INTRODUCTION

This report is a summary of comments from the Peer Review Panel at the FY 2008 DOE Hydrogen Program Annual Merit Review, held on June 9-13, 2008, at the Gateway Crystal Marriott in Arlington, Virginia. The work evaluated in this document supports the Department of Energy (DOE), and the results of this merit review and peer evaluation are major inputs utilized by the DOE in making its funding decisions for following fiscal years.

The objectives of this meeting were to:

- Review and evaluate FY 2008 accomplishments and FY 2009 plans for DOE laboratory programs and industry/university cooperative agreements and R&D that supports development.
- Provide an opportunity for program participants (hydrogen production manufacturers, hydrogen storage manufacturers, fuel cell manufacturers, etc.) to shape the DOE sponsored R&D program so that the highest priority technical barriers are addressed. The meeting also serves to facilitate technology transfer.
- Foster interactions among the national laboratories, industry, and universities conducting the R&D.

The Peer Review process followed the guidelines of the Peer Review Guide developed by EERE. The Peer Review Panel members, listed in Table 1, attended the meeting and provided comments on the projects presented. These panel members are peer experts from a variety of hydrogen and fuel cell related backgrounds including national laboratories, hydrogen production manufacturers, hydrogen storage manufacturers, fuel cell manufacturers, universities, and other U.S. Government agencies. Each member was screened from a conflict of interest (COI) perspective per the Peer Review Guide. A complete list of the meeting participants is presented as Appendix A to this report.

Table 1: Peer Review Panel Members

No.	Last Name, First Name, Organization
1	Abdel-Baset, Tarek, Chrysler Corporation
2	Aceves, Salvador, LLNL
3	Adams, Jesse, DOE Golden Field Office
4	Adams, Mike
5	Adjemian, Kev, Nissan Motor Company
6	Adzic, Radoslav, BNL
7	Ahmed, Shabbir, ANL
8	Ahn, Channing, CalTech
9	Akiba, Etsuo, AIST
10	Anderson, Michelle, Office of Naval Research
11	Armstrong, Tim, Oak Ridge National Laboratory
12	Bakke, Paul, DOE
13	Balachandran, Balu, Argonne National Laboratory
14	Balema, Viktor, Sigma-Aldrich Corp.

15	Baturina, Olga, Naval Research Laboratory
16	Bavarian, Farshad, Chevron
17	Benard, Pierre, Hydrogen Research Institute
18	Benjamin, Thomas, Argonne National Laboratory
19	Birdsall, Jackie
20	Blair, Larry, Consultant (retired from DOE)
21	Bluestein, Linda, DOE/EERE Vehicles Program
22	Bocarsly, Andrew, Princeton University
23	Bonhoff, Klaus
24	Bordeaux, Chris
25	Borup, Rod, LANL
26	Bose, Arun, NETL
27	Bowman, Bob, JPL-retired
28	Buxbaum, Robert, REB Research and Consulting
29	Cai, Mei, GM
30	Casey, Daniel, ChevronTexaco
31	Choate, Bill, BCS
32	Choudhury, Biswajit, DuPont Fuel Cells
33	Christensen, John, Consultant
34	Chu, Deryn, US Army Research Laboratory
35	Collins, Bill, UTC Power/Fuel Cells
36	Conte, Mario, Italian National Agency - ENEA
37	Cooper, Alan, Air Products
38	Costa, Stephen, DOT/Volpe Center
39	Cox, Philip, PolyFuel
40	Curry-Nkansah, Maria, BP
41	Debe, Mark, 3M
42	Domnez, Alkan, NIST
43	Douglas, Trevor, Montana State
44	Driscoll, Daniel, NETL
45	Eisman, Glenn, RPI
46	Erdle, Erich, Retired from Daimler
47	Ernst, Bill
48	Fairlie, Matthew, Retired from Stuart
49	Fenton, Jim, UCF
50	Filiou, Constantina, EC
51	Freund, Deborah, Federal Motor Carrier Safety Administration
52	Gangi, Jennifer, Fuel Cells 2000
53	Gayle, Frank, NIST
54	Ge, Qingfeng
55	Gencer, Mehmet, IMET Corporation
56	Gittleman, Craig, GM
57	Glass, Robert, LLNL

58	Goudy, Andrew, Delaware State U.
59	Grassilli, Leo, Navy
60	Gross, Tom, Consultant
61	Gruber, Jill, DOE
62	Haberman, David, IF, LLC
63	Hamernyik, Erin, WSU
64	Hamrock, Steve, 3M
65	Hardis, Jonathan
66	Heben, Mike, NREL
67	Herring, Andy, Colorado School of Mines
68	Hershkowitz, Frank, ExxonMobil
69	Hirano, Shinichi, Ford Motor Company
70	Hirose, Katsuhiko, Toyota
71	Holladay, Jamie, PNNL
72	Hoskin, Aaron
73	Hua, Thanh, ANL
74	Imam, Ashraf, Naval Research Laboratory
75	James, Brian, Directed Technologies, Inc.
76	Jena, Puru, Virginia Commonwealth U.
77	Jensen, Craig, U of Hawaii
78	Johnston, Christina
79	Jorgensen, Scott, GM R&D
80	Kegerreis, Jim, ExxonMobil
81	Kerr, John, LBNL
82	King, David PNNL
83	King, Merrill, NASA
84	Kirschner, Neil, DOE/NETL
85	Kopasz, John, Argonne National Laboratory
86	Koval, Carl, UC- Boulder
87	Kroposki, Benjamin, National Renewable Energy Laboratory
88	Kumar, Romesh, Argonne National Laboratory
89	Kung, Stephen (for Carl Sink)
90	Kuriyama, Nobuhiro, AIST
91	Lasher, Stephen, TIAX
92	Laskin, Jay, Consultant
93	Lipp, Ludwig, FuelCell Energy
94	Lott, Melissa, Alliance Technical Services
95	Maeland, Arnulf
96	Markovic, Nenad, ANL
97	Maroni, Victor, ANL
98	Masten, David, GM
99	McFarland, Eric
100	McGrath, James, Virginia Tech

101	McKenny, Kurtis, TIAX
102	McQueen, Shawna, Energetics
103	Mehall, Mark, Ford
104	Meier, Paul, ConocoPhillips
105	Melis, Tasios, UC Berkeley and LBNL
106	Mettes, Jacob, Power and Energy
107	Meyers, Jeremy, University of Texas at Austin
108	Miller, Bob, Air Products
109	Miller, Eric, University of Hawaii
110	Miller, Michael, SwRI
111	Mohtadi, Rana, Toyota Technical Center
112	Moore, Tom, Consultant
113	More, Karren, ORNL
114	Moreland, Greg, SENTECH, Inc.
115	Motyka, Theodore, Savannah River National Laboratory
116	Muradov, Nazim
117	Myers, Deborah, Argonne National Laboratory
118	Nakamura, Yumiko, AIST, Japan
119	Nguyen, Kevin, Chevron
120	Nguyen, Yen-Loan
121	Olson, Greg, Consultant
122	Padro, Cathy, Los Alamos National Lab
123	Parkinson, Bruce, Colorado State University
124	Parks, George, Conoco Philips
125	Paster, Mark, Consultant (retired DOE)
126	Patel, Pinakin, FuelCell Energy, Inc.
127	Paul, Dilo
128	Pecharsky, Vitalij, Ames lab
129	Petrovic, John, Petrovic & Associates
130	Pez, Guido, Air Products & Chemicals
131	Pivovar, Bryan, LANL
132	Podolski, Walter, ANL
133	Quah, Micheal, Concurrent Technologies
134	Ramani, Vijay, Illinois Institute of Technology
135	Rambach, Glenn, Quantum Sphere
136	Reilly, Jim, BNL
137	Richards, Mark, Versa Power
138	Roan, Vernon, University of Florida
139	Sandrock, Gary, Consultant
140	Schmetz, Edward
141	Siegal, Don, Ford
142	Skolnik, Ed, Energetics, Inc.
143	Steward, Darlene, NREL

144	Stubos, Athanasios
145	Sudik, Andrea, Ford
146	Thomas, George, DOE (consultant)
147	Thorn, David, LANL
148	Tran, Doanh, Chrysler Corporation
149	Tumas, William, LANL
150	Vanderborgh, Nicholas, Consultant (retired from LANL)
151	Vanderveen, Keith, SNL
152	Von-wild, Juergen, BMW
153	Wagner, Fred, Energetics
154	Waldecker, Jim , Ford Motor Company
155	Weatherwax, Sharlene, DOE
156	Weiner, Steve, PNNL
157	Wesson, Rose, NSF
158	Wheeler, Doug, DJW Technology
159	Wichert, Robert, US Fuel Cell Council
160	Williams, Mark, ex-NETL, consultant
161	Wipke, Keith, NREL
162	Wolfe, Barb, New West Technologies
163	Wolverton, Chris, Northwestern Univ.
164	Yancey, Lea, DOE
165	Zawodzinski, Tom, Case Western
166	Zelenay, Piotr, LANL
167	Ziegler, Dick, SENTECH, Inc.

SUMMARY OF PEER REVIEW PANEL'S CROSS-CUTTING COMMENTS AND RECOMMENDATIONS

The Peer Review Panel members provided a number of comments and recommendations that apply to the Annual Merit Review and peer review process, as well as overall management of the DOE Hydrogen Program. These comments are provided in Appendix C of this report. DOE will utilize these comments to improve both the program and future review meetings.

ANALYSIS METHODOLOGY

As shown above, **167** panel members participated in the merit review process. A total of **232** projects were reviewed at the meeting and a total of **1025** evaluation forms were received from the Peer Review Panel (not every panel member reviewed every project). These panel members were asked to provide numeric scores (on a scale of 1 to 4, with 4 being the highest) for five aspects of the research on their Evaluation Form, a sample of which can be found as Appendix C.

The five criteria and weights were:

- Relevance to overall DOE objectives (20%);
- Approach to performing the research and development (20%);
- Technical accomplishments and progress toward achieving the project and DOE goals (40%);
- Technology transfer and collaborations with industry, universities, and other laboratories (10%); and
- Approach to and relevance of proposed future research (10%).

All the individual criterion scores from various reviewers were averaged together to obtain average scores for each of the five above-mentioned criterion for every project. These average scores were then weighted and combined to produce a final overall score for that project. In this manner, a project's final overall score can be compared to other projects. Following is the formula used to calculate the weighted average overall score:

*Final Score = Score1*0.20 + Score2*0.20 + Score3*0.40 + Score4*0.10 + Score5*0.10*

A few new projects were reviewed, where the third criterion (Technical Accomplishments) did not apply because of the project's recent startup. In this case, the other four criteria were scaled proportionally in the weighting calculation and the following formula was used:

> *Criterion 3/ Technical Accomplishments weighted at 40% not included; therefore, weighting value for remaining scores = (weight +40/60*weight)*
>
> *Final Score = Score1*(0.20+(40/60)*0.20) + Score2*(0.20+(40/60)*0.20) + Score4*(0.10+(40/60)*0.10) + Score5*(0.15+(40/60)*0.15)*
>
> *So, Final Score = Score1*0.33 + Score2*0.33 + Score4*0.17 + Score5*0.17*

A maximum final overall score of 4 signifies that the project satisfied the above mentioned five criteria to the fullest possible extent, while a minimum score of 1 implies that the project did not satisfactorily meet any of the requirements of the five criteria mentioned above.

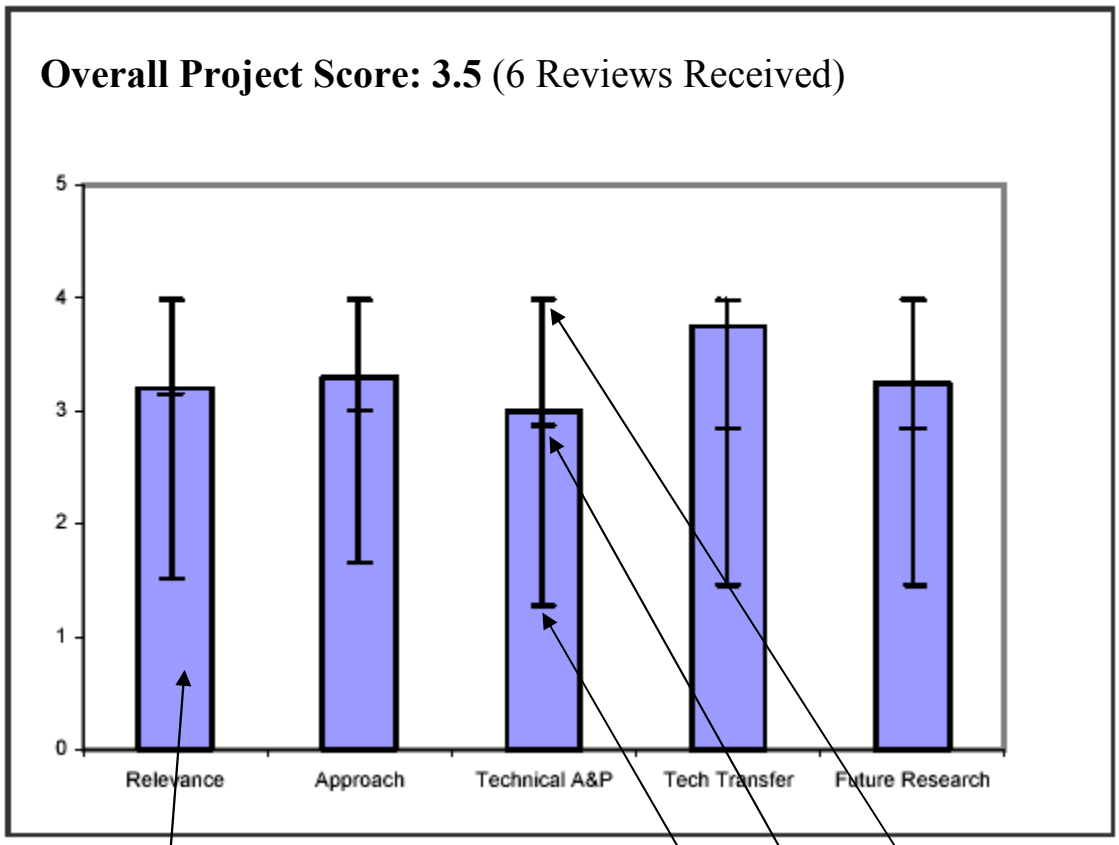
Reviewers were also asked to provide qualitative comments on the five research aspects, as well as the specific strengths and weaknesses of the project, and any recommendations for additions or deletions to the work scope.

These comments, along with the quantitative scores, were placed into a database for easy retrieval and analysis. These comments are summarized in the following sections of this report.

ORGANIZATION OF THE REPORT

This report is organized in seven sections, in an effort to group projects according to the program elements in which they fall in DOE Hydrogen Program planning. A brief description of the general type of research being performed in each category is presented at the beginning of each major report section.

The remaining pages of each section present the results of the analysis for each of the projects discussed at the merit review. A summary of the qualitative comments is provided, as well as graphs showing overall score and how the particular project compared with all other projects presented within each program category. An example of a graph is provided below:



The project comparisons illustrated in the report are criteria based. Each rectangular blue bar in the chart represents that project's score for that particular criterion of the project. The displayed score for each criterion of a project was obtained by averaging the individual reviewer scores for that particular criterion of the project.

This project's score for each particular criterion (each blue bar) was then compared with the maximum, minimum and average score for that same criterion of all the presented projects (across all sub sections of the Hydrogen program). The maximum, minimum and average scores for a criterion across all the presented projects is graphically displayed by the black line bars which overlay the blue rectangular bars.

For clarification purposes consider that only three projects were presented and reviewed. The hypothetical projects were scored by reviewers as displayed in the table below:

	Relevance	Approach	Technical A&P	Tech Transfer	Future Research
Project 1	4	2	1	4	3
Project 2	1	4	4	3	2
Project 3	2	3	2	1	4
Max	4	4	4	4	4
Min	1	2	1	1	2
Average	2.3	3.0	2.3	2.6	3.0

In this case, the chart for project 2 would contain a blue rectangular bar with a value of 1 (reflecting the score obtained by project 2 for the relevance criterion) and a black line bar with max, min and average values of 4, 1, and 2.3 respectively for the relevance criteria. Below is a sample calculation for the Project 1 weighted score.

*Final Score = 4*0.20 + 2*0.20 + 1*0.40 + 4*0.10 +3*0.10= 2.3*