

Project # AN: Systems Analysis*Fred Joseck; Systems Analysis***Degree to which the Sub-Program area was adequately covered and/or summarized**

- Model and analysis matrix shown does an excellent job of putting this subprogram in perspective. Matrix of the models and their function was especially useful.

Were important problem/issue areas and challenges identified/discussed, including plans for addressing these items in the future?

- Although this subprogram lists barriers that must be addressed, its most important contribution is the evaluation of technical and market barriers for the balance of the Program and prioritization of those barriers. Future market behavior is a barrier that is included in the MYPP, but the systems analysis subprogram should take credit for its efforts to understand the technical barriers and their relative priority within the Program.

Does the Sub-Program area appear to be focused, managed well, and effective in addressing the Hydrogen Program R&D needs?

- Models are well focused on understanding the barriers, in particular the market barriers that must be addressed. Use of the models will enable DOE to prioritize those barriers and evaluate where they RD&D funding can be used to reduce those barriers.

Other comments:

- The MYPP for Systems Analysis lists "Inconsistent data, assumptions and guidelines" as a barrier. One area to consider for future work is to focus on resolving these inconsistencies and/or understanding the variations.
- It may be too soon to attempt to add the cost of safety to the models, but it is not too early to evaluate the impact of consumer perception of safety and its impact on market penetration.
- Many of the models have not been validated. Consideration should be given to include a requirement for each project to develop a validation plan during the next FY.

APPENDIX E: SUBPROGRAM EVALUATIONS

Project # ED: Education

Christy Cooper; Education

Degree to which the Sub-Program area was adequately covered and/or summarized

- Very well

Were important problem/issue areas and challenges identified/discussed, including plans for addressing these items in the future?

- Yes — plans for increasing target audience knowledge of hydrogen.

Does the Sub-Program area appear to be focused, managed well, and effective in addressing the Hydrogen Program R&D needs?

- Yes — accomplished a lot with zero or limited funds.

Other comments:

Project # FC: Fuel Cells*Nancy Garland; Fuel Cells***Degree to which the Sub-Program area was adequately covered and/or summarized**

- Excellent overview.
- Pretty quick, due to the short time allotted and the late start, but still was adequate.

Were important problem/issue areas and challenges identified/discussed, including plans for addressing these items in the future?

- Yes.
- Yes, cost and durability are definitely the primary barriers.
- Nice to water transport/management within the stack is finally getting the attention it deserves. This must be understood and effectively dealt with in order to meet the cost and durability targets.

Does the Sub-Program area appear to be focused, managed well, and effective in addressing the Hydrogen Program R&D needs?

- Yes, there is a nice portfolio of membrane projects, although this is a difficult area and you probably can never have enough. More funding should be requested for Non-Pt or ultra low Pt and non-carbon electrodes. This issue is as important as the membrane issue and no one should be kidding themselves that Pt costs will stay low or will be achieved under real manufacturing conditions.
- Yes. The EERE team has consistently listened to fuel-cell developers, component suppliers, and other involved parties, regarding what the challenges are going forward and have adjusted the fuel-cell program accordingly. This review meeting is one good example of that continuous improvement process.

Other comments:

- How will 40,000 h for Distributed Energy be demonstrated by 2011? Since that is 5 years of run time, the demonstration should already be underway. Is it underway, or is the goal that a projection to 40k h, with some high degree of confidence (e.g., based on accelerated testing), can be made by that date?
- One project that does not appear to fit DOE's goals and their stated position on PAFC (no funding) is FC-8. PBI doped with phosphoric acid is essentially a PAFC -- look at the polarization curve and the issues associated with losing electrolyte, they both stink and make meeting the cost and lifetime goals very challenging. DOE's position to not fund PAFC is a good one, since the money is better spent looking for a better high temperature electrolyte, preferably a true polymer electrolyte or a solid electrolyte. If an electrolyte has a vapor pressure, it is not a polymer. Beware of a wolf in sheep's clothing.

Project # ST: Hydrogen Storage*Sunita Satyapal; Hydrogen Storage***Degree to which the Sub-Program area was adequately covered and/or summarized**

- Excellent overview of the sub-program area, of its strategy, technical goals and main achievements.
- A nice description of the program and its goals and rationale for approach. Obviously with 70 some projects they could not all be touched on specifically. Good description of progress to date and plans for the future.
- The overview was good and largely complete in discussing the needs (targets), activities, progress and future plans.
- The overview was complete and accurate with chief achievement descriptions. The presentation gave clear insight of the progress, the expectations and plans.
- The coverage of the issues by the presenter was thorough and clear.
- The sub-program was organized and well-covered, a large achievement given the amount of information, projects, and diversity of topics. The format of the talk addressed the key aspects, enabling reviewers/participants to understand the objectives, technical progress, program structure, and future work. Both short- and long-term goals/plans were also shown and are indicative of a balanced perspective on both details and broad scope.
- Good coverage of the storage program.
- More emphasis needed on system requirements and especially infrastructure issues particularly when it comes to cryogenic temperature.

Were important problem/issue areas and challenges identified/discussed, including plans for addressing these items in the future?

- Both issues and plans were made clear. A nice set up for the individual project talks to come which will no doubt reference these same issues - but in telegraphic form - allowing them more time to discuss what we need to hear, approach, progress and plans. The plans for the engineering center are less than fully defined at this point, but at least the general rational and direction were clear enough.
- There was a good discussion of capacity, kinetics, and delta H and release temperature as key challenges.
- Critical areas and challenges were discussed along with short and longer term plans for attacking them. Important milestones and decision points were presented and so were the results of recent solicitations and the announcement for an expression of interest for a new CoE on engineering issues
- Problems and issues were discussed in some detail: theory assisted materials development, system properties (weight, volume, recharging times, cost, etc.), safety, testing of prototypes, etc. Future efforts and funding requests outlined for long-term efforts to assault the technical barriers. The three CoEs were discussed in terms of their valuable coordination of collaborative activities. An engineering CoE is a good idea.
- The major technical issues have been identified and presented for an open discussion and updating. Of special interest is the focus of the operation and effectiveness of the CoE under revision and the intention to give more emphasis to engineering aspects.
- The considerable challenges facing the storage R&D activities were clearly expressed by the gravimetric vs. volumetric summary figures. Perhaps I could suggest mentioning in the project summary part to state at some point on a slide that the storage densities presented are material capacities. The future plans were clearly summarized at the end of the presentation.
- It was especially useful for common issues to be clarified, for example, reiterating that the storage targets are 'system' and not 'materials' based. Acknowledgement of the difficulty and challenges that are inherent to this research area also helped to motivate and incite optimism. Additionally, clear (go/no-go) decision points were also presented to ensure a roadmap focused on progress is in place.
- Given the limited time, yes in general all important issues were highlighted.
- It is recommended to start emphasizing safety, and toxicity issues for the benefits of all researchers and how it will be used in down-selecting process.
- More emphasis needed on how various storage alternatives affect the infrastructure (well-to-wheel) energy efficiency.

Does the Sub-Program area appear to be focused, managed well, and effective in addressing the Hydrogen Program R&D needs?

- The Storage sub-program is very well focused, with a robust R&D portfolio and clear ties to technical targets and overall efficiently managed.
- The program is extremely well managed and effective in meeting very difficult technology challenges. In particular, the center of excellence approach on each main topic is an excellent and efficient way to pool resources for the R&D and provide clear focus to the participants. Of particular interest is the new Engineering Center of Excellence, which will help address systems issues often neglected by the other centers, and provide some insight on the overall efficiency, cost and thermal management strategies of the storage systems using the various unconventional storage strategies.
- Yes. This sub-program is extremely well-managed. There is a sharp focus on the targets, maintained communication between the program management/tech-team and the projects/CoEs, and a willingness/eagerness to adapt to an evolving and progressing field.
- I feel the DOE team managing hydrogen storage is excellent, and that it is well managed at all levels, not just the level of the presenter. The large and complex task of monitoring the 70 to 80 actual projects (which are required to achieve success with any likelihood) have been grouped into several centers which manage them on a day to day, month to month basis. This allows the management team to focus on a more tractable number of large programs on a day to day and month to month basis, while still retaining the right to investigate progress on individual projects on a more infrequent basis and as needed.
- The selection of programs has been managed well. While a few doubtful projects have been started based on independent reviewers who may not have been well suited to their task, the management team has swiftly isolated those few less appropriate programs and de-funded them so the money available can be focused on productive programs.
- Also despite pressure to focus on many different researchers' pet programs, the management team has held firm to a wide scope until there is significant evidence of a path to solution. They are also self critical and evaluate for example how the centers feel the DOE management is doing.
- Probably the best managed of the subprograms.
- The program is well focused and managed. There are good interactions with BES, FreedomCAR, IPHE, IEA, etc. Progress is nicely mapped and reasonable go/no-go decision points in place.
- The Subprogram remains central in the DOE Program.
- The focus is on key scientific aspects with increased attention, in terms of subprogram efforts (not only targets), to a system approach.
- The management is well motivated and organized with new support from well known and experienced consultants able to enlarge the analysis capacity to better address R&D needs.
- The managing of the program is good.
- Need to develop more flexible strategies to accommodate new data.
- If not already, need to start a review of the portfolio and assess the progress to date.
- The transition scenario analysis showed the effect of storage cost targets on the FCV (fuel cell vehicle) penetration. How much of this information is shared with the researchers?

Other comments:

- H₂ storage has been a driver in inter-team communication, and was so before it was a focus handed to FreedomCAR by the peer review. They have also been highly engaged in coordination with international groups. There are few if any opportunities to improve and leverage their program that they are not currently using.
- The team is responsive and approachable. They have a huge task and are making progress despite the fact I feel they are well understaffed for the job at hand. It is quite beneficial that the manager (Satyapal) is directly involved in all phases, the management of the budget and oversight team, the leadership of the 'technical reference team,' the people in FreedomCAR who critique all the programs, and direct reporting to the DOE management. By doing all these jobs there is automatic coordination which is absolutely crucial to completing this mission. She needs to have sufficient support so she can maintain these many tasks and her sanity. Any other approach will be less effective.
- Maintain independent projects to ensure flexibility and agility.

APPENDIX E: SUBPROGRAM EVALUATIONS

- Ensure transparency on the methods of CoE operation and management (structure, decision process, meetings, communication flow & synergy among the sub-program areas, IPR management).
- Establish interaction mechanisms among the CoEs for sharing experiences and lessons learned particularly on cross-cutting issues - not yet clear how this currently works.
- Engineering issues and tank system design could be further emphasized and the PIs should be encouraged to address them earlier on in the program.
- Keep reminding PIs that they need to address system rather than material targets and also engineering aspects and not just gravimetric capacities.
- Almost all projects have been made to conform to DOE multi-year RD&D plan targets for 2010 and/or 2015.
- It would be interesting to look at different strategies beyond storage density optimization in order to achieve the autonomy expected of hydrogen vehicles. Should we factor in vehicle weight objectives, for instance? I hope such issues will be addressed by the new engineering center, through, for instance, a system analysis that could identify what weight reduction strategy in vehicle infrastructure would be required to achieve consumer acceptable driving range for hydrogen powered vehicles.
- If not already, it is recommended to start a formal review of the portfolio and assess the progress to date.
- What was learned by the outcome maps or (gap analysis)? How does that match with the actual progress metrics to date?
- The transition scenario analysis showed the effect of storage cost targets on the FCV penetration. How much of this information is shared with the researchers? And in general, how much of the project researchers are aware of the cross-cutting impacts of storage on the entire hydrogen chain?

Project # TV: Technology Validation*John Garbak; Technology Validation***Degree to which the Sub-Program area was adequately covered and/or summarized**

- Mr. Garbak provided an excellent summary of a sub-program having a number of important elements.
- Easy-to-grasp budget overview for FY 2007/2008. Clearly identified major areas receiving funds.
- Could have provided more summary data, e.g., total miles.

Were important problem/issue areas and challenges identified/discussed, including plans for addressing these items in the future?

- The major challenges were summarized.
- There was limited discussion of plans for dealing with the challenges. Could have included a few specific examples of both challenges and plans.
- Overall "Good".

Does the Sub-Program area appear to be focused, managed well, and effective in addressing the Hydrogen Program R&D needs?

- Bulk of the DOE funds are used to address transportation issues. The Hydrogen Program Manager should consider increasing the resources devoted to projects that demonstrate and validate integrated systems for stationary applications of hydrogen. Many of those are expected to be economic and commercially competitive before transportation.

Other comments:

- Mr. Garbak's overview provided an excellent lead-in to the more detailed presentations that followed his.