## Prologue

Dear Colleague:

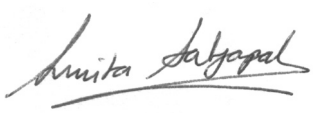
This document summarizes peer review comments and scores for the fiscal year (FY) 2019 U.S. Department of Energy (DOE) Hydrogen and Fuel Cells Program Annual Merit Review and Peer Evaluation Meeting (AMR), held April 29–May 1, 2019, in Arlington, Virginia. In response to direction from various stakeholders, including the National Academies, this review process provides project- and program-level evaluations of DOE-funded early-stage research, development, and analysis of hydrogen and fuel cell technologies.

This year's AMR included, for the second time, a dedicated two-day track on the DOE Office of Fossil Energy's Solid Oxide Fuel Cell Program, a one-day session on interagency- and state-level activities, and a fuel cell car ride-and-learn. The AMR kicked off with a research and development (R&D) discussion led by Dr. Alan Finkel, Australia's Chief Scientist, and Keith Schmid, the Chief Operating Officer of Plug Power. The plenary session also featured keynote remarks by Daniel Simmons, Assistant Secretary from the Office of Energy Efficiency and Renewable Energy (EERE); Michael Berube, Acting Deputy Assistant Secretary for Transportation, EERE; and program and subprogram overview presentations. The AMR was attended by close to 1,000 people, including close to 200 reviewers who reviewed 129 projects and more than 50 reviewers who were asked to provide feedback on the overall R&D program and subprograms.

DOE values the transparent public process of soliciting technical input on its projects and programs from relevant experts with depth and breadth of knowledge across a wide range of areas. The reviewers' recommendations are taken into consideration by DOE technology managers in generating future work plans. The summary table that follows lists the projects presented at the review and the overall evaluation score for each project, and Appendix A provides the scores and comments from the program reviewers. The individual reports present the reviewer comments to be considered during the upcoming fiscal year (October 1, 2019–September 30, 2020). The projects have been grouped according to subprogram and reviewed according to the appropriate evaluation criteria. To furnish principal investigators (PIs) with direct feedback, all of the evaluations and comments are provided to each presenter; however, the authors of the individual comments remain anonymous. DOE instructs the PIs to consider these summary evaluation comments fully, along with any other comments by DOE managers, in the PIs' FY 2020 plans. In addition, DOE managers contact each PI individually to discuss the comments and recommendations as future plans are developed.

Thank you to all 2019 AMR participants. I would like to express my sincere appreciation to the reviewers for your strong commitment, expertise, and dedication to advancing hydrogen and fuel cell technologies. You make this report possible, and we rely on your comments, along with other management processes, to help make project decisions for the new fiscal year. We look forward to your participation in the 2020 AMR, which is scheduled for May 19–21, 2020, in Arlington, Virginia.

Sincerely,



Sunita Satyapal
Director, Hydrogen and Fuel Cells Program
U.S. Department of Energy

## Hydrogen Fuel R&D

### *Hydrogen Production R&D*

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| P-102 | Analysis of Advanced Hydrogen Production Pathways<br>*Brian James, Strategic Analysis, Inc.* | 3.4 | X | | |
| P-143 | High-Temperature Alkaline Water Electrolysis<br>*Hui Xu, Giner, Inc.* | 3.2 | | | X |
| P-177 | Proton-Conducting Ceramic Electrolyzers for High-Temperature Water Splitting<br>*Hossein Ghezel-Ayagh, Fuel Cell Energy* | 3.5 | X | | |
| P-178 | Industrially Scalable Waste Carbon Dioxide Reduction to Useful Chemicals and Fuels<br>*Todd Deutsch, National Renewable Energy Laboratory* | 3.3 | X | | |

### *Hydrogen Production R&D: HydroGEN Seedling*

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| P-148 | HydroGEN Overview: A Consortium on Advanced Water-Splitting Materials<br>*Huyen Dinh, National Renewable Energy Laboratory* | 3.5 | X | | |
| P-152 | Proton-Conducting Solid Oxide Electrolysis Cells for Large-Scale Hydrogen Production at Intermediate Temperatures<br>*Prabhakar Singh, University of Connecticut* | 3.3 | X | | |
| P-153 | Degradation Characterization and Modeling of a New Solid Oxide Electrolysis Cell Utilizing Accelerated Life Testing<br>*Scott Barnett, Northwestern University* | 3.5 | X | | |
| P-154 | Thin-Film, Metal-Supported High-Performance and Durable Proton–Solid Oxide Electrolyzer Cell<br>*Tianli Zhu, United Technologies Research Center* | 3.4 | X | | |
| P-155 | High-Efficiency Polymer Electrolyte Membrane Water Electrolysis Enabled by Advanced Catalysts, Membranes, and Processes<br>*Kathy Ayers, Proton OnSite* | 3.5 | X | | |

[*] HydroGEN seedling projects marked "Continue" are on track, but project continuation is contingent on passing a go/no-go decision.

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| P-156 | Developing Novel Platinum-Group-Metal-Free Catalysts for Alkaline Hydrogen and Oxygen Evolution Reactions<br>*Sanjeev Mukerjee, Northeastern University* | 3.4 | X | | |
| P-157 | Platinum-Group-Metal-Free Oxygen Evolution Reaction Catalysts for Polymer Electrolyte Membrane Electrolyzer<br>*Di-Jia Liu, Argonne National Laboratory* | 3.3 | X | | |
| P-158 | High-Performance Ultralow-Cost Non-Precious-Metal Catalyst System for Anion Exchange Membrane Electrolyzer<br>*Hoon Chung, Los Alamos National Laboratory* | 3.3 | X | | |
| P-159 | Scalable Elastomeric Membranes for Alkaline Water Electrolysis<br>*Yu Seung Kim, Los Alamos National Laboratory* | 3.3 | X | | |
| P-160 | Best-in-Class Platinum-Group-Metal-Free Catalyst Integrated Tandem Junction Photoelectrochemical Water-Splitting Devices<br>*Charles Dismukes, Rutgers University* | 3.3 | X | | |
| P-161 | Protective Catalyst Systems on III-V and Silicon-Based Semiconductors for Efficient, Durable Photoelectrochemical Water-Splitting Devices<br>*Thomas Jaramillo, Stanford University* | 3.5 | X | | |
| P-162 | Novel Chalcopyrites for Advanced Photoelectrochemical Water Splitting<br>*Nicolas Gaillard, University of Hawaii* | 3.3 | X | | |
| P-163 | Monolithically Integrated Thin-Film/Silicon Tandem Photoelectrodes for High-Efficiency and Stable Photoelectrochemical Water Splitting<br>*Zetian Mi, University of Michigan* | 3.4 | X | | |
| P-165 | Accelerated Discovery of Solar Thermochemical Hydrogen Production Materials via High-Throughput Computational and Experimental Methods<br>*Ryan O'Hayre, Colorado School of Mines* | 3.5 | X | | |
| P-166 | Computationally Accelerated Discovery and Experimental Demonstration of High-Performance Materials for Advanced Solar Thermochemical Hydrogen Production<br>*Charles Musgrave, University of Colorado Boulder* | 3.5 | X | | |
| P-167 | Transformative Materials for High-Efficiency Thermochemical Production of Solar Fuels<br>*Chris Wolverton, Northwestern University* | 3.1 | X | | |

* HydroGEN seedling projects marked "Continue" are on track, but project continuation is contingent on passing a go/no-go decision.

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| P-168 | Mixed Ionic Electronic Conducting Quaternary Perovskites: Materials by Design for Solar Thermochemical Hydrogen<br>*Ellen Stechel, Arizona State University* | 3.4 | X | | |
| P-169 | High-Temperature Reactor Catalyst Material Development for Low-Cost and Efficient Solar-Driven Sulfur-Based Processes<br>*Claudio Corgnale, Greenway Energy* | 3.3 | | X | |
| P-170 | Benchmarking Advanced Water-Splitting Technologies: Best Practices in Materials Characterization<br>*Kathy Ayers, Proton OnSite* | 3.5 | X | | |
| P-175 | Intermediate-Temperature Proton-Conducting Solid Oxide Electrolysis Cells with Improved Performance and Delivery<br>*Xingbo Liu, West Virginia University* | 3.4 | X | | |
| P-176 | Development of Durable Materials for Cost-Effective Advanced Water Splitting Utilizing All-Ceramic Solid Oxide Electrolyzer Stack Technology<br>*John Pietras, Saint-Gobain* | 3.3 | X | | |

### *Hydrogen Storage R&D*

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| ST-001 | System-Level Analysis of Hydrogen Storage Options<br>*Rajesh Ahluwalia, Argonne National Laboratory* | 3.6 | X | | |
| ST-100 | Hydrogen Storage Cost Analysis<br>*Brian James, Strategic Analysis, Inc.* | 3.4 | X | | |
| ST-127 | Hydrogen Materials—Advanced Research Consortium (HyMARC): A Consortium for Advancing Hydrogen Storage Materials<br>*Mark Allendorf, Sandia National Laboratories, and Thomas Gennett, National Renewable Energy Laboratory* | 3.4 | X | | |
| ST-128 | Hydrogen Materials—Advanced Research Consortium (HyMARC): Sandia National Laboratories Technical Activities<br>*Mark Allendorf, Sandia National Laboratories* | 3.4 | X | | |

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| ST-129 | Hydrogen Materials—Advanced Research Consortium (HyMARC): Lawrence Livermore National Laboratory Technical Activities<br>*Brandon Wood, Lawrence Livermore National Laboratory* | 3.6 | X | | |
| ST-130 | Hydrogen Materials—Advanced Research Consortium (HyMARC): Lawrence Berkeley National Laboratory Technical Activities<br>*David Prendergast and Jeffrey Long, Lawrence Berkeley National Laboratory* | 3.4 | X | | |
| ST-131 | Hydrogen Materials—Advanced Research Consortium (HyMARC): National Renewable Energy Laboratory Technical Activities<br>*Thomas Gennett, National Renewable Energy Laboratory* | 3.4 | X | | |
| ST-132 | Hydrogen Materials—Advanced Research Consortium (HyMARC): Pacific Northwest National Laboratory Technical Activities<br>*Tom Autrey, Pacific Northwest National Laboratory* | 3.5 | X | | |
| ST-137 | Hydrogen Materials–Advanced Research Consortium (HyMARC) Seedling: Electrolyte-Assisted Hydrogen Storage Reactions<br>*Simon Jones, Liox Power* | 3.2 | X | | |
| ST-143 | Hydrogen Materials–Advanced Research Consortium (HyMARC) Seedling: Atomic Layer Deposition Synthesis of Novel Nanostructured Metal Borohydrides<br>*Steven Christensen, National Renewable Energy Laboratory* | 3.3 | X | | |
| ST-144 | Hydrogen Materials—Advanced Research Consortium (HyMARC) Seedling: Optimized Hydrogen Adsorbents via Machine Learning and Crystal Engineering<br>*Don Siegel, University of Michigan* | 3.3 | X | | |
| ST-146 | Precursor Processing Development for Low-Cost, High-Strength Carbon Fiber for Composite Overwrapped Pressure Vessel Applications<br>*Matthew Weisenberger, University of Kentucky* | 3.1 | X | | |
| ST-147 | Developing a New Polyolefin Precursor for Low-Cost, High-Strength Carbon Fiber<br>*Mike Chung, Pennsylvania State University* | 3.1 | X | | |
| ST-148 | Novel Plasticized Melt-Spinning Process of Polyacrylonitrile Fibers Based on Task-Specific Ionic Liquids<br>*Sheng Dai, Oak Ridge National Laboratory* | 3.1 | X | | |

## Fuel Cell R&D

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| FC-017 | Fuel Cell System Modeling and Analysis<br>*Rajesh Ahluwalia, Argonne National Laboratory* | 3.3 | X | | |
| FC-135 | FC-PAD: Fuel Cell Consortium for Performance and Durability<br>*Rod Borup, Los Alamos National Laboratory* | 3.5 | X | | |
| FC-140 | Tailored High-Performance Low-Platinum-Group-Metal Alloy Cathode Catalysts<br>*Vojislav Stamenkovic, Argonne National Laboratory* | 3.4 | | | X |
| FC-141 | Platinum Monolayer Electrocatalysts<br>*Jia Wang, Brookhaven National Laboratory* | 2.6 | | | X |
| FC-144 | Highly Accessible Catalysts for Durable High-Power Performance<br>*Anusorn Kongkanand, General Motors* | 3.5 | X | | |
| FC-145 | Corrosion-Resistant Non-Carbon Electrocatalyst Supports for Proton Exchange Fuel Cells<br>*Vijay Ramani, Washington University* | 3.1 | X | | |
| FC-146 | Advanced Materials for Fully Integrated Membrane Electrode Assemblies in Anion Exchange Membrane Fuel Cells<br>*Yu Seung Kim, Los Alamos National Laboratory* | 3.4 | | | X |
| FC-147 | Advanced Ionomers and Membrane Electrode Assemblies for Alkaline Membrane Fuel Cells<br>*Bryan Pivovar, National Renewable Energy Laboratory* | 3.5 | | | X |
| FC-155 | Novel Ionomers and Electrode Structures for Improved Polymer Electrolyte Membrane Fuel Cell Electrode Performance at Low-Platinum-Group-Metal Loadings<br>*Andrew Haug, 3M* | 3.3 | X | | |
| FC-156 | Durable High-Power Membrane Electrode Assemblies with Low Platinum Loading<br>*Swami Kumaraguru, General Motors* | 3.2 | X | | |
| FC-157 | High-Performance Polymer Electrolyte Fuel Cell Electrode Structures<br>*Mike Perry, United Technologies Research Center* | 2.7 | | X | |
| FC-158 | Fuel Cell Membrane Electrode Assemblies with Ultralow-Platinum Nanofiber Electrodes<br>*Peter Pintauro, Vanderbilt University* | 3.4 | X | | |
| FC-160 | ElectroCat (Electrocatalysis Consortium)<br>*Deborah Myers, Argonne National Laboratory, and Piotr Zelenay, Los Alamos National Laboratory* | 3.3 | X | | |

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| FC-161 | Advanced Electrocatalysts through Crystallographic Enhancement<br>*Jacob Spendelow, Los Alamos National Laboratory* | 3.4 | X | | |
| FC-162 | Vapor Deposition Process for Engineering of Dispersed Polymer Electrolyte Membrane Fuel Cell Oxygen Reduction Reaction Pt/$NbO_x$/C Catalysts<br>*Jim Waldecker, Ford Motor Company* | 3.2 | X | | |
| FC-163 | Fuel Cell Systems Analysis<br>*Brian James, Strategic Analysis, Inc.* | 3.4 | X | | |
| FC-170 | ElectroCat: Durable Manganese-Based Platinum-Group-Metal-Free Catalysts for Polymer Electrolyte Membrane Fuel Cells<br>*Hui Xu, Giner, Inc.* | 3.0 | X | | |
| FC-171 | ElectroCat: Advanced Platinum-Group-Metal-Free Cathode Engineering for High Power Density and Durability<br>*Shawn Litster, Carnegie Mellon University* | 3.4 | X | | |
| FC-172 | ElectroCat: Highly Active and Durable Platinum-Group-Metal-Free Oxygen Reduction Reaction Electrocatalysts through the Synergy of Active Sites<br>*Yuyan Shao, Pacific Northwest National Laboratory* | 3.3 | X | | |
| FC-173 | ElectroCat: Platinum-Group-Metal-Free Engineered Framework Nanostructure Catalysts<br>*Prabhu Ganesan, Greenway Energy, LLC* | 2.9 | | X | |
| FC-174 | Highly Efficient and Durable Cathode Catalyst with Ultralow Platinum Loading through Synergetic Platinum-/Platinum-Group-Metal-Free Catalytic Interaction<br>*Di-Jia Liu, Argonne National Laboratory* | 3.4 | X | | |
| FC-178 | Lab Call Fiscal Year 2018 (Membrane): Spirocyclic Anion Exchange Membranes for Improved Performance and Durability<br>*Bryan Pivovar, National Renewable Energy Laboratory* | 3.2 | X | | |
| FC-179 | Lab Call Fiscal Year 2018 (Membrane): Stable Alkaline Membrane Based on Proazaphosphatranes Organic Superbase<br>*Gao Liu, Lawrence Berkeley National Laboratory* | 2.7 | | | X |
| FC-180 | Lab Call Fiscal Year 2018 (Membrane): High-Performing and Durable Pyrophosphate-Based Composite Membranes for Intermediate-Temperature Fuel Cells<br>*Cortney Kreller, Los Alamos National Laboratory* | 2.7 | | X | |

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| FC-181 | Lab Call Fiscal Year 2018 (Reversible Fuel Cells): Microstructured Electrodes and Diffusion Layers for Enhanced Transport in Reversible Fuel Cells<br>*Jacob Spendelow, Los Alamos National Laboratory* | 3.4 | X | | |
| FC-182 | Lab Call Fiscal Year 2018 (Reversible Fuel Cells): Bipolar Membrane Development to Enable Regenerative Fuel Cells<br>*Todd Deutsch, National Renewable Energy Laboratory* | 2.9 | | X | |
| FC-183 | Lab Call Fiscal Year 2018 (Reversible Fuel Cells): Technology-Enabling Materials, Cell Design for Reversible Polymer Electrolyte Membrane Fuel Cells<br>*Nem Danilovic, Lawrence Berkeley National Laboratory* | 3.0 | X | | |
| FC-302 | Developing Platinum-Group-Metal-Free Catalysts for Oxygen Reduction Reaction in Acid: Beyond the Single Metal Site<br>*Qingying Jia, Northeastern University* | 3.1 | X | | |
| FC-303 | Mesoporous Carbon-Based Platinum-Group-Metal-Free Catalyst Cathodes<br>*Jian Xie, Indiana University–Purdue University Indianapolis* | 3.0 | X | | |
| FC-304 | Fuel Cell Membrane Electrode Assemblies with Platinum-Group-Metal-Free Nanofiber Cathodes<br>*Peter Pintauro, Vanderbilt University* | 3.3 | X | | |
| FC-305 | Active and Durable Platinum-Group-Metal-Free Cathodic Electrocatalysts for Fuel Cell Application<br>*Alexey Serov, Pajarito Powder* | 2.9 | | X | |
| FC-306 | High-Performance Non-Platinum-Group-Metal Transition Metal Oxide Oxygen Reduction Reaction Catalysts of Polymer Electrolyte Membrane Fuel Cells<br>*Timothy Davenport, United Technologies Research Center* | 2.5 | | X | |
| FC-307 | Cyclic Olefin Copolymer-Based Alkaline Exchange Polymers and Reinforced Membranes<br>*Chulsung Bae, Rensselaer Polytechnic Institute* | 3.3 | X | | |
| FC-308 | Advanced Anion Exchange Membranes with Tunable Water Transport for Platinum-Group-Metal-Free Anion Exchange Membrane Fuel Cells<br>*Michael Hickner, Pennsylvania State University* | 3.4 | X | | |
| FC-309 | Polymerized Ionic Liquid Block Copolymers and Ionic Liquids (PILBCP-IL) Composite Ionomers for High Current Density Performance<br>*Joshua Snyder, Drexel University* | 3.1 | X | | |

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| FC-310 | Composite Polymer Electrolyte Membranes from Electrospun Crosslinkable Poly(Phenylene Sulfonic Acid)s<br>*Ryszard Wycisk, Vanderbilt University* | 3.5 | X | | |
| FC-311 | Novel Non-Perfluorosulfonic Acid Proton Exchange Membrane for Fuel Cell Application<br>*Taoli Gu, Xergy, Inc.* | 3.2 | X | | |
| FC-312 | Molten Hydroxide Dual-Phase Membranes for Intermediate-Temperature Anion Exchange Membrane Fuel Cells<br>*Patrick Campbell, Lawrence Livermore National Laboratory* | 3.2 | X | | |
| FC-313 | Novel Bifunctional Electrocatalysts, Supports, and Membranes for High-Performing and Durable Unitized Regenerative Fuel Cells<br>*Nem Danilovic, Lawrence Berkeley National Laboratory* | 3.1 | X | | |
| FC-314 | Efficient Reversible Operation and Stability of Novel Solid Oxide Cells<br>*Scott Barnett, Northwestern University* | 3.2 | X | | |
| FC-315 | High-Efficiency Reversible Alkaline Membrane Fuel Cells<br>*Hui Xu, Giner, Inc.* | 3.3 | X | | |
| FC-316 | Durable, High-Performance Unitized Reversible Fuel Cells Based on Proton Conductors<br>*Meilin Liu, Georgia Institute of Technology* | 3.0 | X | | |
| FC-317 | Stationary Direct Methanol Fuel Cells Using Pure Methanol<br>*Xianglin Li, University of Kansas Center for Research, Inc.* | 3.0 | X | | |
| FC-318 | Lab Call Fiscal Year 2019: Accessible Platinum-Group-Metal-Free Catalysts and Electrodes: ElectroCat<br>*Jacob Spendelow, Los Alamos National Laboratory* | 3.4 | X | | |
| FC-319 | Lab Call Fiscal Year 2019: Low-Cost Gas Diffusion Layer Materials and Treatments for Durable High-Performance Polymer Electrolyte Membrane Fuel Cells<br>*Rod Borup, Los Alamos National Laboratory* | 3.2 | X | | |
| FC-320 | Lab Call Fiscal Year 2019: Electrode Ionomers for High-Temperature Fuel Cells<br>*Michael Hibbs, Sandia National Laboratories* | 3.1 | X | | |
| FC-321 | Lab Call Fiscal Year 2019: Solid Phase Processing for Reduced Cost and Improved Efficiency of Bipolar Plates<br>*Ken Ross, Pacific Northwest National Laboratory* | 3.0 | X | | |
| FC-322 | Lab Call Fiscal Year 2019: Polymer Electrolyte Fuel Cell Electrode Structures with Encased Catalysts to Eliminate Ionomer Adsorption on Catalytic Sites<br>*Deborah Myers, Argonne National Laboratory* | 3.2 | X | | |

## Infrastructure and Systems R&D

### *Hydrogen Infrastructure R&D*

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| IN-001 | Hydrogen Materials Compatibility Consortium (H-Mat) Overview: Steels<br>*Chris San Marchi, Sandia National Laboratories* | 3.7 | X | | |
| IN-004 | Magnetocaloric Hydrogen Liquefaction<br>*Jamie Holladay, Pacific Northwest National Laboratory* | 3.1 | X | | |
| IN-005 | Electrochemical Compression<br>*Monjid Hamdan, Giner ELX, Inc.* | 3.5 | X | | |
| IN-007 | Metal Hydride Compression<br>*Terry Johnson, Sandia National Laboratories* | 3.4 | | | X |
| IN-008 | Dispenser Reliability<br>*Michael Peters, National Renewable Energy Laboratory* | 3.0 | X | | |
| IN-009 | Advancing Hydrogen Dispenser Technology by Using Innovative Intelligent Networks<br>*Darryl Pollica, Ivys Inc.* | 3.4 | | | X |
| IN-010 | Hydrogen Dispensing Hose<br>*Jennifer Lalli, NanoSonic* | 3.3 | X | | |
| IN-011 | Coatings for Compressor Seals<br>*Shannan O'Shaughnessy, GVD Corporation* | 2.8 | | | X |
| IN-012 | Low-Cost Magnetocaloric Materials Discovery<br>*Robin Ihnfeldt, General Engineering & Research* | 3.2 | X | | |

### *Technology Acceleration*

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| TA-001 | Membrane Electrode Assembly Manufacturing Research and Development<br>*Michael Ulsh, National Renewable Energy Laboratory* | 3.4 | X | | |
| TA-005 | In-Line Quality Control of Polymer Electrolyte Membrane Materials<br>*Paul Yelvington, Mainstream* | 3.3 | X | | |

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| TA-007 | Roll-to-Roll Advanced Materials Manufacturing Lab Consortium<br>*Claus Daniel, Oak Ridge National Laboratory* | 3.1 | X | | |
| TA-008 | Material–Process–Performance Relationships in Polymer Electrolyte Membrane Catalyst Inks and Coated Layers<br>*Michael Ulsh, National Renewable Energy Laboratory* | 3.2 | X | | |
| TA-009 | Maritime Fuel Cell Generator Project<br>*Lennie Klebanoff, Sandia National Laboratories* | 3.4 | X | | |
| TA-011 | FedEx Express Hydrogen Fuel Cell Extended-Range Battery Electric Vehicles<br>*Phillip Galbach, FedEx Express* | 3.4 | X | | |
| TA-012 | Northeast Demonstration and Deployment of FCRx200<br>*Abas Goodarzi, US Hybrid* | 3.2 | | X | |
| TA-013 | Fuel Cell Bus Evaluations<br>*Leslie Eudy, National Renewable Energy Laboratory* | 3.7 | X | | |
| TA-014 | Hydrogen Station Data Collection and Analysis<br>*Sam Sprik, National Renewable Energy Laboratory* | 3.4 | X | | |
| TA-015 | Dynamic Modeling and Validation of Electrolyzers in Real-Time Grid Simulation<br>*Rob Hovsapian, Idaho National Laboratory* | 3.5 | X | | |
| TA-016 | Fuel Cell Hybrid Electric Delivery Van<br>*Jason Hanlin, Center for Transportation and the Environment* | 3.1 | X | | |
| TA-017 | Innovative Advanced Hydrogen Mobile Fueler<br>*Sara Odom, Electricore* | 3.4 | X | | |
| TA-018 | High-Temperature Electrolysis Test Stand<br>*James O'Brien, Idaho National Laboratory* | 3.2 | X | | |
| TA-019 | Modular Solid Oxide Electrolyzer Cell System for Efficient Hydrogen Production at High Current Density<br>*Hossein Ghezel-Ayagh, FuelCell Energy* | 3.4 | X | | |
| TA-020 | Optimal Stationary Fuel Cell Integration and Control (Energy Dispatch Controller)<br>*Genevieve Saur, National Renewable Energy Laboratory* | 3.2 | X | | |
| TA-021 | Integrated Systems Modeling of the Interactions between Stationary Hydrogen, Vehicle, and Grid Resources<br>*Samveg Saxena, Lawrence Berkeley National Laboratory* | 3.4 | X | | |
| TA-022 | H2@Scale: Experimental Characterization of Durability of Advanced Electrolyzer Concepts in Dynamic Loading<br>*Shaun Alia, National Renewable Energy Laboratory* | 2.9 | X | | |

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| TA-023 | Hydrogen Stations for Urban Sites<br>*Brian Ehrhart, National Renewable Energy Laboratory/ Sandia National Laboratories* | 3.5 | | | X |
| TA-024 | Analysis of Fuel Cells for Trucks<br>*Ram Vijayagopal, Argonne National Laboratory* | 3.0 | X | | |

### *Systems Analysis*

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| SA-044 | Cost–Benefit Analysis of Technology Improvement in Medium- and Heavy-Duty Fuel Cell Vehicles<br>*Aymeric Rousseau, Argonne National Laboratory* | 3.0 | X | | |
| SA-169 | Market Segmentation Analysis of Medium- and Heavy-Duty Trucks with a Fuel Cell Emphasis<br>*Chad Hunter, National Renewable Energy Laboratory* | 3.6 | X | | |
| SA-170 | Analysis of Cost Impacts of Integrating Advanced Onboard Storage Systems with Hydrogen Delivery<br>*Amgad Elgowainy, Argonne National Laboratory* | 3.2 | X | | |
| SA-171 | H2@Scale Analysis<br>*Mark Ruth, National Renewable Energy Laboratory* | 3.6 | X | | |
| SA-172 | Hydrogen Demand Analysis for H2@Scale<br>*Amgad Elgowainy, Argonne National Laboratory* | 3.5 | X | | |

## Safety, Codes and Standards

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| SCS-001 | National Codes and Standards Deployment and Outreach<br>*Carl Rivkin, National Renewable Energy Laboratory* | 3.3 | X | | |

| Project Number | Project Title<br>*Principal Investigator Name & Organization* | Final Score | Continue | Discontinue/ Further Review | Completed |
|---|---|---|---|---|---|
| SCS-005 | Research and Development for Safety, Codes and Standards: Materials and Component Compatibility<br>*Chris San Marchi, Sandia National Laboratories* | 3.5 | X | | |
| SCS-007 | Fuel Quality Assurance Research and Development and Impurity Testing in Support of Codes and Standards<br>*Tommy Rockward, Los Alamos National Laboratory* | 3.5 | X | | |
| SCS-010 | Research and Development for Safety, Codes and Standards: Hydrogen Behavior<br>*Ethan Hecht, Sandia National Laboratories* | 3.5 | X | | |
| SCS-011 | Hydrogen Quantitative Risk Assessment<br>*Alice Muna, Sandia National Laboratories* | 3.5 | X | | |
| SCS-019 | Hydrogen Safety Panel, Safety Knowledge Tools, and First Responder Training Resources<br>*Nick Barilo, Pacific Northwest National Laboratory* | 3.7 | X | | |
| SCS-021 | National Renewable Energy Laboratory Hydrogen Sensor Testing Laboratory<br>*William Buttner, National Renewable Energy Laboratory* | 3.5 | X | | |
| SCS-022 | Fuel Cell and Hydrogen Energy Association Codes and Standards Support<br>*Karen Quackenbush, Fuel Cell & Hydrogen Energy Association* | 2.9 | X | | |
| SCS-026 | Hydrogen Materials Compatibility Consortium (H-Mat) Overview: Polymers<br>*Kevin Simmons, Pacific Northwest National Laboratory* | 3.5 | X | | |