

## INTRODUCTION

This report is a summary of comments from the Peer Review Panel at the FY 2005 DOE Hydrogen Program Annual Merit Review, held on May 23-26, 2005, 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 2005 accomplishments and FY 2006 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.

During the plenary session on the first morning, in addition to remarks from the DOE Hydrogen Program and the programs of the European Commission and Japan, the Office of Science provided an overview of its current and future hydrogen and fuel cell efforts. This presentation was a prelude to the 2006 Annual Merit Review, which will expand in scope to cover Office of Science (SC) projects that were awarded in FY 2005. Projects from the Fossil Energy (FE) and Nuclear Energy (NE) program areas were also included in this FY 2005 Annual Merit Review and Peer Evaluation.

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	Abdel-Baset, Tarek	Daimler-Chrysler Corporation
2	Adams, Jesse	Department of Energy - Golden Field Office
3	Adjemian, Kev	Arkema, Inc.
4	Adzic, Radoslav	Brookhaven National Laboratory
5	Anderson, Arlene	Department of Energy
6	Anderson, Michele	Office of Naval Research
7	Arbuckle, Sheral	Ford Motor Company
8	Archer, Douglas	Department of Energy

## INTRODUCTION

9	Armstrong, Tim	Oak Ridge National Laboratory
10	Atanasoski, Radaslov	3M
11	Atanassova, Paolina	Cabot Corporation
12	Bailey, Carol	SENTECH, Inc.
13	Bain, Addison	Consultant
14	Bakke, Paul	Department of Energy - Golden Field Office
15	Balachandran, Balu	Argonne National Laboratory
16	Bauer, David	Ford Motor Company
17	Bavarian, Farshad	Chevron Texaco
18	Benjamin, Thomas	Argonne National Laboratory
19	Blair, Larry	Consultant
20	Borup, Rod	Los Alamos National Laboratory
21	Bose, Arun	National Energy Technology Laboratory
22	Boyd, Lynnae	National Renewable Energy Laboratory
23	Cantão, Mauricio Pereira	LACTEC Instituto Tecnológico para Desenvolvimento
24	Carlson, Eric	TIAX
25	Carole, Tracy	Energetics
26	Carpenter, Joe	Department of Energy
27	Ceasar, Gerry	DOC/ National Institute of Standards and Technology
28	Chahine, Richard	Hydrogen Research Institute / UQTR
29	Chernicoff, Bill	U.S. Department of Transportation – RITA
30	Clark, Todd	Department of Energy
31	Contadini, J. Fernando	Petrobras/CENPES and Clamper Industria e Comercio S.A.
32	Conte, Mario	ENEA, Italy
33	Cross, James	Nuvera Fuel Cells, Inc.
34	Curry-Nkansah, Maria	BP
35	Debe, Mark	3M
36	DeCastro, Emory	De Nora N.A., Inc., E-TEK division
37	Dempsey, Roxanne	Department of Energy
38	Devlin, Pete	Department of Energy
39	DuBois, Jennifer	University of Notre Dame
40	Eisman, Glenn	Rensselaer Polytechnic Institute
41	Elam, Carolyn	Department of Energy - Golden Field Office
42	Ernst, Bill	Plug Power
43	Evans, Bob	National Renewable Energy Laboratory
44	Feinberg, Ed	Decision Support / Energy Consulting
45	Fiegenschuh, Karl	Ford Motor Company
46	Filiou, Constantina	European Commission
47	Fitzimmons, Tim	Department of Energy
48	Fletcher, Jim	University of North Florida
49	Frank, Maria Helena Troise	Petrobras/CENPES
50	Freeman, Scott	Daimler-Chrysler Corporation
51	Gabrielov, Alexei	Shell Chemical LP

52	Geyer, Bernadette	US Fuel Cell Council
53	Gross, Tom	Consultant
54	Gruber, Jill	Department of Energy - Golden Field Office
55	Haberman, Dave	Consultant
56	Hansel, Jim	Air Products and Chemicals
57	Hardis, Jonathan	DOC/ National Institute of Standards and Technology
58	Hennessey, Barbara	National Highway and Traffic Safety Administration
59	Hicks, Mike	3M Center
60	Hirano, Shinichi	Ford Motor Company
61	Hooker, Doug	Department of Energy - Golden Field Office
62	Johnson, Will	W L Gore
63	Jorgensen, Scott	General Motors Corporation
64	Kamat, Prashant	University of Notre Dame
65	Kerr, John	Lawrence Berkley National Laboratory
66	Kopasz, John	Argonne National Laboratory
67	Krause, Curt	ChevronTexaco
68	Kroposki, Benjamin	National Renewable Energy Laboratory
69	Kumar, Romesh	Argonne National Laboratory
70	Laine, Jerri	Tekes, The National Technology Agency, Embassy of Finland
71	Larkins, Jim	Georgetown Bus Program
72	Larsen, Robert	Argonne National Laboratory
73	Lasher, Stephen	TIAX
74	Laskin, Jay	Consultant
75	Lipp, Ludwig	FuelCell Energy
76	Lott, Melissa	QSS Group, Inc.
77	Lutz, Andy	Sandia National Laboratory
78	Mann, Maggie	National Renewable Energy Laboratory
79	Marianowski, Len	Consultant (retired from GTI)
80	Maroni, Victor	Argonne National Laboratory
81	Masten, David	General Motors Corporation
82	Maupin, Paul	Department of Energy Office of Science
83	Mazer, Jeff	Department of Energy
84	McGetrick, Jim	BP
85	McGrath, James	Virginia Tech
86	McQueen, Shawna	Energetics
87	Mettes, Jacques	Power and Energy
88	Moore, Graham	ChevronTexaco Technology Ventures
89	Moore, Tom	Consultant
90	Motyka, Ted	Savannah River National Laboratory
91	Myers, Debbie	Argonne National Laboratory
92	Neves, Jr., Newton Pimenta	CENEH
93	Noronha, Fabio Bellot	National Technology Institute
94	Ozokwelu, Dickson	Department of Energy

**INTRODUCTION**

95	Padro, Cathy	Los Alamos National Laboratory
96	Parks, George	ConocoPhillips
97	Paul, Dilo	National Energy Technology Laboratory
98	Perry, Mike	UTC Fuel Cells, LLC
99	Peters, John	Montana State University
100	Peterson, Dave	Department of Energy - Golden Field Office
101	Pez, Guido	Air Products & Chemicals
102	Podolski, Walt	Argonne National Laboratory
103	Porter, Stephen	Proton Energy Systems
104	Powars, Charles	St. Croix Research
105	Quah, Michael	NextEnergy
106	Reinker, John	GE Global Research
107	Retureta, Stephanie	Department of Energy - Golden Field Office
108	Roan, Vernon	University of Florida
109	Robbins, John	ExxonMobil
110	Roelofs, Mark	DuPont
111	Rogers, Jerry	General Motors Corporation
112	Ross, Phil	Lawrence Berkley National Laboratory
113	Rubinstein, Leon	Shell Hydrogen LLC
114	Saeki, Margarida Júri	Universidade Estadual Paulista Júlio de Mesquita Filho
115	Sandrock, Gary	SunaTech, Inc.
116	Schlasner, Steve	ConocoPhillips
117	Schneider, Jesse	DaimlerChrysler RTNA
118	Serfass, Jeff	National Hydrogen Association
119	Shen, John	Department of Energy
120	Sims, Ron	Consultant
121	Sjoding, Dave	Washington State University
122	Smith, Brad	Shell Hydrogen LLC
123	Sofronis, Petros	University of Illinois
124	Steele, Mike	General Motors Corporation
125	Stevens, Jim	ChevronTexaco
126	Stone, Paul	Stone Team Technology (retired DowChemical)
127	Stroh, Ken	Los Alamos National Laboratory
128	Surdoval, Wayne	National Energy Technology Laboratory
129	Swartz, Scott	NexTech Materials, Ltd.
130	Taylor, Amy	Department of Energy
131	Thomas, George	Sandia National Laboratory (retired)
132	Ticianelli, Edson A.	Universidade de Sao Paulo
133	Titchen , John	Hydro Tasmania
134	Tran, Doanh	DaimlerChrysler Corporation
135	Tumas, Bill	Los Alamos National Laboratory
136	Tyler, Reginald	Department of Energy - Golden Field Office
137	Uihlein, James	BP
138	Vanderborgh, Nick	Consultant

139	Wagner, Fred	General Motors Corporation
140	Wagner, Fred	Energetics
141	Weimer, Alan	University of Colorado
142	Welch, Corey	National Renewable Energy Laboratory
143	Wells, Brian	PolyFuel
144	Wesson, Rose	National Science Foundation
145	Wheeler, Douglas	DJW Technology
146	Williams, Mark	National Energy Technology Laboratory
147	Wipke, Keith	National Renewable Energy Laboratory
148	Wolfe, Barbara	QSS
149	Wolverton, Chris	Ford Motor Company
150	Yancey, Lea	Department of Energy - Golden Field Office
151	Zalesky, Rick	ChevronTexaco
152	Zawodzinski, Tom	Case Western
153	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 in the Table 1 above a total of **153** panel members participated in the merit review process. A total of **191** projects were reviewed at the meeting and a total of **1208** evaluation forms were received from the Peer Review Panel (not every panel member reviewed every project). The 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 D to this report.

The five criteria and weights were:

- Criterion/Score 1: Relevance to overall DOE objectives (20%);
- Criterion/Score 2: Approach to performing the research and development (20%);
- Criterion/Score 3: Technical accomplishments and progress toward achieving the project and DOE goals (35%);
- Criterion/Score 4: Technology transfer and collaborations with industry, universities, and other laboratories (10%); and
- Criterion/Score 5: Approach to and relevance of proposed future research (15%).

The individual criterion scores from various reviewers were averaged together to obtain average scores for each of the five above-mentioned criteria for each project. All scores were used, i.e.

elimination of the highest/lowest scores or other score selection schemes were not employed. The resulting 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:

$$\text{Final Score} = \text{Score1} * 0.20 + \text{Score2} * 0.20 + \text{Score3} * 0.35 + \text{Score4} * 0.10 + \text{Score5} * 0.15$$

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.

A few new projects were reviewed, where the third criterion (Technical Accomplishments) did not apply because of the projects' 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)*

$$\text{Final Score} = \text{Score1} * (0.20 + (35/65) * 0.20) + \text{Score2} * (0.20 + (35/65) * 0.20) + \text{Score4} * (0.10 + (35/65) * 0.10) + \text{Score5} * (0.15 + (35/65) * 0.15)$$

$$\text{So, Final Score} = \text{Score1} * 0.31 + \text{Score2} * 0.31 + \text{Score4} * 0.15 + \text{Score5} * 0.23$$

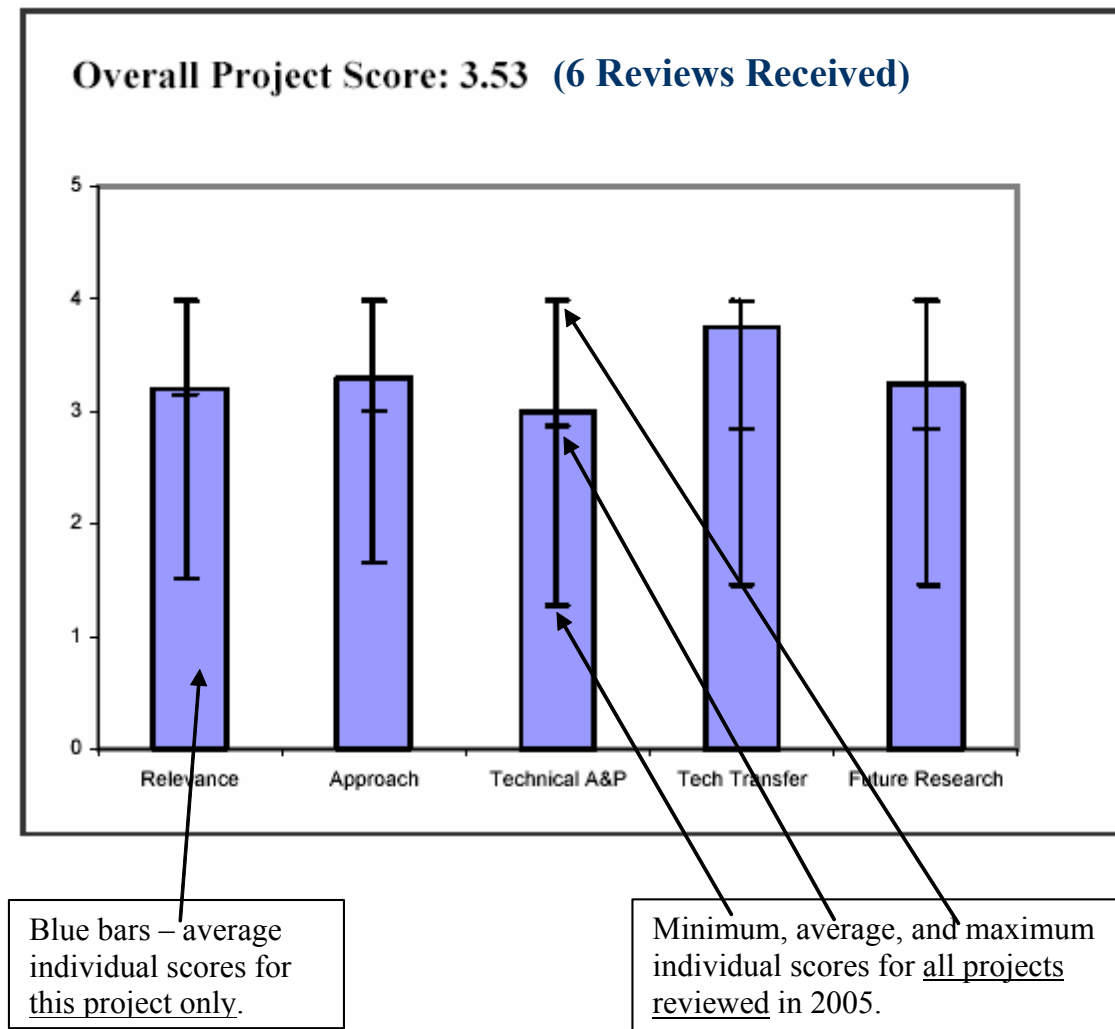
Appendix B lists the new projects for which Technical Accomplishment was not scored. It also provides a list of projects that were presented at the meeting, but were not reviewed.

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, are provided in the seven main 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 (subprograms) into which they fall in DOE Hydrogen Program planning. A brief summary written by the Team Lead for 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 project scores and how the particular project compared with all other projects presented. An example of a graph is provided below:



Using the formula mentioned above, the weighted final score is displayed as the “Overall Project Score” at the top of the chart. The text in parentheses, next to the “Overall Project Score,” indicates the number of panel members who reviewed that particular project.

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 across all the reviewed projects (i.e., across all subprograms 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, suppose that only three projects were presented and reviewed. The hypothetical projects were scored by reviewers as displayed in the table below:

## INTRODUCTION

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

As an example then, the “Relevance” bar/line on 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 with max, min and average values of 4, 1, and 2.3 respectively for the Relevance criteria of all three projects.