8. TECHNOLOGY INTEGRATION

The Technology Integration subprogram accelerates the adoption and use of alternative fuel and advanced technology vehicles to help meet national energy and environmental goals and accelerate dissemination of advanced vehicle technologies through demonstrations and education. This subprogram's efforts logically follow successful research by industry and government and help to accelerate the commercialization and/or widespread adoption of technologies that are developed in other VT program areas. Deployment activities linked to R&D also provide early market feedback to emerging R&D.

Subprogram functions include both regulatory and voluntary components. The regulatory elements include legislative, rulemaking, and compliance activities associated with alternative fuel requirements identified within the Energy Policy Acts of 1992 and 2005 (EPACT 1992 and EPACT 2005). Voluntary efforts include demonstration of advanced technology vehicles to verify market readiness and public information, education, outreach and technical assistance efforts. VTP works with public/private partnerships between DOE and local coalitions of key stakeholders across the country (such as Clean Cities) to implement strategies and projects that displace petroleum. In addition, the annual DOE/EPA Fuel Economy Guide publication and related data dissemination efforts (required by law) are produced, along with the website www.fueleconomy.gov.

Education aids in overcoming institutional barriers to widespread use of advanced vehicle technologies and alternative fuels. Activities such as the Advanced Vehicle Competitions (EcoCAR) and GATE encourage the interest of university student engineers and engage their participation in advanced technology development.

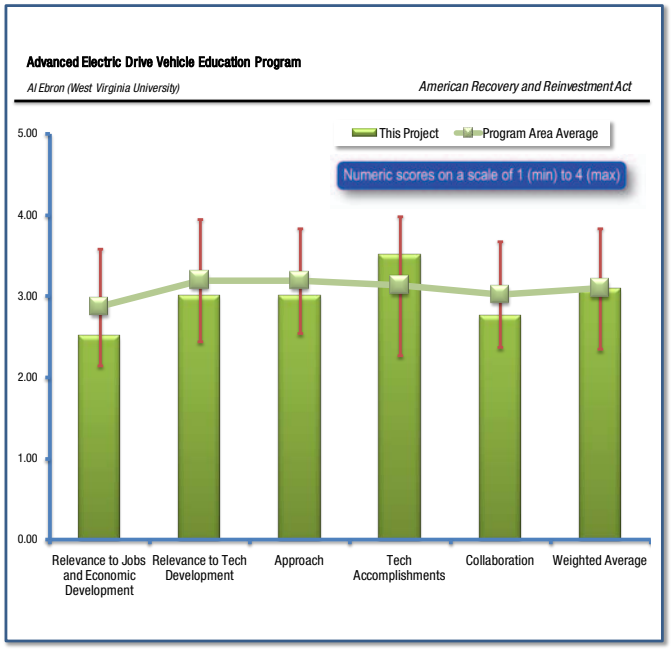
In August 2009, the Department announced the selection of eighteen projects totaling $400 million to purchase thousands of plug-in hybrid and all-electric vehicles for test demonstrations in several dozen locations; to deploy them and evaluate their performance; to install electric charging infrastructure; and to provide education and workforce training to support the transition to advanced electric transportation systems. ARRA-funded Advanced Electric Drive Vehicle Education activity supports educational programs to substantially reduce petroleum consumption. Activities under this program include engineering degree and certificate programs, emergency responder and safety training, consumer and K-12 educational outreach, developing and providing teaching materials, and training service personnel, vehicle mechanics, and supporting infrastructure. For this merit review, these projects were the only ones reviewed: the remainder of the Technology Integration activity was not reviewed in 2010.

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. 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	Relevance to Jobs and Economic Development	Relevance to Technology Development	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Advanced Electric Drive Vehicle Education Program	Al Ebron (West Virginia University)	8-3	2.50	3.00	3.00	3.50	2.75	3.09
Indiana Advanced Electric Vehicle Training and Education Consortium (I-AEVtec)	James Caruthers (Purdue University)	8-6	2.80	3.40	3.40	3.60	3.00	3.34
Advanced Electric Drive Vehicle Education Program: CSU Ventures	Gary Caille (Colorado State University)	8-9	3.50	3.00	3.00	3.67	3.25	3.38
Advanced Electric Drive Vehicles – A Comprehensive Education, Training, and Outreach Program	Mehdi Ferdowsi (Missouri University of Science and Technology)	8-12	2.50	2.80	2.40	3.00	3.00	2.69

Presentation Title	Principal Investigator and Organization	Page Number	Relevance to Jobs and Economic Development	Relevance to Technology Development	Technical Accomplishments	Collaborations	Future Research	Weighted Average
Development and Implementation of Degree Programs in Electric Drive Vehicle Technology	Ka Yuen Simon Ng (Wayne State University)	8-15	3.25	3.25	3.75	3.25	3.25	3.43
U.S. Emergency Responder Safety Training for Advanced Electric Drive Vehicles	Andrew Klock (National Fire Protection Association)	8-18	2.43	3.29	3.14	3.43	2.83	3.10
Recovery Act – An Interdisciplinary Program for Education and Outreach in Transportation Electrification	Carl Anderson (Michigan Technological University)	8-22	3.25	3.50	3.50	3.25	3.25	3.34
Recovery Act—Transportation Electrification Education Partnership for Green Jobs and Sustainable Mobility	Huei Peng (University of Michigan)	8-25	3.00	3.00	3.40	3.20	3.00	3.22
Advanced Electric Drive Vehicles	Lawrence Schwendeman (J. Sargeant Reynolds Community College)	8-28	3.00	3.50	3.25	1.50	3.50	2.51
Electric Vehicle Service Personnel Training Program	Gerald Bernstein (City College of San Francisco)	8-31	2.80	3.20	3.20	2.80	2.60	2.93
OVERALL AVERAGE			**2.87**	**3.20**	**3.19**	**3.13**	**3.02**	**3.09**

Advanced Electric Drive Vehicle Education Program: Al Ebron, West Virginia University



Reviewer Sample Size

This project had a total of 4 reviewers.

Question 1a. Relevance: Is the project effort relevant to the American Recovery and Reinvestment Act (ARRA) of 2009 goals: Create new jobs as well as save existing ones; spur economic activity and invest in long-term economic growth.

The first reviewer stated this project envisions a development of 17 new FTE jobs while retaining 20.5 FTE positions. With the total budget described as $8.6 million for three years, this level of funding appears high in order to support 37.5 positions. The reviewer can't see how this project will invest in long-term economic growth. A second reviewer commented that job creation was not discussed in detail, but the numbers were provided in the slides. Education and training programs are an essential part of workforce development, but must be judged as an indirect rather than a direct contribution to recovery goals. The economic growth was anticipated to come from consumer education. Another reviewer said this project will develop in-classroom training and online information which is geared at educating first responders on the various electric drive technologies, which hopefully should help to retain jobs and also educate people about becoming trainers. The project will also educate the public about advanced transportation technologies, which will hopefully lead to larger market penetration of the technologies into the marketplace.

The final reviewer said that while the development of secondary education materials may make students "more marketable," the fact that all students can find jobs upon graduation tends to indicate that the addition of EV and HEV technology content by itself will not increase the amount of jobs that are created. Where jobs could be created is if the tasks with EV and HEV's are considered as higher status jobs—then more students might enroll and thus fill these empty mechanic jobs. In regards to first responder training, the reviewer sees no additional jobs being created by the creation/addition of EV and HEV specific content to the first responder training curriculum. This reviewer also states in addition to the marketing of EV and HEV technologies and career opportunities, they expect such public outreach can create interest in students to pursue EV and HEV related jobs in which there could be some modest job growth potential for this activity.

Question 1b. Relevance: Does the project's technology development plan and/or deployment plan address the VT ARRA project goals of accelerate the development of U.S. manufacturing capacity for batteries and electric drive components as well as the deployment of electric drive and alternative fuel vehicles and infrastructure? Does the project's development and/or deployment plan address the VT ARRA project goal to establish education projects that accelerate the mass market introduction and penetration of advanced electric drive vehicles, which includes light, medium, and heavy duty advanced electric vehicles (EV), plug-in hybrid electric vehicles (PHEV), and fuel cell electric vehicles (FCV)?

The first reviewer commented that they were unable to determine this as the principal investigator (PI) provided very little real detail as to the project's fundamental underpinnings. The PI spoke in the most general of terms, more about talking to people and different organizations about the effort and almost nothing about the details of the different educational endeavors. This reviewer questioned several numbers that were provided. The PI spoke of the plans to hold 98 one day or half day (depending) seminars over the three-year period with attendance estimated to be about 15 per class, training a total of 1,470 first responders. When asked if police were part of

the population, the PI said they would be invited, even though more often than not police will respond first to a highway incident before fire is ever called, yet the target population for the training is fire fighters. Moreover, when asked about the reach of the program, the PI said 200 million people will be exposed to the information through the use of Odyssey and online programs. There is a lot of space between 1470 folks being trained and 200 million people, so this reviewer needs a lot more detail.

Another reviewer stated that addressing the consumer and emergency responder barriers to widespread acceptance of AEDs should address the VT ARRA project goals of accelerating the development of U.S. manufacturing capacity. Improving automotive technician training will certainly help accelerate the mass market introduction and penetration of AEDs. One other reviewer said this project has a large consumer education/outreach component, including conducting 98 workshops, creating teaching materials, conducting the National AFV Odyssey day two times over the course of the three-year project, trainings to reach multiple audiences, etc. NAFTC has 50 national training centers, tech schools, universities and private schools that do "train the trainer" systems...as the only national group that does this, they can disseminate the training tools to get this new material out across the country. The final reviewer thought that while this project will do little to stimulate/accelerate the development of U.S. manufacturing capacity for batteries and electric drive components, it does lay down the educational underpinnings to stimulate interest in EV/HEV technology, development of the necessary repair technician infrastructure, and assist with the safety of first responders through appropriate education.

Question 2. Development/Deployment Approach: Are the project's technical and deployment milestones and schedule clearly identified, appropriate, and feasible, and are technical and commercial barriers and risks adequately addressed?

The first reviewer said there was so little real detail to the presentation that this is very hard to determine. There appeared to be a number of risks such as the involvement of computer simulations by SABRE but no description of what or how this integration is envisioned was provided. There also wasn't a picture of a proposed simulation concept or strategy. A second reviewer stated the multiple audiences that the team is targeting indicate that the project has outstanding outreach capabilities. The potential of reaching 200 million people in any sort of meaningful way seems a bit dubious, but the team has clearly thought about creating multiple pathways to reach many different audiences. This reviewer is aware that the online simulations haven't yet been started, but careful thought must go into deploying them into schools. Firewalls, administrative hassles and hardware limitations can really cause issues. The bottom line is that it's no simple task, but as the PI indicated, they hadn't yet begun development on that stage. Another reviewer commented that the technical and deployment milestones and schedule are clearly identified, appropriate and feasible, especially given that some of these milestones (conducting the AFV Odyssey Day) have been done in prior years. There wasn't much discussion about technical or commercial barriers and risks, but they are not sure how appropriate that is to this project. The final reviewer said the project seems to have a good handle on how to execute the various elements of the project to meet its specified goals within the specified budget. However, the first responder program seems to be a duplication of efforts with the NFPA project. This reviewer recommends that DOE find a way for them to work together on this project.

Question 3. Technical Accomplishments and Progress: What is the overall progress towards project's objectives and milestones? Is progress adequately reported and quantified (e.g., number of jobs, installations, etc.) as required by ARRA?

The first reviewer said they were unable to determine the rate of progress of overcoming barriers. Two other reviewers stated the project seems to be making good progress at implementation and seemed right on target. The last reviewer commented that given this is a three year project, they have already done a good job getting certain aspects completed: the development of the advisory committee (this group has already had meetings) and are well on their way in developing curriculum and training tools. The slide presentation spoke to being 9% complete in meeting the project objectives, and it seems likely that they will be able to accomplish their overall goals during the three-year period.

QUESTION 4. COLLABORATIONS/PARTNERSHIPS: DOES THE PROJECT TEAM EFFECTIVELY USE COLLABORATIONS/PARTNERSHIPS WITH REGIONAL, STATE, LOCAL GOVERNMENTS, INDUSTRIAL, COMMERCIAL, UNIVERSITY, RESEARCH ORGANIZATIONS, AND SIMILAR ORGANIZATIONS TO ACHIEVE ITS OBJECTIVES?

The first reviewer stated that the PI cited a number of collaborative partners, all of whom are intimately familiar with the automotive industry, and many have experience with the electric vehicle/battery power industry. Another reviewer thought the collaborations and partnerships are where this project really was the strongest. This is a stupendous list of collaborators being incorporated into the project appropriately. One reviewer commented there are a number of partners involved in this project which will help to ensure its success. The final reviewer said the project seems to be well leveraged with significant cost share and a good cross section of partners that have the ability to significantly add value to this project.

PROJECT STRENGTHS

The first reviewer said that presently the concentration on first responder training is good, but the details of how they really intend to do this remain clouded. Another reviewer stated there was an abundance of partners. There was also a good approach of developing a full package of everything from emergency responder training to consumer education to technician training. One reviewer commented that the PI did a good job of outlining the goals and objectives of the project. It appears that they will be able to meet their goal of reaching over 200 million people through all of the activities in this project, including education and outreach activities, safety training and recruiting sites for the National AFV Odyssey. Collaborating with numerous project partners is also a project strength. Nearly 100 training and workshops will be completed through this session. The final reviewer said the project seems to be well organized, leveraged, and supported by a good portfolio of partners.

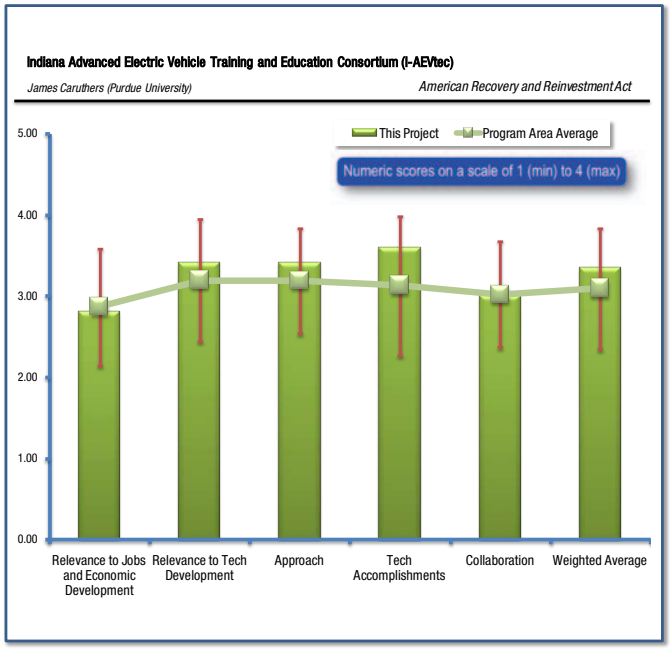
PROJECT WEAKNESSES

The first reviewer said “talk about smoke and mirrors, this project has a lot of it.” The reviewer was troubled by the fact that Sabre is going to develop a simulation, but fails to give details as to what that really means. When asked about how much “hands-on” would be part of the one day or half day training, the PI said about 10%. First responders are hands-on people – they prefer to learn by doing and not sitting through a college type lecture. Hands-on should be no less than 50% of the course, and it can be done with a little thought or imagination. Another reviewer stated there is possible overlap with other projects if the PIs don't talk soon. The reviewer is just not sure the team knows what's involved with online simulations. One reviewer commented their only concern about this project is the degree to which it is creating *new* information, as opposed to simply updating the training curriculum that has been developed over the years by the National Alternative Fuels Training Consortium. Assuming vehicle technologies are continually evolving, then the need to review/update existing training materials is very relevant. The final reviewer said the first responder element of this project is redundant to the efforts being conducted by the NFPA.

SPECIFIC RECOMMENDATIONS

The first reviewer said that a good deal of attention needs to be paid to this program. The details of how and what they intend to do, even from a conceptual perspective, should be demanded by DOE. Their numbers, in terms of expenditures and return on investment and outreach, have no seeming cohesion. The reviewer recommended asking them to provide the details of how they intend to proceed within 90 days, and the answers are not satisfactory this reviewer suggested terminating funding. Two reviewers commented that this is one of several projects addressing emergency responder training. The project needs to coordinate its first responder EV/HEV curriculum development efforts with those being conducted in the NFPA project. In addition, EERE is developing open source technology that may offer a cost savings as this project begins to develop its online simulations.

Indiana Advanced Electric Vehicle Training and Education Consortium (I-AEVtec): James Caruthers, Purdue University



Reviewer Sample Size

This project had a total of 5 reviewers.

Question 1a. Relevance: Is the project effort relevant to the American Recovery and Reinvestment Act (ARRA) of 2009 goals: Create new jobs as well as save existing ones; spur economic activity and invest in long-term economic growth.

The first reviewer said the project directly supports the ARRA 2009 goals to create new jobs and save existing ones in advanced transportation electrification. The project provides 28 new courses for EV education and training and designs and creates new EV certificate programs. Collaborations with industry will provide strong pipelines for students to local and national jobs in the future. Three reviewers stated that no measurable information provided that directly supports job growth. One of those reviewers said that educational efforts clearly support a growing industry and mention of training at Delphi suggests potential for job retention. However, this tie should be strengthened, at least in the presentation. Another reviewer also noted that the PI's response to a question indicated that the project work could result in adding a few positions. While there are important benefits, e.g., improved economic competitiveness, associated with better educated engineers and well-trained technicians, it is difficult to establish a direct link between a project like this and specific job-creation benefits. The last of the reviewers to comment said that no information was provided for job growth, and also said please develop a plan to track students that graduate from the program and go into industry. The final reviewer stated that by educating students in electric vehicle technology, the field of engineering in electric vehicle technology expands and creates a greater opportunity for new ideas and inventions to spur more jobs.

Question 1b. Relevance: Does the project's technology development plan and/or deployment plan address the VT ARRA project goals of accelerate the development of U.S. manufacturing capacity for batteries and electric drive components as well as the deployment of electric drive and alternative fuel vehicles and infrastructure? Does the project's development and/or deployment plan address the VT ARRA project goal to establish education projects that accelerate the mass market introduction and penetration of advanced electric drive vehicles, which includes light, medium, and heavy duty advanced electric vehicles (EV), plug-in hybrid electric vehicles (PHEV), and fuel cell electric vehicles (FCV)?

All five reviewers agreed that the project does an excellent job at developing and creating an EV/VT ARRA education and training project that will directly support the ARRA goal to establish education projects that accelerate mass market production of EV, PHEV and FCV vehicles. One of the reviewers also said that while the deployment to mass market may not be direct, the impact on the market space is indirect. Another reviewer also stated the relevance to impacting medium and heavy duty EVs was not adequately addressed. One reviewer also commented that the involvement of multiple institutions in the project is also important to increasing the numbers of students, as well as consumers generally, whose knowledge will accelerate the introduction and acceptance of competitive vehicles. Another reviewer said this project does not seem to directly address manufacturing capacity and deployment. The final reviewer stated that by educating students and using the go-cart program, the activity will excite the nation into using electric drive vehicles.

Question 2. Development/Deployment Approach: Are the project's technical and deployment milestones and schedule clearly identified, appropriate, and feasible, and are technical and commercial barriers and risks adequately addressed?

The first reviewer said the project team is doing an excellent job at implementation and deployment of their schedule and milestones. Courses are designed and deployed across the university/college systems. A K-12 system is developed, and one EV go-cart race is demonstrated. Multiple hubs are already developed based on the existing nanoHub. The project does an excellent job of leveraging existing resources to accelerate their milestones. The project is extending to other networks like 4-H, which is a creative effect approach. Another reviewer observed that the presenter said that project deliverables were on schedule but the milestones weren't very detailed. Technical and commercial barriers were not really addressed. One reviewer commented that presenter materials suggested that a detailed project plan has been developed. The timeline for each task has been established and activities are well described in both the slides and the oral project presentation. Tasks are clearly identified. Major milestones for each task could be overlaid on the time line, and barriers were not specifically identified or mentioned. A minor point this reviewer had was that it is assumed that the arrows should indicate that Task 6.0 and Task 8.0 activities will occur throughout the three years of the project. Another reviewer said the team addressed coordination/duplication of courses among the many partners, while the last reviewer said this is a very energetic and well rounded program. This project is trying to excite the public into using electric drive vehicles by educating students and using the go-cart program.

Question 3. Technical Accomplishments and Progress: What is the overall progress towards project's objectives and milestones? Is progress adequately reported and quantified (e.g., number of jobs, installations, etc.) as required by ARRA?

The first reviewer stated the project at present stage is making excellent progress toward achieving the project milestones. The number of jobs was not presented, but the fact that 2,000 students attended the first EV go-cart race is impressive and will indirectly impact job creation. Twenty-eight new courses were designed with sixty students. The Indiana Advanced Electric Vehicle Training is also now offering certificates as well as associate degrees for training vehicle technicians, and BS and MS degree programs for design and manufacturing engineers in the electric vehicle industry. They will also offer a certificate program in electric vehicle safety for emergency responders. All of the above demonstrates progress toward the required ARRA goals. Another reviewer said the project was on schedule. All subcontracts with the universities are in place, some just recently. Engagement with industry appears weak at this stage, however. One other reviewer also mentioned the project has gotten off to a great start and all sub-contracts are in place. Courses were developed and delivered in the spring 2010 semester. Both Spring Fest 2010 and the inaugural EV Grand Prix event in April were early accomplishments which are creating awareness of and excitement about the potential for electric drive transportation. Another reviewer commented that this project is just starting; please plan to track students going to industry. The last reviewer said that many classes and labs have already been created. A hands-on approach to education is one of the only ways to have students love the work they do.

Question 4. Collaborations/Partnerships: Does the project team effectively use collaborations/partnerships with regional, state, local governments, industrial, commercial, university, research organizations, and similar organizations to achieve its objectives?

The first reviewer stated the project includes strong industry collaborators such as EnerDel and multiple regional academic centers including Ivy Tech, Notre Dame, IUPUI Purdue-Calumet and IU. The list of industry collaborators is extensive and in fact appears like a consortium. Two MS programs jointly with Delphi and Crane will be highlighted. The project might take under consideration the concept of using staff from industry to lead some of the new courses, for example in advanced battery technology where the speaker indicated that the university does not demonstrate strength. Another reviewer said they would like to see more emphasis with industry and perhaps national laboratories. The presenter indicated there was good integration with multiple Indiana Universities including community colleges. It is unclear how much impact this activity will have outside Indiana. There was also an indicated tie into DoD, which is good but the details need to be explained. A greater role of state and local government other than universities would seem to be an opportunity they could approach. One other reviewer mentioned that the reviewer materials included an impressive list of Indiana academic, industry and other organizations associated with the project. The PI indicated there will be an

initial meeting in July with all members of the consortium. An excellent case was made for the benefits of the emerging partnership with 4-H as a means to engage young people. In response to a question, there was an indication that there will be collaboration with the Indiana Clean Cities coalitions; however, they are not included on the reviewer slides. The last two reviewers agreed there were a very good set of partners, with one of the reviewers also adding to please be sure to coordinate among all of them.

Project Strengths

The first reviewer said the project strengths include a very strong university collaboration and coordinated leadership efforts. The collaborating industry "consortium" is impressive and leveraged well. The program has a strong deployment plan for the Midwest and includes a diversity plan. Performance data and management plans are implemented well. The EV go-cart series is a large draw for exciting the masses and students. The progress on courses is new and certificate programs are very strong. One reviewer stated there were an impressive number of new courses under development. There appears to be significant leveraging with NSF Hub, SmartGrid Award, Clean Cities, etc. Another reviewer stated that the PI has a lot of enthusiasm and excitement. This results in a highly motivated project team, and students who have also become enthused and motivated. There is a comprehensive package of education, training and information initiatives. The project has gotten out of the blocks quickly. Early and successful creation of initial courses bode well for future success. Linkage of this I-AEVtec project with Purdue/Ivy Tech's SmartGrid grant should have benefits for the stakeholders of both projects. One reviewer also said that partnerships are one of the project strengths, leveraging broad capabilities of all the partners. Three of the reviewers also said the EV Grand Prix is an excellent idea and a good strength of the project which will create a lot of outreach opportunity.

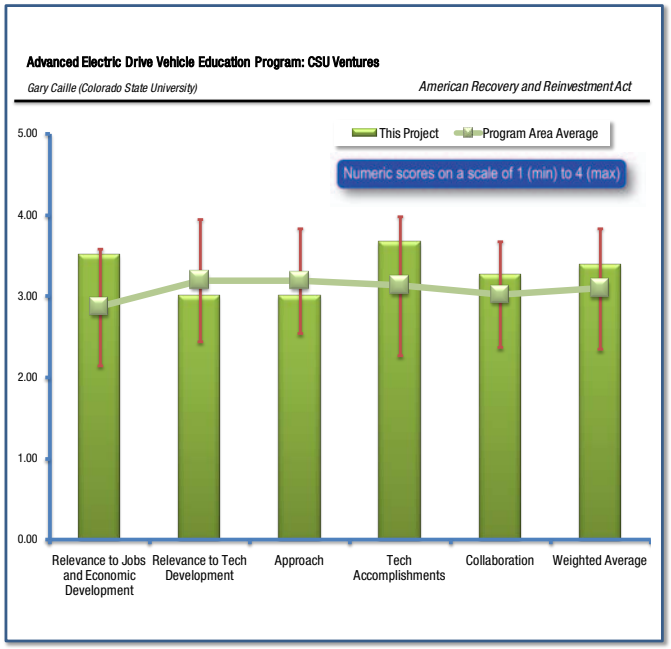
Project Weaknesses

The first reviewer said that the details of courses are lacking. There is a concern about quality of the courses, since many are new without significant new faculty or industry involvement. Another reviewer commented that the large set of partners and capabilities will be very challenging to manage effectively. One other reviewer stated that partnering universities need to become more active in the project. Hopefully by next year with the subcontracts in place, the universities will be active in the project. Two other reviewers mentioned that overall the project is strong and performing at this point very well. One of those reviewers said one thing that may be strengthened is outreach to jobs and training specifically of technicians.

Specific Recommendations

The first reviewer said to consider using EnerDel as a teacher for a battery class. Another reviewer stated this is a good project to continue. Four other reviewers all mentioned the project should get more engagement from the industry, like collaborating with Indiana's Clean Cities coalitions, universities, and vehicle manufacturers as well as exchanging information, etc. with other recipients of ARRA Vehicle Technologies education grants working on other similar efforts to leverage and develop best practices.

Advanced Electric Drive Vehicle Education Program: CSU Ventures: Gary Caille, Colorado State University



Reviewer Sample Size

This project had a total of 5 reviewers.

Question 1a. Relevance: Is the project effort relevant to the American Recovery and Reinvestment Act (ARRA) of 2009 goals: Create new jobs as well as save existing ones; spur economic activity and invest in long-term economic growth.

The first reviewer said one of the more attractive parts of this project is the specific and stated goal of attracting veterans to the training program; this is admirable and correctly done. Another reviewer stated the team has identified several key workforce challenges such as the need for training and addressing the barriers that prevent potential workers from entering jobs (awareness of opportunities, training, financial assistance). They have provided opportunities to address these issues. Their ongoing and proposed activities will increase the effectiveness of training and seem to be on track to create new jobs. It is very exciting to see a project that addresses the issue of how training links to the pipeline of employment—at least for the community college piece. One reviewer commented there is good information about the relationship between potential jobs, the ability for women to be good technicians, the need for returning vets to get jobs, and the well-paying aspect of these jobs. Targeting audiences from middle school all the way through professional educators and conducting related outreach is a strength. Two of the reviewers also noted in their remarks that there is a shortage of 60,000 qualified automotive technicians, with the added complication of those skilled in new propulsion activities.

The last reviewer said the development of secondary education materials may make students "more marketable", but the fact that all students can find jobs upon graduation tends to indicate that the addition of EV and HEV technology content by itself will not increase the amount of jobs that are created. Jobs could be created if the jobs on EV and HEV's are considered to be higher status – then more student enrollment might result and thus fill the empty mechanics jobs that are currently out there. In the first responder training there are no additional jobs being created by the creation/addition of EV and HEV specific content to the first responder training curriculum. For the university engineering degree programs, given the fact that OEM's and system suppliers are in a crash course to develop and market EV and HEV's, there is a need for engineers with appropriate EV/HEV skills. Thus, many current engineers whose skills are not currently in demand may be able to use this training to position themselves to be able to re-enter the job market with skills that are in demand.

Question 1b. Relevance: Does the project's technology development plan and/or deployment plan address the VT ARRA project goals of accelerate the development of U.S. manufacturing capacity for batteries and electric drive components as well as the deployment of electric drive and alternative fuel vehicles and infrastructure? Does the project's development and/or deployment plan address the VT ARRA project goal to establish education projects that accelerate the mass market introduction and penetration of advanced electric drive vehicles, which includes light, medium, and heavy duty advanced electric vehicles (EV), plug-in hybrid electric vehicles (PHEV), and fuel cell electric vehicles (FCV)?

The first reviewer said the project is starting early, as they are working with all levels of education for ULEV technicians starting in middle school to the college level and beyond. This project, as well as the process of educating the interested individuals, will take time and a number of years to complete. Another reviewer commented there is a great approach with curriculum development, hands-

on test equipment and inclusion of virtual reality based training. The program will help to create an educated and skilled group who can service vehicles and fill jobs helping with the deployment of alternative fuel vehicles. By working on modifying course curriculum, this project is helping with institutional change. One other reviewer mentioned that contracts are in place for all subcontractors, there was a kick off meeting held in February, they have started to hire grad students, courses have been started, and a professional course in hybrid technology is being developed. They are also working on a maintenance course to tie in with EV courses as well as looking to leverage course development from various outlets (Georgia Tech and Colorado State). The last reviewer stated that while the first responder and secondary/mechanic training aspects of this project will do little to stimulate/accelerate the development of U.S. manufacturing capacity for batteries and electric drive components, they do lay down the educational underpinnings to stimulate interest in EV/HEV technology, develop the necessary repair technician infrastructure, and assist the safety of first responders through appropriate education. However the university engineering degree program will help generate the U.S. based engineering talent necessary to stimulate/accelerate/sustain the development of U.S. manufacturing capacity for batteries and electric drive components as well as OEM integration of these systems.

Question 2. Development/Deployment Approach: Are the project's technical and deployment milestones and schedule clearly identified, appropriate, and feasible, and are technical and commercial barriers and risks adequately addressed?

The first reviewer said yes, they are faced with similar issues associated with the slow acceptance of change in educational curricula at the state level. Trying to institute institutional change is difficult and the reviewer would recommend that DOE support these endeavors nationwide with appropriate visits by senior DOE managers with their grantees to the state educational decision making bodies to express to them the need to "fast track" approval of the curricula certifications. Another reviewer mentioned it seems hard to improve on the approach. The PI is well aware of the challenges of overcoming the institutional inertia of four-year universities, but the team is working hard on making progress and keeping to schedule. This reviewer is very impressed by the proposed plan that focuses on special needs populations, women and veterans. One reviewer commented that the first responder course mod is 75% complete at Arapahoe Community College; modifications to the automotive tech training course are in progress, the team has procured all of their test equipment, and they have initiated virtual reality training options. The project also initiated a design study to develop a management engine to take inquiries to appropriate web locations. It will be very interesting to know if this project is successful with the returning veterans. The final reviewer stated the project seems to have a good handle on how to execute the various elements of the project to meet its specified goals within the specified budget. However, the first responder program seems to be a duplication of efforts with the NFPA project. This reviewer would recommend that the DOE find a way for them to work together on this project.

Question 3. Technical Accomplishments and Progress: What is the overall progress towards project's objectives and milestones? Is progress adequately reported and quantified (e.g., number of jobs, installations, etc.) as required by ARRA?

The first reviewer said that CSU has procured the equipment necessary to conduct the labs and hands-on training associated with the project. This is considered a major milestone accomplished so far. They appear ready to proceed with the training but were frustrated with the process of gaining certification from the state agencies. Another reviewer stated the progress was well documented and well reported. It seemed like a lot of work had been started but was just in initial phases. The presentation did indicate progress was being made but that more significant progress would be made over the summer. One reviewer mentioned that it was noted that job creation will reach approximately 80-85 new full time employees. When asked how the veterans are responding to the program, it was noted that it is still too early to tell, given the state of the project. The last reviewer commented the project seems to be making good progress at implementation and goal fulfillment.

Question 4. Collaborations/Partnerships: Does the project team effectively use collaborations/partnerships with regional, state, local governments, industrial, commercial, university, research organizations, and similar organizations to achieve its objectives?

The first reviewer said the types and levels of collaboration and partnership associated with this project are outstanding; it appears they are including the right stakeholders into the process from the beginning. Another reviewer stated the collaborations and project

goals that targeted special populations like women and returning vets is laudable. One reviewer commented there is a nice job of mixing various partners in this project (Arapaho, Raytheon, MRI, etc). Attempting to leverage these groups, including veteran organizations, to get financial assistance (and not just from the Veterans Administration but other sources). The project team is also working with the CSU School of Occupancy Therapy as well, and the U.S. Army and Marine Corps. The final reviewer mentioned the project seems to be well leveraged with significant cost share and a good cross section of partners that have the ability to significantly add value to this project. However, it seems that there are a number of parallel efforts to develop service tech curriculum. Perhaps, there could be an effort to coordinate these programs so "best practices" can be developed that leverage the great ideas from each of the individual programs.

Project Strengths

The first reviewer said it is a great project that has aims and partners, but as reviewers we were able to see the project in action and it really showed its strength. During the presentation, the PI recognized that there was overlap with emergency responder training for electric vehicles and he was willing to take steps to address this. This really shows that the VT program has funded a flexible project that wants to do good things and is able to respond quickly to a changing landscape. Another reviewer commented the project seems to be well organized, leveraged, and supported by a good portfolio of partners. The use of "virtual reality" concepts to facilitate effective "long distance learning" opportunities is intriguing. For next year's presentation, it would be great if they could demonstrate how it works (i.e., the scope/look/feel of the system). Two reviewers agreed that attracting veterans is a right course of action and should be commended. One of the reviewers also said it will be interesting to see if it succeeds in getting more women in to the field of training on advanced transportation technologies. The presenter did a good job at outlining future activities (graduate certification in electric transportation, etc).

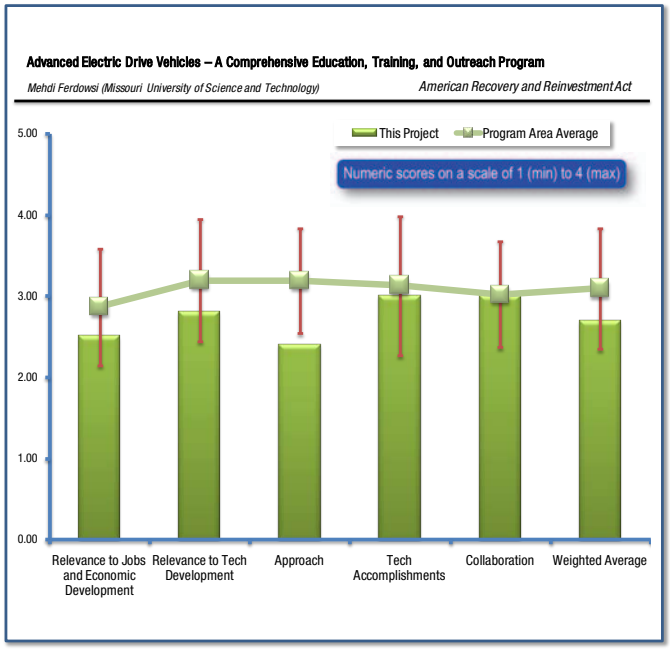
Project Weaknesses

The first reviewer stated that the PI's presentation needs a bit more focus, especially when delineating the program's accomplishments. The reviewer had to ask what they have done so far to learn about the equipment purchase, a major item to report. For the next review, the PI should concentrate on "this is what we were asked to do; this is what we did or have done so far." Another reviewer said the weakness is really minor and probably because of the time allotted for the presentation and the early stage of the project: it was unclear to them how the Virtual Reality (VR) part of the project is integrated. Right now it seems to be a separate part of the effort and it is non-trivial to take high-end simulations and push them out to typical classrooms. The project will need to have a tight integration of trainers, professors, students and VR designers. One reviewer mentioned the first responder element of this project is redundant to the efforts being conducted by the NFPA. The last reviewer did not see any project weaknesses, other than they hope that veterans actually take advantage of the program since it is a great concept.

Specific Recommendations

The first reviewer said that if at all possible, DOE should support presentations to state educational bodies to fast track approval of new curricula. Another reviewer stated they would recommend working with an expert on how best to integrate distance learning. It makes sense given the geographical spread of the partners, but there is an art to it—you can't just decide to use online learning and hope to get the most out of it. The last reviewer commented the project needs to coordinate its first responder EV/HEV curriculum development efforts with those being conducted in the NFPA project. Also, the same type of coordination between parallel programs would also make sense with respect to the development and validation of the service tech curriculum. Perhaps, there could be an effort to coordinate these programs so "best practices" can be developed that leverage the great ideas from each of the individual programs.

Advanced Electric Drive Vehicles – A Comprehensive Education, Training, and Outreach Program: Mehdi Ferdowsi, Missouri University of Science and Technology



REVIEWER SAMPLE SIZE

This project had a total of 5 reviewers.

QUESTION 1A. RELEVANCE: IS THE PROJECT EFFORT RELEVANT TO THE AMERICAN RECOVERY AND REINVESTMENT ACT (ARRA) OF 2009 GOALS: CREATE NEW JOBS AS WELL AS SAVE EXISTING ONES; SPUR ECONOMIC ACTIVITY AND INVEST IN LONG-TERM ECONOMIC GROWTH.

The first reviewer said the project to advance electric drive vehicles using a comprehensive education, training, and outreach program is very relevant to ARRA goals. The project will create new jobs, save existing jobs, and spur economic activity and invest in long-term economic growth by creating a creative outreach and training program for pre-college and high school students in order to develop a pipeline of well-qualified individuals to pursue careers in the field of advanced automotive energy systems. The work includes an innovative technology transfer model to foster research and educational collaborations between the electric drive vehicle industries and academic institutions and presents a means to disseminate the educational research. Three reviewers all said the presentation did not address specific job or economic activity benefits associated with the project. One of those three reviewers also said that refining coursework into a cohesive EV focus thrust will clearly help support the growing need for technologists for a growing EV market. Another one of those reviewers commented that the presented materials have a general statement of the ARRA goals, but no indication of the project's expected contribution to achieving them. No additional information was provided in the oral briefing. While there are important benefits, e.g., improved economic competitiveness, associated with better educated engineers and well-trained technicians, it is difficult to establish a direct link between a project like this and specific job-creation benefits. The last of those three reviewers also said the project is in early stages, and requested that the team develop a plan to track students that graduate from the program and go into industry. The final reviewer observed that by educating students in electric vehicle technology, the field of engineering in electric vehicle technology expands and creates a greater opportunity for new ideas and inventions to spur more jobs.

QUESTION 1B. RELEVANCE: DOES THE PROJECT'S TECHNOLOGY DEVELOPMENT PLAN AND/OR DEPLOYMENT PLAN ADDRESS THE VT ARRA PROJECT GOALS OF ACCELERATE THE DEVELOPMENT OF U.S. MANUFACTURING CAPACITY FOR BATTERIES AND ELECTRIC DRIVE COMPONENTS AS WELL AS THE DEPLOYMENT OF ELECTRIC DRIVE AND ALTERNATIVE FUEL VEHICLES AND INFRASTRUCTURE? DOES THE PROJECT'S DEVELOPMENT AND/OR DEPLOYMENT PLAN ADDRESS THE VT ARRA PROJECT GOAL TO ESTABLISH EDUCATION PROJECTS THAT ACCELERATE THE MASS MARKET INTRODUCTION AND PENETRATION OF ADVANCED ELECTRIC DRIVE VEHICLES, WHICH INCLUDES LIGHT, MEDIUM, AND HEAVY DUTY ADVANCED ELECTRIC VEHICLES (EV), PLUG-IN HYBRID ELECTRIC VEHICLES (PHEV), AND FUEL CELL ELECTRIC VEHICLES (FCV)?

The first reviewer stated the projects is relevant to ARRA goals and as presented will make a substantial contribution to VT ARRA 2009 objectives. Critically important to outstanding success for ARRA is a focus on metrics of success and useful deployment of new materials. The breadth and method for deployment of training tools and education programs is innovative and analytical, and will support the acceleration of development of U.S. manufacturing and an EV infrastructure. Another reviewer said there was no substantive discussion directly addressing manufacturing. Despite identifying two battery companies as half of the industry partners, the educational emphasis on energy storage appears week with the focus being more on power electronics and electric machinery. One reviewer mentioned the initiatives included within the project have the potential to make a significant contribution to a more well-educated and capable electric drive transportation workforce, and to consumers who are better informed. However, the lack of details

and specific plans in the information communicated during the merit review raises concerns about whether the project will achieve its potential.

Another reviewer said this project does not seem to directly address manufacturing capacity and deployment. It does directly establish an education program, and indirectly impacts the mass market introduction of advanced vehicles. Two reviewers commented this project helps prepare automotive engineers, technicians, and personnel for the new field of transportation electrification as well as creates public awareness about electric drive vehicles. One of those reviewers also added the project creates outreach programs.

Question 2. Development/Deployment Approach: Are the project's technical and deployment milestones and schedule clearly identified, appropriate, and feasible, and are technical and commercial barriers and risks adequately addressed?

The first reviewer said while the project is just starting, the approach presented is outstanding. The assessment and deployment plans are far reaching and if implemented correctly, they will have a significant impact on ARRA goals. The milestones are clear and focused. The project will create outreach programs and provide education for pre-college and high school students in order to develop a pipeline of well-qualified individuals to pursue careers in the field of advanced automotive energy systems; create a technology transfer model to foster research and educational collaborations between the electric drive vehicle industries and academic institutions; and conduct and disseminate educational research, which explores factors that mediate learning outcomes. To achieve their project deliverables, the project team is developing an Electric Drive Vehicle Technology Graduate Certificate Program and an Associate of Applied Science degree option. The team is developing hands-on educational tools and interactive exhibits for science centers and museums and has organized summer camps for high school and pre-college students. The managing team presents a strong project controls effort to achieve results with EVMS and go/no-go decision making processes. The leadership has taken care to initiate strategic partnership with the automotive industry and uniquely conduct a systematic-iterative evaluation of learning and educational activities. This type of iterative, dynamic evaluation is outstanding. Another reviewer stated that the details of number of courses to be developed, the subjects, and the timeline were not given in the presentations. Of the five courses mentioned in the presentation, only one was a new course, while the others were modifications. It was also noted that there was a hiring freeze preventing the hiring of a secretary. The project also did not seem to be considering adjunct faculty to provide additional resources/expertise.

A commenter mentioned that the general information presented does not include specific milestones or schedule details. Overall, the merit review slides and briefing do not inspire confidence that the project is being tightly managed and will achieve the results expected for an expenditure of this magnitude. In the presentation slides, there is no indication of which partner organizations will be contributing to which initiatives. The oral briefing provided some information, e.g., that the St. Louis Science Center will be engaged in promoting public awareness. Reference was made to regional dissemination of results in year two, but no information was provided on the approach or particular plans for that activity. No milestones, even general ones, were identified for year three. The statements concerning year one milestones are not very useful or informative, and are repeated word for word in the presented material on future work (lack of attention to detail). Another reviewer asked how the courses will be coordinated among the partner schools. Will there be duplication of effort? The last reviewer said the project will develop degree programs, hands-on educational tools and summer camps for high school students. The project will also initiate partnerships as well as the evaluation of educational materials.

Question 3. Technical Accomplishments and Progress: What is the overall progress towards project's objectives and milestones? Is progress adequately reported and quantified (e.g., number of jobs, installations, etc.) as required by ARRA?

The first reviewer said the project is only 8% complete at time of presentation. Five classes have been taught in support of the project and all contracts/subcontracts finalized. Finalizing the university-industry MOA is also accomplished and includes: University of Central Missouri, Linn State Technical College, St. Louis Science Center, Smith EV, Dow Kokam, Chrysler and A123. Another reviewer stated the progress has been primarily towards equipment procurement. A hiring freeze may create a resource issue. Four reviewers said the sub-contracts have been finalized and three of those reviewers also mentioned that one course has been designed as well. Another reviewer commented there is no indication of specific progress on other initiatives. Problems leading to delays in achieving some actions were noted. Overall, the discussion of issues and concerns seemed at times to be a more important part of the

message than the discussion of accomplishments and progress. The last reviewer said this project is just starting; please plan to track students going to industry.

QUESTION 4. COLLABORATIONS/PARTNERSHIPS: DOES THE PROJECT TEAM EFFECTIVELY USE COLLABORATIONS/PARTNERSHIPS WITH REGIONAL, STATE, LOCAL GOVERNMENTS, INDUSTRIAL, COMMERCIAL, UNIVERSITY, RESEARCH ORGANIZATIONS, AND SIMILAR ORGANIZATIONS TO ACHIEVE ITS OBJECTIVES?

The first reviewer said the balance of university- industry strategic partnering is impressive. Collaborations are strong and the industry players will certainly support an effective dissemination of the results. The alignments with industry may also serve as a purposeful pipeline for students to jobs. Industrial partners include Smith EV, Dow Kokam, Chrysler and A123. Another reviewer commented the project appears to have forged a good mix of strategic partners representing battery companies as well as vehicle OEMs, although it is unclear how extensive this interaction will be. It is unclear whether this effort will extend beyond the state. One reviewer mentioned the strategic partners listed in the presented materials are excellent. However, a project of this magnitude should be more aggressive in seeking additional partners in the state of Missouri. For example, government organizations, consumer groups, Clean Cities coalitions, advocacy groups, utilities, etc. Another reviewer also stated there is a good set of partners; please be sure to coordinate among all of them. The last reviewer said the project is collaborating with three colleges and four strategic partners. There is a battery model from Dow Kokam and they have a 20hp electric powertrain for labs with a DC motor.

PROJECT STRENGTHS

The first reviewer said the main strengths of the project are the breadth of education and outreach, extension and evaluation of learning tools into the public mainstream science centers, and a dynamic iterative process for metrics and success. The industry partners that include A123 are commendable. Two reviewers agreed there are good strategic partners from industry. The last reviewer mentioned these project strengths: battery technology due to partnerships, battery models, and hardware.

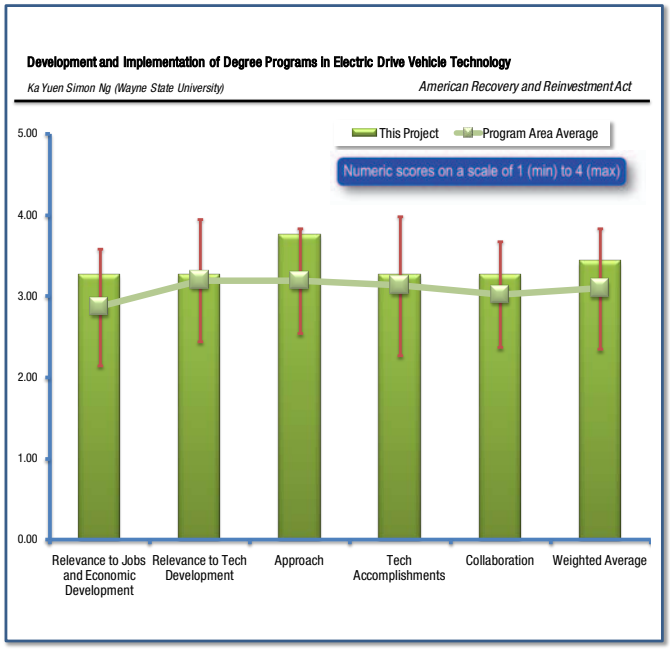
PROJECT WEAKNESSES

The first reviewer said there are no weaknesses obvious at present until project progresses. Another reviewer stated that strong curriculum development and faculty recruitment was not apparent. One reviewer commented that the project management seems to be struggling in dealing with the challenges of moving out smartly on some of the project's initiatives. The slides presented do not portray an active, high energy, well-focused project. The oral briefing helped a bit, but not enough. Another reviewer added that planning for coordination among all of the partners was a weakness. The final reviewer said there was no use of engine/energy storage device with the powertrain, students see and deal with only one part of the system (battery) and there was only one mechanical engineering course.

SPECIFIC RECOMMENDATIONS

The first reviewer said the project should consider adding a training course that includes commercialization and/or deployment aspects of the EV field. Another reviewer stated this project should be provided with additional guidance regarding coursework development and augmentation of faculty, including adjunct faculty from industry perhaps through web-based instruction. One reviewer added that specific milestones, with accomplishment dates, should be established for each initiative/activity/task. Then a management structure, which identifies responsibility and accountability for each milestone, should be clearly defined. The project team should be more aggressive in establishing partnerships and collaborations with other Missouri organizations. Communication about the project should convey more enthusiasm about what is being done, the results achieved, and how the challenges are being met, and less about what the problems and potential problems are. (This does not mean ignoring the problems, or glossing them over, but having a positive attitude and plan for dealing with them.) Another reviewer asked that coordination be undertaken for all of the proposed courses, first responder training, and large number of partnerships among all of the other projects in this area. The final reviewer said to expand the implementation into the mechanical engineering program. While the students learn to highly optimize the electrical powertrain, they might not learn how to optimize the whole system together, such as what can be done with the engine/energy device to help electrical powertrain or batteries instead of only the other way around.

Development and Implementation of Degree Programs in Electric Drive Vehicle Technology: Ka Yuen Simon Ng, Wayne State University



Reviewer Sample Size

This project had a total of 5 reviewers.

Question 1a. Relevance: Is the project effort relevant to the American Recovery and Reinvestment Act (ARRA) of 2009 goals: Create new jobs as well as save existing ones; spur economic activity and invest in long-term economic growth.

The first reviewer said this project has great relevance to the goals of ARRA 2009. It aims at a higher segment of the education market for electric vehicles. The efforts of Wayne State University are commendable: while other programs are concentrating on automotive technicians, the question is who will work on the large scale efforts to develop better electric vehicles in the future. The PI outlined a very comprehensive approach. Another reviewer mentioned job creation was not specifically discussed but the PI has worked hard to incorporate industry input. This should lead to the creation of a highly desirable workforce. One reviewer commented they think they are the only university in the nation to develop a master's degree program in electric transportation and, therefore, they will be model curriculum for other universities around the U.S. Two reviewers said this program works to implement a master's degree, bachelor's degree, and associates degree, as well as an undergraduate concentration and graduate certificate program in electric drive vehicle and electric transportation technology programs. One of those reviewers added this is important to ensure that there is a workforce knowledgeable about E3 activities.

The last reviewer said that while the development of community college-based service technician-focused Associate Degree program may make students "more marketable", the fact that all students can find jobs upon graduation tends to indicate that the addition of EV and HEV technology content by itself will not increase the amount of jobs that are created. Where jobs could be created is if the jobs in the EV and HEV fields are considered to be higher status, then you might see more student enrollment and thus fill the empty mechanics jobs that are currently out there. Given the fact that OEM's and system suppliers are in a crash course to develop and market EV and HEV's in university engineering degree programs, the reviewer believes that there is a need for engineers with appropriate EV/HEV skills. Thus, many current engineers whose skills are not currently in demand may be able to use this training to position themselves to be able to re-enter the job market with skills that are in demand. Also given the location of this program (in the Detroit metropolitan area) it will have a greater positive effect on the local industry and economy in this particularly hard hit area.

Question 1b. Relevance: Does the project's technology development plan and/or deployment plan address the VT ARRA project goals of accelerate the development of U.S. manufacturing capacity for batteries and electric drive components as well as the deployment of electric drive and alternative fuel vehicles and infrastructure? Does the project's development and/or deployment plan address the VT ARRA project goal to establish education projects that accelerate the mass market introduction and penetration of advanced electric drive vehicles, which includes light, medium, and heavy duty advanced electric vehicles (EV), plug-in hybrid electric vehicles (PHEV), and fuel cell electric vehicles (FCV)?

The first reviewer said it was the only program that they reviewed that addressed ARRA goals in terms of the development of new technologies and electric drive components. Housed in the Engineering School, Wayne State is working to deliver highly educated engineers to the future of the electric car development industry. The program is laboratory hands-on intensive with the development of an electric drive vehicle engineering laboratory in process. Another reviewer stated the program is noteworthy for incorporating

storage systems and power electronics. The lab component seems new, but the rest of the curriculum seems to have been recycled. The reviewer asked if DOE paid for curriculum development. If DOE did then this explains the rapid progress. One reviewer commented the purpose of this project is to test real life systems in the energy storage lab, electric propulsion lab and control and integration labs which will assist students in getting jobs in the industry upon graduation. Most of these labs have been ordered with the hope that they will be available by the end of 2010. The goal of this project is to create a comprehensive curriculum. They already have 30 students signed up for the graduate student classes with a target of 50 students. The last reviewer said that while the community college-based service technician-focused associate degree program aspects of this project will do little to stimulate/accelerate the development of U.S. manufacturing capacity for batteries and electric drive components, it does lay down the educational underpinnings to stimulate interest in EV/HEV technology and development of the necessary repair technician infrastructure. However the university engineering degree program (master's and bachelor's) will help generate the U.S. based engineering talent necessary to stimulate/accelerate/sustain the development of U.S. manufacturing capacity for batteries and electric drive components as well as OEM integration of these systems.

Question 2. Development/Deployment Approach: Are the project's technical and deployment milestones and schedule clearly identified, appropriate, and feasible, and are technical and commercial barriers and risks adequately addressed?

The first reviewer said the barriers to the development of the program and course work have been overcome. Another reviewer mentioned that this project is producing a multi-tiered educational experience for students (master's, bachelors, associates level certificate, even K-12 teacher workshop). One other reviewer commented that the project's technical and deployment milestones are well defined. They received a lot of industrial input based on an industry workshop which was used to help develop the curriculum. Being in Detroit has given them highly experienced adjunct faculty to teach some of these courses. Two of the reviewers said the project has already gotten its curriculum approved at the master's, bachelor's and associates level, and classes will be offered in September 2010. The final reviewer mentioned the project seems to have a good handle on how to execute the various elements of the project to meet its specified goals within the specified budget. The management team and advisory board seems to have the depth and diversity necessary to cover the key areas of program development and execution.

Question 3. Technical Accomplishments and Progress: What is the overall progress towards project's objectives and milestones? Is progress adequately reported and quantified (e.g., number of jobs, installations, etc.) as required by ARRA?

The first reviewer said that progress was adequately reported, as the program is said to start with a full class about 15-25 students with over 50 students voicing interest in the program so far. The reviewer's impression is that WSU has the enthusiasm to advance more interests in these degree programs in the future. Another reviewer commented the progress is outstanding, but the reviewer would question how much of this was already "in the can." With so few partners, the goals are far more achievable as well. One reviewer mentioned that the project team has completed all of their year-one activities, while the last reviewer said the project seems to be making good progress at implementation and goal fulfillment.

Question 4. Collaborations/Partnerships: Does the project team effectively use collaborations/partnerships with regional, state, local governments, industrial, commercial, university, research organizations, and similar organizations to achieve its objectives?

The first reviewer said their relationship management process is very good and they have had industry days to garner support and input for the program. They have enlisted Macomb Community College as their partner in this venture. Another reviewer mentioned that NextEnergy and the Industrial Advisory Board are serving as collaborators on this project. The Industrial Advisory Board is a diverse group of labs, battery manufacturers, government, universities, utilities, automobile manufacturers, etc. One other reviewer commented the project seems to be well leveraged with significant cost share. While not explicitly listed, in the course of the presentation it became apparent that it has a good cross section of partners/supporters (including Ford and other local suppliers) that will help make this program a success. The final reviewer said the project has very few partners which might reduce the impact of the program.

Project Strengths

The first reviewer said the project is a laboratory-intensive, learning-based program using three laboratories including: Energy Storage Laboratory, Electric Propulsion Laboratory, and the Control and Integration Laboratory. All the programs are in different phases of development. Another reviewer stated that this is a comprehensive engineering education program and is the first master's degree program in the area. The program integrates production, which is an innovation, and it strives to be the national model. It already had approval from university and state for the program and the degree and certificate program will be ready for implementation. The PI is gathering industry input and working to incorporate a process of continuous improvement. One reviewer commented that this project recognizes the huge need for courses to support the successful introduction of advanced transportation technologies. The last reviewer mentioned the program seems to be well-targeted to meet the needs of both the local industry and engineers who need to gain (or re-tool) skills in this rapidly growing area. The program is also coordinating its curriculum development with the Michigan Tech Program. Perhaps this coordination can be expanded to other DOE sponsored programs that are developing the same type of programs and curriculum.

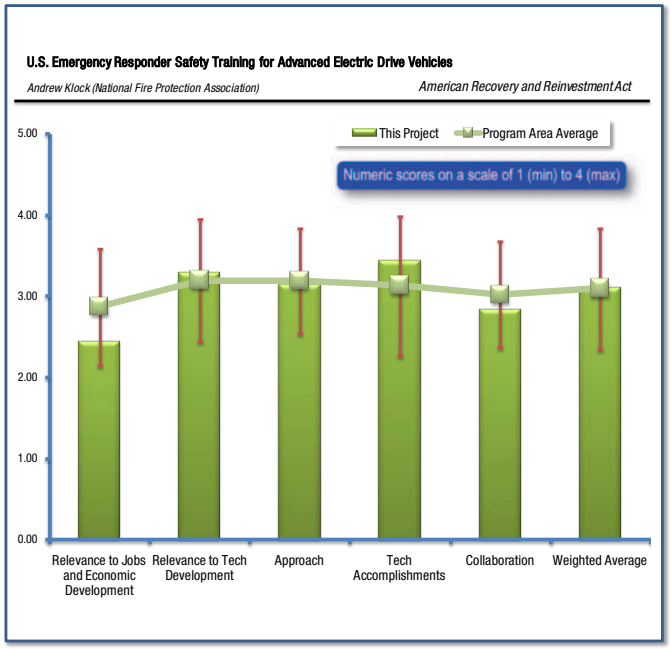
Project Weaknesses

The first reviewer said the project seems to lack scalability. There could be more partnerships with community colleges (in addition to Macomb) and there needs to be some connection with industry on the workforce development side. The reviewer also said it seems like the project reaches very few students (but they acknowledged they might have missed something). Another reviewer mentioned there is a question as to whether this is really a new curriculum or not, as it isn't 100% clear from the presentation. The last two reviewers commented they could not identify any significant program weaknesses.

Specific Recommendations

The first reviewer asked that if this is to be a national model, is there a plan for dissemination? There appears to be a need for systems integration research and coursework. Would the PI be willing to make the curriculum available online? Another reviewer said the project should expand coordination of curriculum development and validation beyond Michigan Tech to include other similar DOE funded programs. The last reviewer commented that additional funding should be provided to Wayne State for year three and beyond.

U.S. Emergency Responder Safety Training for Advanced Electric Drive Vehicles: Andrew Klock, National Fire Protection Association



Reviewer Sample Size

This project had a total of 7 reviewers.

Question 1a. Relevance: Is the project effort relevant to the American Recovery and Reinvestment Act (ARRA) of 2009 goals: Create new jobs as well as save existing ones; spur economic activity and invest in long-term economic growth.

The first reviewer said the project is relevant and will make important and substantial contributions to the ARRA 2009 goals. The project brings together a comprehensive team of first responders and emergency response associations to create a training objective that will provide very important results in support of national accelerated deployment of EVs. The training of emergency responders will reduce property damage, injury, and loss of life, and help achieve public acceptance of high volume advanced EV production in the U.S. Another reviewer commented that job creation and retention were not directly addressed. It is clear that appropriate first responder, EMS, and law enforcement protocols are necessary for full-scale deployment. One reviewer thought the project has a lot of relevance but was unsure about the process and steps used to develop an overall approach. This reviewer kept thinking about what has been done already in the area of electric vehicle emergency operations in cities that still use electric power to drive much of their mass transit systems. Two reviewers stated that this is an important project; however, the presentation did not address specific job or economic activity benefits. One of the two reviewers added that there should be some incremental positions associated with managing and implementing the project activities, but it is difficult to establish a direct link between a project like this and permanent job-creation and economic benefits. Another reviewer said the project is in the early stages, while the last reviewer added the project is expanding fire safety by providing knowledge to fire response teams with experts in EVs.

Question 1b. Relevance: Does the project's technology development plan and/or deployment plan address the VT ARRA project goals of accelerate the development of U.S. manufacturing capacity for batteries and electric drive components as well as the deployment of electric drive and alternative fuel vehicles and infrastructure? Does the project's development and/or deployment plan address the VT ARRA project goal to establish education projects that accelerate the mass market introduction and penetration of advanced electric drive vehicles, which includes light, medium, and heavy duty advanced electric vehicles (EV), plug-in hybrid electric vehicles (PHEV), and fuel cell electric vehicles (FCV)?

The first reviewer said the bottom-line importance to a successful EV deployment plan and penetration of the U.S. market space is safety. This project directly supports the mission of the ARRA goals by supporting the safety of the deployment of electric drive and alternative fuel vehicles and infrastructure. Another reviewer mentioned that whereas educational efforts are not directly addressing the manufacturability of batteries and EVs, this project fills a critical role to enable public acceptance and safety. One reviewer commented there is first responder training considered here and they are not relevant to the goals as stated in 1b. Another reviewer stated the project does look likely to contribute to ARRA project goals to establish education projects that accelerate mass market introduction of advanced electric drive vehicles. One other reviewer added that focused, extensive training of first responders is a vital initiative which needs to be accomplished in conjunction with the commercial introduction of electric drive vehicles. This project should contribute significantly to accomplishing that training. Another reviewer said this project does not seem to directly address manufacturing capacity and deployment. However, it does directly establish a training program, and indirectly impacts the mass

market introduction of advanced vehicles. The last reviewer mentioned that by providing fire safety response, the community becomes more knowledgeable and accepting of electric vehicle technology.

QUESTION 2. DEVELOPMENT/DEPLOYMENT APPROACH: ARE THE PROJECT'S TECHNICAL AND DEPLOYMENT MILESTONES AND SCHEDULE CLEARLY IDENTIFIED, APPROPRIATE, AND FEASIBLE, AND ARE TECHNICAL AND COMMERCIAL BARRIERS AND RISKS ADEQUATELY ADDRESSED?

The first reviewer said the approach to the project is outstanding and the comprehensive collaborations are impressive. The project is just beginning but already demonstrates strong project controls and EVMS skills. The team presents a carefully thought-out PEP and implementation and distribution strategy. The coordination with NFPA will lead efforts in a high-value, standards-based training programs to U.S. emergency responders (fire service, EMS, and law enforcement). The team has considered problems in the community where EV safety is not taken seriously or understood and is addressing the problem. Another reviewer added the project has a very well-organized approach with partners across the stakeholder community. The team needs to find additional resources for training. Expanding the scope to include buses and charging station appears appropriate. One reviewer commented that the approach calls for the hiring of a computer simulation company for training development, but no details were given about what that company is envisioned to do or how will computer simulations be used to support the training goals and objectives. Not much detail was given about the training development program.

Another reviewer stated this project seems very passive. To this reviewer, there did not seem to be a clear plan for dissemination or ensuring this training is used. This reviewer thinks NFPA has a real opportunity to leverage their position and not just function like another grantee. One reviewer mentioned that the materials presented were complemented by the PI's briefing and provided a succinct, understandable and credible statement of barriers. The presentation of milestones, activities and plans, by calendar quarter, provides confidence that the project is well-planned and focused on achieving its objectives. The presented graphics, and the PI's discussion of the training distribution plan, also contribute to this feeling of confidence.

Linking the first responder training to development and adoption of relevant NFPA codes and standards, as stated in the project objectives, should be a significant benefit resulting from this project. The presented materials identify roles of NFPA divisions. Another reviewer said there are a large number of partners to coordinate, and suggested that the team plan to interact with all of the other projects in this area. The last reviewer added that this is a very aggressive project for emergency responder safety training. The project involves many parties and it will be interesting to see if the tasks will be completed on time from all these parties.

QUESTION 3. TECHNICAL ACCOMPLISHMENTS AND PROGRESS: WHAT IS THE OVERALL PROGRESS TOWARDS PROJECT'S OBJECTIVES AND MILESTONES? IS PROGRESS ADEQUATELY REPORTED AND QUANTIFIED (E.G., NUMBER OF JOBS, INSTALLATIONS, ETC.) AS REQUIRED BY ARRA?

The first reviewer said that to date, the team has already accomplished a significant amount of reconnaissance and data collection in the field. The project leadership team has formed technical committees, attended an EV workshop in Detroit, and gathered fire service needs. Already, they have developed the conceptual direction for an emergency response advanced EV training program, and established a communications plan. SMEs are being hired to create a blended learning program to reach as many emergency responders as possible. Another reviewer commented it appears that this project is progressing nicely towards its objective and there is indication that the project is front loaded. One reviewer stated the presentation spoke to training nearly 1.1 million first responders, but the reviewer was left with a sense of not knowing a lot about the details of the development process. Another reviewer added the project is about where it should be for the start time. There is little to quantify at this point, so it is hard to comment on accomplishments early on, but the project looks to be on track. One reviewer said the project is getting out of the blocks quickly. The presentation effectively conveys information on specific results accomplished to date. A plus is that the format created for the milestones/plans is also used to communicate progress. Project partners have been engaged, a fire service technical panel has been established, and feedback from the technical committee has been obtained during two meetings. Another reviewer mentioned to please add a plan to quantify the impact of this project, while the last reviewer said the project clearly is implementing a detailed plan and developing or already developed teams for fire safety review.

QUESTION 4. COLLABORATIONS/PARTNERSHIPS: DOES THE PROJECT TEAM EFFECTIVELY USE COLLABORATIONS/PARTNERSHIPS WITH REGIONAL, STATE, LOCAL GOVERNMENTS, INDUSTRIAL, COMMERCIAL, UNIVERSITY, RESEARCH ORGANIZATIONS, AND SIMILAR ORGANIZATIONS TO ACHIEVE ITS OBJECTIVES?

Five reviewers agreed that the project team effectively uses relevant collaborators and associations extremely well and the list includes most stakeholders from firefighting, automotive OEMs, standards organizations (e.g., SAE and UL, as well as NFPA itself). One of those reviewers added it appears that engaging law enforcement stakeholders could be strengthened. Another reviewer said the project might want to consider adding FEMA and EMS national organizations, since FEMA can add mandated training and EMS is more organized with refreshers and mandated training. Another reviewer mentioned that contracts are set for communications support and web development and additional on-going collaborations should be established. One reviewer commented that the project team should coordinate with other projects in this area that are also working on first responder training regionally. Another reviewer added they are clearly interested in providing the best dynamic training for electric vehicle fire response.

The last reviewer said one of the primary collaborations and partnerships that should be developed is one with Homeland Security, in particular those in charge of the Homeland Security Exercise and Evaluation Program (HSEEP). In the opening of the presentation, the PI spoke to the inability of the fire service to financially sustain the training model. One of the ways in which this might be overcome is for a partnership to emerge with Homeland Security. Consider for a moment, a man pack bomb incident aboard an electric bus or trolley. First responders would have to understand the implications of this scenario outside of the normal mass transit transportation. This reviewer would be very surprised if this has not already been considered in cities where electric power is still used for mass transit. More than that, Homeland Security Exercise Funds could be used to support first responder training and evaluation. Moreover, if this is first responder training it must somehow connect with police since more times than not they are first on the scene of an emergency.

PROJECT STRENGTHS

The first reviewer said the project scope and proposed training program is essential for the nation and success of a national EV deployment program. The project is led by a strong team with a comprehensive and dedicated collaborative team. Future work will continue to develop standards based training content and curriculum, verification with SME review teams, instructor material and field reference guides for all U.S. Emergency Responders. Another reviewer added the project has a very focused effort on a critical need. One reviewer mentioned there is outstanding project approach and planning. The presentation of activities and milestones is complete, covers the entire duration of the project, and is easily understood. NFPA's credibility with the various fire service organizations is yet another strength. Three reviewers agreed there are many organizations involved to provide the right material, feedback on the material, and ensure the material reaches the people that need it, etc. One of those reviewers said they are very knowledgeable on the subject matter and the requirement of dealing with many organizations.

PROJECT WEAKNESSES

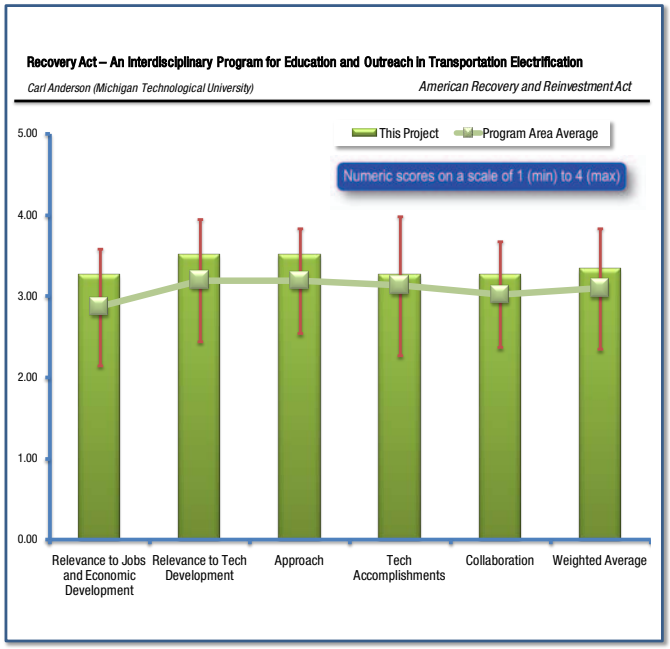
Two reviewers said no weaknesses are observed at present. A reviewer offered that the project may benefit from outreach to local school communities. A reviewer stated the project may consider engaging law enforcement more. Another reviewer mentioned they must admit that the PI surprised them when asked about the National Fire Protection Association's plan to “lash this training” to NIMS in some way. He didn't seem to be familiar with the acronym for the National Incident Management System, primarily a development of fire organizations out of the work in the 1970's called Firescope. One reviewer commented that a weakness is outsourcing or hiring outside firms for all development. The project will be “taken to the cleaners” and these firms will produce proprietary software that will have costs associated for updating. Within a couple of years, the materials will be out of date because the electric vehicle technology will have advanced. Two reviewers added the project does not include an initiative on collaboration with other organizations which are developing and providing electric drive vehicle training for first responders. In particular, these organizations include recipients of Department of Energy grants for projects which include first responder training. The last reviewer said it seems like a low funding amount for all the tasks and parties involved.

SPECIFIC RECOMMENDATIONS

Three reviewers said to coordinate with the other projects in this area that are also working on first responder training. One of those reviewers also requested that the impact of this project on jobs should be quantified. Another reviewer noted that the PI indicated that coordination with other projects can now be done, since NFPA has met for the second time with the project's technical committee. Another reviewer stated that connecting first responder training in ULEV vehicles to incidents within the purview of Homeland Security seems natural to this reviewer. Moreover establishing the connection to the National Incident Management System (NIMS) would create a "pull" strategy for first responders. Simply put, this means that first responders would have to be versed in responding to this ULEV vehicle incident. This would remove a number of barriers to fire participation, since an incident on an electric bus or within the confines of an electric car, for example, would become part of the HSEEP scenarios.

The last reviewer stated to change directions. This reviewer said the team should provide honest-to-goodness firefighter input on developing emergency responder materials to the other projects that are developing modules and put all the project efforts into using the astounding list of partners to work on dissemination to local jurisdictions and academies. The team should help develop recommendations on protocols for response for jurisdictions around the nation to adopt; this is what the NFPA should be doing. The team should work on creating scenarios for drills at local academies and stations. Possibly add FEMA to the project list of partners and work on making some training mandatory through FEMA's capabilities. Alternatively, work with EMS state directors to include material in the refresher course. EMS is more organized and regulated than fire, and the project will have a chance of hitting most of the EMTs during their refreshers over the next three years.

Recovery Act – An Interdisciplinary Program for Education and Outreach in Transportation Electrification: Carl Anderson, Michigan Technological University



REVIEWER SAMPLE SIZE

This project had a total of 5 reviewers.

QUESTION 1A. RELEVANCE: IS THE PROJECT EFFORT RELEVANT TO THE AMERICAN RECOVERY AND REINVESTMENT ACT (ARRA) OF 2009 GOALS: CREATE NEW JOBS AS WELL AS SAVE EXISTING ONES; SPUR ECONOMIC ACTIVITY AND INVEST IN LONG-TERM ECONOMIC GROWTH.

The first reviewer said their enrollment goals of 120 graduate students with an expected 50% split of on-campus and distance education students is also worthy of note, and is an achievable number considering the potential of the mobile laboratory to pre-sell the instruction. Another reviewer stated the project will create interdisciplinary undergraduate curriculum and graduate courses leading to a professional science master's degree. Job creation through training and education was mentioned, but few activities seem to tie in with industry directly. The presentation covers this topic in more depth, but was not covered by the speaker. One reviewer added this project is designed to provide undergraduate and graduate curriculum, and to incorporate distance learning. Two reviewers also mentioned the project is going to create a mobile laboratory for both distance learning and additional education/outreach. The last reviewer commented on the university engineering degree programs, and said given the fact that OEMs and system suppliers are in a crash course to develop and market EV and HEV's, there is a need for engineers with appropriate EV/HEV skills. Thus, many current engineers whose skills are not currently in demand may be able to use this training to position themselves to be able to re-enter the job market with skills that are in demand. Also given the program's Michigan location (and extended reach into the Detroit metropolitan area), it will have a significant positive effect on the local industry and economy in this particularly hard hit area.

QUESTION 1B. RELEVANCE: DOES THE PROJECT'S TECHNOLOGY DEVELOPMENT PLAN AND/OR DEPLOYMENT PLAN ADDRESS THE VT ARRA PROJECT GOALS OF ACCELERATE THE DEVELOPMENT OF U.S. MANUFACTURING CAPACITY FOR BATTERIES AND ELECTRIC DRIVE COMPONENTS AS WELL AS THE DEPLOYMENT OF ELECTRIC DRIVE AND ALTERNATIVE FUEL VEHICLES AND INFRASTRUCTURE? DOES THE PROJECT'S DEVELOPMENT AND/OR DEPLOYMENT PLAN ADDRESS THE VT ARRA PROJECT GOAL TO ESTABLISH EDUCATION PROJECTS THAT ACCELERATE THE MASS MARKET INTRODUCTION AND PENETRATION OF ADVANCED ELECTRIC DRIVE VEHICLES, WHICH INCLUDES LIGHT, MEDIUM, AND HEAVY DUTY ADVANCED ELECTRIC VEHICLES (EV), PLUG-IN HYBRID ELECTRIC VEHICLES (PHEV), AND FUEL CELL ELECTRIC VEHICLES (FCV)?

The first reviewer thought this program has the potential of making a big difference in the understanding of and increased penetration of electric vehicles in the market place. Their secret weapon is the mobile laboratory that can serve a number of purposes from education and hands-on experiential learning to public relations in a number of venues. From recruiting new students, to familiarization of new technologies, to technology demonstrations, the mobile lab has the potential of arresting any fear or doubt about the soundness of electric vehicle technology. Another reviewer sensed that this project represented a modification of curriculum, not the creation of new material. This reviewer also asked if DOE paid for curriculum development out of this grant. It will help advance industry by introducing electrification coursework. One reviewer commented that this is an education/outreach activity comprised of curriculum, a mobile laboratory, and distance learning designed to increase knowledge about electric drive technologies. The last reviewer stated the graduate and undergraduate university certificate programs will help generate the U.S. based engineering talent necessary to stimulate/accelerate/sustain the development of U.S. manufacturing capacity for batteries and electric drive components as well as OEM integration of these systems.

QUESTION 2. DEVELOPMENT/DEPLOYMENT APPROACH: ARE THE PROJECT'S TECHNICAL AND DEPLOYMENT MILESTONES AND SCHEDULE CLEARLY IDENTIFIED, APPROPRIATE, AND FEASIBLE, AND ARE TECHNICAL AND COMMERCIAL BARRIERS AND RISKS ADEQUATELY ADDRESSED?

The first reviewer said the program takes an aggressive yet controlled education development approach to developing graduate and undergraduate interdisciplinary engineering instruction. The three-year objective of developing a master of engineering degree targets the higher end of the market, a noteworthy goal. Another reviewer added that feasible goals have been set, and the program is using well-established mechanisms for delivery of courses. The only real risk is the mobile lab, and it will be interesting to see if the mobile lab becomes sustainable after this grant. One reviewer stated the curriculum for this project is already completed; the mobile laboratory is to be completed by December 2010 and is intended to be used by the end of 2011. The last reviewer mentioned the project seems to have a good handle on how to execute the various elements of the project to meet its specified goals within the specified budget. An interdisciplinary team of faculty and staff appear to have the depth and diversity necessary to cover the key areas of program development and execution.

QUESTION 3. TECHNICAL ACCOMPLISHMENTS AND PROGRESS: WHAT IS THE OVERALL PROGRESS TOWARDS PROJECT'S OBJECTIVES AND MILESTONES? IS PROGRESS ADEQUATELY REPORTED AND QUANTIFIED (E.G., NUMBER OF JOBS, INSTALLATIONS, ETC.) AS REQUIRED BY ARRA?

The first reviewer said the design, development and fabrication of the mobile laboratory for instruction and outreach is worthy of note and is a great idea and effort: what better way to introduce new and potential entrants to the industry of electric vehicles than by bringing a full-on laboratory to their doorstep. This mobile laboratory could very well be modeled by other educational institutions around the country and used to penetrate rural areas where potential electric vehicle students could be found. From an educational perspective, it provides for a full hands-on experience. Another reviewer mentioned the project has made great progress in overcoming institutional inertia. The PI attributes this to close connections with dean. One reviewer commented that the number of jobs reported or quantified was not discussed during the presentation, though there is a slide that addresses this point. In terms of meeting the goal of developing curriculum, that has been accomplished. The mobile lab is being developed (though is not complete as of now); students are already starting to take advantage of the developed curriculum. The last reviewer stated the project seems to be making good progress at implementation and goal fulfillment. This is more impressive given the complexity involved in the design and fabrication of the mobile laboratory (key element of this program).

QUESTION 4. COLLABORATIONS/PARTNERSHIPS: DOES THE PROJECT TEAM EFFECTIVELY USE COLLABORATIONS/PARTNERSHIPS WITH REGIONAL, STATE, LOCAL GOVERNMENTS, INDUSTRIAL, COMMERCIAL, UNIVERSITY, RESEARCH ORGANIZATIONS, AND SIMILAR ORGANIZATIONS TO ACHIEVE ITS OBJECTIVES?

The first reviewer said the partnerships and collaboration for this project is exemplary. MTU as the lead has included GM, Michigan Green Jobs and the Argonne National Laboratory as some of its partners. There is great industry collaboration. Another reviewer added there are good and diverse partners that range from academia to industry to marketing. One reviewer stated that while there are a number of partners in this project based on the slides, the presenter didn't go into their role(s) so it wasn't clear what value they are adding to this project. The last reviewer mentioned the project seems to be well-leveraged with significant cost share and an impressive array of industry partners and supporters.

PROJECT STRENGTHS

All four reviewers all agreed the mobile laboratory will be a key element (and strength) that will greatly enhance the programs distance learning and outreach activities. Another reviewer added the program seems to be well targeted to meet the needs of both the local industry and engineers who need to gain (or re-tool) skills in this rapidly growing area. The program is also coordinating its curriculum development with the Wayne State program. Perhaps this coordination can be expanded to other DOE sponsored programs that are developing the same type of programs and curriculum.

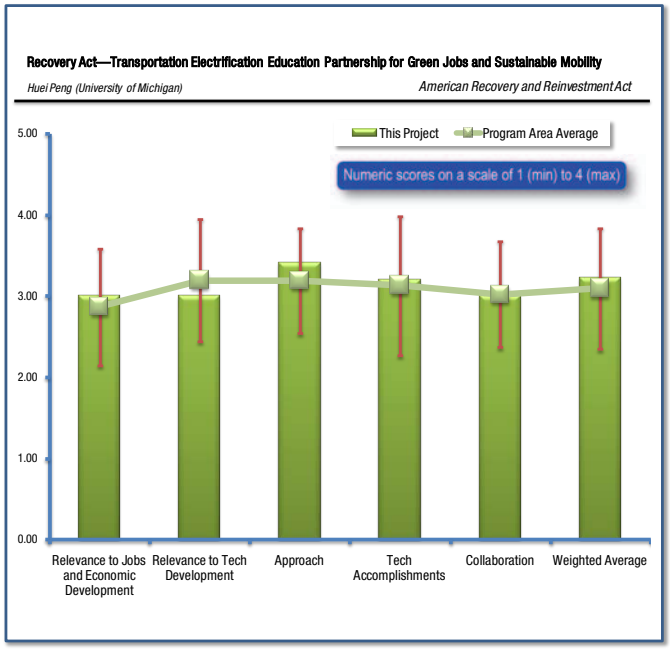
Project Weaknesses

Two of the reviewers both said they could not identify any significant program weakness. Another reviewer added a weakness could be the scalability/sustainability of mobile lab and the small number of participants in the program. The last reviewer observed that the presenter indicated the curriculum for this project was basically already completed prior to issuing of this award. One question the reviewer had is whether federal funding was provided to the funder with the assumption that the monies would be used to develop the curriculum.

Specific Recommendations

The first reviewer recommended that once the first mobile lab is built and successfully piloted, build six more mobile labs and distribute them to other universities across the U.S. Give full credit to MTU for the original idea. Use the mobile labs as hands-on learning laboratories as well as a comprehensive outreach program to bring otherwise forgotten folks into the electric vehicle and power systems industry. Another reviewer stated it would be great if the simulation-based training developed for the lab could be viewed online too (hosted on the university's website and made open source) so that the training material could be used by more than just the few that fit in the bus. In addition, some of the training simulations may be useful for remediation or review before tests. The last reviewer suggested expanding the coordination of curriculum development and validation beyond Wayne State to include other similar DOE funded programs.

Recovery Act—Transportation Electrification Education Partnership for Green Jobs and Sustainable Mobility: Huei Peng, University of Michigan



Reviewer Sample Size

This project had a total of 5 reviewers.

Question 1a. Relevance: Is the project effort relevant to the American Recovery and Reinvestment Act (ARRA) of 2009 goals: Create new jobs as well as save existing ones; spur economic activity and invest in long-term economic growth.

The first reviewer said this project is directly supporting the ARRA 2009 goals and sustaining, maintaining and creating (also regaining) jobs in ET/Automotive and ES. The project demonstrates strong overlap and collaboration with OEMs, and good use of leveraging resources and available funding. The university has observed students move from 65% to 25 % of the automotive engineering program from traditional programs in the past five years. They are finally now seeing re-entry to the program and developing 10 courses under this project. Uniquely, one course combines Energy Systems and Automotive Engineering, and has up to 400 students by combination, and a new course on modeling and simulation is established. This reviewer went on to say that overall the project will directly support job creation through training and education to support deployment and acceptance of EV and spur economic growth. The project will be supporting 10 credit courses that are expected to impact 300-500 students annually. The short courses will impact 100-200 professional engineers annually, and K-12 and other consumer education and outreach activities should impact more than 1,000 annually. The final goal is job creation through training and education. The team is also developing professional web-based training with GM and has two batches of students already. The web-based impact will be far reaching. One reviewer stated while there are important benefits, e.g., improved economic competitiveness, associated with better educated engineers and well-trained technicians, it is difficult to establish a direct link between a project like this and specific job-creation benefits. Three reviewers agreed that job creation was not specifically addressed in the review presentation. One of those reviewers added that job creation and retention were not directly addressed, but proximity to major automotive companies and professional courses would suggest an opportunity for job retention. The last reviewer stated the project provides job creation through training and education.

Question 1b. Relevance: Does the project's technology development plan and/or deployment plan address the VT ARRA project goals of accelerate the development of U.S. manufacturing capacity for batteries and electric drive components as well as the deployment of electric drive and alternative fuel vehicles and infrastructure? Does the project's development and/or deployment plan address the VT ARRA project goal to establish education projects that accelerate the mass market introduction and penetration of advanced electric drive vehicles, which includes light, medium, and heavy duty advanced electric vehicles (EV), plug-in hybrid electric vehicles (PHEV), and fuel cell electric vehicles (FCV)?

The first reviewer said overall the project will directly support job creation through training and education to support deployment and acceptance of EV and spur economic growth. The project will be supporting 10 credit courses that will directly impact VT ARRA project goals of accelerate the development of U.S. manufacturing capacity for batteries and electric drive component. The new courses will cover advanced aspects of VT, AED, batteries and VSS. The course will support the deployment of electric drive and alternative fuel vehicles and their infrastructure by training the future workforce. The courses are crosscutting by nature and designed to accelerate workforce and training in the EV field. Support from the funding will also be used to improve laboratory training facilities. This reviewer went on to say there is impressive progress, as the project started October 2009 and four of the ten courses

have already started. Another reviewer added that funding for this project is relatively modest relative to others. Accordingly, the project seems to be appropriately split between augmentations of an already strong curriculum with investments in laboratory capabilities. One reviewer mentioned this project includes multiple education and training initiatives which, in total, will result in significant numbers of highly qualified professionals whose expertise will benefit the electric drive transportation industry. The inclusion of three universities in the project is also important to increasing the numbers of students, as well as consumers generally; whose knowledge will accelerate the introduction and acceptance of competitive electric drive vehicles. The presented material provides a succinct, easily understood project objective statement and overview of the initiatives within the project. Another reviewer stated this project does not seem to directly address manufacturing capacity and deployment, but it does directly establish an education program, and indirectly impacts the mass market introduction of advanced vehicles. The last reviewer commented that by providing educated students in electric vehicles and electric vehicle technologies, companies have students to hire to accelerate the use of electric vehicles.

Question 2. Development/Deployment Approach: Are the project's technical and deployment milestones and schedule clearly identified, appropriate, and feasible, and are technical and commercial barriers and risks adequately addressed?

The first reviewer said the course designs appear sound and the approach to development appropriate. One particular course, "modeling and control of batteries," is somewhat unique. This project direction is needed as well as innovative. All four courses are taught by two faculty members. This appears to be breaking new ground for the university, and "forcing" collaboration. Other courses are still being approved by distance learning, and new course approval takes time. Student enrollment is impressive, even if the distance learning number is still small. Three labs are being renovated, simulating many different HEVs. Another reviewer mentioned there is good coordination between three universities and also strong industry interaction, including in course development and instruction. There is good leverage of existing strengths in automotive engineering and engineering systems. One reviewer added that overall, the tables and graphics in the presentation do a nice job of communicating the approach to, and content of, the project. They instill confidence that the project has been well planned and address the barriers in a logical manner. However, no indication is provided in the first portion of the presentation about the activities and specific timing associated with laboratory development, which evidently accounts for a significant portion of the project's resources. Information is provided near the end, however. In his oral presentation, the PI discussed the laboratory improvements as an important complement to the course development activity. Another reviewer asked how the courses and labs will be coordinated among the partner schools, and is there a duplication of effort? The last reviewer stated this is a very good plan. The speaker was adamant on leveraging other educational electric vehicle programs to better implement the K-12 education plan.

Question 3. Technical Accomplishments and Progress: What is the overall progress towards project's objectives and milestones? Is progress adequately reported and quantified (e.g., number of jobs, installations, etc.) as required by ARRA?

The first reviewer said five innovative training courses have been created and five more are being offered in fall, including Plug-in Vehicle Infrastructure (Fall 10, UMAA), Automotive Power Electronics Laboratory (Fall 10, UMAA), Vehicular Power Systems and Loads (Fall 10, UMD), Green Mobility Laboratory and associated courses (Fall 10, Kettering), Green Energy Manufacturing (Winter 11, UMAA), Integrated Hybrid Electric System Laboratory (Fall 11, UMAA), Development of an Education Kit for Electric Automobiles (Fall 12), Saturday morning seminar series on Green Mobility and Website Development (Fall 12). The laboratory specs are being developed and under evaluation. Another reviewer mentioned the project has gotten off to an excellent start. Four courses were developed and delivered in the first semester of 2010. The PI also discussed progress on other initiatives, such as education of high school students and laboratory development work. One reviewer added this project is just starting, but please plan to track students going to industry. The last reviewer commented the project is showing progress towards courses, summer camp, education kit, and laboratory development.

QUESTION 4. COLLABORATIONS/PARTNERSHIPS: DOES THE PROJECT TEAM EFFECTIVELY USE COLLABORATIONS/PARTNERSHIPS WITH REGIONAL, STATE, LOCAL GOVERNMENTS, INDUSTRIAL, COMMERCIAL, UNIVERSITY, RESEARCH ORGANIZATIONS, AND SIMILAR ORGANIZATIONS TO ACHIEVE ITS OBJECTIVES?

The first reviewer said this project involves three partner schools: University of Michigan Ann Arbor, University of Michigan Dearborn, and Kettering University. Industrial collaborators are involved in course and lab development and include GM, Ford, DTE, AVL, A&D, and A123. The industrial partners serve the roles of equipment providers, invited lecturers, course material provider, and support our K-12 outreach activities. Another reviewer added that the "SimCity-Like" video education tool is intriguing. One reviewer noted the industrial collaborators listed on the presentation slides, and the roles identified for them in project implementation, are outstanding. However, a project of this magnitude should be more aggressive in seeking additional collaborators, particularly in the state of Michigan. For example, government organizations, consumer groups, Clean Cities coalitions, advocacy groups, utilities, etc. should be engaged and informed. The last two reviewers agreed there is a very good set of partners; while one of the reviewers also said to please be sure to coordinate among all of them.

PROJECT STRENGTHS

Four of the reviewers agreed there is a strong collaboration with the industry. One of those reviewers also added the project strengths included innovative cross disciplinary course development. The K-12 outreach program and summer camps will be effective. Courses involve exciting hands on training opportunities to empower and engage students. Another reviewer added that another project strength is M&S effort for the battery system. One reviewer said the PI makes an outstanding impression. He is articulate and thoughtful, and his presentation contributes to a perspective that the project is logical and well-managed. Another reviewer mentioned there is a very comprehensive set of courses and labs. The last reviewer noted that some of the project strengths were simulations, a hands-on approach with the automotive education kit, multiple faculty members on the same course to implement the best course since the course content is new, summer camp and education kit (K-12), and undergraduate courses and graduate courses.

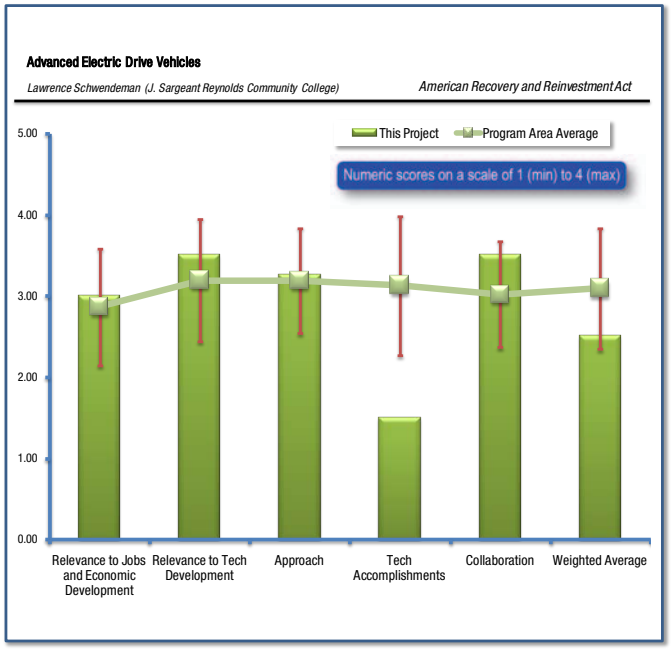
PROJECT WEAKNESSES

The first reviewer said it is not completely clear what is meant by “green” manufacturing. Deployment outside Michigan may be addressed better. Another reviewer mentioned that planning for coordination among all of the partners is a weakness. The last two reviewers agreed that there are no project weaknesses, with one of the reviewers adding the project is doing a very good job for the funding level.

SPECIFIC RECOMMENDATIONS

The first reviewer said the project needs to clarify exactly what “green manufacturing” means. Another reviewer requested development of a table with specific milestones associated with each project initiative, with accomplishment dates, for inclusion in presentation materials. The project team should be aggressive in developing partnerships and collaborations with other Michigan organizations, and with the leaders of other electric drive transportation education and training projects. Information on new course offerings, outlines and content should be routinely shared with other universities and community colleges, particularly those in Michigan and those developing courses with Department of Energy funds. The last reviewer added to please coordinate all of the proposed courses, labs, first responder training, and large number of partnerships among all of the other projects in this area.

Advanced Electric Drive Vehicles: Lawrence Schwendeman, J. Sargeant Reynolds Community College



Reviewer Sample Size

This project had a total of 5 reviewers.

Question 1a. Relevance: Is the project effort relevant to the American Recovery and Reinvestment Act (ARRA) of 2009 goals: Create new jobs as well as save existing ones; spur economic activity and invest in long-term economic growth.

The first reviewer said the folks at J. Sargeant Reynolds Community College have taken a practical, "feet on the ground," well researched and implementable approach to developing education for the future of electric vehicle automotive technicians. They have an intimate understanding of the issues and challenges associated with producing technicians for an ever-increasing complex field of automotive repair. One of the major issues they face can be described as "work ethic:" finding employees that want to work hard and earn their way every day in a tough and demanding business can be difficult to achieve. However, their presentation demonstrated to this reviewer they are the right team for the job. Another reviewer added that this project is likely to have a direct and long term impact on creating new jobs and saving existing ones. The automotive tech course will spur economic activity and enable independent facilities to stay in business as advanced electric vehicles become more prevalent and need servicing. One reviewer mentioned this project targets the training of automotive technicians. The program involves developing a career certificate for advanced EVs and to develop five advanced EV courses in the study certificate. The plan calls for developing the courses, including a lab component, piloting the course, and then refining the course and offering it. The first course is being offered this summer on HEVs with 5 students. EVs and plug-in hybrid courses will take place in 2011, FCEVs in 2012. They have a marketing plan but have not released it yet. The project will do a distance education program when the other courses are finalized. Two reviewers agreed that, in terms of creating new jobs, everyone that signs up for the training and completes the training can be gainfully employed, so the success rate is 100%. The last reviewer commented that the Development of Automotive Technology Education Materials may make students "more marketable," but the fact that all students can find jobs upon graduation tends to indicate that the addition of EV and HEV technology content by itself will not increase the amount of jobs that are created. Where jobs could be created is if the jobs for EV and HEV's are considered to be higher status – then you might see more student enrollment and thus fill the empty mechanics jobs that are currently out there.

Question 1b. Relevance: Does the project's technology development plan and/or deployment plan address the VT ARRA project goals of accelerate the development of U.S. manufacturing capacity for batteries and electric drive components as well as the deployment of electric drive and alternative fuel vehicles and infrastructure? Does the project's development and/or deployment plan address the VT ARRA project goal to establish education projects that accelerate the mass market introduction and penetration of advanced electric drive vehicles, which includes light, medium, and heavy duty advanced electric vehicles (EV), plug-in hybrid electric vehicles (PHEV), and fuel cell electric vehicles (FCV)?

The first reviewer said they have taken a practical and implementable approach to developing a career studies program of 22 credits targeted towards developing an ever increasing gap in automotive repair for electric vehicles. That gap lies between the manufacturer's automotive repair department, which they in fact supply with trained technicians, and the non-manufacturer repair shop which has no electric car technician supply chain. JSRCC's program is designed to fill that gap. Another reviewer mentioned that by providing an educational facility for technician training, this project will help accelerate mass market introduction and penetration

of EV's by enabling them to be treated as the norm and not a specialty that must be taken to a manufacturer-specific shop for a pricey repair. One reviewer added by educating this segment of the population, they will be getting jobs in a growing market segment. The last reviewer stated that while the service technician training aspects of this project will do little to stimulate/accelerate the development of U.S. manufacturing capacity for batteries and electric drive components, it does lay down the educational underpinnings to stimulate interest in EV/HEV technology and the development of the necessary repair technician infrastructure.

Question 2. Development/Deployment Approach: Are the project's technical and deployment milestones and schedule clearly identified, appropriate, and feasible, and are technical and commercial barriers and risks adequately addressed?

The first reviewer said they described a simple and straightforward development and implementation plan, with reachable milestones and a good system of checks and balances to assure the programs are in fact piloted before going to distribution. The reviewer was concerned that the final iteration of the courses would not provide the students with enough hands-on work, since the plan for implementation called for using distance education. They have filled this gap with planned labs so that courses will have a real hands-on element, most essential for a program such as this. Another reviewer added the project is well-focused and on track. Institutional inertia in creating a degree pathway or certificate was not an issue. One reviewer stated the milestones are clearly defined and the team has already gotten a course up and running on hybrids. The EV and FCEV courses will come in the next year or so. The last reviewer mentioned the program seems to be focused on the creation of courses. Lack of partners and reliance on vehicle "donations" limits the students' ability to work directly on vehicles using different types of EV/HEV technologies. No plan to address this, other than to convert a conventional vehicle to an electric vehicle, was given. While such a conversion would be interesting, the technology levels of typical "conversions" significantly lags that of vehicles currently entering the market and thus would likely have limited educational value.

Question 3. Technical Accomplishments and Progress: What is the overall progress towards project's objectives and milestones? Is progress adequately reported and quantified (e.g., number of jobs, installations, etc.) as required by ARRA?

The first reviewer said they will teach their first course in the summer of 2010, having initiated the program in December of 2009 and there has been excellent progress so far. Another reviewer stated the progress was reported adequately and quantified in terms of coursework created, under development and equipment to be purchased. One reviewer mentioned the project has five students in the HEV program currently, and the team indicated they can place everyone who graduates from the program because the need is great. The PI will be getting a free gas-powered automobile and converting it to an EV as the lab exercise for the EV course. The last reviewer added that progress on the course work is adequate but there are little to no results on the development of appropriate labs and lab materials (i.e., EV or HEV vehicles of differing technologies).

Question 4. Collaborations/Partnerships: Does the project team effectively use collaborations/partnerships with regional, state, local governments, industrial, commercial, university, research organizations, and similar organizations to achieve its objectives?

Three of the reviewers all said there were no partnerships listed on presentation materials. One of those reviewers added the presenter did indicate they would like to partner: this seems like a terrific opportunity, since they have identified a real workforce need. Another reviewer also stated Firestone service facilities were mentioned as providing lab/instructional facilities. The last reviewer commented there are collaborations with GM, Ford and Bridgestone for hands-on collaboration.

Project Strengths

The first reviewer said one of the project strengths is that there is a simple, straightforward, "feet on the ground," implementable approach to developing a career studies program to fill the gap left by manufacturer training programs for electric automotive technicians. Another reviewer added the PIs have identified an outstanding workforce development project that will meet a real need. Project implementation seems right on track and we need to make them a national model. One of the reviewers stated the project is educating an important segment of the population. The last reviewer mentioned they can't really point to any specific strength as this project only has a range from poor to adequate.

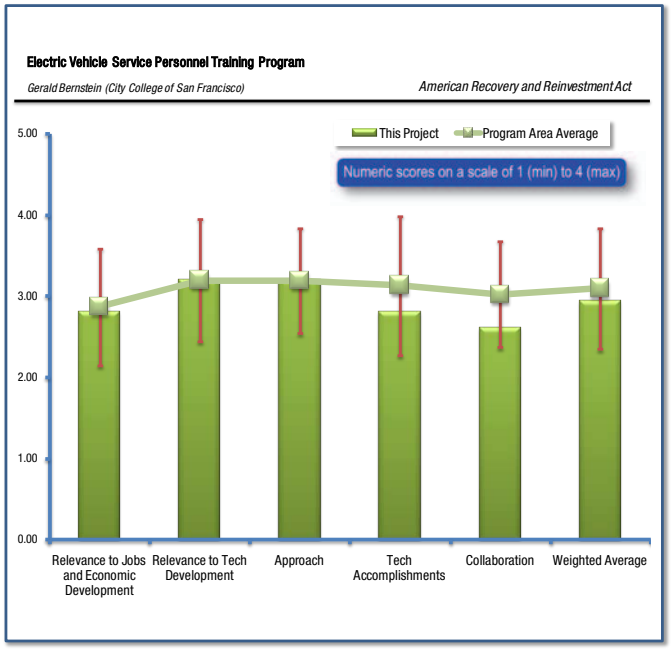
Project Weaknesses

Three of the reviewers agreed that collaborations and partnerships is a weakness of the project. One of those reviewers said this is a great program, and this reviewer was sure the team can be linked up with more community colleges to help meet the need of independent shops that need higher trained mechanics. Another reviewer added that low student enrollment/throughput and poor lab facilities are weaknesses. The last reviewer stated they couldn't think of any project weaknesses.

Specific Recommendations

The first reviewer said to keep the project going, while another reviewer suggested perhaps attending a relevant conference, contacting AACC, or linking up with some of the other DOE-funded AEV projects would increase the impact of this program. The last reviewer added the project needs to aggressively seek industry partners that can provide assistance in areas of weakness, and also coordinate curriculum development with other parallel DOE funded projects.

Electric Vehicle Service Personnel Training Program: Gerald Bernstein, City College of San Francisco



Reviewer Sample Size

This project had a total of 5 reviewers.

Question 1a. Relevance: Is the project effort relevant to the American Recovery and Reinvestment Act (ARRA) of 2009 goals: Create new jobs as well as save existing ones; spur economic activity and invest in long-term economic growth.

The first reviewer said the project directly supports the VT 2009 ARRA goals by making an investment in training technicians and creating new jobs for repair and maintenance positions for EV. This will help accelerate electric vehicles into the market space by supporting consumer behavior and alleviating worry about maintenance problems. Another reviewer added the project is addressing a key barrier for customer acceptance by training the technicians for independent repair shops and municipal fleets. The project is located in an area with one of the highest concentrations of HEV in the nation, thus serving critical training needs for the deployment of EVs. One reviewer mentioned the presentation did not identify specific job or economic activity impacts associated with the project. While there are important benefits, e.g., improved economic competitiveness, associated with better educated engineers and well-trained technicians, it is difficult to establish a direct link between this type of project and specific job-creation benefits. Another reviewer stated the project is in the early stages and job creation was not specifically addressed in the review presentation. This reviewer asked that the team develop a plan to track graduates from the program that go into industry. The last reviewer commented this project helps educate the new generation of auto technicians to become familiar with electric vehicles, which creates an expertise in electric vehicles.

Question 1b. Relevance: Does the project's technology development plan and/or deployment plan address the VT ARRA project goals of accelerate the development of U.S. manufacturing capacity for batteries and electric drive components as well as the deployment of electric drive and alternative fuel vehicles and infrastructure? Does the project's development and/or deployment plan address the VT ARRA project goal to establish education projects that accelerate the mass market introduction and penetration of advanced electric drive vehicles, which includes light, medium, and heavy duty advanced electric vehicles (EV), plug-in hybrid electric vehicles (PHEV), and fuel cell electric vehicles (FCV)?

The first reviewer said the training of service and repair technicians will only support the ARRA goal of accelerating the development of U.S. manufacturing capacity for batteries and electric drive components as well as the deployment of electric drive and alternative fuel vehicles and infrastructure. Having more service technicians who are trained in the new technologies, systems and components will be critical for sustainability and consumer confidence. Another reviewer added this project includes technician training initiatives that will result in increased numbers of qualified vehicle maintenance personnel whose expertise will benefit the electric drive transportation industry. The inclusion of small businesses which have developed a knowledge base and practical skills in working on electric drive systems, together with a large fleet customer requiring hybrid vehicle maintenance, is a plus. This project is the smallest of the ARRA-funded vehicle technologies education projects. It is expected that this will limit the reach of the project and the number of individuals trained with project funds compared to other projects. Two of the reviewers agreed this project does not seem to directly address manufacturing capacity and deployment. However, one of the reviewers said it does directly establish a training program, and indirectly impacts the mass market introduction of advanced vehicles. The other reviewer also said it clearly addresses long-term

maintenance needs. The last reviewer stated with more technicians that are familiar with electric vehicles, consumers become more likely to purchase EVs because they will talk to and know people personally who can fix these vehicles.

Question 2. Development/Deployment Approach: Are the project's technical and deployment milestones and schedule clearly identified, appropriate, and feasible, and are technical and commercial barriers and risks adequately addressed?

The first reviewer said the project approach appears sound. The team will develop a curriculum for hybrid, PHEV, EV and FCV technologies and identify training aids for automotive technician programs, independent technicians, and municipal fleet operators. They will disseminate curriculum locally to test portability, and sample colleges and employers in Southern California and neighboring states to identify training support and infrastructure needs. Deployment efforts are strong. The team plans to adapt newly created curriculum for high school/ vocational schools. Another reviewer mentioned that despite a relatively modest budget, it is a well thought out plan that addresses all technician needs (outside of the OEMs) as well as for expanding training efforts from San Francisco to the Bay Area, to California, to neighboring states. Also, the team could use a strategy to HEV as initial stages for future expansion of training program for EVs and FCVs. One reviewer added the milestones for 2010, and the approach to accomplishing them, are clearly stated, straightforward and reasonable. From the PI's oral presentation, it can be concluded that the project team has a good grasp of the work required to develop and deliver the electric drive technical training curriculum, and the capability to accomplish it. What is not so clear is how the expansion of the training outside the San Francisco Bay area will be accomplished with available project resources. Neither the approaches to expansion, nor the organizations with which CCSF expects to collaborate, were spelled out. In response to a question, the PI stated that training programs in Oregon are targeted, but that no one there has been approached yet. Another reviewer asked how will the training courses be coordinated among the partner schools and others? Is there a duplication of effort? The last reviewer commented the approach is to develop and pilot a series of related training courses, and then improve course content, equipment requirements and instructor skills.

Question 3. Technical Accomplishments and Progress: What is the overall progress towards project's objectives and milestones? Is progress adequately reported and quantified (e.g., number of jobs, installations, etc.) as required by ARRA?

The first reviewer said the team is making strong progress on goals and milestones. Prior to the project the team launched a first Hybrid Maintenance and Repair course piloted at CCSF during fall 2009 using a donated Prius. The team also held a Saturday class for thirty students in automotive electrical that is a pre-requisite. In February 2010, the team held its first study kick-off meeting. The project also has two of the three partner contracts in place; the third is in process. The first curriculum-design meetings conducted with San Francisco shops (site for municipal and private fleet maintenance training) and the first curriculum-design meeting conducted with Chabot College faculty for both their student program and independent technician program curriculum. The team has made an initial equipment list for first round of training (diagnostic software, in addition to a donated hybrid car). Another reviewer stated that the presentation materials support a conclusion that there has been excellent progress in meeting the objectives, and achieving the milestones, associated with the project's first year. The project got out of the blocks quickly, with a new course piloted during the fall of 2009. The municipal fleet partner (which is also a customer for trained technicians) has been engaged in curriculum design. A reviewer added this project is just starting; please plan to track graduates of this program going to the industry. A final reviewer said the project is making good progress under very modest funding.

Question 4. Collaborations/Partnerships: Does the project team effectively use collaborations/partnerships with regional, state, local governments, industrial, commercial, university, research organizations, and similar organizations to achieve its objectives?

The first reviewer said the project lead is College of San Francisco and collaborators include Chabot College, Pat's Garage, Perfect Sky, and San Francisco Municipal Shops. The beauty of the collaborations in this project is the model may be adapted, repeated and deployed. Another reviewer added that the project has built a team with good experience from early EV vehicles as well as Hymotion conversions and SAE training courses. One reviewer mentioned there seem to be excellent working relationships among the community colleges leading the project, the small businesses specializing in maintenance of electric drive vehicles, and

representatives of fleets which require maintenance personnel with electric drive vehicle expertise. Those organizations involved in the project to date are all in or near San Francisco (which is reasonable for year one).

If the objectives and milestones for years 2 and 3 are to be successfully achieved, then collaborators/partners must be identified and working relationships developed. The concept of expanding the project is sound, but partners are needed. Another reviewer stated there are a good set of partners and to please be sure to coordinate among all of them while the last reviewer said the project has maintenance shops, especially the shop that specializes in EVs.

Project Strengths

The first reviewer said a project strength is the planned deployment into other cities. San Francisco is an EV training ground for technicians and consumers. Another reviewer stated it is a well-organized and cost effective program with a great strategy to expand training activities to surrounding areas. One reviewer added the project leaders and participants have practical, "hands-on" experience with both vehicle maintenance and imparting their expertise to students.

Project participants recognize the growing need for electric drive vehicle technicians to be employed by organizations other than those directly connected with vehicle manufacturers. The project is responsive to this increasingly important market. Another reviewer mentioned another strength is the partnerships with others schools and some industry. The last reviewer commented the strengths are the collaborations with garages specializing in electric vehicles, training technicians and fleet operators, and free short courses for marketing to technicians.

Project Weaknesses

The first reviewer said a project weakness is the geographic confinement at present, while another reviewer added coordination of training courses among other schools as another weakness. One reviewer mentioned there are no specific plans which seem to have been developed for meeting the objective to expand the training beyond the San Francisco area. The last reviewer stated the project could use some collaboration directly from OEMs. The reviewer then says that is easier said than done for a small school, but this would help with the availability of equipment and support.

Specific Recommendations

The first reviewer said the project should share the model with other regions as the concentration of vehicles grows. Another reviewer commented an action should be taken soon on assembling the plan for expansion and sharing of the training curricula developed, and approach used, in the Bay area during the initial project year. This should include near-term engagement of other leaders among community colleges and technical schools in California.

The PI should present his work, and its results to date, to leaders of DOE Clean Cities coalitions in California and Oregon. Linking to Clean Cities initiatives, and using their contacts, could assist in achieving the benefits of the expansion planned for the CCSF project. The last reviewer requested that the team please coordinate the proposed training courses, first responder training, and large number of partnerships among all of the other projects in this area.