INTRODUCTION

This report is a summary of comments from the Peer Review Panel at the FY 2007 DOE Hydrogen Program Annual Merit Review, held on May 15-18, 2007, 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 2007 accomplishments and FY 2008 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.	Name	Organization
1	Tarek Abdel-Baset	DCX
2	Jesse Adams	DOE
3	Kev Adjemian	Nissan Motor Company
4	Shabbir Ahmed	ANL
5	James Alkire	GFO
6	Michele Anderson	ONR
7	Mike Anderson	DOE-ID
8	Tim Armstrong	Oak Ridge National Laboratory
9	Radoslav Atanasoski	3M
10	Carol Bailey	SAIC
11	Balu Balachandran	Argonne National Laboratory
12	Bhaskar Balasubramanian	Chevron
13	Viktor Balema	Sigma-Aldrich
14	Olga Baturina	Naval Research Laboratory
15	Farshad Bavarian	Chevron
16	Bud Beebe	SMUD

17	Harold Beeson	NASA
18	Pierre Benard	Pierre U of Quebec
19	Thomas Benjamin	Argonne National Laboratory
20	Jeff Bentley	CellTech Power
21	Larry Blair	Consultant (retired from DOE)
22	Chris Bordeaux	Bordeaux International Energy Consulting, LLC
23	Silvia Boschetto	BP
24	Arun Bose	NETL
25	Lynnae Boyd	National Renewable Energy Laboratory
26	Robert Buxbaum	REB Research & Consulting
27	Mei Cai	GM
28	Jim Campbell	Air Liquide
29	Daniel Casey	ChevronTexaco
30	William Chernicoff	DOT - Volpe
31	Biswajit Choudhury	DuPont Fuel Cells
32	Larry Christner	LGC Consultant LLC
33	Deryn Chu	U. S. Army Research Laboratory
34	Bill Collins	UTC Power/Fuel Cells
35	Mario Conte	EC
36	Cecilia Cropley	Giner Electrochemical
37	Maria Curry-Nkansah	BP
38	Dennis Curtin	DuPont
39	Mark Debe	3M
40	Millie Dresselhaus	MIT
41	Daniel Driscoll	NETL
42	Glenn Eisman	RPI
43	Carolyn Elam	DOE
44	Mohammad Enayetullah	Protonex Technology Corporation
45	Gonzalo Escobedo	DuPont
46	Leslie Eudy	NREL
47	Dave Farese	Air Products
48	Christian Fau	Freudenberg-NOK General Partnership
49	Constantina Filiou	EC
50	James Fletcher	James
51	Scott Freeman	DaimlerChrysler Corporation
52	Robert Friedland	Proton Energy Systems Inc.
53	George Frudakis	George (Greece)
54	Alexi Gabrielov	Shell
55	Jennifer Gangi	Fuel Cells 2000
56	Craig Gittleman	GM
57	Bob Glass	Lawrence Livermore
58	Adam Gromis	CaFCP
59	Tom Gross	IF,LLC/LMI
60	Jill Gruber	DOE/GO

61	Nikunj Gupta	Shell
62	Steve Hamrock	3M
63	Jonathon Hardis	DOC/ NIST
64	Barbara Hennessey	National Highway and Traffic Safety Administration
65	Andy Herring	Colorado School of Mines
66	Steve Herring	INEL
67	Shinichi Hirano	Ford Motor Company
68	Kasuhiko Hirose	Toyota
69	Peter Hoffman	The Hydrogen & Fuel Cell Letter
70	Jamie Holladay	PNL
71	Doug Hooker	DOE
72	Ashraf Iman	Ashraf NRL
73	Brian James	Directed Technologies, Inc.
74	Puru Jena	VA Commonwealth University
75	Craig Jensen	U of Hawaii
76	Karl Jonitez	Karl LANL
77	Scott Jorgensen	GM
78	Karel Kapoun	Shell
79	Jim Kegerreis	ExxonMobil
80	John Kerr	Lawrence Berkeley National Laboratory
81	Tom Kimbis	DOE
82	John Kopasz	Argonne National Laboratory
83	Ted Krause	ANL
84	Benjamin Kroposki	National Renewable Energy Laboratory
85	Romesh Kumar	Argonne National Laboratory
86	Nobuhiro Kuriyama	Nobuhiro
87	Stephen Lasher	TIAX
88	Jay Laskin	Consultant
89	Lawrence Barton	University of Montana
90	Michelle Lewis	ANL
91	Ludwig Lipp	Fuel Cell Energy
92	Rob Lucchesi	ExxonMobil
93	Andy Lutz	Sandia National Laboratories
94	Maggie Mann	National Renewable Energy Laboratory
95	Robert Mantz	ARO
96	Victor Maroni	ANL
97	David Masten	GM
98	Thomas McNulty	GE Global Research
99	Shawna Mcqueen	Energetics
100	Paul Meier	ConocoPhillips
101	Jeremy Meyers	University of Texas at Austin
102	Eric Miller	University of Hawaii
103	James Miller	Argonne National Laboratory
104	George Mitchell	George

105	Rana Mohtadi	Toyota
106	Tom Moore	Consultant
107	Karren More	ORNL
108	Deborah Myers	Argonne National Laboratory
109	Yumiko Nakamura	AIST
110	Kevin Nguyen	Chevron
111	Frank Novachek	Xcel Energy
112	Greg Olsen	Consultant
113	Cathy Padro	Los Alamos National Laboratory
114	Pinakin Patel	FuelCell Energy, Inc.
115	Dilo Paul	NETL
116	Mike Perry	UTC Fuel Cells, LLC
117	John Peters	Montana State University
118	John Petrovic	Consultant
119	Bryan Pivovar	LANL
120	Walter Podolski	Argonne National Laboratory
121	C.G. Michael Quah	Concurrent Technologies Corporation
122	Martin Quintus	DaimlerChrysler AG
123	Kwan Quon	DOT
124	Venki Raman	Protium Energy
125	Vijay Ramani	Illinois Institute of Technology
126	Robert Remick	Colorado Fuel Cell Center
127	Vernon Roan	University of Florida
128	John Robbins	ExxonMobil
129	Jerry Rogers	General Motors Corporation
130	Neil Rossmeissl	DOE Office of Biomass Program
131	Dr. Samuels	Consultant
132	Gary Sandrock	Consultant
133	Steve Schlasner	ConocoPhillips
134	Jesse Schneider	DaimlerChrysler
135	John Shen	DOE
136	John Shewchun	Wayne State University
137	Neel Sirosh	Quantum Technologies Inc.
138	Dave Sjoding	Washington State University
139	Ed Skolnik	Energetics, Inc.
140	Sofronis Smith	Shell
141	Mike Sofronis	University of Illinois
142	Mike Steele	GM
143	Rhoads Stephenson	Safety Panel
144	Darlene Steward	NREL
145	Howard Stone	ARUP Energy
146	Ken Stroh	Los Alamos National Laboratory
147	Thanos Stubos	NCSR Demokritos
148	Andrea Sudik	Ford

149	Bill Summers	SRNL
150	Karen Swider Lyons	NRL
151	Hazem Tawfik	State University of New York & BNL
152	George Thomas	Consul.
153	Doanh Tran	Radiance Technologies
154	George Tsotridis	EC
155	John Turner	NREL
156	Nick Vanderborgh	Consultant
157	Keith Vanderveen	Sandia National Laboratories
158	Henry Voss	PolyFuel
159	Fred Wagner	Energetics
160	Jim Waldecker	Ford Motor Company
161	Sharlene Weatherwax	DOE
162	Steven Weiner	Pacific Northwest National Laboratory
163	Doug Wheeler	DJW Technology
164	Robert Wichert	USFCC
165	Barbara Wolfe	New West
166	Chris Wolverton	Northwestern Univ.
167	Chao (Tony) Wu	Southern Company
168	Jung Yi	Arkema Inc
169	Piotr Zelenay	LANL
170	Dick Ziegler	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, **170** panel members participated in the merit review process. A total of **161** projects were reviewed at the meeting and a total of **977** 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 (35%);

- Technology transfer and collaborations with industry, universities, and other laboratories (10%); and
- Approach to and relevance of proposed future research (15%).

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*0.35 + Score4*0.10 + Score5*0.15*

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 35% not included; therefore, weighting value for remaining scores = (weight +35/65*weight)*
>
> *Final Score = Score1*(0.20+(35/65)*0.20) + Score2*(0.20+(35/65)*0.20) + Score4*(0.10+(35/65)*0.10) + Score5*(0.15+(35/65)*0.15)*
>
> *So, Final Score = Score1*0.31 + Score2*0.31 + Score4*0.15 + Score5*0.23*

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.

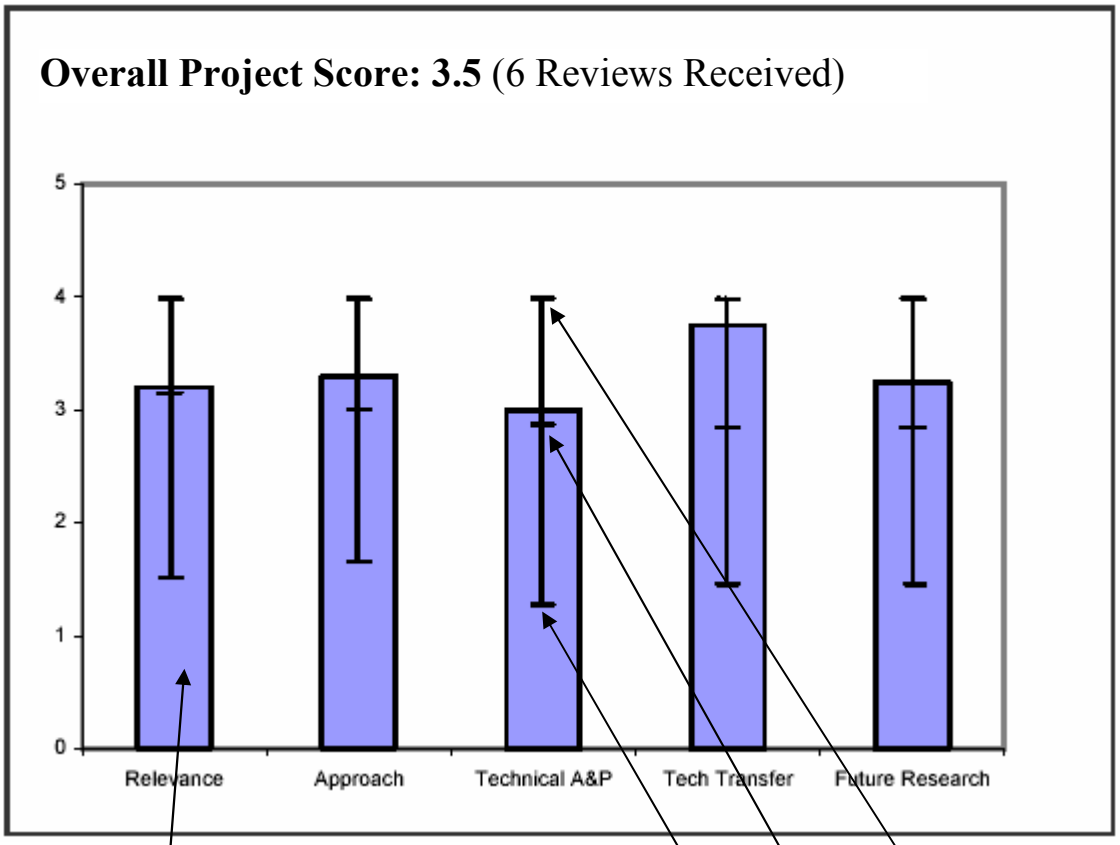
Reviewers were also asked to provide qualitative comments on the five research aspects, as well as the specific strengths and weaknesses of the project, and any recommendations for additions or deletions to the work scope.

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*0.35 + 4*0.10 +3*0.15= 2.4*