE committee in development of communication standards. A third reviewer stated that they are essentially repeating previous comments, but thinks the work is good and worthwhile; however, what is really lacking is a clear plan of what the exact end goal of this work is. This reviewer commented that this should be addressed (i.e., some thought should be given to exactly what the end goal is and how that addresses the big picture of providing an integrated grid).

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

The first reviewer said that this project appeared to accomplish much in a short period of time and with limited resources. In that sense, the project team was very efficient in carrying out their tasks to meet key project objectives. The second reviewer thought the resources are appropriate for the work they seem to be doing. Again, this reviewer really had a hard time understanding the big picture plan.

CRADA with PACCAR Experimental Investigation in Coolant Boiling in a Half-Heated Circular Tube: Yu, Wen (Argonne National Laboratory) – vss057



Reviewer Sample Size

This project had a total of four reviewers.

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

The first reviewer stated that the project directly supports the overall DOE objective of petroleum displacement by investigating and quantifying engine coolant boiling heat transfer in heavy-duty trucks for engine system efficiency and overall optimized thermal control management. The reviewer perceived that such work may influence fuel efficiency and petroleum displacement by reducing parasitic energy losses, reducing size, weight, and pumping power of cooling systems, increasing engine thermal efficiency and improve engine temperature gradients for HD trucks. A second reviewer remarked that this project is indirectly supporting the DOE objective of improved fuel economy and the resulting reduction in fuel consumption on a national level. The reviewer acknowledged that the objective of the program is to better understand and quantify heat transfer capabilities of a cylinder head of a diesel engine. The reviewer pointed out that better understanding of heat transfer capabilities at critical points of the engine allows optimization of the cooling system, including, but not limited to: (1) controlling (hopefully reducing) radiator size; (2) reducing coolant flow rate and also parasitic losses from water pump; (3) limiting hp loss due to cooling fan; and (4) improving power density of engine (allow engine to run at higher hp without concerns over cooling capabilities. Furthermore, the reviewer stated that each of these items will directionally improve efficiency and thereby reduce fuel consumption. A third reviewer noted the project is intended to assist engine analysis/design tools, which will ultimately lead to more efficient engines and cooling systems. The final reviewer was unable to attend the session Monday evening, but based only on reviewing the slides they stated that boiling heat transfer limits efficiency of a wide range of energy consuming devices (computers that use liquid cooling, air conditioning, refrigeration, industrial heat transfer devices and automotive intercoolers and radiators). The reviewer felt that the specific work here on heavy truck engines brings much needed knowledge that is applicable to other fields.

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

One reviewer stated that the project takes both an experiment and theoretical approach to the work. The reviewer also pointed out that the work includes experimentally determination of boiling heat transfer rates and limits in the head region of heavy duty truck engines; and mathematical models for boiling heat transfer coefficient and development of engine computer codes for heavy duty trucks. A second reviewer acknowledged that a test fixture was developed to simulate the critical heat transfer point of a cylinder head. The heat transfer coefficient was experimentally determined, using a matrix of coolant temperatures, simulated cylinder head temperatures, and coolant flow rates. The reviewer pointed out that with this information, an effective heat transfer coefficient can be calculated over a

broad range of conditions. This heat transfer coefficient will become an input parameter for a complex CFD model that will be used to ultimately optimize cooling capabilities through geometry, flow, and coolant temperature parameter changes. The first reviewer also had a question concerning the technical approach as whether the results are "transportable" to other critical geometric points of the engine, or if it is very specific only to the cylinder head section that was the model for this experimental set up. The reviewer pointed out that this potential lack of flexibility would limit the broader use of these experimental data to evaluate other portions of the engine. A second reviewer said this was one of the better cases where the presenter could clearly explain how his piece fit into the big picture. The reviewer stated that ultimately the "impact" slides that are shown are always at a very high level, while the research programs are often fairly small. The reviewer pointed out that here the researcher could clearly explain where the work fit and how it helped to achieve the big picture. The reviewer pointed out that they are always trying to get this information, but have very mixed success. The final reviewer was unable to attend the session, but based only on reviewing the slides the reviewer stated the project is a well-organized study, with solid experimental design and construction of equipment that appear well-adapted to measure regime of engine operations. Furthermore this reviewer pointed out that the materials, material surface preparation and material surface characterization weren't noted other than "cast iron material". The reviewer understands this may be proprietary information of PACCAR but inclusion of this information will improve the quality of the work. Also, the reviewer noted that understanding influence of manufacturing variation and of processes to modify surface characteristics may be important to ensure that results measured in the laboratory hold up in on vehicle performance evaluation.

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

The first reviewer stated that the experimental development and design is creative and built on a modest budget. The reviewer pointed out that the facility is a new addition to the ANL APRF. The reviewer remarked that Labview is used to implement and track facility data, and remarked that technical accomplishments are impressive, fast and performed on a very modest budget. A second reviewer commented that the efforts to date have focused on planning the test, designing the bench test set up, and procuring and assembling components for the test bench. The test fixture is nearly ready for checkout and initial data collection. The reviewer noted that no data have yet been collected. The reviewer remarked that the results of effort to date are acceptable, although it appears to have taken a longer than expected time to generate the test plan and design and build the test set up. A significant portion of the effort to date appears to have been devoted to selecting appropriate instrumentation for measurement of test parameters. A third reviewer stated that the laboratory work seems to be well developed and an appropriate test rig has been built. The final reviewer was unable to attend the session, but based only on reviewing the slides, this reviewer stated that it is early in the project but advancing nicely.

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

The first reviewer commented that there is an increase in project collaboration to extend the range of the work and PACCAR is the primary collaborator through a Cooperative Research and Development Agreement (CRADA). The reviewer remarked this is a nice opportunity for university outreach, graduate work and/or thesis. A second reviewer stated that collaboration has primarily occurred with PACCAR, the CRADA partner. This reviewer pointed out that given the length of time devoted to "designing the test plan," as well as designing and building the test bench, one wonders if there was expertise elsewhere within Argonne or at one of the other National Labs that might have facilitated this effort and accelerated the process. The third reviewer simply stated that the project is working with an OEM. The final reviewer was unable to attend the session Monday evening, but based only on reviewing the slides they felt the division of experimental work at ANL and computational work at PACCAR is logical. The final reviewer pointed out that the final phase of interpretation and evaluation is unclear as to how the heat transfer code will be cross checked compared to experimental results. However, the reviewer noted that the project has not advanced to that phase.

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

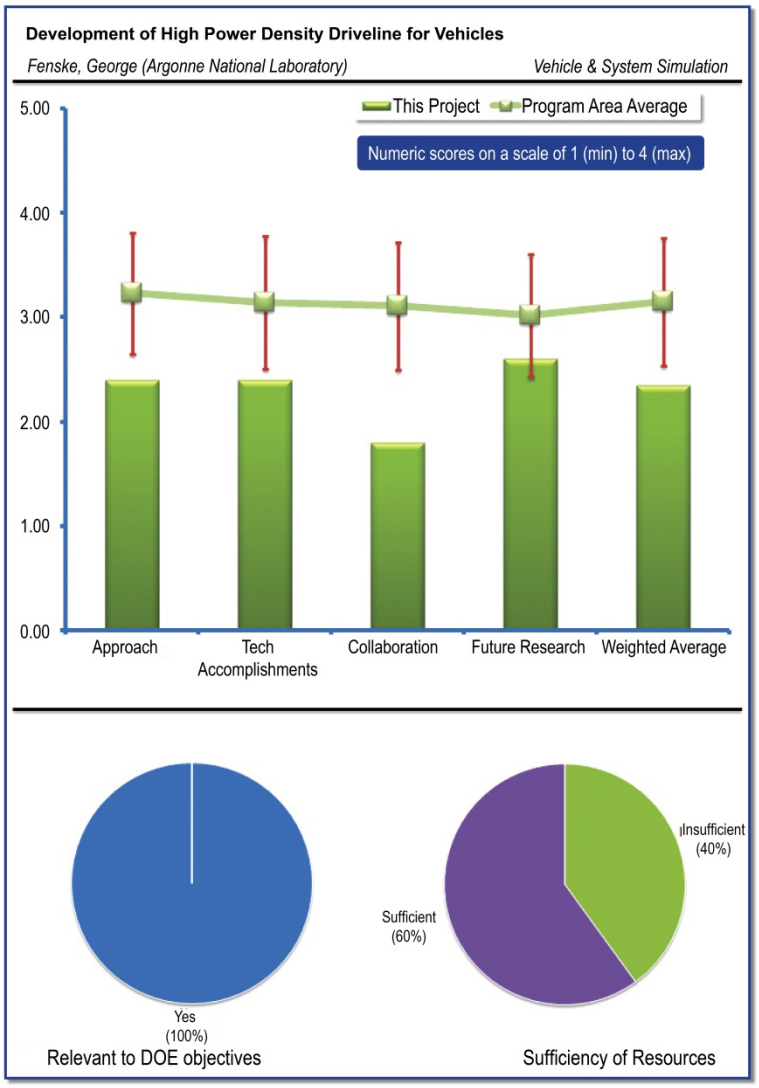
The first reviewer remarked that the project is well-positioned for its future work now the testing prototype is built. Future work includes experimental facility verification, detailed boiling heat transfer tests and experimental data comparison, interpretation, and correlation. Furthermore, the reviewer pointed out that theoretical work includes computer code optimization and validation. The

first reviewer felt that the approach to future work is logical and results will be telling. The second reviewer stated that future work will be focused on (1) checkout of the experimental test set up; (2) data collection; and (3) use of results to modify/refine heat transfer model. The reviewer noted that an opportunity for improvement in the presentation would have been a visual that showed the complete matrix of testing to be completed. Such a matrix would have shown all parameters to be varied and the range of variation. The reviewer pointed out that it is perhaps somewhat surprising that the future work noted will take approximately two years to complete; it is not clear from the presentation what percentage of the time will be devoted to testing versus using the results to complete the heat transfer modeling analysis. A third reviewer stated that the remaining work seems appropriate with funding level and general vision of what this work is to accomplish. The final reviewer was unable to attend the session, but based only on reviewing the slides they noted that the future research addressed existing materials and surface finishes and appears to assume that all future improvements will come from design changes to the coolant boilers (radiators, intercoolers, etc.) or perhaps change of water/ethylene glycol ratio. This reviewer said that it appears that the study could be easily extended to investigation of surface roughness, coatings and similar technologies to enhance heat transfer coefficient of the cast iron surface.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

One reviewer was unable to attend the session Monday evening, but based only on reviewing the slides they remarked that funding appears minimal for the study to advance quickly. Elaborating, the reviewer stated that the funding looks like enough to cover equipment and perhaps 1/4 to 1/2 of a lab technician and engineer. The reviewer felt that with additional funding it appears the project could advance 2 to 4 times faster. A second reviewer said that the project should extend the scope of project; with a further detailed scope of work, and extended collaborators, DOE may consider increased funding. Another reviewer felt that with four individuals contributing to this program, there appears to be sufficient resources to carry out the project plan. The reviewer said that the time to complete all activity seems relatively extended, given the resource availability. The final reviewer stated again that this seems to be a well-designed project that is on track.

Development of High Power Density Driveline for Vehicles: Fenske, George (Argonne National Laboratory) – vs058



Reviewer Sample Size

This project had a total of five reviewers.

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

Reviewers found that the project supports DOE objectives. The first reviewer believed that this project directly supports the overall DOE objective of petroleum displacement. The reviewer pointed out that various projects have shown that 2% to 5% fuel savings may be accomplished by a 10% reduction of vehicle weight (in all classes of vehicles/impact variable per vehicle). The reviewer pointed out that this project investigates weight of the vehicle driveline that is approximately 20% of total vehicle weight. The reviewer pointed out that of course, safety, durability and reliability must be maintained. The second reviewer noted that weight reduction and subsequent reduction in fuel consumption does support DOE objectives. Furthermore, the reviewer commented that in the commercial arena the reduction in weight yields opportunities for increased payloads and subsequent reduction in vehicles on highway which has additional benefits. The third reviewer felt that the project is relevant if the stated goal (increase power density of transmission components) could be achieved; lighter weight subsystems could be produced, leading to lighter weight vehicles and reduced fuel consumption. A third reviewer stated that the project directly addresses parasitic frication losses and weight reduction. The reviewer elaborated that lightweighting in structural, frame and body, attacking the heavy drivetrain weight is needed but durability risks are higher. The reviewer pointed out that there is a clear need for this work as transmission, axles etc. are a large portion of vehicle weight. This reviewer noted that "Power density = higher load through smaller surfaces". The reviewer also questioned, Is not a lighter powertrain also higher performance? (inertial responsiveness, etc. more to performance than just friction). A fourth reviewer remarked that smaller components should need less energy to turn where stopping and starting are involved because of rotational inertia. Also, vehicle weight savings-saves fuel.

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

The first reviewer stated that the project proposes to reduce driveline size by increasing the power density of the systems, and takes a look at various components (and various aspects of these components). Furthermore, the reviewer stated that the project proposes to use high power density gearing and bearings to reduce the size of the planetary gear system, and thus begin to study materials and engineering aspects of such components (wear, scuffing, and contact fatigue (pitting)). The reviewer noted that the team considers the effect of integrated materials, surface and lubricant technologies that may impact results. The first reviewer pointed out that collaboration with OEM partners, ANL proposed to develop and evaluate prototype HPD gearbox for transportation vehicles. The first reviewer remarked that while it is nice to see the topic, and the "concept" of the approach is excellent, the approach to the work is very broad with SO MANY engineering variables, let alone the materials variables, that the approach seems somewhat disparate, as

presented. In some sense, the approach is too broad. The approach to the task does not appear as systematic as it could, in both materials and engineering aspects of the work. The second reviewer felt that the approach to explore and evaluate integrated materials, surface and lubricant technologies and create models to determine kinematics is a logical plan. Unfortunately, the reviewer pointed out that this approach is only focused on an automatic transmission, and does not consider other non-planetary gear sets. The third reviewer stated that collectively there seems to have been three projects leveraging the tribological knowledge/expertise of Argonne researchers. The reviewer noted that as a whole the the projects represent a fairly modest budget and as a whole, the work seems to have been very good and very worthwhile. However, the reviewer points out that this particular project does not seem to be well conceived. Researchers/lab seem to be suited towards conducting basic research and there is a need for basic research. However, the reviewer again points out that this program seems to try to look at more applied research and seems to be struggling. A fourth reviewer stated that there was a good approach to an area that has been quiet: planetary gears and bearings with focus severity of contact for scuffing and fatigue. The reviewer pointed out the integrated materials, surface and lubricants approach. The reviewer commented on the approach of (1) modeling of size and weight vs. contact forces, (2) State of art search for technologies capable of meeting requirements, (3) Develop new if needed and integrate with others, (4) Then prototype with OEM and eventually hand off. The fourth reviewer also noted that cost and economics will play heavily in the eventual commercial adoption. This should be better addressed in the approach. The final reviewer stated that the material and lubricant paths are viable ones, but the path to gear tooth redesign could be explored more.

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

The first reviewer noted that most of the work accomplished includes gear box modeling and planetary size reduction assessment. This reviewer said that with the gear geometry and parameters unchanged, results show planetary gearbox size reduction will result in substantial increases in contact and bending stresses and reduction in lubricant entrainment velocity. The reviewer acknowledged that the new severe contact conditions in gears and bearings as and result of size reduction will have significant effect on gearbox reliability and durability. The second reviewer felt that the lack of participation from an OEM/Tier 1 supplier and limited access to proprietary software from the OEMs appears to have had an impact on accomplishments. The third reviewer felt that most of the work is to be done since the project has only been underway a few months, as was mentioned. The reviewer pointed out that the calculations and results of the increased stress in the gears are valuable. A fourth reviewer pointed out that this is a new project just organizing and that there are nice analyses to understand the problem. The reviewer felt that the project is off to a solid start, but more work may be needed to identify technologies used in other industries that could be applied here. The reviewer also noted that clarification of needs between bending fatigues, contact stress and boundary layer sliding speed is a good approach to begin an optimization. Optimization with known technologies using improved modeling techniques may allow project to meet goals. However, the reviewer said that identification of new technologies is likely necessary. Technologies to improve contact fatigues (coatings) are available (racing, aerospace) but may be too expensive. The reviewer asked if there should be an economic/business case component to the project to help understand markets that may best use the results. The reviewer recommended that some sort of cost/benefit analysis be added. This reviewer suspected that this is an area that can afford to spend much more on coatings than current OEMs accept. The fifth reviewer stated again that the basic project does not seem well designed. This reviewer pointed out that comments from last year suggest more OEM involvement was needed and that this does not yet seem to have happened, so it seems that researchers spent a lot of time in areas slightly outside of their expertise (trying to "fill in" for OEM). The reviewer stated that researchers have been trying to understand tradeoffs gear designers make in balancing gear life based on various failure criteria—bending strength, contact strength, wearing, scuffing.

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

Reviewers suggested additional collaboration. The first reviewer said that the partner is General Motors. Concur it would be nice to collaborate with DOE Wind TP. The team needs to invite more partners. The second reviewer stated that there is no OEM at this time, only General Motors was approached with no response. The reviewer was surprised that Allison transmission was not involved as they are solely a manufacturer of planetary gear set transmissions. The third reviewer pointed out that reviewer comments from last year stressed the need for collaboration. The reviewer noted that collaboration with General Motors is mentioned, but the reviewer did not believe much has occurred to date. This reviewer's comment for this year is to repeat comments from last year: collaboration is needed. The reviewer is concerned that researchers will not be able to establish this collaboration given their current path. The

reviewer stated that it would seem that the researchers want OEMs to fully outline their methods for balancing gear life, based on all criteria, in a public forum. The reviewer is not sure anyone will sign up for this. A fourth reviewer stated that the project is just starting and there are no firm partners yet. The reviewer felt that the project will accelerate with the right OEM partner and that it is a key risk for the project. The reviewer said that bringing in aerospace partner is good approach and that more work is needed in this area. The reviewer stated that a racing engine partner, oil and gas, biomedical, coating partner or a fluid power partner may bring new ideas from industries that now may much more for their surfaces than automotive applications. The final reviewer noted that as was mentioned by the presenter, a committed partner to provide a target gearbox would be helpful. It would help to have more concrete collaborations from other gearbox makers (such as for the mentioned helicopter) that need to minimize weight.

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

The first reviewer said that the project will look at the effect of load, speed and lubrication on performance on the gearbox and develop and integrate materials, surface and lubricant technologies to meet and perhaps exceed tribological performance targets for smaller and lighter HPD gearbox for transportation vehicles. In theory, this project's future work is great, but it is not clear yet how the work will be accomplished and seriously optimized. The reviewer felt that the project seems to need further refinement on approach so results do not digress. The reviewer quoted the presentation: "Technology transfer and adoption the ultimate end result"; the reviewer stated that this project seems a long way off with limited budget to accomplish tech transfer. Another reviewer remarked that there is still a lot more modeling and development to be done before this project can demonstrate a commercializable opportunity. The third reviewer said that IF an OEM comes on board with a specific program then all will be well, but this reviewer was very concerned that this will not happen. Instead the reviewer thought that maybe something more basic (general questions to OEMs about improvements that could increase power density, freeing researchers to perform more basic research) would help; alternatively other government labs may be able to help (perhaps NASA Glenn Research Center in Cleveland, OH). The fourth reviewer stated that OEM involvement to help guide and direct is crucial and that applying technology from engine and other areas, and conducting experimental and modeling validation is great. This reviewer was concerned ANL will experience a steep learning curve if OEMs cannot be brought in an effective manner. The final reviewer stated that more material on paths to gear redesign would be helpful.

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

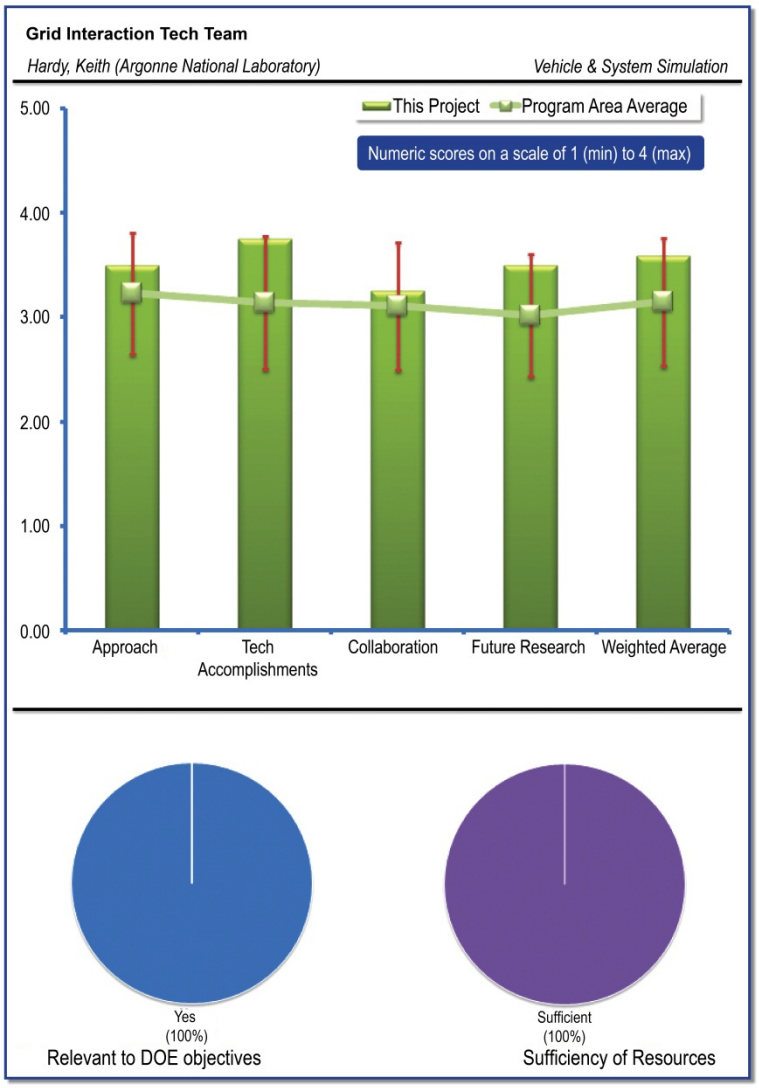
The first reviewer stated "see above". Another reviewer remarked that funding is small on this project and that without the support of a transmission manufacturer this project has limited opportunity for success. A second reviewer stated that the researchers and lab are very good; however, this project seems to have moved out of their core area of expertise. The reviewer felt that some small changes in approach could get things on track. This reviewer felt that they should really not have to give a low score when the research done in the lab is good, needed and the overall budget is quite reasonable. The reviewer requested that the project please try to fill in the gaps that seem to be present. A third reviewer remarked that resources appear sufficient to start investigation but will need to ramp up if OEMs join the effort. The final reviewer agreed with the third reviewer by stating that the resources are sufficient this year. This project would likely need to continue into the following year to achieve its goals.

Grid Interaction Tech Team: Hardy, Keith (Argonne National Laboratory) - vss059

Reviewer Sample Size

This project had a total of four reviewers.

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



Reviewers perceived that this project supports DOE's objectives. One reviewer stated that the project promotes implementation of and overcomes barriers to grid-connected vehicles that can use electricity in place of petroleum for some or all of their driving. A second reviewer felt that this project is relevant and pointed out that it is led by K. Hardy (ANL) and directly supports DOE's overarching mission "to ensure America's security and prosperity" by addressing its energy, environmental, and nuclear challenges through transformational science and technology solutions. The reviewer remarked that the project VSS 059 directly supports the mission of DOE's VTP program to develop more energy efficient and environmentally friendly highway transportation technologies that enable the United States to use less petroleum. The long-term aim is to develop "leap frog" technologies that will provide the United States with greater freedom of mobility and energy security, with lower costs and lower impacts on the environment. The reviewer noted that this project addresses a critical aspect of electrification transportation infrastructure (grid interaction) and its development, and addresses key challenges to make Electrification Transportation and EDV systems a standard in the U.S. and abroad. The reviewer felt that a fully loaded EDV and grid interaction system for the United States could provide energy efficient and environmentally friendly solutions that could greatly reduce the nation's dependence on petroleum. A third reviewer felt that grid electric energy can displace significant petroleum fuel energy and that this work enables grid energy to be effectively used for transportation. The fourth reviewer stated that the advances in the vehicle/grid interfaces including interoperability, communications, harmonization of connectivity standards, and cost reduction of technology is critical to the successful implementation of plug-in electric vehicles on a mass scale. The reviewer noted that this is a new and rapidly evolving area involving many stakeholders including automotive OEMs, EVSE manufacturers, utilities, and HAN suppliers, as well as potentially renewable energy providers. The reviewer noted that failure to adequately address vehicle/grid interface challenges in a timely manner has the potential to significantly impede or even prevent the successful implementation of PEVs in the relatively near term. The reviewer stated that successfully addressing these issues and staying ahead of the technology curve can accelerate implementation of PEVs in the consumer market as well as facilitate earlier and wider implementation of renewable energy sources in support of PEVs.

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

One reviewer said that there was an appropriate focus on development of standards and enabling technologies. The second reviewer said that the project has produced significant results and reached numerous performance goals since its inception of funding (~ $900K in FY 2010), including creating a national permitting standards template for EVs that was transitioned to Clean Cities. The reviewer felt that the approach is widespread and comprehensive and includes appropriate stakeholders to achieve results. A third reviewer stated that this area is difficult to work in effectively, but the team has done a very good job. The final reviewer commented that the approach is sound, tapping input and recommendations from a broad range of stakeholders, although it is not readily apparent how specific tasks are chosen. The reviewer assumed that it is a consensus process among grid integration tech team (GITT) members. It appears the immediate GITT team and project consensus process does not include industrial communications/networking/software firms. The reviewer commented that maybe it can be inferred they are implicitly included via the utility and automotive OEM representatives on GITT. If not, the reviewer points out that it may be an avenue for consideration.

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

The first reviewer remarked that the National EVSE Installation Permit Template will make it easier for consumers, fleets, and cities to deploy plug-in vehicles. The reviewer stated that the standards validation and work on communication between EVSE, EVs, home and metro area networks, and grid are key enablers. This reviewer said that prototyping of the low-cost End User Measurement Device (EUMD) that can replace the need for a second smart electric meter for a home vehicle-charging circuit is a very useful accomplishment. Another reviewer said that working with OEM partners, and key supplier partners, the project team has future work planned and is appropriate and on-schedule, and uses the budget appropriated adequately and efficiently. The reviewer noted that hardware and software development (test capability to evaluate SAE J2847 messages) across the vehicle-grid connection between the vehicle, EVSE, home gateway and utility, and representative human-machine interface (HMI) to facilitate the evaluation. This reviewer noted that second generation will transition to third generation at the end of FY2011 with the necessary field integration in FY2012. This reviewer said that OEM and utilities collaborators are appropriately engaged. International partners are appropriately engaged. UMAN and Compact Metrology projects are logical, approach is sound, and on schedule. The final reviewer stated that the technical accomplishments are basically in several areas, including enabling technology development, support for codes and standards, and facilitation of international harmonization. The reviewer said that significant hardware and software progress has been achieved for metrology and communication technologies. The reviewer said the project focuses on key enabling technologies to support the vehicle/grid interface system and may serve as a forcing function to accelerate advances in the commercial sector. Overall, the technical progress is good to impressive given the start date in 2009 and resources devoted to this task.

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

Reviewers provided suggestions about possible future collaborators. One reviewer noted that collaboration includes electric utilities, PNNL, NREL, NIST, EU (through NIST), and China. The reviewer also pointed out that collaboration includes U.S. Big 3 automakers, but apparently not any other automakers with a U.S. presence. The reviewer stated that it seems like it would be stronger if coordination/collaboration efforts included those as well. A second reviewer noted that all of the standards organizations are difficult to coordinate, but the team has done very well so far. While a third reviewer said that the overall collaboration is good across utilities, automotive OEMs, and the government including National Labs. As alluded to earlier, the reviewer went on to state that it may be beneficial to expand direct cooperation and involvement with commercial communication, software, networking firms. The final reviewer responded with four questions: (1) Why is Nissan not an OEM partner on this project, given the extent of Nissan on the ECOtality American Recovery and Reinvestment Act (ARRA) award and its importance as a stakeholder in this field of integration and standards? (2) Why/how is NREL collaboration on this project, to share its work in renewable integration? (3) How does GITT now fit into U.S. Drive, and is this seamless with the new initiative? The reviewer assumes, but will/should Tesla now be engaged in this project as a collaborator/stakeholder? (4) How well is NIST actually involved? Could they assist more?

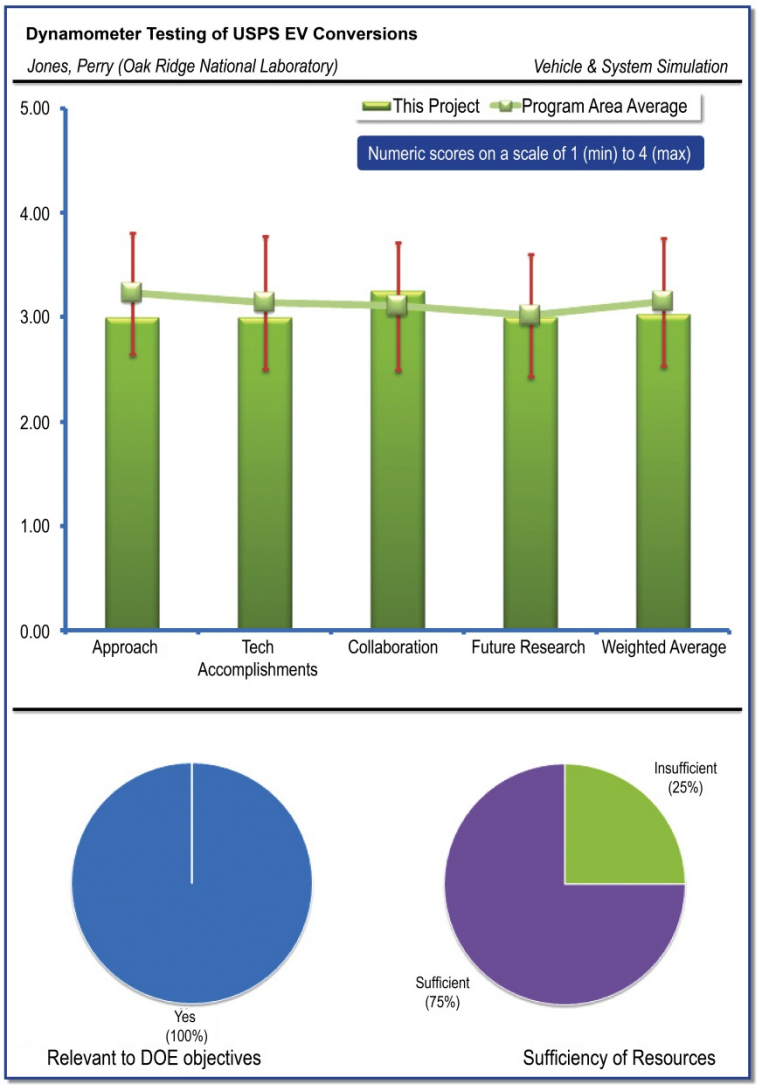
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

The reviewer remarked that development of smart-grid communications architecture is appropriate and will be valuable. The reviewer remarked that (International) standards harmonization is a key enabler for leveraging large-scale private investment in vehicle and support equipment development and deployment. Another reviewer said that joint work with DOE OE is commendable, but must be expanded. Cost targets are a start at collaboration, but this topic should eventually be a strongly supported OE effort with VTP. Interoperability remains an outstanding challenge for this field, and should continue to take a front seat for support, scope and budget. The reviewer also suggested that attention be paid to lowering cost charging infrastructure, plus international collaborators, plus OE wireless fast charging. For interoperability, the reviewer felt that the field and stakeholders need to better communicate data and standards to accelerate standard development. This reviewer questioned, this may not happen fast enough for OEMs? The final reviewer noted that future activities are projected to include development of advanced communication architectures for the Smart Grid, compact metrology development and testing, assessment of cost reduction technology for charging infrastructure, inductive charging, and harmonization of standards. The reviewer remarked that all are important areas and efforts may be needed to systematically prioritize (if have not been already) all these important areas and consider if some elements could be delegated more heavily to the commercial sector.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

One reviewer said that this project should continue to be supported at its maximum requested levels. This project topic is critical to the national energy security environment and reducing the nation's dependency on petroleum. The reviewer said that the team leading the project is skilled and well-versed in leading a project of this scope and breath. The reviewer stated that the budget is reasonable, however if more funds become available, an increase may be suggested. Another reviewer stated that the financial resources appear relatively sufficient but additional human resources may be appropriate given the technical nature and breadth of activities under this task.

Dynamometer Testing of USPS EV Conversions: Jones, Perry (Oak Ridge National Laboratory) – vss060



Reviewer Sample Size

This project had a total of four reviewers.

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

The first reviewer stated that the project supports product developments and acquisition decisions that could lead to large-scale deployment of EVs to replace gas-guzzling USPS LLVs. The presentation claims that the overall USPS fleet is "the largest non-military fleet in the world" and LLVs are a substantial portion of that fleet. Another reviewer said that this project does help support the USPS's efforts to electrify their fleet. A third reviewer stated that electric vehicles, which may replace petroleum-using vehicles, will need dynamometer testing regimes for design as well as to understand their benefits.A final reviewer stated USPS is the largest non-military fleet in the world using 650 million gallons of fuel in 2010. The reviewer pointed out that USPS is very sensitive to fluctuations in fuel cost and is facing an enormous competitiveness challenge with regards to costs. The final reviewer stated that electrifying the USPS has the potential to save significant amounts of petroleum fuel, dramatically increase visibility for electric-drive vehicle technologies, improve the economic bottom line, and enhance driver working conditions.

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

The first reviewer stated that the project is using dynamometer testing of USPS electric-drive LLVs using standardized procedures. The reviewer also commented that use of USPS's "worst-case" cycle is valid, but it might have been more relevant to run more typical USPS cycles and sensitivity analyses too. The reviewer felt that the lack of HVAC loads may make data less useful. The reviewer understands that USPS directives may have constrained what tests were done and how. A second reviewer said the only real shortcoming seems to have been customer imposed. Ultimately drive cycles and accessories make a big difference when evaluating fuel economy and range. It is really too bad the USPS did not leverage the expertise in various DOE labs (e.g., NREL, ANL, and ORNL) when it comes to the collection and analysis of driving cycle data and generation of appropriate drive cycles. Again, the reviewer felt that it is hard to really hold this against the project. (The customer already had a drive cycle and wanted to use their drive cycle). A reviewer asked if a Volt or Leaf is not an option but would more standard vehicle being "mass produced" be possible? Is there nothing like the Ford Ranger based-USPS vehicle of the past? The reviewer thought it would be interesting to know how five different up-fitters were picked and the criterion for picking them. This reviewer also felt that it is valuable to get the drive cycles from real world data. The final reviewer stated that this project encompasses baseline dynamometer testing of five USPS long life vehicles converted to electric drive using various battery technologies. The reviewer said the approach is solid if conventional and electric vehicles utilize the SAE J1634 test procedure coupled with development of a USPS worst-case delivery cycle; conducts vehicle track

characterization; conducts dynamometer testing; and compares and validates with field usage data at INL. The reviewer pointed out that no accessory (A/C nor heat) loads are incorporated.

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

The first reviewer commented that it is a small project and started 11/10, now complete. The reviewer commented that it seems like a good characterization of the vehicles given the small resources, sample size, and constraints. The reviewer noted that selection of the drive cycle to use appears to have been challenging, but they feel the dynamometer testing itself appears straightforward. A reviewer stated that it seems a suboptimal choice was made for the driving cycle. The reviewer felt that not much time was spent reviewing possible cycles and selecting appropriate cycles. However, it also seemed that this was a customer choice. The second reviewer stated that the energy cost per mile and regenerative braking effectiveness are good data with which to make component and system choices. Production system payback time would also be helpful. The reviewer said that it will be helpful for future designs to have representative delivery cycle. This reviewer commented that the results pointed out charge time to USPS and the need for Level 2 charging. The third reviewer said technical accomplishments are completed and in-line with task scope. The reviewer thought that it is interesting how test results vary by conversion vehicle /battery technology, leading to impressions that different vehicle/battery configurations are most appropriate for different routes as some rather significant differences in efficiency are demonstrated. The reviewer noted that differences in regenerative braking effectiveness are even more pronounced. The reviewer commented that drive cycle cost as low as $0.10/mile is demonstrated based on electricity at $0.12 per KWh AC. The reviewer felt this indicates significant potential fuel savings exist at economically viable conditions.

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

One reviewer stated that ORNL worked with USPS, INL, and ECOtality. The reviewer went on to point out that there actually quite a lot of collaboration for such a small project. Another reviewer commented the project work was carried out with other labs and the USPS and is well-coordinated. The third reviewer stated that collaborations are relatively narrow but appropriate for this task. Collaborations are with USPS and INL/ECOtality for vehicle prep and field data collection and analysis. A final reviewer remarked that some extra modeling would seem to have been very useful. The reviewer did gather that the modeling was begun at ORNL; it would have been nice to have seen a little more, although the reviewer was not aware if there was much funding to support this. The final reviewer commented that there was good collaboration with INL and end customer (USPS).

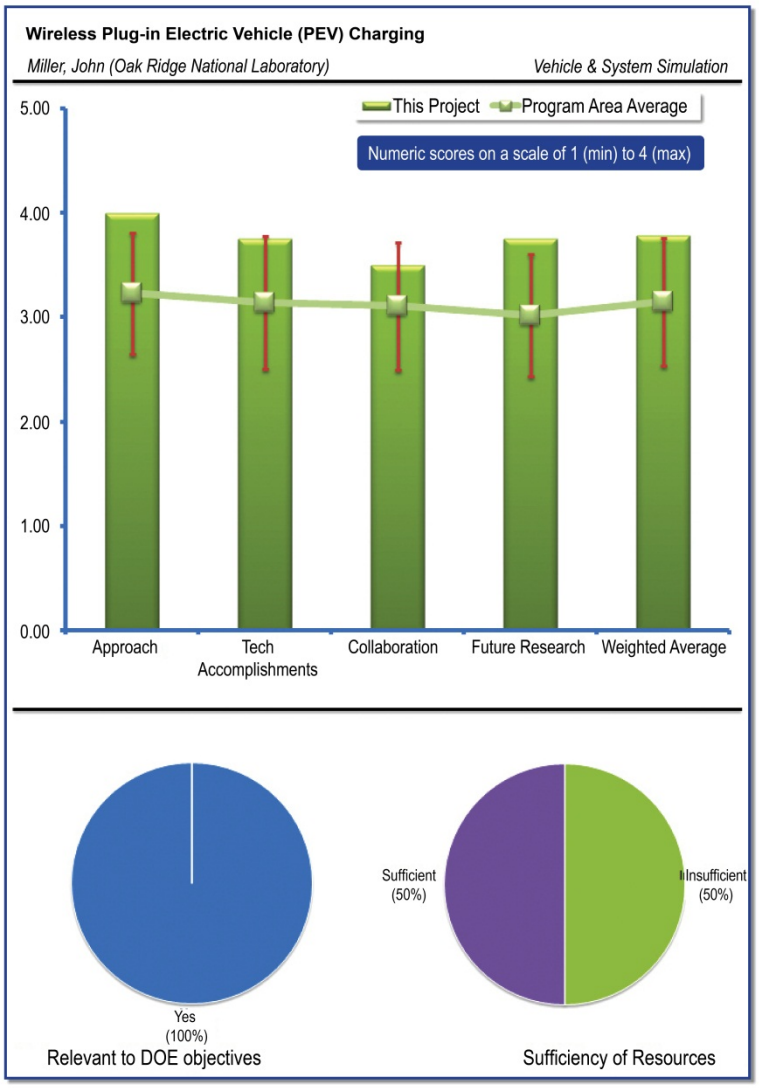
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The reviewer stated that the project is reportedly complete and there is no more funding, yet several follow-up activities are described. The reviewer felt it is unclear how these follow-up activities fit into the overall project timing or funding, but assuming the follow-up activities occur they seem good. The second reviewer commented that they liked the proposed use of "in-use" drive cycle information and more extended use of modeling and simulation. The reviewer remarked that both seem to be appropriate (and help address the only real shortcoming of this project, which again does not seem to have been the choice of the researchers on this program.) A third reviewer stated that the other DOE project will correlate the projects dynamometer work with road testing. This reviewer asked if the work will guide other vehicle choices in the future. The final reviewer remarked that the proposed future work is to tap results to further assess drive cycle impacts on technology applicability, establish a baseline vehicle as a platform for architecture sensitivity studies, and to use modeling to achieve the maximum regeneration scenarios. The final reviewer said that using results from this project (and possibly others) as a basis, it may be beneficial to conduct simulation studies of various battery/powertrain/regenerative braking combinations for eLLVs under a variety of drive cycle scenarios to optimize identification of the efficiency sweet spot.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

One reviewer said that there were good ideas for future work but the project is completed. A second reviewer stated that the project is complete. A third reviewer stated that the current phase of project is completed. Resources were sufficient and appropriate.

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



Reviewer Sample Size

This project had a total of four reviewers.

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

Reviewers thought that the project supports DOE objectives. The first reviewer felt that the project was relevant and directly supports overall DOE objectives of petroleum displacement by supporting advanced technology in EDVs. The overall project is development of a wireless charging system for PEV stationary and dynamic conditions. A second reviewer stated that this is one of the most phenomenal projects that they reviewed in the VSS area. The reviewer stated that they would never have dreamed of such high efficiencies could be accomplished in non-contact space. The reviewer stated that they can only imagine how many challenges lie ahead (durability, political on a local basis, every imaginable angle). A third reviewer stated that the development of Wireless Plug-in electric charging system is a significant step towards greater acceptance and hence deployment of electric vehicles. The reviewer felt that this is in-line with the DOE's objectives. A final reviewer stated that this work is an enabling technology for adoption of PHEVs to reduce petroleum fuel consumption.

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

One reviewer said that this team and its approach is outstanding. The reviewer remarked that the performance goals and objectives are clear and well defined. The reviewer pointed out that the team will demonstrate 90% transfer efficiency from plug to battery at SAE J1772 Level II power of 3.6kW to 19kW. The work complies with SAE J2954 Wireless Power Transfer (WPT) emissions guidelines of 500uT in active zone and <62.5mG outside the active zone. The project Target for Vehicle application: Level III >60kW to vehicle in motion. The reviewer said that the team is working with RF power experts and ORNL fusion research teams to accelerate the innovation. A second reviewer felt that the use of field shaping and magnetic resonance is an interesting approach and does offer a robust solution to coil misalignment and power transfer. The reviewer commented that it does not require that the PHEV/EV operator to precisely park the vehicle over the charge pad, making it more acceptable for the general public. The final reviewer stated the project had a very good plan for exploratory work and milestones.

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

The first reviewer stated the three completed milestones: (1) Completed three iterations of antenna design, (2) Completed skin and proximity effect model and simulation to understand power loss mechanisms, and (3) Completed current sensor scale calibration. The reviewer said that the initial focus of the work is on efficiency, not power. The reviewer also said that the physical effects have proven

most challenging, such as resistance in transmit coil and capture coils. The reviewer stated that the team now has a much better understanding of the parasitics. The reviewer also stated that the team had to calibrate sensors, optimize coil shape excreta, and plans a demonstration in 2012. A final reviewer remarked that the three iterations of coil designs and the lessons learned so far clearly shows solid progress and technical accomplishments.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

The first reviewer remarked that the project cannot get a stronger, more experienced team for the work and that it was nice to see BMW participating. A second reviewer stated that they were surprised that there is no commercial company participating in this project. This reviewer stated that an infrastructure company that could commercialize this technology would be a key asset to this project.

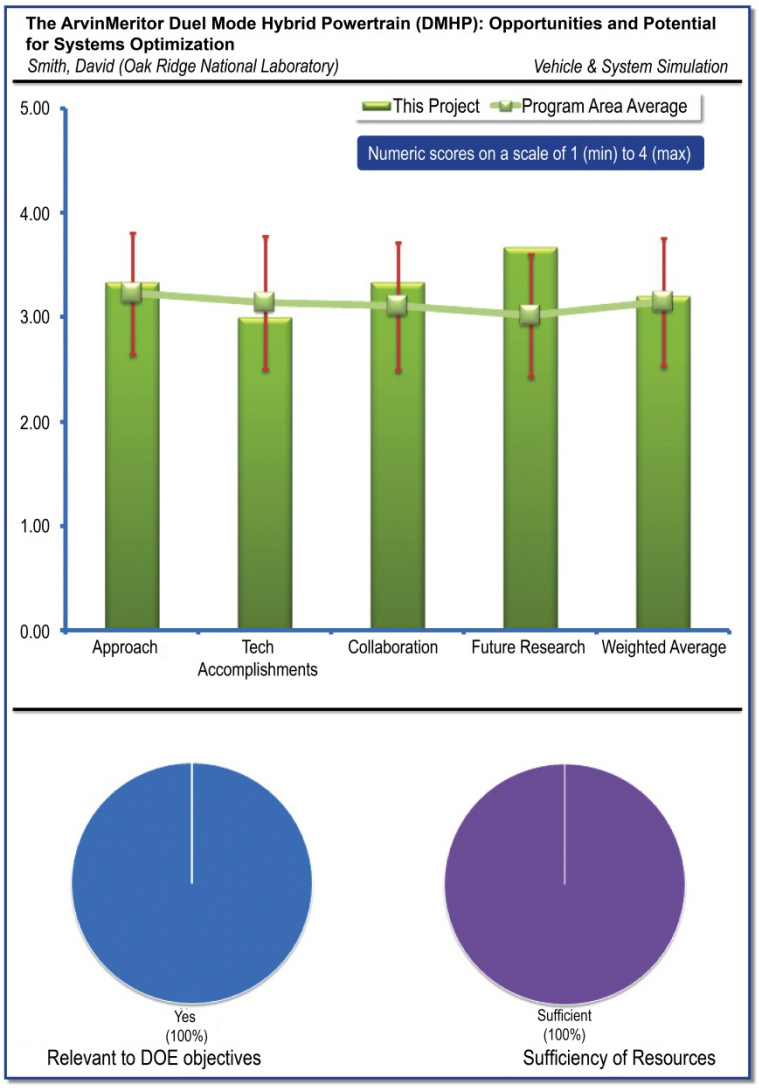
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

The first reviewer stated that the future work will need more efficient power inverters, more communications and controls along with security protocols. The reviewer pointed out that continued work includes design, model, simulation and fabrication of strip line power cables, characterization of antenna shielding effect in proximity to concrete and vehicle chassis floor pan galvanizing, and refinement of design for vehicle integration and stationary vehicle charging demonstration. This reviewer stated that the project is awesome and that it has an experienced team at its helm to see to reality. The reviewer stated “INVEST in this project”. Another reviewer commented that continuing the antenna design and development towards an efficient energy transfer system is critical. They also felt that turning this energy transfer system into a stationary charging demonstration is the logical conclusion of this project for 2012.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

One reviewer stated to “triple the budget”. A second reviewer said resources appear sufficient

The ArvinMeritor Dual Mode Hybrid Powertrain (DMHP): Opportunities and Potential for Systems Optimization: Smith, David (Oak Ridge National Laboratory) – vss062



Reviewer Sample Size

This project had a total of three reviewers.

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

The first reviewer felt that this project is relevant and that it directly contributes to the overall DOE objective of petroleum displacement by optimizing dual mode hybrid powertrain (DMHP) for fuel savings and energy efficiency. The reviewer pointed out that the project has only just begun (0% complete) but results will be important for reducing petroleum consumption for Class 8, HD trucks through advanced powertrain hybridization. The reviewer noted that hybridization of the Class 8, HD powertrain is inherently challenging due to expected long-haul driving and limited opportunities for regenerative braking, which is an excellent target for ROI. A second reviewer said that the program is relevant and that it involves further research and development of an advanced technology powertrain. This powertrain has been designed and developed to reduce fuel consumption. A third reviewer said that it is important to explore opportunities for hybrid powertrains in Class 8 long haul trucks based on the amount of fuel consumed in this vehicle class. This reviewer stated that the project is directly relevant to DOE objectives

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

The first reviewer said the work WILL study systems optimization through model-based design and simulation of the ArvinMeritor Dual Mode Hybrid Powertrain (DMHP) specifically for Class 8 long haul trucks. The reviewer stated that the approach appears a sound planned balance between theory and experiment. The reviewer acknowledged that the results will be used to estimate improvements in drive-cycle energy efficiency, fuel mileage and emissions. The second reviewer stated that this is a controls development program. The reviewer felt it was a good idea to properly characterize engine as a first step of testing. The second reviewer would like to see some more discussion about how the proposed process would allow for different engines to be used with a minimum of additional work. (i.e., the new engine would require another characterization. But once that was done the new characterization could be "dropped" into the controls software or dropped into some pre-processor allowing the controls software to be seamlessly updated.) A third reviewer stated that the project seems well defined to exploit modeling, dynamometer work and on-road data collection.

QUESTION 3: CHARACTERIZE YOUR UNDERSTANDING OF THE TECHNICAL ACCOMPLISHMENTS AND PROGRESS TOWARD OVERALL PROJECT AND DOE GOALS.

A reviewer commented that it is extremely challenging to score based on 0% complete. The reviewer pointed out that the CRADA was just signed. However, ArvinMeritor funded preliminary and exploratory studies where accomplishments included (1) full vehicle model with DMHP powertrain in Autonomie modeling environment, (2) proprietary engine data used for representative 2007 emissions compliant HD engine, (3) prototype electric machine (traction motor and generator) integrated into overall model, (4) well-structured supervisory control model architecture created and integrated into model, (5) vehicle model simulated over standard and "real world" drive cycles, and (6) standard heavy vehicle drive cycles were exercised to confirm expected operation of the DMHP, as well as baseline comparison for data found in the literature. This reviewer is LOOKING FORWARD TO DOE results. The reviewer said that DMHP warrants much deeper research and development efforts. The second reviewer pointed out that it is fairly early in the overall project and maybe simulations could have been a little further along, but again it seems very early in this project. A third reviewer stated that pre-funding progress toward objective (via Arvin-Meritor funding advance work). The reviewer went on to point out that the CRADA was still being finalized per presentation and that there is no confirmed project roadblocks for progress but risk identified for on-time completion of ORNL Vehicle System Integration Lab and procurement of engine and controls.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

For collaboration one reviewer simply mentioned the ArvinMeritor CRADA. The second reviewer went into more detail stating that the project has a final user for actual use testing, in addition to a powertrain supplier with an advanced transmission concept. The final reviewer felt that there was good collaboration with Arvin-Meritor and within ORNL, but has concern over diesel engine manufacturer not being engaged to assure availability of engine and controls. The reviewer points out that this has slowed some other DOE VTP projects.

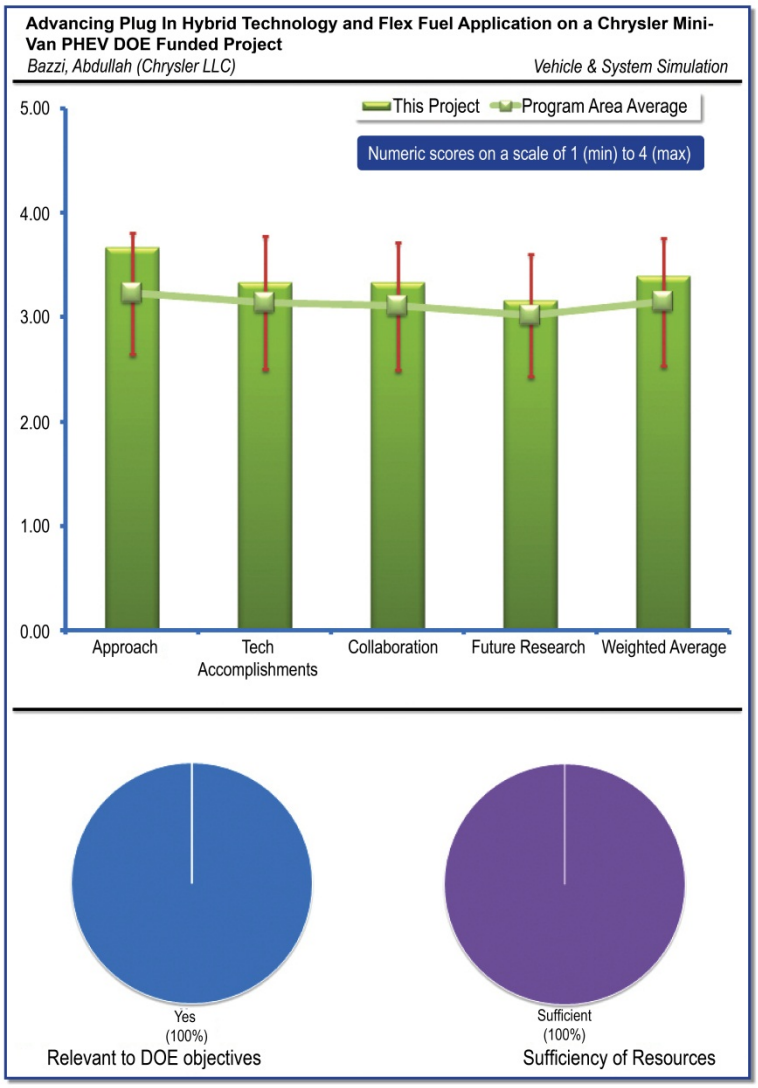
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

The first reviewer felt that this is hard to assess based on 0% complete and that there is much future work planned and if accomplished, the work will be very important data and findings for DOE and the trucking community. A second reviewer stated that it seems to be a good research program leveraging modeling and simulation and testing to develop controls and assess fuel economy. The second reviewer also pointed out that heavy duty transmissions often have to work across a wide range of applications and with a wide range of engines. The reviewer stated that there might have been plans to address this, but if there were the reviewer missed them. Also the reviewer noted that the infield testing has to focus on a given engine/application, but modeling and simulation could allow exploration of other cases. A final reviewer stated that future work was well described through FY2013.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

The first reviewer said that having subsequently heard about some delays in the dynamometer facility, there may be some issues with completing any dynamometer testing (including characterizing the engine). The second reviewer felt that the project appears well funded if projections are accurate for out-years (FY2012 & 2013). The reviewer also pointed out that resources sound potentially dependent on (uncertain?) commitment by Arvin-Meritor to fund the on-road testing phase as implied by "Critical Assumptions and Issues" slide.

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



Reviewer Sample Size

This project had a total of six reviewers.

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

The first reviewer stated that through their direct use of electricity for a substantial portion of the driving, and increased fuel economy over the rest of the operation, PHEVs have the potential to substantially displace petroleum consumption. A second reviewer commented that the demonstration and deployment of 25 PHEV is very relevant with DOE's mission statement. The third reviewer remarked that PHEVs can be very effective in petroleum displacement. The reviewer said that this project helps OEMs perform risky new development and deployment of PHEVs in the future. A fourth reviewer said that the combination of plug in hybrid coupled with renewable fuel use very pertinent to goals of DOE. The fourth reviewer felt that there are multiplicative effects of renewable fuels and electrification greatly additive in petroleum displacement. Another reviewer said that flex fuel maximizes efficiency impact of PHEV in petroleum displacement. The fifth reviewer said that 14 vehicles are re-lease content, and would highlight programs capability to displace petroleum from in-use data .The final reviewer stated that this project will improve the efficiency of a Chrysler minivan and will also be flex fuel capable.

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

The first reviewer pointed out that Chrysler is developing a PHEV flex-fuel minivan, 25 of them on a 2-year demo, to get real-world data and evaluate customer expectations and acceptance. This reviewer had wondered aloud for years why no OEMs were offering PHEV minivans - the potential fuel cost savings, duty cycles, and buyer demographics seem very favorable. The first reviewer mentioned that the project is targeting 53 mpg in charge-depleting mode. The reviewer felt that 22-mile all-electric range seems an appropriate tradeoff and that Chrysler is treating this as a production program rather than R&D (in terms of decision making). The reviewer was a bit surprised that Chrysler chose to use a 290 hp 3.6-L V6 engine, perhaps this was chosen to allow minimal changes to the base model and use an engine already flex-fuel certified, but such a large, powerful engine seems somewhat excessive. A second reviewer stated that the project had a good approach starting with a currently available platform to keep cost down while still effectively demonstrating the technology on-road. The second reviewer recommended the project utilize analysis to maximize architecture impacts, for conversion from conventional vehicle to PHEV including crash compliance and customer utility. The second reviewer suggested addressing different ESS technologies and subsystem impacts on economy/efficiency. This reviewer felt there was good use of appropriate milestones in development phases - using production cadence requirements implies commitment to program

feasibility. A third reviewer commented on the overall approach for system architecture. While using an existing powertrain mated to a charge depleting battery pack and hybrid drive system will allow for a quick demonstration of the technology, the optimization of the system will enable better market penetration and fuel savings. The reviewer also said that simulations of new engine and hybrid drivetrain components to optimize fuel economy, cost and range should be pursued. A fourth reviewer said the powertrain selection (engine) is not as conducive to demonstrate petroleum displacement potential (oversized). However, for demonstration purposes the reviewer felt it is a good program. A final reviewer said the component selection (namely engine) is weak. The reviewer pointed out that the object given of the study were to develop a PHEV with flex fuel capability. The reviewer stated that the study will address the original objectives but because the design is not well optimized, it will not be useful in revealing PHEV capabilities and expectations of petroleum displacement of this technology in the field; the reviewer expressed disappointment as a result.

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

The first reviewer stated that 21 vehicles have already been built and rigorously tested in laboratory, on-road, and severe environments. The reviewer pointed out that 25 EVSE built and delivered to partner organizations. The reviewer said that the project appears to have a reasonable likelihood of leading to mass-produced practical PHEV minivans. A second reviewer felt that there was good progress towards charge control demonstration and showed EAER meeting goal (> 20 mi) future plans to test mpg and Wh/mi and emissions. The second reviewer wondered if there is opportunity for engine downsizing. A third reviewer felt that it was hard to judge progress as the presentation was weak on performance expectations and results could have been better described. A fourth reviewer stated that the project is on track, mules completed, and already tested on road. A fifth reviewer commented that there was a wide list of technical accomplishments listed, but unclear where the project was in regards to the status of some of the technical areas. The final reviewer felt that the project seems to be on track.

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

The first reviewer said that Chrysler is collaborating with Austin Energy, Behr, Electrovaya, INL (for data processing and reporting), SMUD, and the State of Michigan. The second reviewer felt there was good collaboration with a few utilities, but wondered if any vehicles will be driven by non-business fleet drivers (i.e., private drivers)? One reviewer stated that suppliers and DOE labs are involved, and another reviewer said appropriate partners were on board. A fourth reviewer said that there was good collaboration with DOE's INL lab for information distribution and existing collaborations with other OEMs.

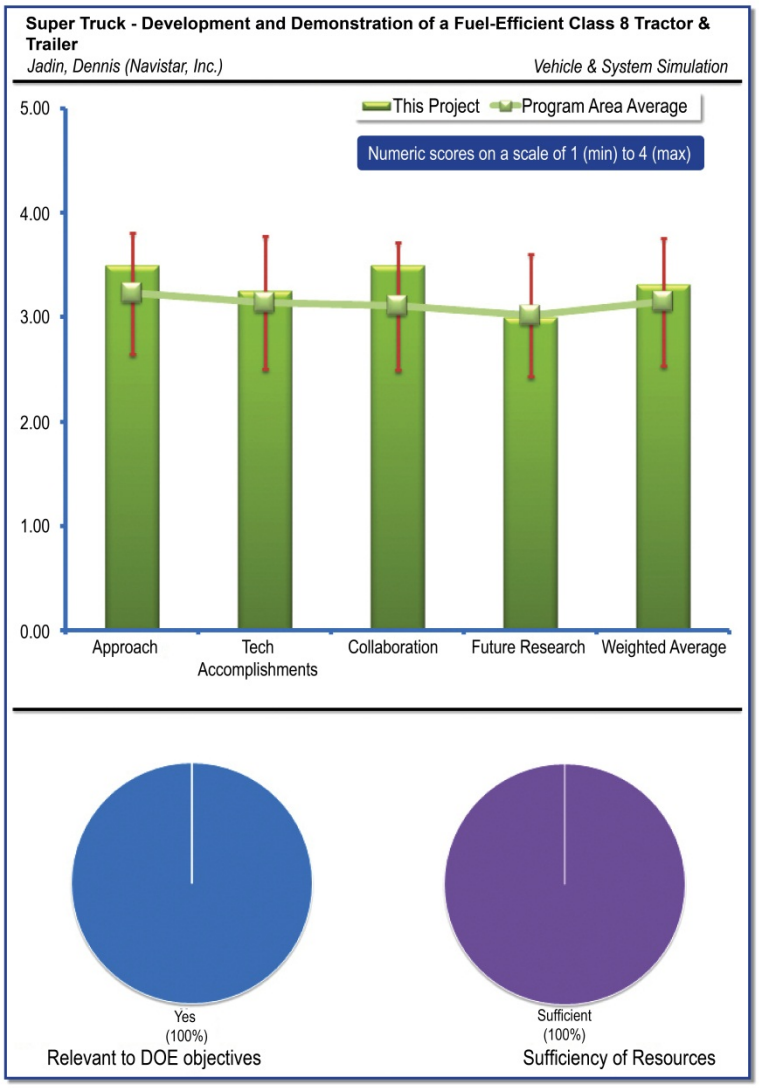
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

One reviewer felt that the project was a very detailed project plan with FMVSS testing. A second reviewer stated that thorough demonstration from simulation results to dynamometer testing to on-road operation across a wide range of temperature and operation. A second reviewer stated that the plans for deployment and data collection are adequate. A third reviewer stated that it would be nice to better understand the possibilities for this program to lead into a production vehicle application. The final reviewer said the next steps to improve system cost, performance should be pursued and system optimization studies could be helpful

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

The first reviewer commented that 25 PHEVs are a good sample size and that it is large enough to get a good sample set of data yet small enough to keep project efficient. A second reviewer said the project is leveraged with Chrysler's own engineering activities. The reviewer felt that it is very likely that the project will be completed on time. A third reviewer acknowledged that it appears that Chrysler had allocated appropriate resources to meet the objectives of the program. The final reviewer said that the resources are sufficient to integrate existing technology into a vehicle, but new components may require additional resources

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



Reviewer Sample Size

This project had a total of four reviewers.

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

One reviewer said that the project is relevant and directly addresses fuel savings. A second reviewer said the goal of 50% reduction is appropriate. A third reviewer commented on the stated program goals and objectives and that they agree with SuperTruck objective of demonstrating 50% improvement in freight efficiency. The final reviewer pointed out that Class 8 application is a significant portion of the overall on-road fuel consumption

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

A reviewer said that work seems to be appropriately holistic with systems approach to integrate various subsystem improvements. Argonne has superior modeling expertise. However, the reviewer is unsure of ANL's heavy vehicle expertise. A second reviewer felt that the approach was clear, well planned and gives confidence that the project will meet or exceed the goals. Also, the second reviewer said that early vehicle demonstrations are great and that they like the down select stage. The reviewer commented that the project is planning to have more solutions than they need so that they can select based on economics or fleet acceptance criteria. The reviewer also felt that component integration across suppliers is really novel if they can pull this off. The reviewer commented that the moving 5th wheel is quite novel. A third reviewer felt there was a reasonable approach to successful program including model based design, prototype vehicle development, and testing. The reviewer stated that the plan is to attack 50% improvement through structure approach. The reviewer also pointed out that the assumption that each technology is purely additive on the path to 50% improvement is questionable. A final reviewer said that fleet input, modeling and simulation driving down selection of technology seems ideal.

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

The first reviewer said that there is minimum progress towards overall goals. However, the reviewer pointed out that the project is only 6 months in and anticipated project length is 5.5 years. A second reviewer commented that there have been strong accomplishments in six months and that this gives strong confidence that the project will meet or exceed the goals. The reviewer remarked on the good simulation and hardware in loop studies with nice simulation of ton-mile/g results. The reviewer felt that there has been an impressive amount of work completed and impressive work to get things on test vehicles so quickly. The second reviewer said that there is a wonderful demonstration of innovation and willingness to test really new things (hybrid options, 5th wheel moving,

etc.). A third reviewer said there is significant progress exhibited with prototype vehicle development near completion (almost 2 trucks). The reviewer remarked that there is good work shown in modeling and evaluation of various concepts. The reviewer felt that the movable 5th wheel concept interesting but safety/vehicle dynamics are a concern. The reviewer thought that there is more work with the movable 5th wheel concept and wondered what the cost implications for this technology are versus improvement in freight efficiency? The final reviewer stated that the mule vehicles are close to completion and testing with project only six months in thus far.

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

One reviewer stated that there is a good balance of partnerships. While a second reviewer said there is a great team that has partners to address all of the key areas, with good inclusion of National Labs, fleets, and a wide range of suppliers. A third reviewer commented that there is a very good mix of partners including trailer manufacturer, tire manufacturer, materials suppliers, and national laboratories.

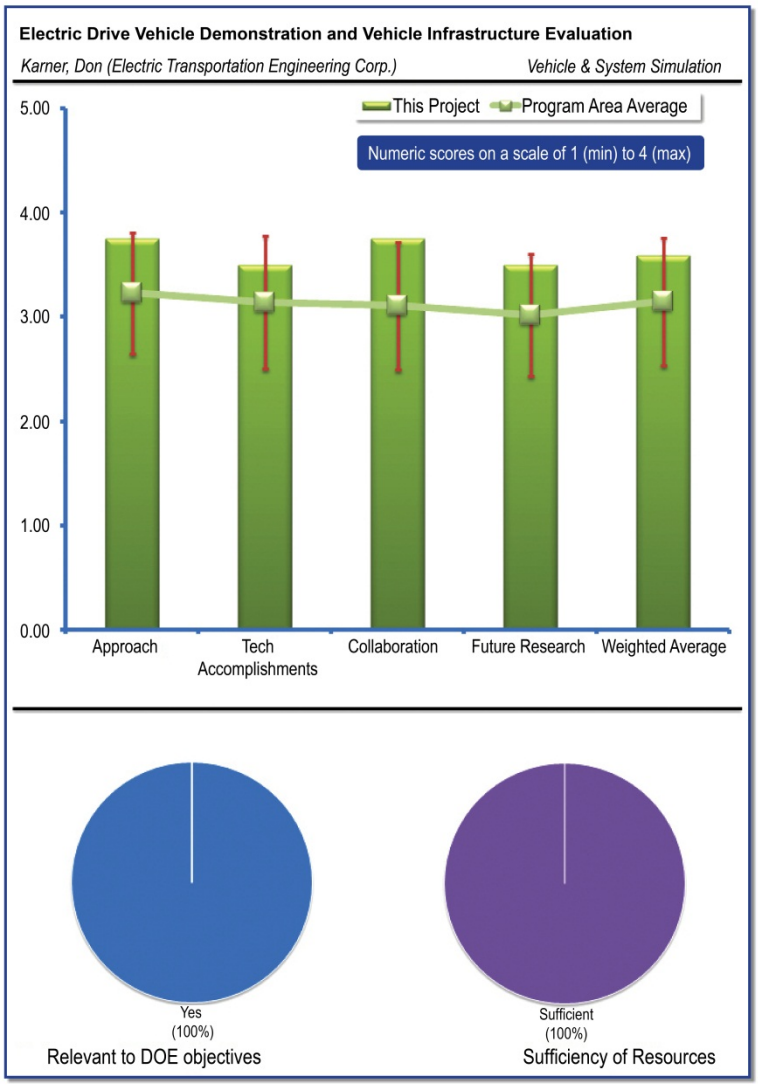
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer commented that the project truck design down-select process and timeline seems appropriate. The reviewer stated that assuming 2,000 lbs. hybrid system penalty is appropriate, but assuming future truck penalty will be "much less" my be risky. The reviewer felt that the dual mode hybrid drive is interesting and may provide significant future fuel savings. However, the reviewer pointed out that futuristic approach for Class 8 trucks may prove risky. The reviewer also thought that component integration and packaging may be difficult. The first reviewer said that moving fifth wheel dynamics and strength requirements may make success difficult and will surely aid weight. The second reviewer felt that there is a clear plan that gives confidence the project will get there. The reviewer said that the project plans to overshoot and down select. A third reviewer commented that the timelines presented are reasonable, although somewhat high level (a little vague). The third reviewer said that the direction of research is logical. The final reviewer said that the voice of the customer activity is good and thought that fleets should be named. The final reviewer thought that future fuel economy testing will be valuable, but the method should be defined better.

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

The first reviewer said that the DOE spending level verbally stated of $8 million is 22% of total DOE budget, while project progress is only at 9% raises flags. However, the reviewer understands that it may just have high start up costs, but felt consideration should be given to tracking this closely. The second reviewer said that ramp up is a bit slow $5.4M (verbally said $8M to date) versus $89M over 5 years. $8M for 6 months puts them about on track. The third reviewer stated that the resources presented appear sufficient. The third reviewer said that the aerodynamic work (full scale wind tunnel) could borderline on excessive. The reviewer felt that CFD and physical demonstration will prove out concepts. The final reviewer felt that spending vs. allocation seemed appropriate.

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



Reviewer Sample Size

This project had a total of four reviewers.

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

The first reviewer noted that yes, there will be savings but there is not a measurement tool in place. Another reviewer noted that this was the big picture definition. The third reviewer asserted that in order for electric vehicles to reach their full market potential, a robust, standardized charging infrastructure must be in place, including provisions for both in-home charging and public charging facilities. This project seeks to explore infrastructure alternatives and make recommendations for future deployment. The reviewer added that a sound, standardized, cost effective infrastructure will accelerate acceptance of electric vehicles, which obviously results in reduced petroleum consumption. The final reviewer indicated that this is the largest EV and infrastructure deployment effort in U.S. history. It will cut across essentially all the critical areas identified as barriers to deployment of light duty electric vehicles. Overcoming infrastructure barriers, including fully understanding charging profiles, consumer use patterns, improving bidirectional communications from the vehicle to the grid, development of sustainable business models, and so forth are essential to the successful commercialization of electric-drive vehicles to the broad consumer market.

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

The first respondent stated that this project seeks to deploy over 8,000 electric vehicles, install charging devices (including home, commercial and fast charging commercial units), collect data on said vehicles and charging units to understand charging practices, and ultimately make specific recommendations on future infrastructure requirements. Data analysis is being conducted by Idaho National Labs. The reviewer added that the large number of vehicles in the study was deemed necessary to create an appropriate "density" of electric vehicles in order to gain insight on charging and infrastructure requirements. The original quantity of over 5,000 vehicles (1,000 cars clustered in 5 metro areas) was expanded to accommodate two additional metropolitan areas. This aspect of the program appears to have been well thought out. This reviewer continued that the project also seeks to determine the merits of a smart charging system that can reduce peak demand and level off power requirements.The reviewer pointed out that an open question is whether or not the project could have been just as successful with fewer overall vehicles, which would have substantially lowered overall project cost. In summary, this reviewer felt that this project appears to be a very well thought out. The creations of "high density" EV areas should prove to be a very successful model for projecting future charging habits and infrastructure requirements. All aspects of EV charging and deployment are being explored in this program. Though overall program cost is extremely high, the amount of

information to be garnished from this comprehensive study should prove worthwhile for planning the next phase of higher volume EV deployment and infrastructure creation.

The final reviewer indicated that a significant amount of upfront planning has gone into the development of this project, including the development of 10 year plans and EV micro-climate studies. A significant amount of work has gone into infrastructure planning including the organization of regional stakeholders and the development of certified contractor networks, as well accommodations for ADA requirements. This project includes broad residential and public installation of charging infrastructure, including fast charging.

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

The first reviewer felt that it would be hard to say what exactly is contributable to the project and other market forces. The second reviewer noted that much has been accomplished to date including project management infrastructure set up and staff hired, "High Density" EV locations were identified, with the intent of installing the required charging infrastructure at these locations, both the EVSE and Fast Charger units are now being manufactured and deployed, a communications network and data collection network established, with all acquired data being funneled to INL for analysis, and barriers and "open issues" (ADA requirements, charge station signage, utility demand and overloading, setting standards for fast charge connector) have been identified and are being addressed. The reviewer added that a summary of each area was provided in the presentation, and there seems to be an approach to address each item. The fourth reviewer asserted that the project appears to be largely on schedule and has a litany of notable accomplishments, including completion of ten year plans and micro climate studies, completion of residential and commercial UL listed EVSE level-2 equipment, development of a communications network, and infrastructure barrier identification.

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

The first respondent acknowledged that there are many collaborators on this program including utilities, city governments, and EVSE manufacturers, as well as Idaho National Labs. It is clear that such cooperation was absolutely critical to obtaining meaningful results from the program. A key addition to the team was Underwriters Labs, who are playing a major role in certifying EVSE units and fast chargers. This is one of several projects dealing with current and future infrastructure and V2G communication needs for electric vehicles. There appears to be an attractive opportunity for collaboration amongst these DOE sponsored programs, which could either reduce aggregate cost, accelerate learning, or both. DOE is encouraged to look for these opportunities. The final reviewer agreed by adding that extensive collaborations exist with OEMs, 18 cities, multiple cities and universities, and UL.

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

The first reviewer noted that the proposed future work includes completion of deployment of all vehicles, EVSE's, and fast chargers. Data collection (including both vehicle utilization data and charger utilization) will continue and all data will be fed to INL for analysis and report out. The data collection effort is expected to greatly assist in projecting future charging needs and in designing the grid to accommodate the expected ramp up of electric vehicles. Also planned is the development of business models for production of EVSE units and for commercial charging. This information, coupled with usage data discussed above, will assist in the creation of a recommended approach for infrastructure design and deployment in major metropolitan areas. The second respondent pointed out that the proposed future work includes continued expansion of EVSE deployment to 8,300 grid connected vehicles and 12,000+ EVSE systems, including 200 DC fast chargers. Future work will also include increased data collection and reporting, analysis and projections of demand response, business model development, and compilation of lessons learned from peripheral areas including signage. Future work may also want to consider methods to tap ideas from EV customers to expand receptivity to EVs outside the domain of first adopters.

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

The first reviewer felt that this is a very relevant project. Another reviewer pointed out that this is very large, well-funded program and there appears to be adequate resources (human and financial) to complete the project per plan. Success will depend, however, on

effective collaboration with the utilities, metropolitan governments, and national labs. The final reviewer noted that the resources are currently appropriate and sufficient.

Advancing Transportation Through Vehicle Electrification - PHEV

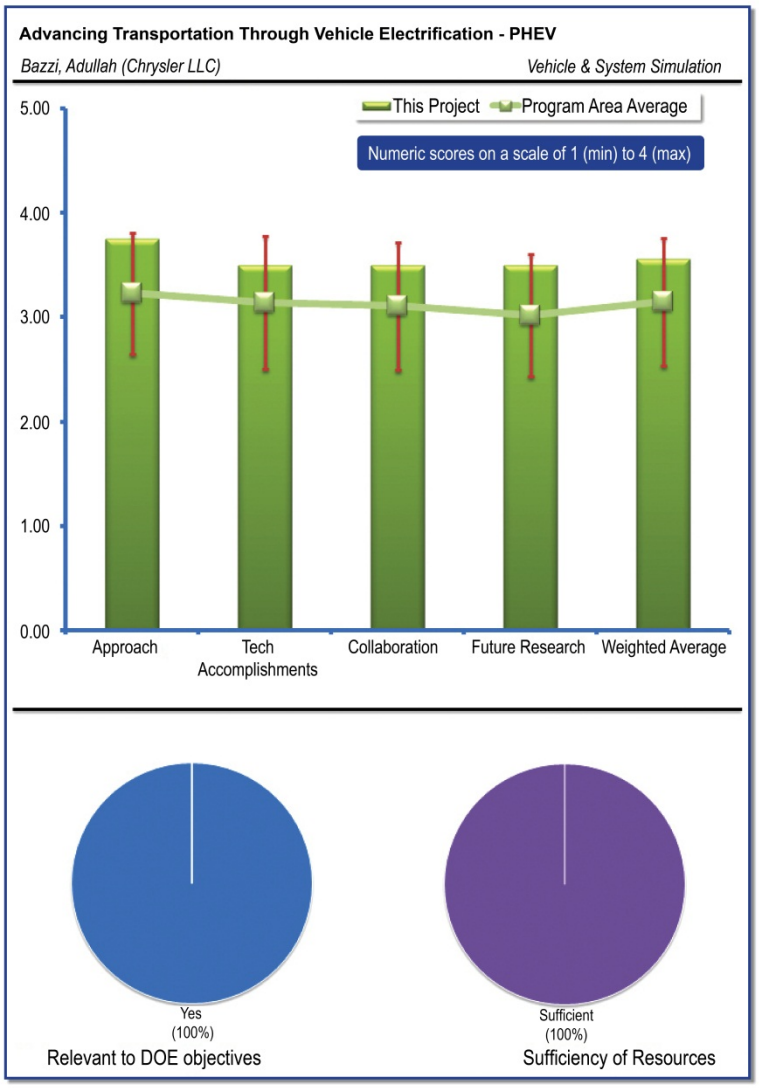
: Bazzi, Abdullah (Chrysler LLC) – arravt067

Reviewer Sample Size

This project had a total of four reviewers.

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

The first reviewer noted that there was significant fuel savings achieved during charge depleting mode. Fleet deployment will be large enough to expose many potential customers to plug in electric technologies. The second reviewer asserted that the project is relevant as it extends the capabilities of hybrids to utilize grid power, further reducing the dependence on fossil fuels and supporting the federal government drive for energy security. Another reviewer confirmed that in order for fuel saving hybrids to gain market acceptance, an understanding is needed of how fuel saving hybrids actually perform in the field and how much fuel they save in the real world applications. The final reviewer indicated that this project addresses battery performance for real world environmental conditions as well as charging system integration. The reviewer added that these are very important topics for a widespread launch and integration of PHEVs.



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

The first reviewer felt that the team has clearly a strong commitment to engineering a production ready solution, including significant durability testing prior to deployment. Great targeting of a market that will enjoy vehicle feature content that is enabled by the hybrid transmission and battery pack (on-board power generation).Also comforting that crash certification activities were complete prior to deployment. The second reviewer thought that the project had a very thorough and structured approach utilizing the latent skills of an established organization and demonstrating new focus. The third reviewer felt that much of the vehicle had to be designed although it looks like the 2-mode hybrid transmission was "stock." Money could have been saved if a more predesigned vehicle and systems could have been used (if they existed.) On the positive side, following the Chrysler Development System will let it go to production if that decision is made. There should be a sizable field support budget as at least a few issues will probably come up that were not found in the initial 12 truck fleet in 2010. A tiered release of the 140 truck fleet (if schedule can be modified to allow it) would help identify issues so the same problem does not need to fixed in 140 trucks. Another reviewer pointed out that the project includes demonstration across diverse environments and that it is extremely important to understanding technology potential under extreme conditions. This reviewer added that three phases seem logical and there is a reasonable amount of detail for a presentation of this length. However, the reviewer found it hard to determine whether approach matches funding level just due to brevity of talk. The reviewer added that the

mix of current and existing components seems reasonable and cost effective and the deployment partners and vehicle allocation is excellent.

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

The first reviewer noted that significant technical hurdles appear to have been overcome. Although the most complicated system (the hybrid transmission) was a commercially available item, this project still includes a reasonable level of technology development (battery pack, inverters, power panel, charging). This reviewer also noted that it seems like the project is a little behind in terms of completion of the vehicles compared with the original plan, but the situation appears to be recoverable and reasonable progress has been made. Another reviewer felt the technical accomplishments were good given the resources but expected more innovation. The third reviewer pointed out that technical accomplishments were met or are scheduled to be met shortly. The final reviewer assumed that the 20 miles electrical drive range was part of proposal package. It seemed like more range in the 30 or 40 miles would be more relevant. This reviewer added that the comments by speaker indicated that it could go 40 to 50 miles before the engine would engage, but this will, of course, depend on a lot of conditions. There was good progress on fuel economy, exceeded target, and substantial compared to gasoline vehicle. The reviewer noted that the data are available to national laboratories and partners and that this is important for further understanding of customer interactions with technology. Finally, this reviewer noted that it needed more detail to understand technical accomplishments and progress and thought more detail could have been included in this time frame.

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

The first reviewer felt that there was a good selection between key sub-system vendors, academia and deployment partners. Having the OEM run the program lends significant credibility to the solution. The second reviewer noted that because of the company brand and resources this will not have been a problem. This reviewer had hoped to see some smaller innovative organizations taken under their wing but no real risk or development of smaller companies was evident. Another reviewer confirmed that it makes sense to cooperate with the utility companies to monitor charging and modify the charge schemes to keep from grid going down. Collaboration list and roles seem suited and coordinated for this project. More information on roles and interactions would have been very useful and the participation level of everyone it is not clear.

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

The first reviewer noted the focus on deployment, field testing, and addition of key (and interesting) functionality with regards to smarter charging and interaction with the grid and added that these items will be important to enable large scale deployment. The second reviewer indicated that the future research is well thought through and relevant not only to this project and vehicle platform but also capable of significant impact in other business areas. The third reviewer mentioned that the nonproprietary field data should be released to the public. Also nonproprietary components could be released in industries which do not compete with Chrysler such as the charger or on board AC power. The reviewer added that there should also be an ROI calculation (for the customer) done on the product in production if it has not been done already. The final reviewer felt that the future seems consistent and focused with plan.

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

The first reviewer noted that it appears to be a little behind, but with significant progress over the last 12 months. Another evaluator noted that there was no lack of resources. The third reviewer felt that it is quite a few trucks for initial startup testing and they will require a fair amount of field support personnel. The final reviewer indicated that the internal and external resources appear to be sufficient to meet milestones and that it has been demonstrated with progress to date.

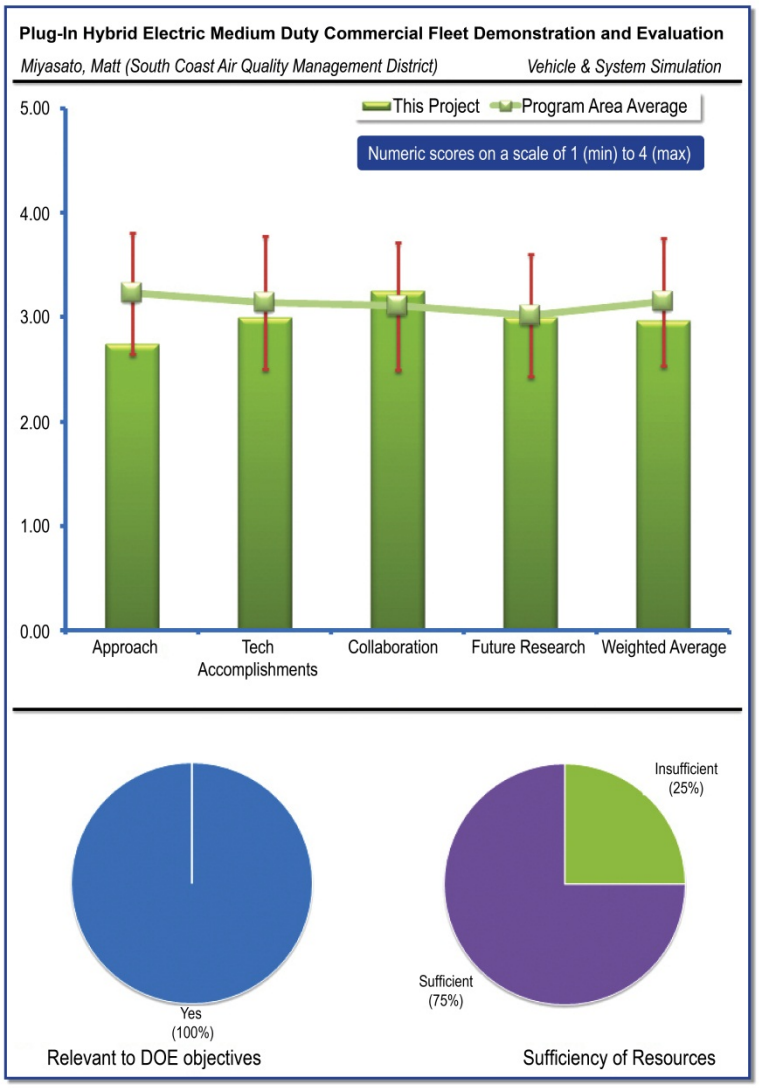
Plug-In Hybrid Electric Medium Duty Commercial Fleet Demonstration and Evaluation: Miyasato, Matt (South Coast Air Quality Management District) – arravt068

Reviewer Sample Size

This project had a total of four reviewers.

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

The first reviewer noted that this project is focused on a quite small component of the overall market, but selection of utility industry as one of the primary targets will likely lead to a more accepting customer base than a typical commercial entity. The second reviewer pointed out that this reduces idling requirements for these types of vehicles within service applications and the use of fossil fuels. The third reviewer asserted that the hybrids will save fuel and the project will point out field issues that when solved will help larger scale acceptance. The final reviewer pointed out the focus on MD PHEVs, which is good match for this technology due to drive-cycle and range of many of these applications. The reviewer also stated that it was good to see "cost" mentioned in objectives which is very important to wide spread acceptance, and noted that "smart charging" is very important to use with existing grid system.



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

The first reviewer noted that it is unclear what the route to production implementation of this package will be and that maybe the body builder partner will manage integration and assembly, but this would be significantly more complex than typical 2nd stage assembly activity (transmission replacement, changes to body in white, high voltage system integration). The role Ford is playing in the program appears to have diminished over the last 12 months (although this was not clearly described during the briefing). This could be lead to a significant increase in the difficulty of fielding the product of this project as a production vehicle. Eaton seems to have been heavily leveraged during the development phase. It is unclear how much of the development was funded by the program, since much of the system was already commercially available. The level of robustness that the full systems integration tasks (cooling, electrical system etc.) have been executed with was difficult to assess. The reviewer also added that the deployment plan was not very clearly presented, other than “it's defined and includes utilities around the U.S.” The second respondent thought that the technical approach is good, especially the idea of using an Azure system that is already proven. It also makes sense to try two different approaches (Eaton and Azure Dynamics) and pull the best aspects of the two systems forward into production. This reviewer added that the project approach of releasing so many vehicles up front is risky for potential field issues. This reviewer realized that the schedule calls for certain money to be spent in certain time periods, especially since recovery funds may be used for this project. However, time should be made to allow for a staged release would greatly lessen the risk of having issues with all 280 vehicles. Large issues on release would decrease market acceptance of hybrid vehicles. This reviewer added that there is a good selection of relevant vehicles for this size

class. Electric powered auxiliaries make sense for 550. Specifications in approach but would like to see more detail in terms of timeline, decision points, etc. The reviewer questioned where the deployment will be and what the approach to securing deployment partners is.

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

The first reviewer felt that the cost and schedule control of key (unnamed) hybrid sub-systems has obviously been a significant issue on the program, leading to a very significant reduction in the planned size of the fleet and delayed deployment. The reviewer expressed that this is a real shame and it has to lead to questions around the robustness of the proposal submittal planning. The reviewer also pointed out that the F550 system is stated as having a blended regenerative braking system, but the presenter stated that this system has no iteration with the brakes other than through removal of regeneration during ABS events. The reviewer did not view the system as implemented to be a blended system, which typically bypass the base brake systems for initial applies. This is a shame on a project with a significant budget. While it is easy to understand the risk reduction measure (this reviewer has been involved in similar strategies for one-off technology demonstrators), development of a true blended system with a brake system vendor partner would have been a major "win" for the project because nothing exists in this vehicle sector currently, this is an opportunity lost. The second reviewer indicated that given the partnerships, this reviewer felt that they should have made greater progress. Another reviewer stated that the systems as designed appear to be sufficient for the applications and also look to be cost effective designs. The three different vehicle calibrations for the F550 should maximize the fuel savings in different applications. The final reviewer noted nice accomplishments so far. As with the approach, would be nice to see where you are compared to where you intend to be at this time. This reviewer added that the discussion of accomplishments was nice and the reviewer realizes that time is very limited but the project did convey a sense good progression. This reviewer noted that the project team showed three calibrations for the F550, and questioned how the decision will be make on which to deploy and if they all work effectively with same hardware technology package, questioned if they have material orders for 50 F550s, how many F550s they intend to build and deploy, and if orders are already placed, does it mean that the design is finalized.

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

The first reviewer pointed out that it was not clear what Ford's role in the project is, it certainly appears that it would be beneficial for them to have had a more significant role than was implied in the briefing. Also a braking system partner developing a hybrid blended brake system would have enabled higher efficiencies to have been gained. It is unclear what the path to production would be for this project when the DOE effort is completed. The second responder acknowledged that the partners for this project have large resources and good technical knowledge of which the project makes use. The third respondent noted excellent collaborations and appreciated the description of the nature of each collaboration.

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

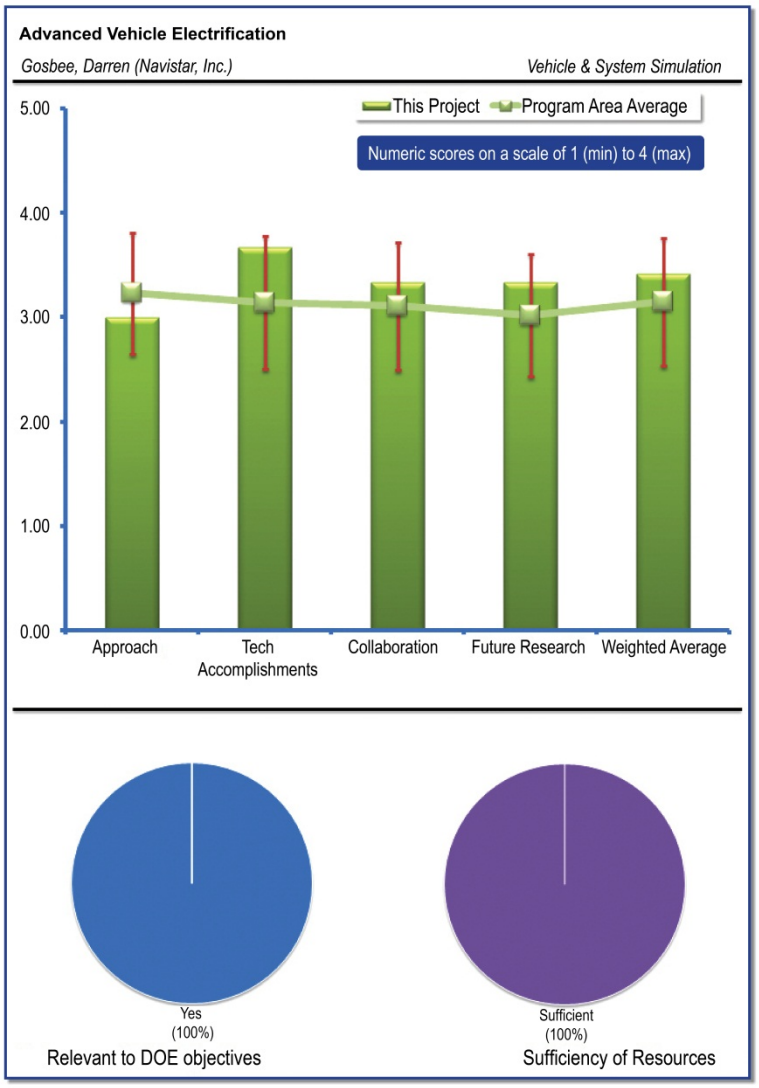
The first reviewer stated that the completion of the system development, builds, deployment and data acquisition and analysis will be a major accomplishment for this project. The second asserted that efforts should be made to share the designs with non-competing industries such as class 6 and 7 trucks that would be able to use the F-550 hybrid design or slightly upsized versions of it. The battery packs should have a 2nd life planned if possible for when they do not meet energy or power specs after a few years. The final reviewer noted that future plans look reasonable but questioned where the vehicles will be deployed for evaluation and how they will be deployed and tracked.

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

The first reviewer indicated that the project appears to be at risk of overspending and is delayed. The reviewer added that DOE should maintain close watches on progress to make sure the deliverables are not diluted to the point of no longer adding the value that would be expected for the significant levels of investment. The second respondent expressed that extensive field support resources may be needed if there are field issues. Resources should be sufficient unless there are many field issues which is a possibility with some of

the newly designed components. It appears the budget did not cover the initial field test estimate of 378 vehicles. The reviewer questioned if studies where done to see where the discrepancy was between planned budget and actual cost of components.

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



Reviewer Sample Size

This project had a total of three reviewers.

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

The first reviewer stated that the estimated savings of 1250 gal/yr. per eStar vehicle across a 950 vehicle fleet will lead to substantial petroleum displacement. The second reviewer pointed out that it will save fuel by having vehicles run off electricity instead of petroleum. The final reviewer asserted that this is a development and launch of zero tailpipe emissions EVs but added that the presentation also included estimates of fuel savings. Overall, project appears to be on target. However, more information in presentation would have helped this reviewer to better evaluate although this reviewer realized that these are brief presentations due to time constraints. The reviewer also added that the Q&A was very helpful.

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

The first reviewer indicated that adapting an existing UK-market battery-electric truck to the U.S. market speeds time to market and reduces costs. The multi-year plan to grow capabilities of local suppliers in order to increase the domestic content of later-production vehicles appears to be a powerful strategy. The first reviewer added that as an ARRA-funded project, goals are not just petroleum displacement but also creation and/or preservation of domestic jobs. Navistar reports that some potential eStar customers do not require a 100-mile driving range and would prefer a reduced driving range version of the vehicle in order to meet their actual driving needs with a less costly vehicle. The third reviewer felt that the use of the previous design is a good way to save resources. Up front battery and vehicle cost estimation and ROI for the customer might have pointed to challenges in sales. The final reviewer noted well defined near-term milestones but was unclear on the duration of project, when starts, and when it ends. The final reviewer was unclear on specifications of vehicle which is being transitioned to the U.S. but thought it was a decent approach to make use of some existing technology.

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

The first reviewer indicated that this project has introduced a new medium-duty battery-electric truck into the U.S. market (by bringing a production EV over from the UK). Navistar adapted the eStar vehicle to use a larger A123 battery pack in order to meet the grant requirement of a 100-mile driving range. The reviewer added that vehicles are rolling off the line with 75 or 80 are currently deployed. The target for full 950 vehicle deployment by September 2011 is being reassessed. The project team is working with local suppliers to significantly increase the domestic content of the eStar vehicles and leveraging existing Navistar dealer network to train sales and maintenance personnel. The reviewer also noted that the team added Canadian homologation to previously-achieved Federal

Motor Vehicle Safety Standards (FMVSS), EPA and CARB. The second reviewer pointed out that with reported Price of $150K from Navistar it may be difficult to get the amount of customers the program planned. Subsidies or further subsidies may be needed to get significantly more vehicles into the field or close to 950 in the objectives. Durability life testing that was completed and sufficient data from R&Q fleet over time will be the key to ensuring product quality of production release. The final reviewer mentioned that it was good to see estimates of actual vs. project job creation but was not clear of assumptions and job accounting. Navistar has identified an extensive list of participants to train for field and also makes use of Navistar's extensive dealer network. The reviewer added that the 100 mile range is outstanding and has been demonstrated. Overall, 75 to 80 vehicles have been deployed.

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

The first reviewer pointed out that the project team is collaborating with A123 on development of larger-capacity battery pack and lighter pack housing. They are also collaborating with NREL on data collection, analysis, reporting, and dissemination. The reviewer also indicated that they are developing relationships with utilities, local suppliers, local & state governments and participated in/presented the eStar at numerous industry events. The reviewer also stated that one Navistar comment near the end of the presentation indicates potential trouble with the planned approach: "The industry supply base has not progressed at the development rate required to support electric vehicles, technology is still young. As a result [Navistar has] continued relationships with existing suppliers until such time as domestic cost, quality, and durability targets can be met." Continued issues with developing domestic suppliers could diminish the project's fulfillment of ARRA goals (though that won't affect the project's impact on DOE petroleum displacement goals). The second reviewer confirmed that all collaboration reported is appropriate. However, the plan to address the bankruptcy of Modec and any new challenges that it adds (or does not add) to the program should be better explained. The final reviewer asserted that the collaboration and role with A123 good but was unclear on the status of developing relationships. The reviewer added that data collection sharing with DOE is important.

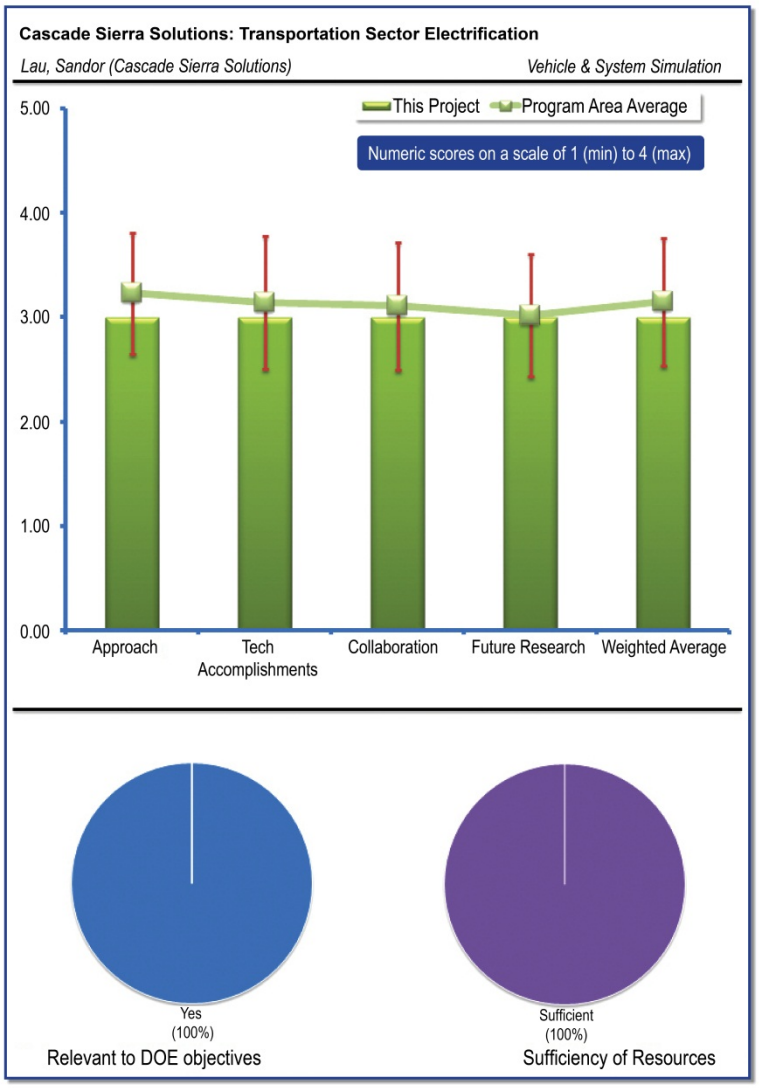
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer's comments include noting that the project team is working at cost reduction and development of local supplier base and will explore range alternatives (reduced range to lower cost). Current customers are averaging 23 miles/day meaning that many could be satisfied with 75 mile vehicle range. This reviewer also noted that they will be looking at how to replace unique motor/axle with components that interface with existing Navistar line so that EV versions of other vehicles can be offered, developing and adding numerous product improvements, and plan to seek Canadian homologation. The second reviewer confirmed that the costs savings for the components will be key to long term savings from the truck. It appears like release of all the vehicles is slower than planned which may be advantageous as issues are found and addressed. It is a good realization that a smaller battery pack will help and the grant requirement should be modified. Customers will need to see an ROI for them to invest in the technology. With a high cost battery on a $150K vehicle it will be hard for them to get an ROI. Extensive dealer training is and will be important to address the field issues that will likely arise with a new product. The final reviewer noted that cost is important and good to see. Most of proposed work with a few exceptions appears to be focused on more conventional vehicle issues. If 70-80 vehicles have been launched, this reviewer quested if the remaining "future" research issues are necessary within this activity.

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

The first reviewer pointed out that if project results in deployment of proposed 950 eStar electric trucks, DOE investment per truck will be about $41K, which seems reasonable for the truck alone. Adding in the value of significant petroleum displacement, the development of hundreds of direct and indirect U.S. jobs, and the example of commercial viability to other potential U.S. electric truck manufacturers, this project appears to be achieving a very favorable return on investment. The reported slower-than-expected development of domestic suppliers is a concern however, and may argue for targeted investments in developing supplier capabilities. The second reviewer asserted that appropriate field resources will be needed, as will possible subsidies, to sell a sufficient number of vehicles to get the field data desired. Possibly the subsidies could be increased by reducing the number of vehicles from 950.

Cascade Sierra Solutions: Transportation Sector Electrification: Lau, Sandor (Cascade Sierra Solutions) – arravt070



Reviewer Sample Size

This project had a total of four reviewers.

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

The first reviewer stated that this project addresses a key enabler to reduce idle time of the heavy truck fleet, and provides grants to promote adoption of more efficient technologies into the legacy fleet. The second reviewer asserted that this was clearly an application that this reviewer had not considered and is a well thought out fuel saving application. The third reviewer expressed that it will improve the fuel efficiency of the many vehicles in the field to be able take electricity from truck stops and not have the trucks idle or run diesel APU's. The final reviewer pointed out that the project supports DOE objectives from enabling infrastructure perspective and addresses very challenging barriers.

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

The first reviewer indicated that there appears to have been a very robust selection process around the locations of the targeted truck stops. The fact that truck owners still have to pay a significant portion of the technology costs may reduce uptake, but will ensure commitment from those that do participate that should lead to higher quality results overall. Good combination of working with truck stops and fleets both and an interesting project addressing lack of plug-in infrastructure for commercial vehicles that will certainly restrict adoption of anti-idling technologies. Another reviewer felt that the idea of leveraging the grant funds to encourage the drivers and truck stop operators to install equipment is a good one. Getting the drivers (fleets) and truck stops to sign on will be key and the incentives will need to be sufficient for them. The data collected on the chargers and the trucks will be valuable to understand driver's habits. Having a small convenient power charging device will help adoption. The final reviewer comment on several aspects of the project, including indicating that the project spans 2010 to 2014, working with SmartWay is good approach, identified potential truck stops with plans for 50 installations, 25 connections per site, opportunity to monitor utilization and patterns of use for diesel fuel displacement, job creation through installations at truck stops and truck installations, and milestones are well-defined and appear to be on target.

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

The first reviewer expressed that the project spend rate has been quite low, but it appears that a significant amount of planning and preparation work has been completed and it's perceived by the reviewer that the spend rate should significantly increase as installation activity at the truck stops ramps up in the near future. No mention of any testing/validation of the truck stops pedestals was mentioned

- DOE may want to ensure that this is a fully validated product before installations are completed (this was not questioned during the session). The second respondent noted that higher voltage chargers are accomplished and the portable A/C design and manufacturing contracting is done. The approximately 25 truck stops to date is important progress towards the key milestone of 50 stops. This reviewer added that fleet participation is also necessary and it is not clear how many of the 5,000 trucks have signed up. The final reviewer confirmed decent achievements to date with fuel and CO_2 savings, and further suggested that more information is needed here. Need more information here. This reviewer added that the Milestones are well defined and appear to be on target. However, it was hard to judge whether accomplishments are good progress. Not sure how much funding has been spent to date and need more information. Good to see commitment from large chain as well as others and it should be more than enough to meet target of 50 sites.

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

The first reviewer asserted that there appears to be strong interaction with fleets and truck stop facilities, and also equipment vendors and financing partners. Another reviewer expressed that the university partner's role in data analysis will be very helpful and important, and also mentioned that it sounds like the follow-on of the other chains (in addition to the one that was mentioned) to sign up will be important and the drivers will need to have an incentive to participate. The final reviewer was not clear on details of collaborations and noted that it would have been good to have more detail but realized that time does not allow.

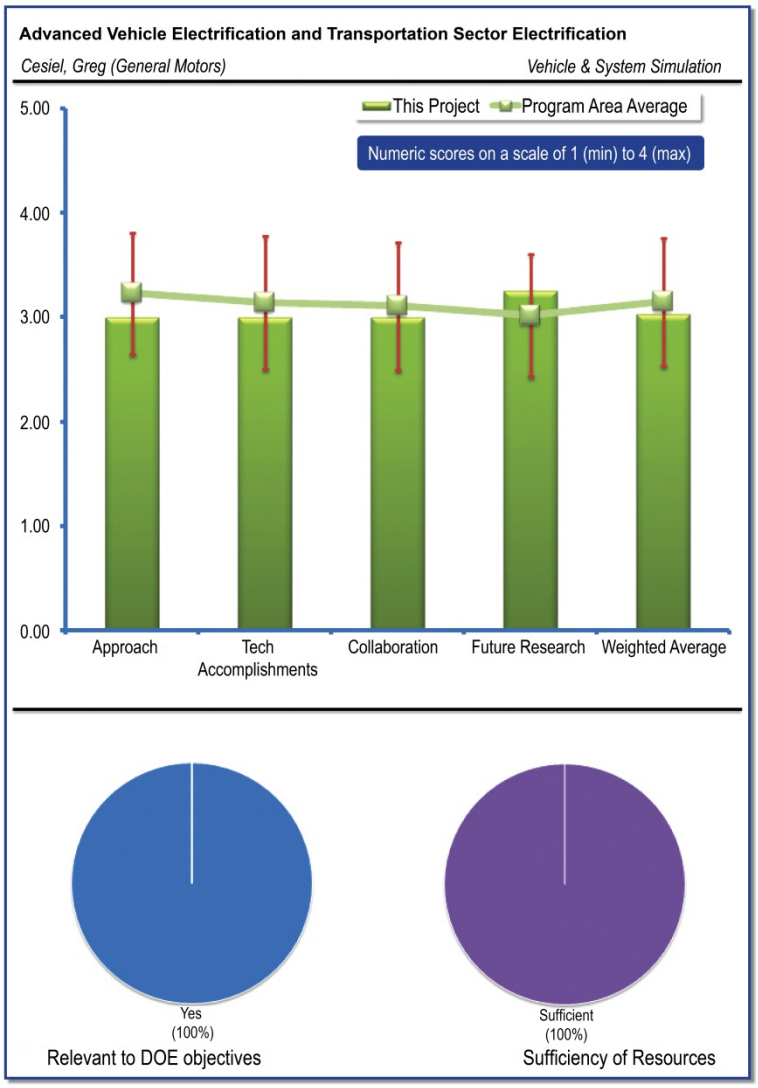
Question 5: Has the project effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology, and, when sensible, mitigating risk by providing alternate development pathways?

The first reviewer felt that the business case around ownership of the pedestals and purchase of time/energy still appears to need maturing, which is probably ok at this point in the project. The truck stops will likely need to pull revenue in to offset fuel sale losses. There was limited discussion around capturing data from the initial fielding fleet and this area should be examined so the level of success of the project can be measured. The second respondent believed that the work plan for 2013-2014 makes sense but more could be done to plan how to bring other drivers and truck stops on board. The final reviewer thought that plans forward seem on track and consistent with objectives but added that more detail would have been good.

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

The first reviewer felt that the project was off to a slow start, but that it would be expected based on the level of planning and coordination being performed in the early stages and that it should increase quickly from this point forward. The second reviewer indicated that there is a possible tradeoff to consider if drivers are not using the stops and devices. Money could be increased to encourage drivers to use the improvements at the stops and less of the actual devices/stops could be financed.

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



Reviewer Sample Size

This project had a total of four reviewers.

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

The first reviewer noted that this project does reduce fuel usage. The second reviewer pointed out that the Chevy Volt development has generated significant interest in electric vehicles, due to its extended range capabilities, which neutralizes one of the major concerns about electric vehicles, getting stranded without the ability to replenish onboard power. With this vehicle, and with the adoption of this technology by other OEM's, the acceptance and deployment of electric vehicles should accelerate and thereby reduce national dependence on foreign oil. Extended range EV's bridge a gap between gasoline powered cars and full electric vehicles. The extended range concept is a potentially game changing technology. This technology appears to give a U.S. based company the technological lead in the electric powered vehicle arena, which should result in job creation within the U.S. The specific focus of this project was to support the final validation of the vehicle (already designed before the start of this project) and to support the data collection and analysis efforts. In the latter case, the objective is to learn more about how the vehicle will be driven, and the charging habits of users, while also gaining an understanding of future grid requirements as the population of electric vehicles grow. The final reviewer indicated that a full understanding of the electric vehicle consumer market, including data on vehicle performance and infrastructure under real world conditions is essential. This is a large, far reaching project utilizing the Chevy Volt as the electric vehicle of choice to push the envelope on development of a sustainable and growing electric-drive market for the general consumer.

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

A respondent asserted that the approach is generally sound, characterized by a multi-year, comprehensive development program, with strategic collaboration with utilities, and an extended vehicle test program in key metropolitan areas in the U.S. Program included development of key systems and components (batteries, generator, engine) followed by system integration and complete vehicle testing. Final validation depended heavily on feedback from selected users in the general public. Vehicle usage and charging data are now being collected on deployed vehicles with data transmitted by OnStar. The reviewer added that it appears that the project was focused on two separate, but nonetheless related areas: (1) final validation of the vehicles (through extensive field testing); and (2) acquiring vehicle and charging data to understand driving habits and charging requirements. It seems that the project will yield very useful information in both areas. The final respondent indicated that the basic approach is to launch the Volt in select markets starting in December 2010 and expand to across the country by the end of 2011. GM is working with utilities to install charging stations in

residential and public locations in support of the Volt roll out. Data from charging station activity will be used to assess consumer behavior and inform future technology and infrastructure activities, including integration with the Smart Grid.

QUESTION 3: CHARACTERIZE YOUR UNDERSTANDING OF THE TECHNICAL ACCOMPLISHMENTS AND PROGRESS TOWARD OVERALL PROJECT AND DOE GOALS.

The first reviewer pointed out that battery standardization needs to be considered in these early deployments. The project team needs to ensure that the second purpose or afterlife of lithium ion batteries is useful and not regarded as hazardous waste. The second respondent stated that the Volt had been already been designed, developed, and extensively tested prior to the start of this project. Under this current project, vehicles are now being deployed, and charging stations are being installed for both private and public use. Beginning in the fall of 2010, data have been collected and sent to Idaho National Labs for analysis and summary. It is somewhat unclear how much of the final component and system validation was conducted under this program versus with GM internal funding. The final reviewer expressed that insufficient detail is provided to gauge technical progress and no hard milestones and little technical detail is provided. One interesting development is the Smartphone app by OnStar to assist driver's connection with the Volt.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

The first respondent indicated that data are being collected and sent to Idaho National Labs for data reduction and summary in a format accepted by DOE. GM has looked to EPRI for encouraging the involvement of key utilities to deal with the issue of charging facilities in metro areas. A total of nine large utilities are involved in the program so far. This project is similar to several other DOE programs that attempt to understand vehicle driving and charging patterns, and to project future infrastructure needs. A key opportunity is for DOE to facilitate cooperation and information exchange between the principals of the several programs. Another reviewer confirmed that sufficient collaboration appears to exist primarily with EPRI, various utilities, and INL for compilation and amalgamation of driving and vehicle data.

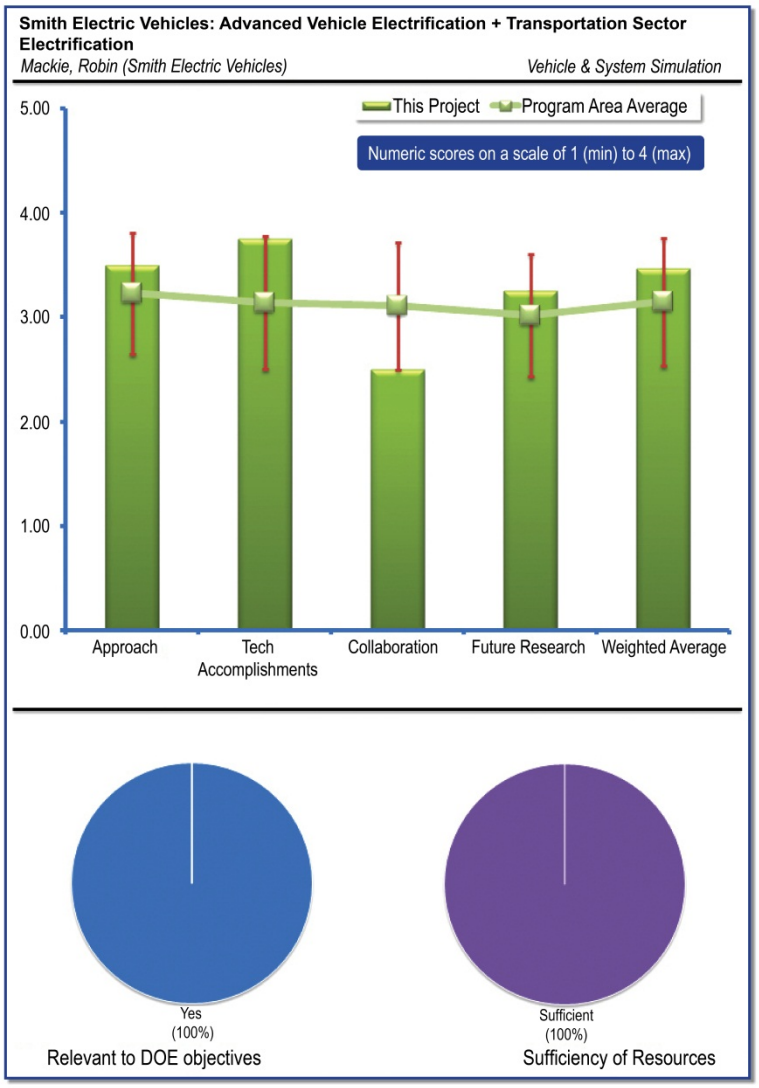
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

A reviewer noted that the future work will be centered on additional charging station installations and continued data acquisition and analysis. A number of future development opportunities have been identified. (See Special Projects). Most significant activities include support of fast charging development and data collection activities, and support of efforts to develop "smart" charging capabilities, which includes among other things, effective vehicle to grid communications. Another reviewer stated that the proposed future work is a logical extension of existing activities and will include data gathering on charging installation and use, as well as special projects to support fast charging, smart charging and secondary battery use.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

The reviewers indicated that the resources appear to be sufficient. One reviewer did point out that it is unclear whether the "special projects" summarized in the presentation are funded under the current project budget.

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



Reviewer Sample Size

This project had a total of four reviewers.

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

The first reviewer pointed out full EV 100% fuel reduction and that the team will capture data in the future. Another reviewer asserted that the development and release of full electric commercial values obviously supports the national initiatives to decrease petroleum usage and reduce dependence on foreign oil. A cost effective version of this vehicle promises to be well accepted in the light vehicle commercial markets whose duty cycles feature limited daily mileage. The deployment of 500+ vehicles and subsequent data collection will provide invaluable information to guide next generation development, focused on cost reduction. It was reported that up to 225 new jobs will be created as a result of this program. The third reviewer confirmed that while the biggest and most attractive arena for electric drive vehicles is the light-duty market, applications also exist in the medium-duty delivery market. The medium-duty market is commercial in nature often with well-established urban driving routes and centralized charging which provides some natural advantages to electric drive vehicles. Establishment of a sustainable medium duty electric vehicle market and manufacturing base can help create jobs and pull electric-drive vehicles further into the mainstream.

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

The first reviewer pointed out that the program used technology transferred from Smith U.K. The U.S. technical contingent has been built up to support next generation development. Homologation of the vehicle was required to meet all U.S. requirements. Using data collection (from Smith developed telemetry) and lessons learned from vehicle launch, a Gen 2 development is now underway. A conventional drive axle is used, which directionally will reduce powertrain cost. The second reviewer indicated that Smith U.S. has a well-thought-out approach capitalizing initially on the technical expertise and long experience of Smith U.K. This includes the conversion of the Newton platform to DOT requirements, R&D of second generation vehicle systems emphasizing performance and cost reduction, as well as telemetry systems. This project includes the development of a new manufacturing facility, enhancements to the supply chain, and a requirement that customers agree to participation in a 2-3 year data collection program. The overall approach is multi-faceted, currently utilizing battery technology from Valance and A123. The one area that is not ostensibly noted is strong efforts at visibility and awareness. Consideration should be given to ways to highlight the visibility of these vehicles through the media in local communities.

QUESTION 3: CHARACTERIZE YOUR UNDERSTANDING OF THE TECHNICAL ACCOMPLISHMENTS AND PROGRESS TOWARD OVERALL PROJECT AND DOE GOALS.

The first respondent noted that homologation was successfully completed and that the vehicle has been launched in the marketplace. Supply base in the U.S. in several areas has now been established, though much more work is required to fully develop a U.S. supply base. Approximately 247 units have been sold, with 147 vehicles delivered to date. This reviewer added that the project team has worked to obtain NREL approval of Smith Data Acquisition System. The next phase (and most challenging) is to develop a cost reduced Gen 2 version. This was a very rational, logical approach, building on existing proven technology to produce a U.S. version of the Smith vehicle. The final reviewer indicated that the project has clear milestones and appears largely on track for achieving them. To date, notable technical accomplishments have been achieved across the board including transfer of the Newton platform, institution of successful localization of the supply base, initiation of second generation product development, establishment of a manufacturing facility (leading to 95 new jobs), successful implementation of a Smith telemetry system, and confirmed orders for 235 vehicles (about half of the project target total).

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

The first reviewer stated that primary collaboration has been with Smith U.K. and all technology has now been purchased by Smith U.S. Smith U.S. has developed relationships with key suppliers and is currently working to increase U.S. supply base for a wider range of components. It is suggested that Smith reach out and become involved in one or more of the initiatives to develop standardized charging facilities and vehicle to grid communications. The second reviewer felt that the collaboration is responsible but appears largely limited to within Smith U.S. / U.K. other than some first generation suppliers and university contacts for technology R&D and education and training. Smith is working closely with customers to specify product improvements. There may be opportunities working with NREL to identify additional optimal medium duty applications for the Smith Technology. NREL has done numerous studies and conducted modeling activities examining attractive medium duty applications for advanced vehicle technologies. There may also be some opportunities to team with other vehicle manufacturers who have readymade platforms for specific medium duty electric vehicle applications. The final reviewer pointed out that the presentation was kind of vague in the presentation as to "collaborators" including customers, suppliers, and institutions.

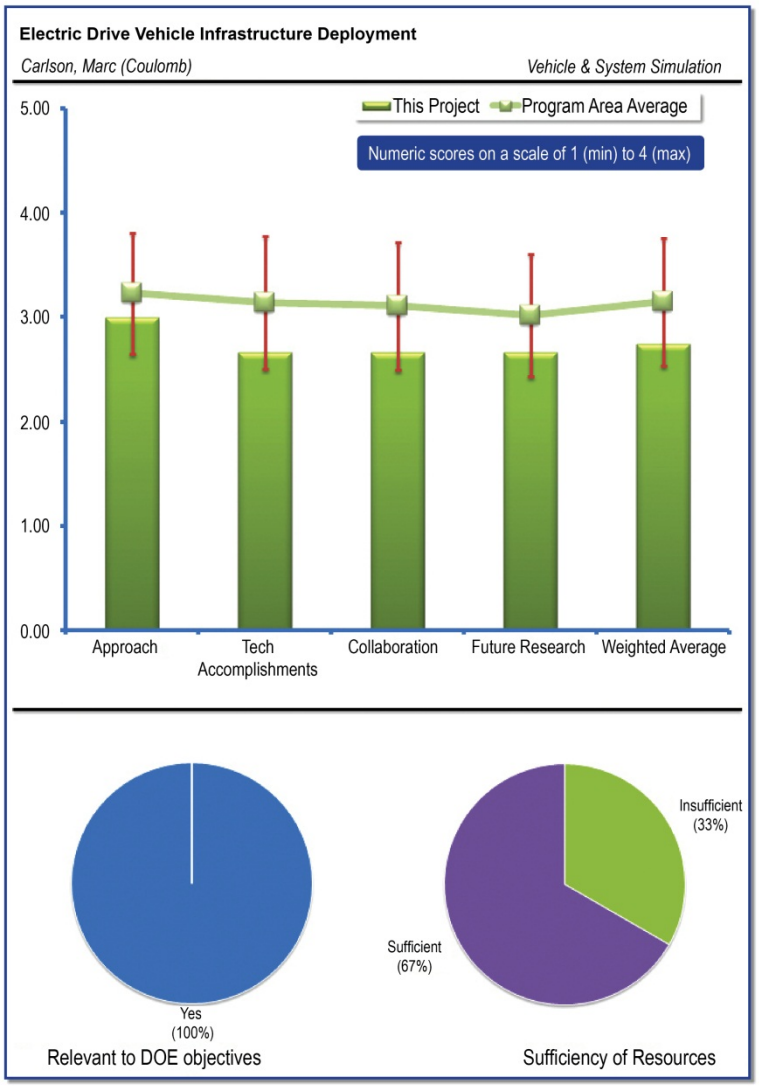
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

The first respondent pointed out that future work includes full deployment of 510 vehicles, continuation of data collection and development of Gen 2 systems. In addition, more development of manufacturing and assembly processes is required in anticipation of complete vehicle assembly in the U.S. This reviewer thought that their approach is logical, and the emphasis on cost reduction for Gen 2 is well placed. The vehicle cannot likely achieve attractive production volumes without a strong business case for owner, which mandates a modest premium over the cost of a conventionally powered vehicle. The final reviewer felt that the proposed future work is a logical extension of Smith current activities to improve the technology and manufacturing processes, strengthen the supplier chain, expand training of the work force, and reduce costs. Smith believes they may be able to sell 4,000-5,000 electric medium duty vehicles over the next 3 years. Again, as part of this project, efforts should be made to highlight visibility in local communities.

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

Reviewers felt that this was a very relevant project and resources appear to be adequate, although based on verbal comments during the presentation, Smith is still ramping up both their production and technical areas. The final reviewer expressed that this is a large ARRA task ($32M) of which most (88%) of funding passes through to the vehicle purchasers. The task is sufficiently funded for now. If significant success is achieved, costs are dramatically reduced, and notable vehicle sales are achieved after removable of incentives, consideration should be given to additional funding to further accelerate penetration of the medium-duty vehicle market.

Electric Drive Vehicle Infrastructure Deployment: Carlson, Marc (Coulomb) – arravt073



Reviewer Sample Size

This project had a total of three reviewers.

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

The first reviewer noted that in order for electric vehicles to reach their full market potential, a robust, standardized charging infrastructure must be in place, including provisions for both in-home charging and public charging facilities. This project seeks to demonstrate the viability and benefits of an EV charging infrastructure. A sound, standardized, cost effective infrastructure clearly will accelerate acceptance of electric vehicles, which obviously results in reduced petroleum consumption. Another reviewer indicated that overcoming barriers to charging infrastructure for electric drive vehicles is essential to market implementation of electric vehicles.

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

The first reviewer asserted that the focus of this project is to demonstrate the viability of an electric drive vehicle charging infrastructure. The project will provide approximately 4,600 public and private Level 2 charging stations from which data will be collected and forwarded to INL for compilation and analysis. Efforts are being made to coordinate OEM EV deployments (GM Volt and Ford Transit Connect and FOCUS BEV, as well as smart EV) with charging station installations to maximize usage. The project will leverage other company efforts and infrastructure. The project is also working with the local press to expand awareness and receptivity. The second respondent acknowledged that under this project, approximately 4,600 charging stations (both public and private) will be deployed in 10 metropolitan areas. The project includes three OEM partners (GM, Ford, and SMART Car). The first phase of the program, which began in June 2010, involves the deployment of the charging stations, with a targeted completion date of December 2011. Phase 2 will have a two-year duration, during which time data will be collected concerning the times of highest charging, charging rates, and load on the grid. This program does not appear to be quite as well organized as several other DOE-sponsored projects with similar objectives. The lack of detail in the presentation and the apparent delays in charger installations are two indicators. The reviewer added that all data will be forwarded to Idaho National Labs for analysis and summary.

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

The first respondent expressed that charging station installations have begun and are scheduled to be completed by the end of 2011. This phase of the program appears to be significantly behind schedule. Of the 4,600 stations to be installed, only 1,000 units have been built, and only 500 installed to date. Completion by December seems ambitious at this point. This reviewer added that data

are now being collected and forwarded to INL. Early observations point to the fact that requirements may vary by region. General knowledge of EV's and charging facilities differs by region. The challenge in densely populated metropolitan areas is the lack of parking spaces, where public charging stations could be installed. Some metro areas are opting for "free parking and charging" as a means of stimulating interest in and acceptance of EV's. Other metro areas will provide charging on a fee basis. According to this reviewer, no hard data were shared during the presentation and it is not known if there is sufficient data yet available to form the basis of a summary report. Another reviewer stated that not much information is provided beyond a high level on the technical progress of this task which appears to be somewhat behind schedule based on shipped and installed units. Some early insights and observations are noted as to differences across regions, business models, charging hosts. Some early policy recommendations are provided that largely correlates with current conventional thinking surrounding the development of a viable electric vehicle charging infrastructure.

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

A reviewer pointed out that partnerships have been formed with GM (Volt), Ford (Transit Connect vehicle) and SMART Car (EV version). In addition, ten metropolitan areas have been selected for charging station installations. To some extent, installations are being patterned after EV sales in a particular region. As noted, INL is handling all data analysis and summary. The reviewer added that this project is similar to several other DOE sponsored programs exploring current and future EV infrastructure requirement, and also strongly recommended that DOE find a means of facilitating collaboration amongst these several projects, to the benefit of all. The final reviewer noted that little specific information was provided as to existing and future planned collaborations outside of obvious connections with the automotive OEMs. Reference is made to multiple "matching sources" but is not clearly elucidated.

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

The first respondent stated that future work involves completion of charging station installations and continuation of data collection and analysis. Another reviewer indicated that little information was provided to assess proposed future activities outside the ultimate deployment target of 4,600 stations.

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

Based on delay in charging station installations, there is some indication that resources may be lacking. This was not specifically addressed in the slides or during the verbal presentation. The final reviewer felt that the resources are sufficient for this task.

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

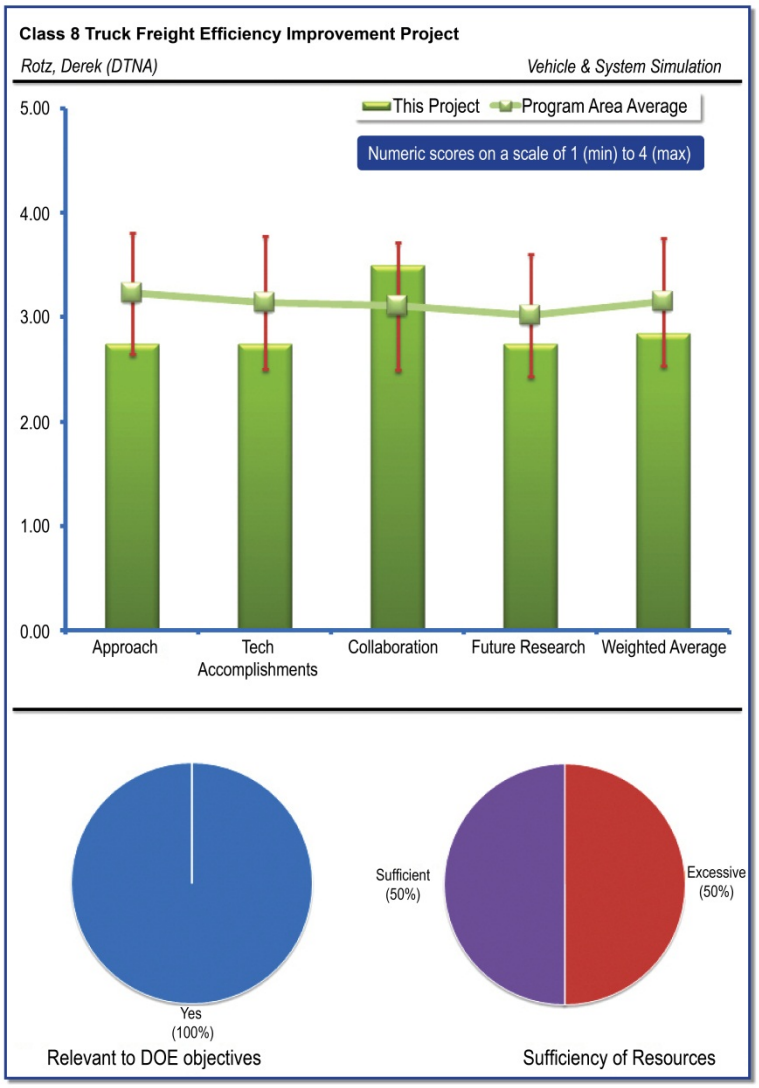
Reviewer Sample Size

This project had a total of four reviewers.

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

Reviewers generally thought that the project supported overall DOE objectives. The first reviewer pointed out that this is the direct study of fuel use reduction in heavy trucks. Another reviewer felt that the stated program objective supports the overall SuperTruck goal of a 50% improvement in freight efficiency. Multiple advanced technologies are being considered and integrated into the demonstration including hybridization, weight reduction, and aerodynamic improvements. The third reviewer stated that Class 8 trucking is a significant portion of on-highway fuel use and that a 50% improvement in freight efficiency would enable petroleum displacement. The final reviewer noted that the goal is 50% increase in fuel efficiency. However, given the five year time line, success is difficult to evaluate with this only being the first year review.

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



Reviewers generally provided a positive assessment, and offered suggestions. The first reviewer indicated that the approach to holistic fuel use reduction is good. They are trying to integrate multiple subsystems and the interaction between each subsystem and have a good approach to developing baseline drive-cycle. Only criticism would be limited hours and miles documented, in a limited region of the U.S. Drive cycle documentation does not include middle America prairie routes, nor Rocky Mountain basin range cycles. However, wind tunnel testing hours seem appropriate. Another reviewer asserted that this was a logical approach but some partners are missing versus claims for performance improvement (tires, axles, ...). Michelin is tire partner that was answered in questions. The reviewer also added that the torque limiting and energy management solutions are novel but questions if there are safety risks with it. The third reviewer confirmed that a structured approach was presented and appears to be followed. Good use of model based design and simulation to evaluate candidate technologies and their respective impacts on the overall goal of the project. The final reviewer asserted that the approach includes analysis of options to improve freight efficiency, but there was no mention or acknowledgement of past experiences and/or constraints based on user expectations and paybacks. Understanding that this is a “demo/development” project, it is acceptable that there will not be a commercial product as an output, but there could be better acknowledgement of past fleet trials (tires, aero and hybrid) to avoid demonstrating technologies that fleets will not implement. If it is a technology that has shown significant implementation barriers, then an effort should be made to improve this in order to gain acceptance.

QUESTION 3: CHARACTERIZE YOUR UNDERSTANDING OF THE TECHNICAL ACCOMPLISHMENTS AND PROGRESS TOWARD OVERALL PROJECT AND DOE GOALS.

Reviewers saw evidence of progress in the early stages of the project. The first reviewer pointed out that the project is only 20% complete on a time line basis, so success to final goal cannot be expected to be high. However, on this basis, progress appears to be significant. The second reviewer asserted that less than $3M has been spent in $80M project and good work to establish baselines on baseline vehicles but appears to be little work to date on advanced technologies, and also pointed out good simulations and computation done by the project. They are hiring new employees to gear up for this effort and thus expect technical efforts to accelerate in future years. Other reviewers indicated that the project appears to be on suggested timeline and making good progress. The budget YTD seems reasonable for work presented, presumed to significantly ramp out when prototype hardware builds begin.

QUESTION 4: WHAT IS YOUR ASSESSMENT OF THE LEVEL OF COLLABORATION AND COORDINATION WITH OTHER INSTITUTIONS?

Reviewers saw a high-level of collaboration, and also suggested additional partners. The first reviewer expressed that the project has very good partner profile, including a university, two engine manufacturers, two large truck fleets, truck OEM, and two trailer/aerodynamics companies. Michelin needs to be identified as a partner, given the potential fuel savings from tire design changes. Waste heat recovery system partner needs to be identified. Another reviewer pointed out that this is the smallest of the three teams, some critical partners seem to be missing compared to claims for performance. From the response to questions it sounds like Daimler is working with a number of supplier partners (Michelin, axle, ...) that are officially on the team and perhaps are not participating in team meetings. It is unclear if there is true collaboration or if Daimler is simply passing requests along to suppliers. The third reviewer confirmed that the team had a good mix of partners to successfully complete and demonstrate technology. The reviewer added that the universities and fleet identified, as well as trailer manufacturer and aero improvements company. The final reviewer felt that interaction with Fleets should be highlighted better to show a “customer acceptable” solution.

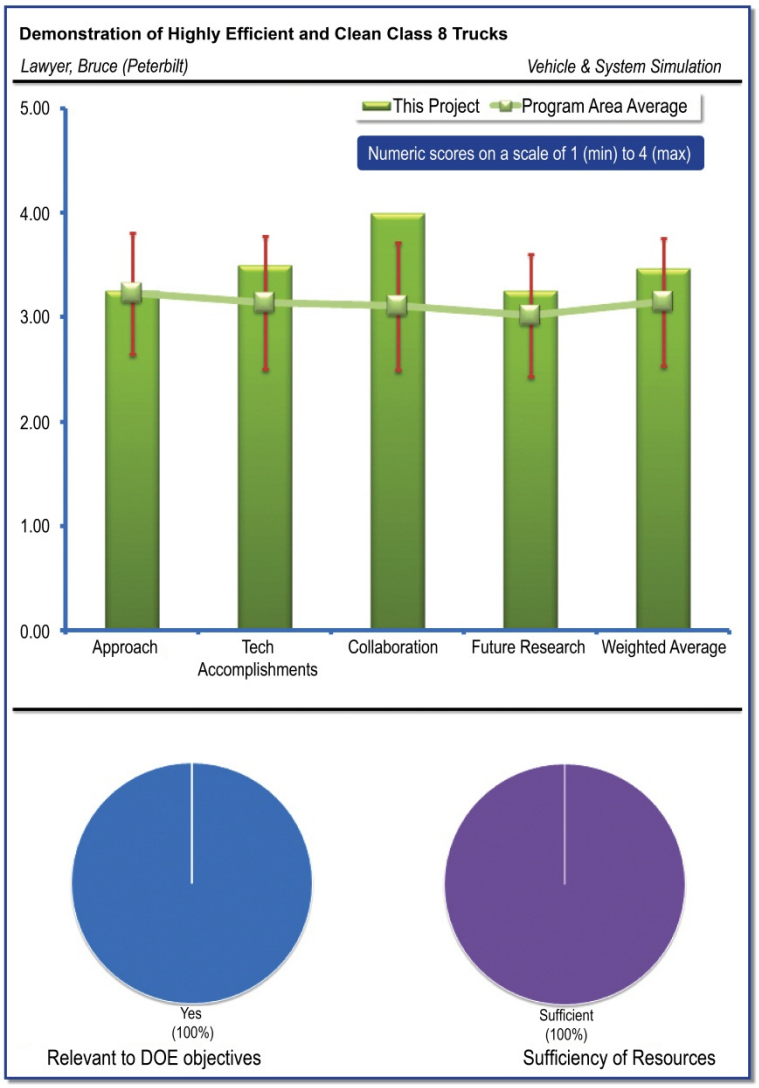
QUESTION 5: HAS THE PROJECT EFFECTIVELY PLANNED ITS FUTURE WORK IN A LOGICAL MANNER BY INCORPORATING APPROPRIATE DECISION POINTS, CONSIDERING BARRIERS TO THE REALIZATION OF THE PROPOSED TECHNOLOGY, AND, WHEN SENSIBLE, MITIGATING RISK BY PROVIDING ALTERNATE DEVELOPMENT PATHWAYS?

The first reviewer acknowledged that the future work was presented as a natural progress to completed work to date. Detailed timeline developed and presented supports logical progression to completion. The second reviewer confirmed that the decision points based on simulation, data and builds seems logical**.** The third reviewer thought that the research is too preliminary to require decision points, as all research to date indicates positive potential fuel use reductions. Continuation of holistic systems approach is positive at this point in this project. Hardware, design, and control systems research, including potentially limiting driver toque demands is good approach. The final reviewer noted that the engine goals of around 10% do not appear to be aggressive enough compared to amount of money being spent. This reviewer also observed a lot of work on parasitic, aero etc., but engine work appears too limited. The engine work is being presented separately so this may be addressed later. A few areas appear to rely more on hope than on a clearly defined plan (tires). Tire baseline appears to be dated technology; that is perhaps half of projected tire gains are already commercially available (singles).

QUESTION 6: HOW SUFFICIENT ARE THE RESOURCES FOR THE PROJECT TO ACHIEVE THE STATED MILESTONES IN A TIMELY FASHION?

The first reviewer indicated that the project had $79 million total budget, or $16 million per year, which seems to be a very reasonable budget for work envisioned. Another reviewer stated that the program demonstrated sufficient resources are being employed. Vehicle prototype integration plans not fully presented which is critical to success of program. The third reviewer stated that the distribution of expenditures versus the tasks and the work / resources proposed versus gains expected is unclear. The third reviewer pointed out that the team has spent less than $3M of 5 year/$80M project. If linearly scaled up, they should have spent around $16M and are now hiring to ramp up to spend later. The reviewer questioned if actions are necessary to ensure that the funds will be used and that the targets will be achieved. The final reviewer indicated that the $40 million budget is less than 5% spent, so available resources seem excessive.

Demonstration of Highly Efficient and Clean Class 8 Trucks: Lawyer, Bruce (Peterbilt) – arravt081



Reviewer Sample Size

This project had a total of four reviewers.

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

One reviewer indicated that the goal of 50% is appropriate, and a second reviewer commented that the project directly addresses fuel consumption. Another reviewer pointed out that powertrain focus coupled with aero and rolling resistance reductions are used to focus on fuel efficiency benefits. The final reviewer asserted that the project properly baselined their test case and evaluated against commercially viable technologies which meet the Super Truck #2 objectives.

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

Reviewers generally responded positively to the approach, while also providing comments about addressing technical barriers. The first reviewer stated that the initial modeled results are showing 24 hour duty cycle results very positive to date. Another reviewer noted well planning, an aggressive approach, fast launch, and a good use of resources. The reviewer also added that the project had a comprehensive approach including CO_2 and pollution analyses as well as fuel and weight issues. This reviewer indicated that adding route performance partner (Garmin) and research is quite innovative. The targets are believable by technology area. They are starting with a baseline that is already at an aggressive level for fuel economy (2009 model). The third reviewer pointed out that the project is in early stages, modeling completed. This reviewer expressed a need to see how project progresses to determine if approach and technical barrier issues are addressed. The final reviewer stated that the program identified categories for energy losses which allowed for technology focus areas including cooling and Waste heat recovery, weight reduction, RPM reduction, Trailer Aero, and communication speed from Vehicle to Trailer/system. A basic project schedule was shown, but prioritization or recognition of the difficulties in the different categories was not addressed. There was attention to the impact/ (value of program goals) from the different categories.

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

Reviewers saw evidence of progress towards meeting goals. The first reviewer indicated very strong accomplishments to date based on fuel reductions to date against current year goals toward final project goals. The second reviewer saw strong progress, particularly with the aero work, and that the results to date give confidence they will meet the goals. The reviewer questioned if too much weight is assumed to come from the trailer, but utilities and Alcoa give confidence they will achieve this. The reviewer added that overall weight gains are impressive and there was nice work on vehicle and systems communications system, and pointed out that the trailer is

built, the transmission has been designed, and the APU and heat recovery systems have been designed. The reviewer also noted that all team members appear to be contributing. Another reviewer confirmed that the project has met all milestones to date (design phase, computer intensive). The final reviewer confirmed the list of technical accomplishments and noted simulation versus initial test results (3-5%) variance. However, mentioned that the accomplishments were not listed as a % of goal achieved for specific categories, only overall truck system. The reviewer also stated that no discovered technical barrier issues were discussed, though in question and answer the comment regarding Solid Oxide Fuel cell issues for warm-up.

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

Reviewers were complimentary about the collaboration and coordination with other stakeholders. The first reviewer expressed very good partnering group from supplies to trailer manufacturer, end-user fleet, and OEMs and added that there does not appear to be a missing partner. The second reviewer pronounced them a great team and stated that they have all the right partners to address the key issues and a great plan. The reviewer indicated that the team members and plan provide confidence that they are working together and collaborating. This reviewer was given the impression of strong team work rather than an OEM dictating targets to suppliers. There was also validation by running vehicles in fleet with partner (U.S. Express) during the program is a plus. Other reviewers commented on the long list of pertinent industry collaborators to achieve goals and the excellent partnering network, to properly distribute work with subsystem experts.

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

The first reviewer asserted that to date, results are exceeding current goals, suggesting good planning, with both excessive weight reductions and fuel savings. The anticipation of on road testing of second truck is appropriate. This reviewer also indicated good real world research lead by a company that understands need for final research to produce an economically viable product. Another stated that the project's very clear and logical approach gave this reviewer confidence that this team will meet the goals and deliver some breakthroughs along the way. The reviewer added that there are plenty of options to ensure that some can fail and they will still meet or exceed targets. The final reviewer asserted that the future work is in an alignment with the overall plan, but does not list the weighting factor of the future work versus the "to date" in the ability of the modifications to meet the over program goals. The final reviewer questioned if they have knocked of the low hanging fruit and now will be struggling to meet the goals of the next phase.

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

The first reviewer confirmed that resources appear to be sufficient as measured by funds spent to date and fuel reduction progress to date. Another reviewer felt that the project's resource level was great and the project had a fast ramp-up and good use of resources to aggressively achieve the plan. The final reviewer pointed out that the partnership list appears to be capable of delivering on the project deliverables. The reviewer added that the next steps in validation of the upfront analysis, will truly determine if the proper resources have been applied by each of the partners.