

Education

Summary of Annual Merit Review Education Subprogram

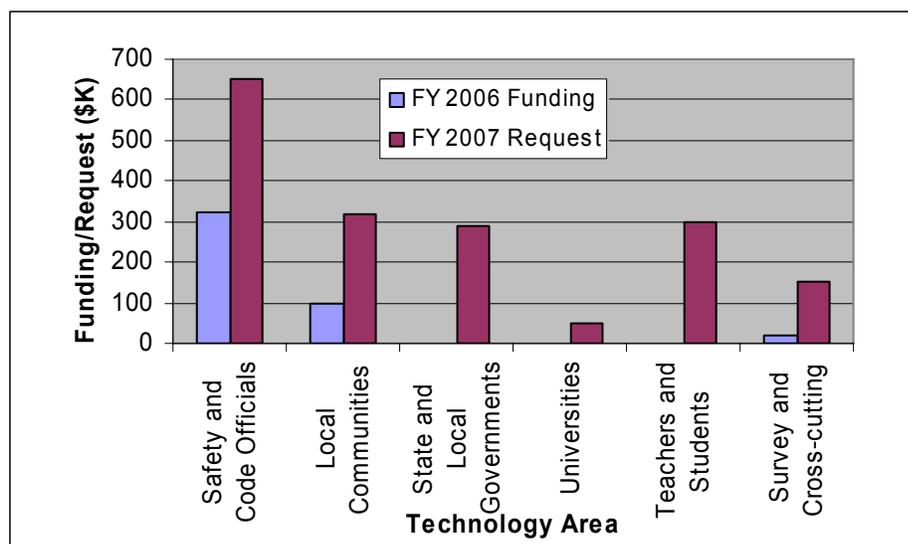
Summary of Reviewer Comments on Education Subprogram:

Reviewers felt that the hydrogen education subprogram is important to the success of the President's Hydrogen Fuel Initiative, and they commented on how the DOE Hydrogen Baseline Knowledge Survey results point to the need for a robust education effort to build the currently low levels of knowledge and awareness. Reviewers expressed continuing concern over the lack of funding to support education activities; they recognized that budget constraints have created a significant challenge and required difficult decisions regarding project funding.

Education projects funded this period focused on emergency responders and communities hosting demonstration projects. In accordance with previous merit review recommendations, both projects have connections to the safety codes and standards and technology validation subprograms. Projects to educate teachers and students were also included in the merit review despite not being funded this fiscal year due to subprogram budget constraints. Reviewers recognized these projects for their importance over the long-term and particularly for their efforts to find additional partners and cost share that have enabled their progress this year. Reviewers also commented on the need to focus Congressionally-directed projects more specifically on achieving DOE Hydrogen Program goals and avoiding redundancy with other efforts.

Hydrogen Education Funding:

The Education sub-program has prioritized its efforts to focus on target audiences involved in the near-term use of hydrogen technology. The fiscal year 2006 budget for Education included funds to support only two projects – an introduction to hydrogen safety for emergency responders and a community information project that focuses on areas hosting demonstration projects. Previously-awarded projects to create Hydrogen Technology Learning Centers at universities are closing out, due to lack of funding. Previously-awarded projects focused on middle school and high school teachers and students, although unfunded in 2006, will continue in fiscal year 2007, pending Congressional appropriations.



Majority of Reviewer Comments and Recommendations:

The reviewer scores for the Education projects reviewed were average, with scores of 3.5, 3.0, and 2.1 for the highest, average, and lowest scores respectively. The scores reflect progress made over the past year. Key comments and recommendations are summarized below. DOE will act on reviewer recommendations as appropriate to the overall scope, direction, and coherency of the Education effort.

Emergency Responders: Project shows clear relevance to the DOE Hydrogen Program and meets a critical near-term need. Good approach and progress so far. Coordinate with other entities and take advantage of the many outlets available for sharing this type of information.

Local Communities: Good project concept; a strong tool for the Program. Coordination with other entities will be critical to project success. Need to be focused and maintain realistic expectations for the scope of the project given ongoing budget constraints.

Middle Schools and High Schools: Important topic to address long-term need. Both projects have made excellent progress has been made despite lack of funding. Consider revising scope, as appropriate, given availability of funds. Focus on increasing availability of materials.

Community and Technical Colleges: Both efforts are important and relevant. Both projects are limited to certain states and should coordinate with others to avoid redundancy and expand reach. Linkages with other universities and organizations are critical.

Project # ED-01: Hydrogen Technology and Energy Curriculum (HyTEC)

Barbara Nagle; UC Berkeley

Brief Summary of Project

The Hydrogen Technology and Energy Curriculum (HyTEC) project will develop and test hydrogen and fuel cell curriculum for high school students. The materials include student handouts, teachers' guides, kits for student investigations and experiments, and strategies for professional development of teachers. The project advances awareness of hydrogen technologies and the future path to a hydrogen economy throughout the United States.

Question 1: Relevance to overall DOE objectives

This project earned a score of **3.4** for its relevance to DOE objectives.

- Good relevance but presenter should address specific goals of DOE and how this effort connects.
- Curriculum development for high school teachers and students is very important to the goal of improving awareness.
- This fits squarely with the long-term education objective. Near-term to longer-term budget priorities are tough choices. Finishing the first module is important. It needs full commercialization.
- Highly relevant.

Question 2: Approach to performing the research and development

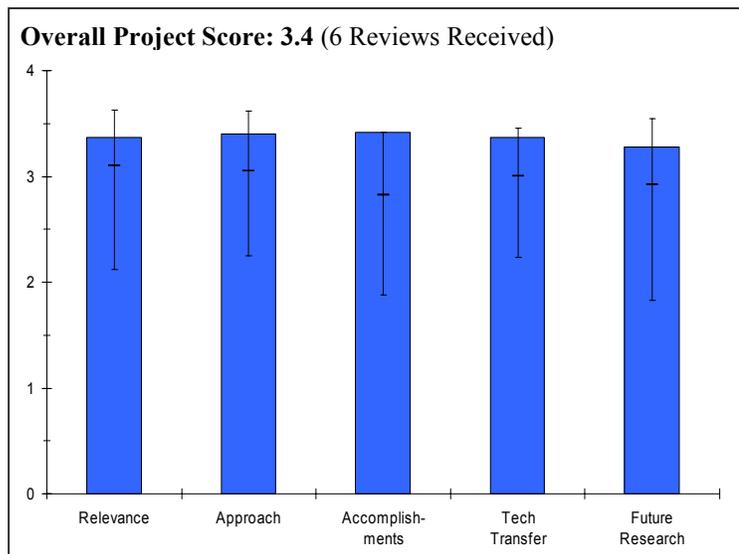
This project was rated **3.4** on its approach.

- Good idea to put together a "Setup" Instructional Model.
- Good use of teacher input and curriculum developers. Good use of scientist input. Should do a better job on literature review (what is already out there.)
- Structured approach that has been significantly scaled back because of funding shortfalls.
- Approach is very mature and fits in a broader structure of science curriculum.
- The approach of showcasing the electrolyzer making hydrogen separate from the fuel cell is very applicable to real world transportation use.

Question 3: Technical accomplishments and progress toward project and DOE goals

This project was rated **3.4** based on accomplishments.

- Good example of pilot testing in Berkeley.
- Good progress despite funding shortfall. Good use of pilot testing to develop materials.
- Good progress.
- Pace of project is tailored to student learning curve timing - end of school year. This is an understandable barrier to faster progress. There is a window for once a year pilot testing.
- Excellent job of prioritizing work effort given funding limitation AND showing progress. Integrating video clips into curriculum is excellent.
- Project is progressing well despite two-year lack of DOE funding. Feedback from teachers and students using curriculum is positive.



Question 4: Technology transfer/collaborations with industry, universities and other laboratories

This project was rated **3.4** for technology transfer and collaboration.

- Need to determine a plan to make the materials publicly available at end of the project.
- Working well with teacher groups. Good set of partners.
- Teacher workshops are a great way to share what's available.
- Good collaboration.
- Working with teachers, curriculum developers, engineers, and project partners – and the field trips to AC Transit - brings the real world to students.

Question 5: Approach to and relevance of proposed future research

This project was rated **3.3** for proposed future work.

- Pre- and post-testing will be critical to determine effectiveness of materials.
- Would like to see a fully field-tested module in a variety of settings.
- The project team has effectively thought out future efforts for several funding scenarios. Additional modules, national field testing is well-focused.
- The project partners have mapped out a strategy to continue and expand the project regardless of DOE funding.
- Good plan.

Strengths and weaknessesStrengths

- Good, well thought out plan for hydrogen education.
- Continued work despite lack of funding. Good use of expert input. Good use of sequencing in the class development.
- A very strongly integrated approach. The review of what was on the market was a key step. The recycling of Lab-Aids royalties speaks very well to commitment.
- Excellent and enthusiastic presentation and delivery of results.

Weaknesses

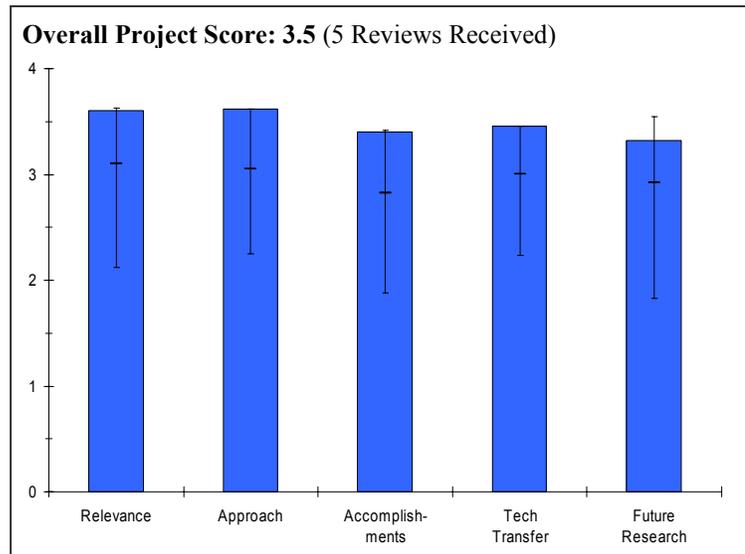
- More information should be given regarding the approach.
- Materials and kit development are proprietary. This does not allow for easy duplication by others. Should be more explicit about how this program is better than existing materials. Should address the question about hydrogen production methods that will be covered.
- Not enough funding for this project.
- Expanding project nationally may be challenge with support and funding.

Specific recommendations and additions or deletions to the work scope

- A science subject area seems expansive (and impressive). With reduced scope, it might be necessary to revise the areas. Should evaluate which science subject areas are best suited for the program. Understand which work best. Consider shifting development towards publicly available materials and guidelines for equipment purchase (as opposed to equipment development).
- As noted by the speaker, including discussion of numerous production technologies in curriculum materials is a good idea. Continue to seek feedback on material/products being developed.

Project # ED-02: H2 Educate!*Mary Spruill; NEED***Brief Summary of Project**

The National Energy Education Development (NEED) Project is working with DOE on the H2 Educate project designed to provide hands-on kits, classroom curriculum, and teacher training on hydrogen and fuel cells. The project will reach a network of classrooms with one-day workshops, week-long conferences, and strategic partnerships around the country. The project is targeted at middle schools, but also has applications in the elementary and secondary schools. The program and materials were designed by teachers, for teachers, with support from SENTECH, Inc., the National Hydrogen Association, Los Alamos National Laboratory the U.S. Fuel Cell Council, NYSERDA, the Fuel Cell Store, and State Energy Offices.

**Question 1: Relevance to overall DOE objectives**

This project earned a score of **3.6** for its relevance to DOE objectives.

- Need to better articulate how these materials relate to the DOE education goals.
- This project fits the long-term education goal but is not a near-term goal. This is a tough budget situation.
- Important topic at the right time.
- Focusing on middle schools is highly relevant.

Question 2: Approach to performing the research and development

This project was rated **3.6** on its approach.

- Need to better explain how this program differs from competitive materials (lit review.) Objectives should be more quantitative, tied to DOE education goals. Asking people what they want to know about hydrogen is not necessarily the best way to understand what needs to be taught. Good use of state standards to match against program. Good use of "Train the Teacher."
- Needs network of teachers helps ensure maximum reach.
- Appropriate level for middle school. Key messages thought-through. State level standards engaged.
- Obtaining data on whether the project is working and the relevant to teacher standards are two important aspects of the approach.

Question 3: Technical accomplishments and progress toward project and DOE goals

This project was rated **3.4** based on accomplishments.

- 550 modules deployed, 1000 print materials deployed. Need additional quantitative metrics to show progress.
- Record over 2,800 teachers' projects and a broad scope/range.
- The supplemental funding speaks volumes. Glad to see that "it's done." Project moved ahead of schedule with adjustments as needed.

Question 4: Technology transfer/collaborations with industry, universities and other laboratories

This project was rated **3.5** for technology transfer and collaboration.

- Good partnering with industry (BP) to provide materials.
- Expanding to other classes (besides science) very useful. A report on what has been learned by teachers and students who participate will be extremely valuable.
- The unexpected broader use beyond science classes is a strong advantage. The annual teacher workshops give great long-term life to the work.
- Ability to get funding from others speaks to worthiness of project and effectiveness of the collaboration.

Question 5: Approach to and relevance of proposed future research

This project was rated **3.3** for proposed future work.

- Need to be clear about what you are trying to measure in terms of success metrics. Not clear what is planned going forward.
- Project is nearly complete and materials are available on web. Good closeout.
- Not research.
- Moving ahead in spite of zero budget for future programming.

Strengths and weaknesses

Strengths

- Progress on project despite funding shortfall. Good anecdotes of success (but still need key metrics).
- Program addresses all pathways of hydrogen production as well as all of the different fuel cell applications, and ensures that the curriculum fits ties to national and state standards.
- Lots of outreach and workshops. This is super. The project highlighted the "up from scratch" level of hydrogen education in the U.S.
- Focused program – target audience seems to be engaged. Feedback survey appears to be a good way to gauge success of program. Scope of program appears to cover most forms of hydrogen production.
- Excellent presentation. Delivered with enthusiasm.

Weaknesses

- Presenter mentioned effect (30% increase in understanding), but it's not clear what this means.

Specific recommendations and additions or deletions to the work scope

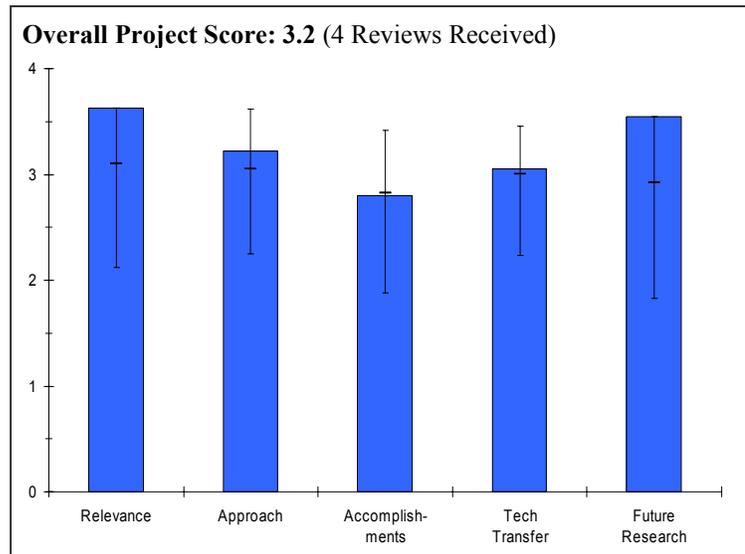
- Add a section to gauge perceptions of hydrogen (positive/negative).
- Need to benchmark these materials with other available materials. Show the specific value added.
- Project is well focused on middle school students, but nonetheless it might be worth investigating whether some interaction with ED-01 Nagle project which focuses on high schools could provide some benefits.

Project # ED-03: Hydrogen Safety Education and Training for Emergency Responders

Bruce Kinzey; PNNL

Brief Summary of Project

The objectives of this project are to: 1) prepare emergency responder and other related safety communities for near-term hydrogen demonstrations and the long-term hydrogen economy; 2) develop hydrogen safety educational materials for first responders and code officials that can be used alone or “dropped in” to a wide variety of existing training activities, depending on the needs of the audience (must be accomplished in close collaboration with relevant hydrogen and safety communities); and 3) complete and release awareness-level educational materials for emergency responders who must be able to recognize a hydrogen incident and take initial protective measures.



Question 1: Relevance to overall DOE objectives

This project earned a score of **3.6** for its relevance to DOE objectives.

- Clear relevance to the goals of the DOE program. Safety official training is a clear near-term need for demonstration and deployment.
- Training and education of first responders are critical to the safe introduction of hydrogen applications.
- Training of emergency responders is a key step to fear reduction of hydrogen. A trained cadre of first responders is very important.
- This is an extremely important area where synergy exists between Education and Safety, Codes & Standards. It's fantastic to see DOE funding a cross-cutting project like this, especially in a year of such reduced Education funding.

Question 2: Approach to performing the research and development

This project was rated **3.2** on its approach.

- Good process description. Good description of expert input.
- Good approach.
- 2008 for full complete set of materials is a good pace. Good tie to Safety, Codes and Standards and to an existing facility. The broad stakeholder input and review strengthens the finished product. This is probably the first key audience of Hydrogen Education.
- Since the project is not very far along, it's hard to rate this higher. In theory though, the planned approach looks good.

Question 3: Technical accomplishments and progress toward project and DOE goals

This project was rated **2.8** based on accomplishments.

- Pilot tests, information collection, revision process well described.
- Good progress.
- Glad the Awareness-Level is almost finished. This module should have broader audience appeal.
- Scored lower simply because there was not yet much progress reported.

Question 4: Technology transfer/collaborations with industry, universities and other laboratories

This project was rated **3.1** for technology transfer and collaboration.

- Good partnering with HAMMER. Good plan to make the materials publicly available.
- Outreach to target audiences has been well-received.
- A good set of partners for further collaboration efforts will be needed for acceptance. Need the state fire marshals. Web materials are needed quickly.
- The project talks about how this information will be disseminated among the intended audiences, but not how the training materials may be shared with colleagues or other institutions which may be interested in using this material. Very vague mention as to who the information is being shared with and other partners.

Question 5: Approach to and relevance of proposed future research

This project was rated **3.6** for proposed future work.

- Good description of products that will be released by FY06.
- Good plan.
- The completion of the whole project will provide a full set of training materials.
- What needs to be done next is obvious and well spelled-out. I look forward to seeing more progress.

Strengths and weaknesses

Strengths

- Good partner with HAMMER. Good articulation how this project interacts with other research activities
- The web-based approach is a way to reach very broadly.
- The concept of this project and its cross-cutting value is significant. This project addresses well-known needs in a way that looks like it will be very effective.

Weaknesses

- Presentation should be clear about value added by this activity (what was done by this vs. other organizations). Presenter should include some discussion of feedback received from the pilot testing.
- The project is in its beginning draft stages, so it's hard to make judgments. I look forward to hearing more about how the technology transfer with other organizations is planned to occur. There are many outlets for sharing this type of information. The PI should mention and take advantage of them.

Specific recommendations and additions or deletions to the work scope

- Don't let the web review process bog this down.
- Should interact with other international activities currently looking at safety issues (DOE, EU, JHFC, etc.).
- There are other projects relevant to this at University of Montana, CaFCP (their training materials) and Hydrogen Safety does some of this as well. If not already coordinated with them, it might be beneficial.

Project # ED-04: Increasing “H₂IQ”: A Public Information Program

Henry Gentenaar; The Media Network

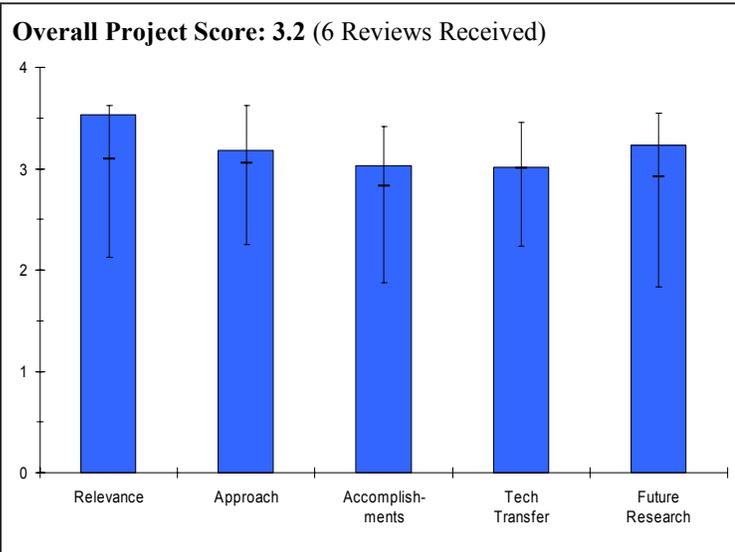
Brief Summary of Project

The objectives of this project are to:

Develop and disseminate resonant messaging that communicates to the general public basic facts about –

1. Hydrogen as a fuel/form of energy
2. The coming hydrogen economy
3. The DOE Hydrogen Program and Hydrogen Fuel Initiative
4. Generate interest and increase public requests for more information
5. Give the Hydrogen Program a communications mechanism with a flexible framework for reasons of timing and budget
6. Support the DOE brand
7. Help position the Program and Initiative in the mind of the public
8. Build recognition of hydrogen and government efforts to build the hydrogen economy
9. Make the most of DOE resources and provide a gauge of success.

These objectives are planned to be accomplished using print, radio, television, satellite, and new forms of media. The project will coordinate closely with the Technology Validation Sub-Program and focus initially on Hydrogen Learning Demonstration project areas/locations. The primary target audience is the general public.



Question 1: Relevance to overall DOE objectives

This project earned a score of **3.5** for its relevance to DOE objectives.

- Education is important, but it is critical that accurate technical language is used. Critical that message is realistic as well as truthful and accurate.
- This project ties directly to the Hydrogen Education Baseline Study.
- If successful, should raise the H₂IQ of general public. Given the high level of misinformation currently being put into the media, this activity will be critical.
- Important topic to get H₂ education into media.

Question 2: Approach to performing the research and development

This project was rated **3.2** on its approach.

- The sound-bite mentality has a high likelihood of inaccuracy and misunderstanding.
- Well thought, thorough approach to huge audience - the general public. Mature thinking of approach shines.
- The Communications Blueprint and The Program Model provide excellent long-term approach. Simple positive messaging approach is excellent.
- Impressive in scope, not clear that such a plan is possible without significant funding (beyond what is currently available). Need to be careful about over promising, maintain trust.
- Good concept, but slide hard to read.
- Very balanced and approach all media included.

Question 3: Technical accomplishments and progress toward project and DOE goals

This project was rated **3.0** based on accomplishments.

- Project just started. Technical experts with experience with general public education on hydrogen must be consulted on the accuracy and understandability of the messages.
- This is a new project. It is well crafted for this stage.
- Progress limited by recent start date but progress not totally apparent to reviewer based on Slide #9.
- Good start, but need more information on what are the top priority messages.
- More clarity should be given on technical accomplishments.
- In short time program has been running it seems to have accomplished several key objectives.

Question 4: Technology transfer/collaborations with industry, universities and other laboratories

This project was rated **3.0** for technology transfer and collaboration.

- Just beginning to look for partners. Need to engage education experts, scientists and engineers, and social scientists.
- Collaboration will take a lot of work. This will need a future focus.
- Much is going on in industry and academia. Need to understand how these messages fit in with what is already out there.
- Outside organization will ensure that there no overlap with other activity out there.

Question 5: Approach to and relevance of proposed future research

This project was rated **3.2** for proposed future work.

- Has potential for success with appropriate participation.
- Looking forward to what is coming in 2006, 2007 and beyond.
- Budget is very limited and, therefore future efforts need to be very focused and based upon realistic expectations as to what budgets might be available for this work.
- Ambitious future plans. Future plans need to articulate priorities for message and medium.
- Project seems to be optimistic with strategies and the goals do not seem realistic considering the amount of funding.

Strengths and weaknesses

Strengths

- A very well thought out approach. Looking forward to its launch. A prediction - this will become a very strong tool for the Hydrogen, Fuel Cells, and Infrastructure Technologies Program.
- Enthusiastic speaker.
- Using modern technology (I-Pods) and conventional media means (TV).
- Reasonable statements within the "think future" scenario (good target).
- Strategy specific to hydrogen and fuel cells.

Weaknesses

- Metrics beyond web hits and calls to the Information Center will need to be developed.
- Amount of funding doesn't seem realistic based on plan.
- Need to articulate a plan that can be executed at different funding levels (prioritize).
- Message needs to be concise. Good concepts, but unclear from presentation how the subjects were presented.

Specific recommendations and additions or deletions to the work scope

- Additional funding recommended.
- Make sure to document "success stories" especially in situations where you have to respond to "misinformation."
- Presentation slides are very complex. Work on communication.

Project # EDP-01: Hydrogen/Alternative Energy Center

Ruth Borger; Lansing Comm. College

Brief Summary of Project

Lansing Community College (LCC) is focused on increasing the number of technicians available to service and maintain hydrogen equipment by providing an open and accessible lab in which students can learn about hydrogen fuel cells and alternative energy. LCC is also building links between businesses and industry and educational institutions. Its goal is to become a resource center for educators, innovators, and policy makers.

Question 1: Relevance to overall DOE objectives

This project earned a score of **2.9** for its relevance to DOE objectives.

- Relevance very focused on State of Michigan and specifically the Lansing Community College.
- Educational efforts are important. Flexibility of course materials will be critical, given the lack of commercial products.
- Generally aligned with the President's Initiative. It certainly is important that technicians be trained to work on and repair these emerging technologies.
- This project is a critical groundbreaker. Creating this curricula will not only address technical knowledge areas, but will provide positive outreach as well and start to build a base of knowledgeable technicians.

Question 2: Approach to performing the research and development

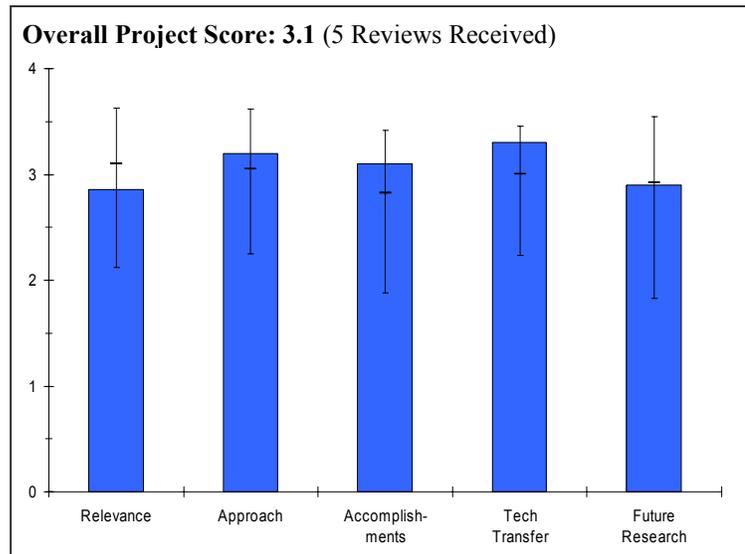
This project was rated **3.2** on its approach.

- Scattered over too many (only slightly related) activities.
- The curriculum being developed to train technicians or as a bridge to a four year institution seems reasonable. It is not clear that the vehicle transporter and assortment of vehicles is a significant contributor to the education process.
- Area focused on (training technicians) is desperately needed. Very thorough method of approach.
- Logical, straight-forward approach.

Question 3: Technical accomplishments and progress toward project and DOE goals

This project was rated **3.1** based on accomplishments.

- Curriculum development and progress in educating students is to be applauded.
- Progress in curriculum development is good. Outreach activities are varied.
- It is encouraging that most of the courses have been taught at least once and these courses are making a difference in students finding jobs.
- Program has met targeted goals.
- It appears that the project is moving along according to the execution plan.



Question 4: Technology transfer/collaborations with industry, universities and other laboratories

This project was rated **3.3** for technology transfer and collaboration.

- Good set of universities.
- The collaborations with universities are good, but the partnerships need to be expanded to include more industry. This expansion should include fuel providers, fuel cell suppliers and other automotive component suppliers. They could be brought in as members of an advisory committee and hopefully would see value in donating or loaning equipment.
- Projects collaboration with other local universities with similar fuel cell degrees or vehicle programs bolsters strength and reach.
- Collaboration with the other institutions and companies is not only essential, but looks to be quite comprehensive. I would be very interested in knowing as follow-up, which schools built on this project and to what extent companies like GM were able to take advantage of students who graduated with this degree.

Question 5: Approach to and relevance of proposed future research

This project was rated **2.9** for proposed future work.

- The need/objective of using a hydrogen fueling station to support the education of technicians is a worthy one, but they should seek collaboration with existing/planned Michigan fueling facilities to accomplish this objective.
- Completion of the curriculum is important.
- Continuing course development is good, but plans to procure a hydrogen refueling station are not worth the high cost. This is another area where they should search out a partnership for industry to obtain a training platform.
- Program provides substantial room for growth and success. Many possible routes and partnerships available in location.
- The plan for finishing this project and looking ahead looks logical. I have a slight hesitation about whether a fully dedicated fueling station would need to be built for an extension of this project, however a slightly modified approach might be beneficial – find a locally convenient site where a fueling station is needed for other reasons (fleet fueling, auto company, etc.) and construct one with the appropriate partners so that students have access to it for training. Expanding the technician training to include fueling stations is logical. I wonder if the industrial gas companies and energy companies see the same need for trained personnel as the auto companies do.

Strengths and weaknesses**Strengths**

- Courses are being offered and students are being employed!
- Linkages with universities are very good.
- Working with local universities and organizations (NextEnergy) provides great rewards.
- Basic, straightforward approach to a known issue. Good progress so far.

Weaknesses

- Limited to Michigan.
- Focus on high-visibility items, such as the vehicle transporter and hydrogen refueling station, may detract from the educational process.
- None identified.

Specific recommendations and additions or deletions to the work scope

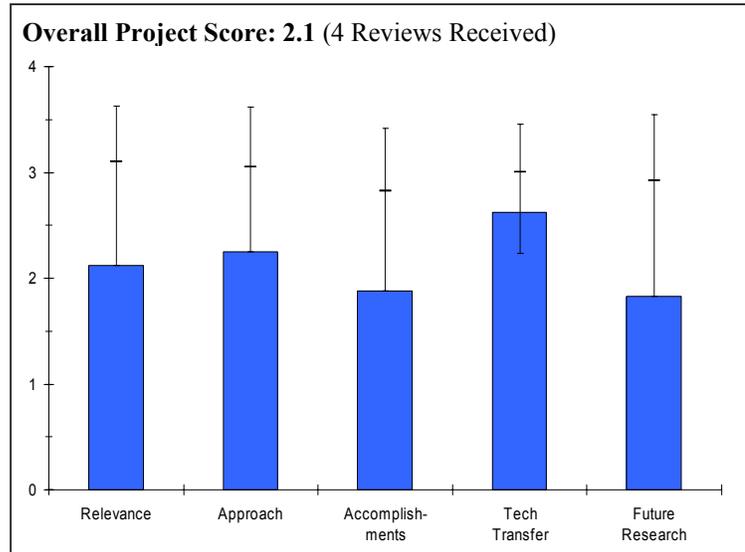
- Concentrate remaining financial resources on building partnerships with industry. Show the value of educating technicians that will work for them or service their equipment. Build training partnerships, possibly even performing some of the class/lab work in an industrial setting of the partner. EDP-01 and EDP-03 should form a collaborative and jointly expand their curriculum.

Project # EDP-02: Shared Technology Transfer Project

John Griffin; Nicholls State Un.

Brief Summary of Project

The overarching goal of the Nicholls State University project is to establish a collaborative process with domestic industries for the purpose of sharing Navy-developed technology. The purpose is to educate private sector businesses and increase their awareness of available technologies, with an initial focus on technology applications that are related to the DOE Hydrogen Program. NAVSEA-Carderock and the Houston Advanced Research Center are teaming with Nicholls State University to catalog NAVSEA-Carderock unclassified technologies, rate the level of technology readiness, and establish a web-based catalog of the technologies. The catalog contains technology descriptions, including testing summaries and overviews of related presentations, and an evaluation of the technology readiness.



Question 1: Relevance to overall DOE objectives

This project earned a score of **2.1** for its relevance to DOE objectives.

- This project does not directly support the President's hydrogen initiative. This is a technology transfer project geared towards identifying patents that could be relevant to industry. It is not geared towards advancing hydrogen technologies, nor educating the public and other stakeholders as to the opportunities for hydrogen.
- Very focused on Navy technology, but hydrogen appears to be an after thought.
- This is a problematic project. It has not aligned itself to the HFCITP Program. The presenter did not show up at conference.
- The arguments given for this project appear to be well-aligned with the goals the President's Initiative and the HFCIT Program

Question 2: Approach to performing the research and development

This project was rated **2.3** on its approach.

- Although this project could yield some useful information, it is unclear if the team has the technical expertise to draw the relationships between the various patents and their potential relevance to hydrogen technologies. The example shown in the presentation as a relevant technology is concerning, particularly the claim relative a hydrogen cost of <\$2 /kg. No basis is provided for this claim.
- Rather than an education effort, this appears to be a consulting activity to match technical needs of the Navy with local industry. The Integrated Technology Manufacturing Initiative has performed a similar activity for DOD with far less funding and developed a database which is much larger.
- The approach to bringing out U.S. Navy technologies is a good one. It needs to target hydrogen and fuel cell technologies better.
- Some parts of the approach seem well thought out and straightforward like the cataloguing and the creation of the website. The relationship between the students and the outreach to the private sector was confusing from the slides/poster.

Question 3: Technical accomplishments and progress toward project and DOE goals

This project was rated **1.9** based on accomplishments.

- The cost of this project is very high relative to the scope. The database architecture, including the catalog categories and technology maturation codes, should make the database useful. Seems to have completed objective of cataloging 600 patents.
- A database has been developed, but the accomplishments do not match the level of funding.
- How many hydrogen technologies have been identified? How many fuel cell technologies have been identified? These are unknowns from the poster.
- It's hard to measure progress unless you can quantify how many industry professionals felt there was value in being educated about the different technologies. The website is extensive, but does not communicate well. As someone who is familiar with underwater technologies like the ones discussed, I often did not understand what the technology did or the relevancy to the hydrogen program. Perhaps those in the private sector would have this same issue.

Question 4: Technology transfer/collaborations with industry, universities and other laboratories

This project was rated **2.6** for technology transfer and collaboration.

- Good effort is being made to ensure that the database will be visible and to alert the technical community of its availability.
- Technology matching may be good, but without the PI to answer questions, I could not verify.
- There is a need for saltwater technologies to be identified for use in saltwater wind to hydrogen applications. None were shown.
- Looks like a good team. Improving the ability of the website to communicate would greatly increase the opportunity for this database of information to be useful to other audiences. I think one of the main points of this project is to help little-known technologies become better-known to companies that can use them. Therefore, the scope of the outreach and the ability of the website to communicate would greatly increase the technology transfer.

Question 5: Approach to and relevance of proposed future research

This project was rated **1.8** for proposed future work.

- Although the planned efforts for tracking the relevancy of the database and for measuring inquiries is good, it is unclear whether the technical expertise exists to proactively identify opportunities for applying the technologies.
- Future work consists mostly of more meetings.
- This project is in the wrap-up stage. The opportunity for hydrogen/fuel cell identified technologies appears to have been missed.

Strengths and weaknesses

Strengths

- The strongest point of this effort is providing the linkage between the Navy and local industry.
- Great database of untapped information that could prove to be very useful if discovered by the right persons/companies. Innovative concept.
- As far as database development and understanding the naval patents in their intended application, the team seems well qualified.
- A good approach is used to rating the market readiness of the identified technologies.

Weaknesses

- Based on poster language, technical expertise in hydrogen production is questionable. Website does not communicate clearly.
- The project provides little, if any benefit to advancing hydrogen technologies and supporting the President's Hydrogen Initiative. There is no benchmarking to assess the real potential of technologies and there appears to be limited technical expertise being applied to the valuation of technologies.
- The accomplishments and future work do not justify nearly \$1M in funding.
- This project is not recommended for further HFCIT funding.

Specific recommendations and additions or deletions to the work scope

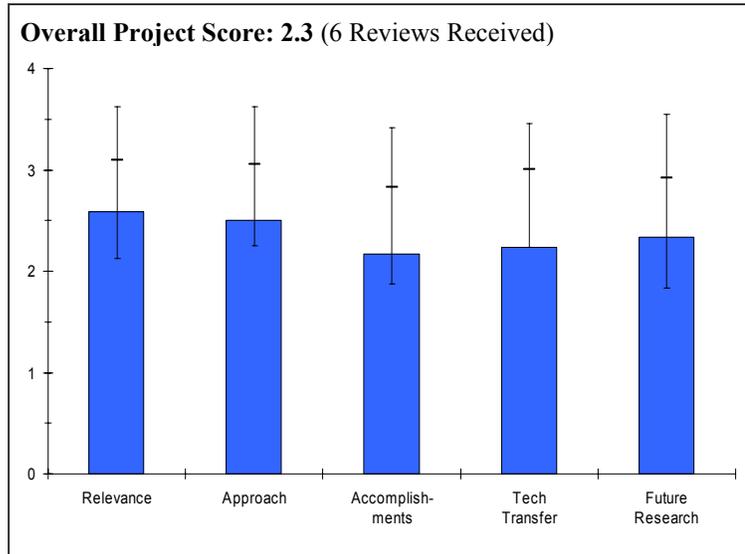
- Project representative should be available to address questions.

Project # EDP-03: Montana Hydrogen Futures Project

Paul Williamson; U of Montana

Brief Summary of Project

The Montana Hydrogen Futures Project includes: a new web-based curriculum for Alternative Energy Technicians' one-year certificates and two year associate degrees leading to an Energy Engineer Degree; a hydrogen education website (www.H2education.com) for students and teachers of all ages; an Alternative Energy and Hydrogen Safety Training Site to provide safety training and certification; and planning for the Hydrogen Futures Park to house a sustainable college campus.



Question 1: Relevance to overall DOE objectives

This project earned a score of **2.6** for its relevance to DOE objectives.

- While a pilot education program in Montana setting up a college curriculum for hydrogen education may be a good thing and a web site will reach more than Montana residents, this work does not appear to be critical, and in many cases it is redundant.
- This project appears limited to Montana and it is not very clear how it will help foster Montana's hydrogen economy.
- Generally aligned with the President's Initiative. It is important that technicians be trained to work on and repair these emerging technologies.
- Although educating the next generation work force on hydrogen technologies will be important, this program seems more focused on infrastructure upgrades at the University. It should focus on curriculum development that can be replicated nationally. Although safety training is extremely important, it is not clear that the team is qualified to create a safety training center.
- Great relevance to the hydrogen program; this project addresses key areas that need more activity. The cross-cutting issues that this project tackles between education and safety, codes and standards are fantastic

Question 2: Approach to performing the research and development

This project was rated **2.5** on its approach.

- I believe that more needed to be done to ensure that the work was not going to be redundant. For instance, is a hydrogen safety training center at the University of Montana necessary if there is going to be one at HAMMER? The question that must be asked is: "What is being proposed/performed here that is value-added and just not another website or education program?"
- The approach is worthy but not very clear as to how this project will "support the creation of a Montana hydrogen economy and stimulate national progression...."
- The approach has been refined, but it is still searching for a niche that needs to be filled.
- Would benefit from greater emphasis on benchmarking of technology status, related programs at other institutions and need. The current hydrogen industry members are the leaders in hydrogen safety and hydrogen safety training, yet there appears to be no effort to involve these experts in the design and implementation of the hydrogen safety center and its curriculum.
- Straightforward approach. Could be better documented in the presentation but overall, the path is well defined and set-up for success.

Question 3: Technical accomplishments and progress toward project and DOE goals

This project was rated **2.2** based on accomplishments.

- It cannot be expected that much other than planning be done when there are four topics and only about 750K available, so it seems that they are making some progress. I looked at the website, however, and there does not seem to be much there that can't be found elsewhere. Much of the material is redundant with information from DOE, NHA and many others. There are a lot of useful links here, but I don't see any uniqueness. One disturbing thing is that there is a plethora of "Hydrogen News" referenced over the time period June–October 2005 and then nothing after that. A website that looks like it is not being kept up to date gives one the feeling of being defunct, and is perhaps worse than no website at all.
- H₂ Education Website is a worthy accomplishment.
- Progress has been slow, but this has benefited the approach. It appears that this project lacks internal support and may not be sustainable.
- Although the project was scheduled for completion in April 2006, the work is not yet complete. It appears as though the project tried to take on too much. It would have benefited from a narrower focus.
- Good progress made in developing the materials and coursework. Website looks great and is easy to navigate. Looking forward to seeing the curriculum. Is the project 80% complete if the curriculum is not completed and the Safety Program is not yet completed? May need more funding to finish.

Question 4: Technology transfer/collaborations with industry, universities and other laboratories

This project was rated **2.2** for technology transfer and collaboration.

- They have contacted the right people, but it seems more an act of collecting data than of a real collaboration.
- Having interaction with noted partners is fine but if project is "designed to foster the infrastructure needed in Montana's Hydrogen Economy" the reviewer questions whether the project has the right set of partners.
- The project is working with others to improve its value.
- This project would have benefited from stronger ties to other curriculum development efforts. Should have leveraged more external expertise. Unclear how much of the curriculum developed has been vetted by the technical community.
- Plans for collaboration could be better articulated. I question the claim of 50 presentations made in Montana. Over two years, that's a presentation every-other week (and to an average audience of 60 people)? If it's true, that's great but supporting information would be helpful.

Question 5: Approach to and relevance of proposed future research

This project was rated **2.3** for proposed future work.

- The future plan, assuming there is money (this present contract is finished,) calls for completion of what has been started. This is always a logical approach.
- Creation of a Hydrogen Safety Center is worthy but unfocused.
- At the current level of internal support, it is not clear that many, if any, future plans will be carried out.
- It is unclear how curriculum will be maintained and revised as technologies mature. Again, the lack of involvement by industrial hydrogen safety experts in the hydrogen safety program development is a concern.
- See technical accomplishments/progress. Otherwise, clear and straightforward approach to finishing this project.

Strengths and weaknesses**Strengths**

- Teaching more people - the public, energy technicians, school children or fire marshals - about is a good thing.
- Serving Montana's interests.
- Linkages with other educational institutions.
- Project addresses well-known needs in a straightforward manner. Scope is broad but achievable.
- Good efforts related to outreach in the Montana community.

Weaknesses

- Redundancy with other projects. While redundancy is good on a technical project where different approaches may lead to a more efficient or less expensive product, this is not necessarily true in the education arena. Quality must far outweigh quantity. There is not a lot of value added here. A website that features old news is worse than no website at all.
- A number of aspects of this project seem to have "the cart before the horse" when it comes to the development and support of a Montana hydrogen infrastructure and plan toward a hydrogen economy.
- Lack of internal support.
- Need to wait for DOE National efforts. Coordinating with DOE and DOT does not mean creating own curriculum without their input.
- Presentation documents could include more detailed information on progress and achievements.
- The project appeared to take on too broad of a scope and would have benefited from a focused effort in one or two areas.
- Appears to have been limited involvement only from external experts.

Specific recommendations and additions or deletions to the work scope

- If there is to be further federal funding here, it would be good to focus on one item and get it done rather than partially develop several. Care should be taken to avoid redundancies.
- Recommend utilizing DOE Emergency Response materials and not trying to create another effort.
- Plans for continuation of this effort should be aligned with the school's mission and goals to assure full support from the school. EDP-01 and EDP-03 should form a collaborative and jointly expand their curriculum. Also, identifying a niche and tailoring the curriculum for that niche would be beneficial.