

---

## XVI. Project Listings by State

### Alabama

- V.B.2 CFD Research Corp.: Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization . . . . . 711
- V.B.2 ESI US R&D: Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization . . . . . 711

### Alaska

- VIII.9 Tanadgusix Foundation: TDX Foundation Hydrogen Project/PEV Project . . . . . 1288
- VIII.9 TDX Power: TDX Foundation Hydrogen Project/PEV Project . . . . . 1288
- VIII.9 Alaska Center for Energy and Power: TDX Foundation Hydrogen Project/PEV Project . . . . . 1288

### Arizona

- II.C.3 Arizona State University: Zeolite Membrane Reactor for Water-Gas Shift Reaction for Hydrogen Production . . . . . 67
- V.D.10 University of Arizona: Protic Salt Polymer Membranes: High-Temperature Water-Free Proton-Conducting Membranes . . . . . 786
- V.D.10 Arizona State University: Protic Salt Polymer Membranes: High-Temperature Water-Free Proton-Conducting Membranes . . . . . 786
- VI.5 Arizona State University: Adaptive Process Controls and Ultrasonics for High Temperature PEM MEA Manufacture . . . . . 1144

### Arkansas

- II.G.11 University of Arkansas, Little Rock: Photoelectrochemical Generation of Hydrogen. . . . . 182
- II.G.13 University of Arkansas, Little Rock: Photoelectrochemical Generation of Hydrogen from Water Using Visible Light Sensitive Ferro-Electric BiFeO<sub>3</sub> and Semiconductor Nanotubes. . . . . 191
- IV.H.4 University of Arkansas, Little Rock: An Integrated Approach of Hydrogen Storage in Complex Hydrides of Transitional Elements . . . . . 639
- XI.9 FedEx Freight: Fuel Cell-Powered Lift Truck FedEx Freight Fleet Deployment . . . . . 1466

### California

- II.C.2 University of Southern California, Los Angeles: Development of Hydrogen Selective Membranes/Modules as Reactors/Separators for Distributed Hydrogen Production . . . . . 62
- II.F.2 Science Applications International Corporation: Solar High-Temperature Water-Splitting Cycle with Quantum Boost . . . . . 120
- II.G.2 Stanford University: Nanostructured MoS<sub>2</sub> and WS<sub>2</sub> for the Solar Production of Hydrogen. . . . . 138
- II.G.3 University of California, Santa Barbara: Photoelectrochemical Hydrogen Production Using New Combinatorial Chemistry Derived Materials. . . . . 145
- II.G.4 Stanford University: Semiconductor Materials for Photoelectrolysis . . . . . 150
- II.G.12 Lawrence Livermore National Laboratory: Characterization and Optimization of Photoelectrode Surfaces for Solar-to-Chemical Fuel Conversion . . . . . 187
- II.H.1 University of California, Berkeley: Maximizing Light Utilization Efficiency and Hydrogen Production in Microalgal Cultures . . . . . 195
- III.1 Physical Optics Corporation: Photochemical System for Hydrogen Generation. . . . . 212
- III.3 Sierra Marine Technologies: Aqueous Phase Base-Facilitated Reforming (BFR) of Renewable Fuels. . . . . 220
- III.4 HyGen Industries: Development of a Centrifugal Hydrogen Pipeline Gas Compressor. . . . . 267
- III.7 Lawrence Livermore National Laboratory: Inexpensive Delivery of Cold Hydrogen in High Performance Glass Fiber Pressure Vessels . . . . . 282

**California (Continued)**

III.7	Spencer Composites: Inexpensive Delivery of Cold Hydrogen in High Performance Glass Fiber Pressure Vessels. . . . .	282
III.12	Sandia National Laboratories: Hydrogen Embrittlement of Structural Steels . . . . .	306
III.20	Lawrence Livermore National Laboratory: Rapid Low-Loss Cryogenic Hydrogen Refueling . . . . .	341
IV.A.1a	Sandia National Laboratories: Five-Year Review of Metal Hydride Center of Excellence . . . . .	361
IV.A.1d	Sandia National Laboratories: Development of Metal Hydrides at Sandia National Laboratories . . . . .	377
IV.A.1j	Jet Propulsion Laboratory: Development and Evaluation of Advanced Hydride Systems for Reversible Hydrogen Storage. . . . .	408
IV.A.1j	California Institute of Technology: Development and Evaluation of Advanced Hydride Systems for Reversible Hydrogen Storage. . . . .	408
IV.A.2	Sandia National Laboratories: Tunable Thermodynamics and Kinetics for Hydrogen Storage: Nanoparticle Synthesis Using Ordered Polymer Templates . . . . .	423
IV.A.2	Lawrence Livermore National Laboratory: Tunable Thermodynamics and Kinetics for Hydrogen Storage: Nanoparticle Synthesis Using Ordered Polymer Templates . . . . .	423
IV.A.3	University of California, Los Angeles: Efficient Discovery of Novel Multicomponent Mixtures for Hydrogen Storage: A Combined Computational/Experimental Approach . . . . .	428
IV.C.1e	Karl Gross: NREL Research as Part of the Hydrogen Sorption Center of Excellence . . . . .	486
IV.C.1h	Lawrence Livermore National Laboratory: Carbon Aerogels for Hydrogen Storage . . . . .	502
IV.D.1a	Jet Propulsion Laboratory: Hydrogen Storage Engineering Center of Excellence . . . . .	514
IV.D.1a	California Institute of Technology: Hydrogen Storage Engineering Center of Excellence . . . . .	514
IV.D.1i	Jet Propulsion Laboratory: Key Technologies, Thermal Management, and Prototype Testing for Advanced Solid-State Hydrogen Storage Systems . . . . .	556
IV.D.1i	California Institute of Technology: Key Technologies, Thermal Management, and Prototype Testing for Advanced Solid-State Hydrogen Storage Systems . . . . .	556
IV.E.5	Sandia National Laboratories: The Reactivity Properties of Hydrogen Storage Materials in the Context of Systems. . . . .	586
IV.E.6	H2 Technology Consulting LLC: Best Practices for Characterizing Hydrogen Storage Properties of Materials . . . . .	591
IV.F.1	University of California, Los Angeles: A Joint Theory and Experimental Project in the Synthesis and Testing of Porous COFs for On-Board Vehicular Hydrogen Storage. . . . .	595
IV.G.1	Lawrence Livermore National Laboratory: Extended Dormancy, Vacuum Stability, and Para-Ortho Hydrogen Conversion in Cryogenic Pressure Vessels . . . . .	615
IV.H.1	Trulite Inc.: NaSi and Na-SG Powder Hydrogen Fuel Cells . . . . .	628
V.B.1	Lawrence Berkeley National Laboratory: Water Transport Exploratory Studies. . . . .	706
V.D.1	Lawrence Livermore National Laboratory: New Polyelectrolyte Materials for High Temperature Fuel Cells. . . . .	741
V.E.1	Jet Propulsion Laboratory: Advanced Cathode Catalysts and Supports for PEM Fuel Cells . . . . .	790
V.E.4	California Institute of Technology: Non-Platinum Bimetallic Cathode Electrocatalysts . . . . .	811
V.E.5	University of California, Riverside: Advanced Cathode Catalysts . . . . .	816
V.E.7	University of California, Riverside: Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes . . . . .	830
V.E.7	Stanford University: Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes . . . . .	830
V.E.8	Jet Propulsion Laboratory: Nanosegregated Cathode Alloy Catalysts with Ultra-Low Platinum Loading . . . . .	835
V.E.11	Lawrence Livermore National Laboratory: Molecular-Scale, Three-Dimensional Non-Platinum Group Metal Electrodes for Catalysis of Fuel Cell Reactions . . . . .	850
V.G.1	Intelligent Energy: Development and Demonstration of a New Generation High Efficiency 10-kW Stationary PEM Fuel Cell System. . . . .	861

**California (Continued)**

V.G.4	University of California, Davis: Research and Development for Off-Road Fuel Cell Applications . . . . .	873
V.H.2	Lawrence Berkeley National Laboratory: Durability Improvements through Degradation Mechanism Studies. . . . .	881
V.H.5	Lawrence Berkeley National Laboratory: Accelerated Testing Validation . . . . .	895
V.I.2	Electricore, Inc.: Solid Oxide Fuel Cell Development for Auxiliary Power in Heavy Duty Vehicle Applications. . . . .	907
V.J.1	Jet Propulsion Laboratory: Novel Approach to Advanced Direct Methanol Fuel Cell (DMFC) Anode Catalysts . . . . .	911
V.J.2	QuantumSphere Inc.: Novel Materials for High Efficiency Direct Methanol Fuel Cells . . . . .	915
V.K.1	Honeywell Aerospace: Development of Thermal and Water Management System for PEM Fuel Cell. . . . .	919
V.M.2	Lawrence Livermore National Laboratory: Fuel Cell Fundamentals at Low and Subzero Temperatures. . . . .	948
V.M.3	Sandia National Laboratories: Development and Validation of a Two-Phase, Three-dimensional Model for PEM Fuel Cells. . . . .	952
V.M.3	Lawrence Berkeley National Laboratory: Development and Validation of a Two-Phase, Three-dimensional Model for PEM Fuel Cells. . . . .	952
V.M.4	Lawrence Berkeley National Laboratory: Transport Studies Enabling Efficiency Optimization of Cost-Competitive Fuel Cell Stacks . . . . .	956
V.N.2	Jet Propulsion Laboratory: Resonance-Stabilized Anion Exchange Polymer Electrolytes . . . . .	967
V.N.2	University of Southern California, Los Angeles: Resonance-Stabilized Anion Exchange Polymer Electrolytes. . . . .	967
V.P.24	Stanford University: Development and Mechanistic Characterization of Alloy Fuel Cell Catalysts. . . . .	1095
V.P.28	Lawrence Livermore National Laboratory: The Development of Nano-Composite Electrodes for Solid Oxide Electrolyzers. . . . .	1109
V.P.30	Lawrence Berkeley National Laboratory: Proton Conduction in Rare-Earth Phosphates . . . . .	1115
VI.3	UltraCell Corporation: Modular, High-Volume Fuel Cell Leak-Test Suite and Process. . . . .	1135
VI.10	Quantum Fuel Systems Technologies Worldwide, Inc.: Development of Advanced Manufacturing Technologies for Low Cost Hydrogen Storage Vessels . . . . .	1165
VII.2	Sandia National Laboratories: Analysis of Energy Infrastructures and Potential Impacts from an Emergent Hydrogen Fueling Infrastructure . . . . .	1181
VII.7	Lawrence Livermore National Laboratory: Hydrogen and Water: Engineering, Economics and Environment . . . . .	1200
VIII.2	Hyundai-KIA America Technical Center Inc.: Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project . . . . .	1261
VIII.2	Alameda-Contra Costa Transit: Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project . . . . .	1261
VIII.2	Southern California Edison: Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project . . . . .	1261
VIII.3	Mercedes-Benz Research & Development North America, Inc.: Hydrogen to the Highways . . . . .	1264
VIII.6	University of California, Irvine: California Hydrogen Infrastructure Project. . . . .	1277
IX.1	Steele Consulting: National Codes and Standards Template . . . . .	1307
IX.1	Smart Chemistry: National Codes and Standards Template . . . . .	1307
IX.3	Steele Consulting: Codes and Standards Training and Outreach and Education for Emerging Fuel Cell Technologies . . . . .	1315
IX.3	Smart Chemistry: Codes and Standards Training and Outreach and Education for Emerging Fuel Cell Technologies . . . . .	1315

**California (Continued)**

IX.5 Sandia National Laboratories: Materials and Components Compatibility . . . . .1326

IX.8 City of Santa Fe Springs: Hydrogen Safety Panel . . . . . 1338

IX.9 Sandia National Laboratories: Hydrogen Release Behavior . . . . . 1342

IX.10 Sandia National Laboratories: Risk-Informed Separation Distances for H<sub>2</sub> Facilities . . . . .1347

IX.11 Sandia National Laboratories: International Energy Agency Hydrogen Implementing Agreement Task 19 Hydrogen Safety . . . . .1352

IX.12 Intelligent Optical Systems, Inc.: Safe Detector System for Hydrogen Leaks . . . . .1355

IX.13 California Fuel Cell Partnership: Hydrogen Safety Training for First Responders. . . . . 1360

IX.14 Lawrence Livermore National Laboratory: Hydrogen Safety Training for Researchers . . . . .1363

X.1 California Fuel Cell Partnership: Hydrogen Safety Training for First Responders. . . . .1379

X.2 Steele Consulting: Education for Emerging Fuel Cell Technologies . . . . . 1382

X.2 Smart Chemistry: Education for Emerging Fuel Cell Technologies. . . . . 1382

X.3 California State University, Los Angeles: Hydrogen and Fuel Cell Education at California State University, Los Angeles. . . . . 1385

X.4 Humboldt State University Sponsored Programs Foundation: Hydrogen Energy in Engineering Education (H<sub>2</sub>E<sup>5</sup>). . . . . 1389

X.4 University of California, Berkeley: Hydrogen Energy in Engineering Education (H<sub>2</sub>E<sup>5</sup>). . . . . 1389

X.14 Schatz Energy Research Center: H2L3: Hydrogen Learning for Local Leaders . . . . .1422

X.16 University of California, Berkeley: Hydrogen Technology and Energy Curriculum (HyTEC) . . . . .1428

X.16 Humboldt State University: Hydrogen Technology and Energy Curriculum (HyTEC) . . . . .1428

XI.2 Electricore, Inc.: Solid Oxide Fuel Cell Diesel Auxiliary Power Unit Demonstration. . . . . 1446

XI.3 University of California, Irvine: Highly Efficient, 5 kW CHP Fuel Cells Demonstrating Durability and Economic Value in Residential and Light Commercial Applications . . . . .1449

XI.5 Jadoo Power, Inc.: Jadoo Power Fuel Cell Demonstration. . . . .1454

XI.6 Peek Site-Com, Inc.: PEM Fuel Cell Systems Providing Back-Up Power to Commercial Cellular Towers and an Electric Utility Communications Network . . . . .1456

XI.6 Jeffrey Rome and Associates: PEM Fuel Cell Systems Providing Back-Up Power to Commercial Cellular Towers and an Electric Utility Communications Network . . . . .1456

XI.12 Alteryg Systems, Folsom: Demonstrating Economic and Operational Viability of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications on the Sprint Nextel Network. . . . .1472

**Colorado**

II.A.4 National Renewable Energy Laboratory: Distributed Bio-Oil Reforming . . . . .38

II.C.1 Colorado School of Mines: High-Performance Palladium-Based Membrane for Hydrogen Separation and Purification . . . . .57

II.D.3 Eltron Research Inc.: Scale Up of Hydrogen Transport Membranes for IGCC and FutureGen Plants . . . . .82

II.E.3 National Renewable Energy Laboratory: Renewable Electrolysis Integrated System Development and Testing. . . . .107

II.E.3 Engineering Procurement & Construction: Renewable Electrolysis Integrated System Development and Testing. . . . .107

II.E.3 Spectrum Automation: Renewable Electrolysis Integrated System Development and Testing . . . . .107

II.F.3 University of Colorado: Solar-Thermal Atomic Layer Deposition Ferrite-Based Water Splitting Cycles . . . . .126

II.G.4 National Renewable Energy Laboratory: Semiconductor Materials for Photoelectrolysis . . . . .150

II.G.6 National Renewable Energy Laboratory: Photoelectrochemical Materials: Theory and Modeling . . . . .162

**Colorado (Continued)**

II.G.7	MVSystems, Incorporated: Progress in the Study of Amorphous Silicon Carbide (a-SiC) as a Photoelectrode in Photoelectrochemical (PEC) Cells . . . . .	167
II.G.8	MVSystems, Incorporated: Progress in the Study of Tungsten Oxide Compounds as Photoelectrodes in Photoelectrochemical Cells . . . . .	171
II.G.9	MVSystems, Incorporated: Progress in the Study of Copper Chalcopyrites as Photoelectrodes in Photoelectrochemical Cells . . . . .	175
II.G.10	National Renewable Energy Laboratory: Critical Research for Cost-Effective Photoelectrochemical Production of Hydrogen . . . . .	179
II.G.13	National Renewable Energy Laboratory: Photoelectrochemical Generation of Hydrogen from Water Using Visible Light Sensitive Ferro-Electric BiFeO <sub>3</sub> and Semiconductor Nanotubes . . . . .	191
II.H.2	National Renewable Energy Laboratory: Biological Systems for Hydrogen Photoproduction. . . . .	198
II.H.3	National Renewable Energy Laboratory: Fermentation and Electrohydrogenic Approaches to Hydrogen Production. . . . .	203
II.I.2	Synkera Technologies, Inc.: Nanotube Array Photoelectrochemical Hydrogen Production. . . . .	216
II.I.8	National Renewable Energy Laboratory: Development of a Hydrogen Home Fueling System . . . . .	240
II.J.2	National Renewable Energy Laboratory: Purdue Hydrogen Systems Laboratory: Hydrogen Production. . . . .	245
III.2	National Renewable Energy Laboratory: H <sub>2</sub> A Delivery Analysis and H <sub>2</sub> A Delivery Components Model . . . . .	259
IV.C.1a	National Renewable Energy Laboratory: Overview of the DOE Hydrogen Sorption Center of Excellence. . . . .	460
IV.C.1e	National Renewable Energy Laboratory: NREL Research as Part of the Hydrogen Sorption Center of Excellence. . . . .	486
IV.D.1a	National Renewable Energy Laboratory: Hydrogen Storage Engineering Center of Excellence . . . . .	514
IV.D.1e	National Renewable Energy Laboratory: System Design, Analysis, Modeling, and Media Engineering Properties for Hydrogen Energy Storage. . . . .	537
IV.H.2	National Renewable Energy Laboratory: Purdue Hydrogen Systems Laboratory: Hydrogen Storage. . . . .	632
V.C.4	National Renewable Energy Laboratory: Effect of System and Air Contaminants on PEMFC Performance and Durability. . . . .	737
V.D.2	Colorado School of Mines: Membranes and MEAs for Dry, Hot Operating Conditions . . . . .	748
V.D.4	BekkTech LLC: Lead Research and Development Activity for DOE's High Temperature, Low Relative Humidity Membrane Program . . . . .	758
V.D.7	Colorado School of Mines: Novel Approaches to Immobilized Heteropoly Acid (HPA) Systems for High Temperature, Low Relative Humidity Polymer-Type Membranes . . . . .	772
V.E.7	National Renewable Energy Laboratory: Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes . . . . .	830
V.I.1	Protonex Technology Corporation: Diesel-Fueled SOFC System for Class 7/Class 8 On-Highway Truck Auxiliary Power. . . . .	903
V.J.1	National Renewable Energy Laboratory: Novel Approach to Advanced Direct Methanol Fuel Cell (DMFC) Anode Catalysts . . . . .	911
V.J.1	Colorado School of Mines: Novel Approach to Advanced Direct Methanol Fuel Cell (DMFC) Anode Catalysts . . . . .	911
V.N.1	Versa Power Systems: Advanced Materials for RSOFC Dual Operation with Low Degradation . . . . .	963
V.O.2	Colorado School of Mines: Renewable and Logistics Fuels for Fuel Cells at the Colorado School of Mines . . . . .	983
V.O.2	Protonex Technology Corporation: Renewable and Logistics Fuels for Fuel Cells at the Colorado School of Mines. . . . .	983
V.O.2	Reaction Systems, LLC: Renewable and Logistics Fuels for Fuel Cells at the Colorado School of Mines. . . . .	983



**Colorado (Continued)**

V.O.9 Colorado School of Mines: Biomass Fuel Cell Systems . . . . .1011

V.P.16 National Renewable Energy Laboratory: Fundamentals of Hydroxide Conducting Systems for Fuel Cells and Electrolyzers. . . . . 1069

VI.1 National Renewable Energy Laboratory: Fuel Cell Membrane Electrode Assembly Manufacturing R&D. . . . .1127

VII.1 National Renewable Energy Laboratory: Scenario Evaluation, Regionalization and Analysis (SERA) Model. . . . .1177

VII.1 Allegiance Consulting: Scenario Evaluation, Regionalization and Analysis (SERA) Model. . . . .1177

VII.5 National Renewable Energy Laboratory: Biogas Resources Characterization. . . . .1191

VII.6 National Renewable Energy Laboratory: Cost and GHG Implications of Hydrogen for Energy Storage . . . . . 1196

VII.8 National Renewable Energy Laboratory: Analysis of Business Cases with the Fuel Cell Power Model. . . . . 1205

VII.10 National Renewable Energy Laboratory: Macro System Model . . . . .1213

VII.14 National Renewable Energy Laboratory: Fuel Cell Power Model: Evaluation of CHP and CHHP Applications . . . . .1232

VII.16 National Renewable Energy Laboratory: HyDRA: Hydrogen Demand and Resource Analysis Tool. . . . . 1240

VII.16 A Mountaintop LLC: HyDRA: Hydrogen Demand and Resource Analysis Tool . . . . . 1240

VIII.1 National Renewable Energy Laboratory: Controlled Hydrogen Fleet and Infrastructure Analysis . . . . .1253

VIII.7 National Renewable Energy Laboratory: Technology Validation: Fuel Cell Bus Evaluations . . . . . 1280

IX.1 National Renewable Energy Laboratory: National Codes and Standards Template . . . . .1307

IX.1 FP2 Fire Protection Engineering: National Codes and Standards Template . . . . .1307

IX.1 MorEvents: National Codes and Standards Template . . . . .1307

IX.2 National Renewable Energy Laboratory: Component Standard Research and Development . . . . .1311

IX.3 National Renewable Energy Laboratory: Codes and Standards Training and Outreach and Education for Emerging Fuel Cell Technologies . . . . .1315

IX.3 FP2 Fire Protection Engineering: Codes and Standards Training and Outreach and Education for Emerging Fuel Cell Technologies . . . . .1315

IX.3 MorEvents: Codes and Standards Training and Outreach and Education for Emerging Fuel Cell Technologies . . . . .1315

IX.11 Element One, Inc.: International Energy Agency Hydrogen Implementing Agreement Task 19 Hydrogen Safety . . . . .1352

X.2 National Renewable Energy Laboratory: Education for Emerging Fuel Cell Technologies . . . . . 1382

X.2 FP2 Fire Protection Engineering: Education for Emerging Fuel Cell Technologies. . . . . 1382

X.2 MorEvents: Education for Emerging Fuel Cell Technologies. . . . . 1382

X.15 National Conference of State Legislators: Hydrogen Education State Partnership Program . . . . .1426

XI.2 TDA Research, Inc.: Solid Oxide Fuel Cell Diesel Auxiliary Power Unit Demonstration. . . . . 1446

XI.6 Front Range Wireless: PEM Fuel Cell Systems Providing Back-Up Power to Commercial Cellular Towers and an Electric Utility Communications Network . . . . .1456

**Connecticut**

II.B.1 United Technologies Research Center: A Novel Slurry-Based Biomass Reforming Process . . . . .46

II.D.5 United Technologies Research Center: Experimental Demonstration of Advanced Palladium Membrane Separators for Central High-Purity Hydrogen Production . . . . .90

II.E.1 Avalance, LLC: High-Capacity, High-Pressure Electrolysis System with Renewable Power Sources. . . . .99

**Connecticut (Continued)**

II.E.4	Proton Energy Systems: High-Performance, Low-Cost Hydrogen Generation from Renewable Energy . . . . .	112
II.I.7	Proton Energy Systems: Hydrogen by Wire - Home Fueling System . . . . .	236
III.13	Gas Equipment Engineering Corporation: Innovative Hydrogen Liquefaction Cycle. . . . .	310
III.13	R&D Dynamics: Innovative Hydrogen Liquefaction Cycle. . . . .	310
III.14	United Technologies Research Center: Reversible Liquid Carriers for an Integrated Production, Storage and Delivery of Hydrogen . . . . .	314
III.16	FuelCell Energy, Inc.: Development of Highly Efficient Solid-State Electrochemical Hydrogen Compressor . . . . .	323
III.16	Sustainable Innovations, LLC: Development of Highly Efficient Solid-State Electrochemical Hydrogen Compressor . . . . .	323
IV.D.1a	United Technologies Research Center: Hydrogen Storage Engineering Center of Excellence . . . . .	514
IV.D.1c	United Technologies Research Center: Advancement of Systems Designs and Key Engineering Technologies for Materials-Based Hydrogen Storage . . . . .	524
IV.E.4	United Technologies Research Center: Quantifying and Addressing the DOE Material Reactivity Requirements with Analysis and Testing of Hydrogen Storage Materials and Systems . . . . .	581
V.C.3	University of Connecticut: The Effects of Impurities on Fuel Cell Performance and Durability . . . . .	731
V.C.3	FuelCell Energy, Inc.: The Effects of Impurities on Fuel Cell Performance and Durability . . . . .	731
V.C.3	United Technologies – Hamilton Sundstrand: The Effects of Impurities on Fuel Cell Performance and Durability. . . . .	731
V.D.8	FuelCell Energy, Inc.: High Temperature Membrane with Humidification-Independent Cluster Structure. . . . .	777
V.E.2	UTC Power: Highly Dispersed Alloy Catalyst for Durability . . . . .	799
V.E.3	University of Connecticut: Development of Alternative and Durable High Performance Cathode Supports for PEM Fuel Cells . . . . .	805
V.H.1	United Technologies Research Center: Polymer Electrolyte Fuel Cell Lifetime Limitations: The Role of Electrocatalyst Degradation . . . . .	876
V.H.4	UTC Power: Improved Accelerated Stress Tests Based on Fuel Cell Vehicle Data . . . . .	890
V.H.4	United Technologies Research Center: Improved Accelerated Stress Tests Based on Fuel Cell Vehicle Data . . . . .	890
V.L.4	UTC Power: Low-Cost Durable Seals for PEMFCs . . . . .	939
V.L.4	Henkel Corporation: Low-Cost Durable Seals for PEMFCs. . . . .	939
V.M.2	United Technologies Research Center: Fuel Cell Fundamentals at Low and Subzero Temperatures. . . . .	948
VI.4	UTC Power: Manufacturing of Low-Cost, Durable Membrane Electrode Assemblies Engineered for Rapid Conditioning . . . . .	1139
VIII.2	UTC Power: Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project . . . . .	1261
VIII.5	FuelCell Energy, Inc.: Validation of an Integrated Hydrogen Energy Station . . . . .	1273
IX.1	GWS Solutions of Tolland, LLC: National Codes and Standards Template. . . . .	1307
IX.3	GWS Solutions of Tolland, LLC: Codes and Standards Training and Outreach and Education for Emerging Fuel Cell Technologies . . . . .	1315
IX.8	Hydrogen Safety, LLC: Hydrogen Safety Panel . . . . .	1338
IX.8	GWS Solutions of Tolland, LLC: Hydrogen Safety Panel . . . . .	1338
X.2	GWS Solutions of Tolland, LLC: Education for Emerging Fuel Cell Technologies . . . . .	1382
X.12	Connecticut Center for Advanced Technology, Inc.: State and Local Partnership Building. . . . .	1417

**Delaware**

IV.A.4 Delaware State University: Hydrogen Storage Materials for Fuel Cell-Powered Vehicles . . . . . 433

V.E.3 University of Delaware: Development of Alternative and Durable High Performance Cathode Supports for PEM Fuel Cells . . . . . 805

V.F.1 University of Delaware: CIRRU: Cell Ice Regulation & Removal Upon Start-Up . . . . . 857

V.H.2 Ion Power: Durability Improvements through Degradation Mechanism Studies . . . . . 881

V.H.5 Ion Power: Accelerated Testing Validation . . . . . 895

VI.4 University of Delaware: Manufacturing of Low-Cost, Durable Membrane Electrode Assemblies Engineered for Rapid Conditioning. . . . . 1139

**Florida**

II.F.2 University of Central Florida: Solar High-Temperature Water-Splitting Cycle with Quantum Boost . . . . . 120

V.D.4 University of Central Florida: Lead Research and Development Activity for DOE's High Temperature, Low Relative Humidity Membrane Program . . . . . 758

V.J.3 University of North Florida: New MEA Materials for Improved DMFC Performance, Durability, and Cost . . . . . 917

V.J.3 University of Florida: New MEA Materials for Improved DMFC Performance, Durability, and Cost. . . . . 917

VIII.11 University of Central Florida: Florida Hydrogen Initiative . . . . . 1294

VIII.11 EnerFuels, Inc.: Florida Hydrogen Initiative. . . . . 1294

VIII.11 Florida Solar Energy Center: Florida Hydrogen Initiative. . . . . 1294

VIII.11 Orlando Science Center: Florida Hydrogen Initiative . . . . . 1294

IX.8 Addison Bain: Hydrogen Safety Panel. . . . . 1338

X.6 University of Central Florida: Bachelor of Science Engineering Technology Hydrogen and Fuel Cell Program Concentration . . . . . 1396

XI.4 University of North Florida: Advanced Direct Methanol Fuel Cell for Mobile Computing . . . . . 1452

XI.4 University of Florida: Advanced Direct Methanol Fuel Cell for Mobile Computing. . . . . 1452

XI.6 Betacom, Inc.: PEM Fuel Cell Systems Providing Back-Up Power to Commercial Cellular Towers and an Electric Utility Communications Network . . . . . 1456

XI.6 United Commercial Real Estate Services, Inc.: PEM Fuel Cell Systems Providing Back-Up Power to Commercial Cellular Towers and an Electric Utility Communications Network . . . . . 1456

**Georgia**

II.D.4 Georgia Institute of Technology: Amorphous Alloy Membranes for High Temperature Hydrogen Separation . . . . . 86

III.15 Chemical Composite Coatings Int'l, LLC: Materials Solutions for Hydrogen Delivery in Pipelines . . . . . 318

V.H.6 Georgia Institute of Technology: Development of Micro-Structural Mitigation Strategies for PEM Fuel Cells: Morphological Simulations and Experimental Approaches . . . . . 899

V.P.2 Georgia Institute of Technology: Ab-initio Screening of Alloys for Hydrogen Purification Membranes . . . . . 1021

**Hawaii**

II.G.1 University of Hawaii at Manoa: Photoelectrochemical Hydrogen Production: DOE PEC Working Group Overview . . . . . 131

II.G.7 University of Hawaii at Manoa: Progress in the Study of Amorphous Silicon Carbide (a-SiC) as a Photoelectrode in Photoelectrochemical (PEC) Cells . . . . . 167

II.G.8 University of Hawaii at Manoa: Progress in the Study of Tungsten Oxide Compounds as Photoelectrodes in Photoelectrochemical Cells . . . . . 171



**Hawaii (Continued)**

II.G.9	University of Hawaii at Manoa: Progress in the Study of Copper Chalcopyrites as Photoelectrodes in Photoelectrochemical Cells . . . . .	175
IV.A.1b	University of Hawaii: Fundamental Studies of Advanced High-Capacity, Reversible Metal Hydrides . . . . .	364
V.C.4	University of Hawaii: Effect of System and Air Contaminants on PEMFC Performance and Durability . . . . .	737
V.D.9	University of Hawaii: Improved, Low-Cost, Durable Fuel Cell Membranes . . . . .	782
VIII.8	Hawaii Natural Energy Institute: Hawaii Hydrogen Power Park . . . . .	1284
IX.1	University of Hawaii: National Codes and Standards Template . . . . .	1307
IX.3	University of Hawaii: Codes and Standards Training and Outreach and Education for Emerging Fuel Cell Technologies. . . . .	1315
X.2	University of Hawaii: Education for Emerging Fuel Cell Technologies . . . . .	1382

**Illinois**

II.A.3	Argonne National Laboratory: Hydrogen from Glycerol: A Feasibility Study. . . . .	34
II.A.5	Argonne National Laboratory: Distributed Reforming of Renewable Liquids Using Oxygen Transport Membranes. . . . .	42
II.B.3	Gas Technology Institute: One Step Biomass Gas Reforming-Shift Separation Membrane Reactor . . . . .	54
II.F.1	Argonne National Laboratory: R&D Status for the Cu-Cl Thermochemical Cycle-2010. . . . .	115
III.1	Argonne National Laboratory: Hydrogen Delivery Infrastructure Analysis. . . . .	255
III.10	University of Illinois: Hydrogen Embrittlement of Pipeline Steels: Fundamentals, Experiments, Modeling . . . . .	296
III.18	Argonne National Laboratory: Hydrogen Pipeline Compressors . . . . .	333
IV.A.1f	University of Illinois at Urbana-Champaign: Reversible Hydrogen Storage Materials - Structure, Chemistry, and Electronic Structure . . . . .	389
IV.A.3	Northwestern University: Efficient Discovery of Novel Multicomponent Mixtures for Hydrogen Storage: A Combined Computational/Experimental Approach . . . . .	428
IV.C.1f	Argonne National Laboratory: Hydrogen Storage through Nanostructured Porous Organic Polymers (POPs). . . . .	495
IV.C.1f	University of Chicago: Hydrogen Storage through Nanostructured Porous Organic Polymers (POPs). . . . .	495
IV.C.3	Gas Technology Institute: Electron Charged Graphite-Based Hydrogen Storage Material . . . . .	510
IV.C.3	Superior Graphite Company: Electron Charged Graphite-Based Hydrogen Storage Material . . . . .	510
IV.E.1	Argonne National Laboratory: On-Board and Off-Board Analyses of Hydrogen Storage Options . . . . .	566
IV.F.2	Northwestern University: New Carbon-Based Porous Materials with Increased Heats of Adsorption for Hydrogen Storage. . . . .	600
V.A.1	Argonne National Laboratory: Fuel Cell Systems with Low Platinum Loadings. . . . .	661
V.A.7	Argonne National Laboratory: Fuel Cell Testing at Argonne National Laboratory. . . . .	699
V.E.1	Argonne National Laboratory: Advanced Cathode Catalysts and Supports for PEM Fuel Cells. . . . .	790
V.E.4	Argonne National Laboratory: Non-Platinum Bimetallic Cathode Electrocatalysts . . . . .	811
V.E.4	University of Illinois at Urbana-Champaign: Non-Platinum Bimetallic Cathode Electrocatalysts . . . . .	811
V.E.5	Argonne National Laboratory: Advanced Cathode Catalysts . . . . .	816
V.E.5	University of Illinois at Urbana-Champaign: Advanced Cathode Catalysts . . . . .	816
V.E.8	Argonne National Laboratory: Nanosegregated Cathode Alloy Catalysts with Ultra-Low Platinum Loading . . . . .	835
V.H.1	Argonne National Laboratory: Polymer Electrolyte Fuel Cell Lifetime Limitations: The Role of Electrocatalyst Degradation . . . . .	876

**Illinois (Continued)**

V.H.2	Argonne National Laboratory: Durability Improvements through Degradation Mechanism Studies . . . . .	881
V.H.3	Argonne National Laboratory: Durability of Low Platinum Fuel Cells Operating at High Power Density . . . . .	886
V.J.2	Illinois Institute of Technology: Novel Materials for High Efficiency Direct Methanol Fuel Cells . . . . .	915
V.L.2	Gas Technology Institute: Low-Cost PEM Fuel Cell Metal Bipolar Plates . . . . .	930
V.L.3	Argonne National Laboratory: Metallic Bipolar Plates with Composite Coatings . . . . .	934
V.L.3	Southern Illinois University Carbondale: Metallic Bipolar Plates with Composite Coatings . . . . .	934
V.L.3	Gas Technology Institute: Metallic Bipolar Plates with Composite Coatings . . . . .	934
V.L.3	Orion Industries: Metallic Bipolar Plates with Composite Coatings . . . . .	934
V.P.7	University of Illinois at Urbana-Champaign: Cathode Catalysis in Hydrogen/Oxygen Fuel Cells: Mechanism, New Materials, and Characterization . . . . .	1037
V.P.8	Argonne National Laboratory: Fundamental Studies of Electrocatalysis for Low Temperature Fuel Cell Catalysts . . . . .	1040
V.P.15	Argonne National Laboratory: Structure/Composition/Function Relationships in Supported Nanoscale Catalysts for Hydrogen . . . . .	1065
V.P.18	Northwestern University: High Performance Nano-Crystalline Oxide Fuel Cell Materials . . . . .	1075
V.P.23	Illinois Institute of Technology: Metal- and Metal Oxide-Supported Platinum Monolayer Electrocatalysts for Oxygen Reduction . . . . .	1092
VII.3	Argonne National Laboratory: Agent-Based Model of the Transition to Hydrogen-Based Personal Transportation: Consumer Adoption and Infrastructure Development Including Combined Hydrogen, Heat, and Power . . . . .	1185
VII.9	Argonne National Laboratory: Fuel Quality in Fuel Cell Systems . . . . .	1209
VII.11	Argonne National Laboratory: Life-Cycle Analysis of Criteria Pollutant Emissions from Stationary Fuel Cell Systems with the GREET Model . . . . .	1217
VIII.10	Gas Technology Institute: Texas Hydrogen Highway . . . . .	1291

**Indiana**

II.J.2	Purdue University: Purdue Hydrogen Systems Laboratory: Hydrogen Production . . . . .	245
IV.H.2	Purdue University: Purdue Hydrogen Systems Laboratory: Hydrogen Storage . . . . .	632
V.E.8	Indiana University: Nanosegregated Cathode Alloy Catalysts with Ultra-Low Platinum Loading . . . . .	835
XI.6	Fortune Wireless: PEM Fuel Cell Systems Providing Back-Up Power to Commercial Cellular Towers and an Electric Utility Communications Network . . . . .	1456

**Kansas**

XI.12	Black & Veatch Corporation: Demonstrating Economic and Operational Viability of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications on the Sprint Nextel Network . . . . .	1472
XI.12	Ericsson Services, Inc.: Demonstrating Economic and Operational Viability of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications on the Sprint Nextel Network . . . . .	1472

**Kentucky**

III.15	Secat, Inc.: Materials Solutions for Hydrogen Delivery in Pipelines . . . . .	318
III.15	Columbia Gas of Kentucky: Materials Solutions for Hydrogen Delivery in Pipelines . . . . .	318

**Louisiana**

III.15	Hatch Mott MacDonald: Materials Solutions for Hydrogen Delivery in Pipelines . . . . .	318
--------	--	-----

**Maryland**

II.H.2	Johns Hopkins University: Biological Systems for Hydrogen Photoproduction . . . . .	198
II.H.4	J. Craig Venter Institute: Hydrogen from Water in a Novel Recombinant Oxygen-Tolerant Cyanobacterial System . . . . .	208
II.I.3	Sentech, Inc.: Aqueous Phase Base-Facilitated Reforming (BFR) of Renewable Fuels . . . . .	220
IV.A.1h	National Institute of Standards and Technology: Neutron Characterization and Calphad in Support of the Metal Hydride Center of Excellence . . . . .	399
IV.C.1d	National Institute of Standards and Technology: Neutron Characterization in Support of the Hydrogen Sorption Center of Excellence . . . . .	481
V.A.5	National Institute of Standards and Technology: Neutron Imaging Study of the Water Transport in Operating Fuel Cells . . . . .	686
V.B.1	National Institute of Standards and Technology: Water Transport Exploratory Studies . . . . .	706
V.F.1	W.L. Gore & Associates, Inc.: CIRRUS: Cell Ice Regulation & Removal Upon Start-Up . . . . .	857
V.K.2	W.L. Gore & Associates, Inc.: Materials and Modules for Low-Cost, High-Performance Fuel Cell Humidifiers . . . . .	922
V.P.9	Johns Hopkins University: Engineering Catalytic Nanoporous Metals for Reactions Important to the Hydrogen Economy . . . . .	1044
V.P.21	University of Maryland: Atomic-scale Design of a New Class of Alloy Catalysts for Reactions Involving Hydrogen: A Theoretical and Experimental Approach . . . . .	1084
VI.4	W.L. Gore & Associates, Inc.: Manufacturing of Low-Cost, Durable Membrane Electrode Assemblies Engineered for Rapid Conditioning . . . . .	1139
VI.6	National Institute of Standards and Technology: Cause-and-Effect: Flow Field Plate Manufacturing Variability and its Impact on Performance . . . . .	1149
VI.7	National Institute of Standards and Technology: Non-Contact Sensor Evaluation for Bipolar Plate Manufacturing Process Control . . . . .	1153
VI.8	National Institute of Standards and Technology: Optical Scatterfield Metrology for Online Catalyst Coating Inspection of PEM Soft Goods . . . . .	1157
IX.8	Energetics, Inc.: Hydrogen Safety Panel . . . . .	1338
X.11	University of Maryland: VA-MD-DC Hydrogen Education for Decision Makers . . . . .	1414
X.17	Sentech, Inc.: H <sub>2</sub> Educate – Middle School Hydrogen Education Program . . . . .	1432

**Massachusetts**

II.D.1	Worcester Polytechnic Institute: Composite Pd and Alloy Porous Stainless Steel Membranes for Hydrogen Production and Process Intensification . . . . .	74
II.D.6	Worcester Polytechnic Institute: Supported Molten Metal Membrane (SMMM) for Hydrogen Separation . . . . .	95
II.E.2	Giner Electrochemical Systems, LLC: PEM Electrolyzer Incorporating an Advanced Low-Cost Membrane . . . . .	103
II.H.2	Massachusetts Institute of Technology: Biological Systems for Hydrogen Photoproduction . . . . .	198
II.I.4	ElectroChem, Inc.: Advanced PEM-Based Hydrogen Home Refueling Appliance . . . . .	224
II.I.5	Giner Electrochemical Systems, LLC: Unitized Design for Home Refueling Appliance or Hydrogen Generation to 5,000 psi . . . . .	227
III.4	Concepts NREC: Development of a Centrifugal Hydrogen Pipeline Gas Compressor . . . . .	267
III.13	Massachusetts Institute of Technology: Innovative Hydrogen Liquefaction Cycle . . . . .	310
IV.A.2	Massachusetts Institute of Technology: Tunable Thermodynamics and Kinetics for Hydrogen Storage: Nanoparticle Synthesis Using Ordered Polymer Templates . . . . .	423
IV.C.2	PoroGen, LLC: Nanostructured Activated Carbon for Hydrogen Storage . . . . .	506
IV.E.2	TIAX, LLC: Analyses of Hydrogen Storage Materials and On-Board Systems . . . . .	572
IV.E.4	Kidde-Fenwal: Quantifying and Addressing the DOE Material Reactivity Requirements with Analysis and Testing of Hydrogen Storage Materials and Systems . . . . .	581

**Massachusetts (Continued)**

V.A.3	TIAX, LLC: Cost Analyses of Fuel Cell Stacks/Systems	672
V.D.3	Giner Electrochemical Systems, LLC: Dimensionally Stable Membranes (DSMs)	754
V.E.9	Massachusetts Institute of Technology: Contiguous Platinum Monolayer Oxygen Reduction Electrocatalysts on High-Stability Low-Cost Supports	841
V.F.1	Nuvera Fuel Cells: CIRRUS: Cell Ice Regulation & Removal Upon Start-Up	857
V.G.2	Acumentrics Corporation: Development of a Low Cost 3-10 kW Tubular SOFC Power System	866
V.H.1	Massachusetts Institute of Technology: Polymer Electrolyte Fuel Cell Lifetime Limitations: The Role of Electrocatalyst Degradation	876
V.H.3	Nuvera Fuel Cells, Inc.: Durability of Low Platinum Fuel Cells Operating at High Power Density	886
V.J.3	Northeastern University: New MEA Materials for Improved DMFC Performance, Durability, and Cost	917
V.L.2	IBIS Associations, Inc.: Low-Cost PEM Fuel Cell Metal Bipolar Plates	930
V.M.4	Nuvera Fuel Cells, Inc.: Transport Studies Enabling Efficiency Optimization of Cost-Competitive Fuel Cell Stacks	956
V.M.5	Giner Electrochemical Systems, LLC: Transport Studies and Modeling in PEM Fuel Cells	960
V.M.5	Tech-Etch: Transport Studies and Modeling in PEM Fuel Cells	960
V.M.5	Ballard Material Products, Inc.: Transport Studies and Modeling in PEM Fuel Cells	960
V.P.6	Massachusetts Institute of Technology: Activity and Stability of Nanoscale Pt-based Catalysts	1033
V.P.19	Tufts University: Nanostructured, Metal-Modified Oxide Catalysts for Steam Reforming of Methanol and the Water-Gas Shift Reactions	1078
VI.2	Ballard Material Products, Inc.: Reduction in Fabrication Costs of Gas Diffusion Layers	1131
VII.8	IDC Energy Insights: Analysis of Business Cases with the Fuel Cell Power Model	1205
VII.15	TIAX, LLC: Geo-Spatial Analysis of Hydrogen Infrastructure	1236
IX.8	Firexplo: Hydrogen Safety Panel	1338
XI.8	Nuvera Fuel Cells, Inc.: H-E-B Grocery Total Power Solution for Fuel Cell-Powered Material Handling Equipment	1462

**Michigan**

III.3	Energy Conversion Devices, Inc.: Aqueous Phase Base-Facilitated Reforming (BFR) of Renewable Fuels	220
III.3	Western Michigan University: Aqueous Phase Base-Facilitated Reforming (BFR) of Renewable Fuels	220
IV.C.1g	University of Michigan: Hydrogen Storage by Spillover	499
IV.D.1a	General Motors Company: Hydrogen Storage Engineering Center of Excellence	514
IV.D.1a	Ford Motor Company: Hydrogen Storage Engineering Center of Excellence	514
IV.D.1a	University of Michigan: Hydrogen Storage Engineering Center of Excellence	514
IV.D.1f	General Motors Company: System Design and Media Structuring for On-Board Hydrogen Storage Technologies	541
IV.D.1g	Ford Motor Company: Ford/BASF-SE/UM Activities in Support of the Hydrogen Storage Engineering Center of Excellence	546
IV.D.1g	University of Michigan: Ford/BASF-SE/UM Activities in Support of the Hydrogen Storage Engineering Center of Excellence	546
IV.I.1	Ovonic Hydrogen Systems LLC: Standardized Testing Program for Solid-State Hydrogen Storage Technologies	647
V.B.3	General Motors Company: Visualization of Fuel Cell Water Transport and Performance Characterization Under Freezing Conditions	716

**Michigan (Continued)**

V.B.3	Michigan Technological University: Visualization of Fuel Cell Water Transport and Performance Characterization Under Freezing Conditions . . . . .	716
V.D.2	University of Detroit Mercy: Membranes and MEAs for Dry, Hot Operating Conditions . . . . .	748
V.H.6	Michigan Technological University: Development of Micro-Structural Mitigation Strategies for PEM Fuel Cells: Morphological Simulations and Experimental Approaches . . . . .	899
V.L.1	General Motors Company: Nitrided Metallic Bipolar Plates . . . . .	925
V.L.4	Freudenberg-NOK General Partnership: Low-Cost Durable Seals for PEMFCs . . . . .	939
V.M.3	Ford Motor Company: Development and Validation of a Two-Phase, Three-dimensional Model for PEM Fuel Cells . . . . .	952
V.O.1	Michigan Technological University: Center for Fundamental and Applied Research in Nanostructured and Lightweight Materials . . . . .	978
VIII.3	DTE Energy: Hydrogen to the Highways . . . . .	1264
VIII.3	NextEnergy: Hydrogen to the Highways . . . . .	1264
IX.1	Sloane Solutions: National Codes and Standards Template . . . . .	1307
IX.3	Sloane Solutions: Codes and Standards Training and Outreach and Education for Emerging Fuel Cell Technologies . . . . .	1315
IX.8	General Motors Company: Hydrogen Safety Panel . . . . .	1338
X.2	Sloane Solutions: Education for Emerging Fuel Cell Technologies . . . . .	1382
X.5	Michigan Technological University: Hydrogen Education Curriculum Path at Michigan Technological University . . . . .	1393
XI.2	Delphi Automotive Systems, LLC: Solid Oxide Fuel Cell Diesel Auxiliary Power Unit Demonstration . . . . .	1446
XI.5	Delphi Corporation: Jadoo Power Fuel Cell Demonstration . . . . .	1454
XI.6	Telecom, Tower and Power, LLC: PEM Fuel Cell Systems Providing Back-Up Power to Commercial Cellular Towers and an Electric Utility Communications Network . . . . .	1456

**Minnesota**

II.A.4	University of Minnesota: Distributed Bio-Oil Reforming . . . . .	38
II.E.4	Entegris, Inc.: High-Performance, Low-Cost Hydrogen Generation from Renewable Energy . . . . .	112
V.D.2	3M Company: Membranes and MEAs for Dry, Hot Operating Conditions . . . . .	748
V.D.7	3M Company: Novel Approaches to Immobilized Heteropoly Acid (HPA) Systems for High Temperature, Low Relative Humidity Polymer-Type Membranes . . . . .	772
V.E.1	3M Company: Advanced Cathode Catalysts and Supports for PEM Fuel Cells . . . . .	790
V.E.6	3M Company: Durable Catalysts for Fuel Cell Protection during Transient Conditions . . . . .	825
V.E.8	3M Company: Nanosegregated Cathode Alloy Catalysts with Ultra-Low Platinum Loading . . . . .	835
V.G.4	The Toro Company: Research and Development for Off-Road Fuel Cell Applications . . . . .	873
V.I.1	Cummins Power Generation: Diesel-Fueled SOFC System for Class 7/Class 8 On-Highway Truck Auxiliary Power . . . . .	903
V.M.2	3M Company: Fuel Cell Fundamentals at Low and Subzero Temperatures . . . . .	948

**Mississippi**

V.O.4	University of Southern Mississippi: Alternate Fuel Cell Membranes for Energy Independence . . . . .	993
-------	---	-----

**Missouri**

IV.A.1d	University of Missouri, St. Louis: Development of Metal Hydrides at Sandia National Laboratories . . . . .	377
IV.A.2	University of Missouri, St. Louis: Tunable Thermodynamics and Kinetics for Hydrogen Storage: Nanoparticle Synthesis Using Ordered Polymer Templates . . . . .	423



**Missouri (Continued)**

IV.C.1c	University of Missouri: Multiply Surface-Functionalized Nanoporous Carbon for Vehicular Hydrogen Storage . . . . .	474
IV.C.1c	Midwest Research Institute: Multiply Surface-Functionalized Nanoporous Carbon for Vehicular Hydrogen Storage . . . . .	474
IX.8	Becht Engineering: Hydrogen Safety Panel . . . . .	1338
XI.12	Burns & McDonnell Engineering Co., Inc.: Demonstrating Economic and Operational Viability of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications on the Sprint Nextel Network . . . . .	1472

**Nebraska**

III.8	Lincoln Composites, Inc.: Development of High Pressure Hydrogen Storage Tank for Storage and Gaseous Truck Delivery . . . . .	290
IV.D.1a	Lincoln Composites, Inc.: Hydrogen Storage Engineering Center of Excellence . . . . .	514
IV.D.1k	Lincoln Composites, Inc.: Development of Improved Composite Pressure Vessels for Hydrogen Storage . . . . .	563
XI.6	Vertical Horizons Contracting: PEM Fuel Cell Systems Providing Back-Up Power to Commercial Cellular Towers and an Electric Utility Communications Network . . . . .	1456

**Nevada**

II.G.4	University of Nevada, Las Vegas: Semiconductor Materials for Photoelectrolysis . . . . .	150
II.G.5	University of Nevada, Las Vegas: Characterization of Materials for Photoelectrochemical Hydrogen Production . . . . .	157
II.G.13	University of Nevada, Reno: Photoelectrochemical Generation of Hydrogen from Water Using Visible Light Sensitive Ferro-Electric BiFeO <sub>3</sub> and Semiconductor Nanotubes . . . . .	191
IV.A.11	University of Nevada, Reno: Effect of Gaseous Impurities on Long-Term Thermal Cycling and Aging Properties of Complex Hydrides for Hydrogen Storage . . . . .	417
IV.H.3	University of Nevada, Las Vegas: HGMS: Glasses and Nanocomposites for Hydrogen Storage . . . . .	637
V.E.4	University of Nevada: Non-Platinum Bimetallic Cathode Electrocatalysts . . . . .	811

**New Jersey**

III.14	BMW Technology Corporation: Reversible Liquid Carriers for an Integrated Production, Storage and Delivery of Hydrogen . . . . .	314
IV.F.3	Rutgers University: Hydrogen Trapping through Designer Hydrogen Spillover Molecules with Reversible Temperature and Pressure-Induced Switching . . . . .	605
V.L.2	TreadStone Technologies, Inc.: Low-Cost PEM Fuel Cell Metal Bipolar Plates . . . . .	930
VI.9	BASF Fuel Cell, Inc.: High-Speed, Low-Cost Fabrication of Gas Diffusion Electrodes for Membrane Electrode Assemblies . . . . .	1162
VIII.3	Mercedes-Benz USA LLC: Hydrogen to the Highways . . . . .	1264
XI.11	Linde North America: Fuel Cell-Powered Lift Truck GENCO Fleet Deployment . . . . .	1470

**New Mexico**

II.B.2	Los Alamos National Laboratory: Catalytic Solubilization and Conversion of Lignocellulosic Feedstocks . . . . .	50
IV.B.1a	Los Alamos National Laboratory: 2010 Overview and Wrapup: DOE Chemical Hydrogen Storage Center of Excellence (CHSCoE) . . . . .	437
IV.B.1c	Los Alamos National Laboratory: Chemical Hydrogen Storage R&D at Los Alamos National Laboratory . . . . .	447
IV.D.1a	Los Alamos National Laboratory: Hydrogen Storage Engineering Center of Excellence . . . . .	514
IV.D.1d	Los Alamos National Laboratory: Chemical Hydride Rate Modeling, Validation, and System Demonstration . . . . .	529

**New Mexico (Continued)**

IV.F.4	Los Alamos National Laboratory: Capacitive Hydrogen Storage Systems: Molecular Design of Structured Dielectrics	610
V.A.8	Los Alamos National Laboratory: Technical Assistance to Developers	703
V.B.1	Los Alamos National Laboratory: Water Transport Exploratory Studies	706
V.B.1	Sandia National Laboratories: Water Transport Exploratory Studies	706
V.C.1	Los Alamos National Laboratory: Effects of Fuel and Air Impurities on PEM Fuel Cell Performance	722
V.C.4	Los Alamos National Laboratory: Effect of System and Air Contaminants on PEMFC Performance and Durability	737
V.E.4	Los Alamos National Laboratory: Non-Platinum Bimetallic Cathode Electrocatalysts	811
V.E.5	Los Alamos National Laboratory: Advanced Cathode Catalysts	816
V.E.5	Cabot Fuel Cells: Advanced Cathode Catalysts	816
V.E.5	University of New Mexico: Advanced Cathode Catalysts	816
V.E.7	Los Alamos National Laboratory: Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes	830
V.E.10	Los Alamos National Laboratory: The Science and Engineering of Durable Ultralow PGM Catalysts	845
V.H.2	Los Alamos National Laboratory: Durability Improvements through Degradation Mechanism Studies	881
V.H.2	University of New Mexico: Durability Improvements through Degradation Mechanism Studies	881
V.H.3	Los Alamos National Laboratory: Durability of Low Platinum Fuel Cells Operating at High Power Density	886
V.H.4	Los Alamos National Laboratory: Improved Accelerated Stress Tests Based on Fuel Cell Vehicle Data	890
V.H.5	Los Alamos National Laboratory: Accelerated Testing Validation	895
V.H.6	Los Alamos National Laboratory: Development of Micro-Structural Mitigation Strategies for PEM Fuel Cells: Morphological Simulations and Experimental Approaches	899
V.H.6	University of New Mexico: Development of Micro-Structural Mitigation Strategies for PEM Fuel Cells: Morphological Simulations and Experimental Approaches	899
V.M.2	Los Alamos National Laboratory: Fuel Cell Fundamentals at Low and Subzero Temperatures	948
V.M.3	Los Alamos National Laboratory: Development and Validation of a Two-Phase, Three-dimensional Model for PEM Fuel Cells	952
V.N.2	Los Alamos National Laboratory: Resonance-Stabilized Anion Exchange Polymer Electrolytes	967
V.N.2	Sandia National Laboratories: Resonance-Stabilized Anion Exchange Polymer Electrolytes	967
V.N.3	Los Alamos National Laboratory: Engineered Nano-Scale Ceramic Supports for PEM Fuel Cells	971
V.N.3	University of New Mexico: Engineered Nano-Scale Ceramic Supports for PEM Fuel Cells	971
VI.6	Los Alamos National Laboratory: Cause-and-Effect: Flow Field Plate Manufacturing Variability and its Impact on Performance	1149
IX.4	Los Alamos National Laboratory: Hydrogen Safety Sensors	1319
IX.7	Los Alamos National Laboratory: Hydrogen Fuel Quality	1335
X.11	Los Alamos National Laboratory: VA-MD-DC Hydrogen Education for Decision Makers	1414
X.17	Los Alamos National Laboratory: H <sub>2</sub> Educate – Middle School Hydrogen Education Program	1432

**New York**

II.C.1	Pall Corporation: High-Performance Palladium-Based Membrane for Hydrogen Separation and Purification	57
--------	--	----

**New York (Continued)**

II.D.5	Pall Corporation: Experimental Demonstration of Advanced Palladium Membrane Separators for Central High-Purity Hydrogen Production . . . . .	90
II.F.2	Electrosynthesis Co., Inc.: Solar High-Temperature Water-Splitting Cycle with Quantum Boost . . . . .	120
III.3	Mohawk Innovative Technologies, Inc.: Oil-Free Centrifugal Hydrogen Compression Technology Demonstration . . . . .	263
III.4	Praxair, Inc.: Development of a Centrifugal Hydrogen Pipeline Gas Compressor. . . . .	267
III.5	Praxair, Inc.: Advanced Hydrogen Liquefaction Process . . . . .	274
III.15	ASME Standards and Technologies LLC: Materials Solutions for Hydrogen Delivery in Pipelines . . . . .	318
III.19	Mohawk Innovative Technologies, Inc.: Advanced Sealing Technology for Hydrogen Compression . . . . .	337
IV.A.1e	Brookhaven National Laboratory: Aluminum Hydride Regeneration . . . . .	385
IV.C.1e	Shengbai Zhang: NREL Research as Part of the Hydrogen Sorption Center of Excellence. . . . .	486
IV.C.2	State University of New York, Syracuse: Nanostructured Activated Carbon for Hydrogen Storage. . . . .	506
IV.H.1	SiGNa: NaSi and Na-SG Powder Hydrogen Fuel Cells. . . . .	628
V.B.3	Rochester Institute of Technology: Visualization of Fuel Cell Water Transport and Performance Characterization Under Freezing Conditions . . . . .	716
V.C.4	General Motors Company: Effect of System and Air Contaminants on PEMFC Performance and Durability . . . . .	737
V.D.3	State University of New York, Syracuse: Dimensionally Stable Membranes (DSMs). . . . .	754
V.E.2	Brookhaven National Laboratory: Highly Dispersed Alloy Catalyst for Durability . . . . .	799
V.E.5	Brookhaven National Laboratory: Advanced Cathode Catalysts . . . . .	816
V.E.7	State University of New York, Albany: Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes . . . . .	830
V.E.9	Brookhaven National Laboratory: Contiguous Platinum Monolayer Oxygen Reduction Electrocatalysts on High-Stability Low-Cost Supports . . . . .	841
V.G.3	Plug Power Inc.: Intergovernmental Stationary Fuel Cell System Demonstration . . . . .	870
V.I.2	Delphi Corporation: Solid Oxide Fuel Cell Development for Auxiliary Power in Heavy Duty Vehicle Applications . . . . .	907
V.L.2	State University of New York, Stony Brook: Low-Cost PEM Fuel Cell Metal Bipolar Plates . . . . .	930
V.M.1	Plug Power Inc.: Air-Cooled Stack Freeze Tolerance. . . . .	943
V.P.13	Brookhaven National Laboratory: In-Situ Studies of Active Sites and Mechanism for the Water-Gas Shift Reaction on Metal/Oxide Nanocatalysts . . . . .	1058
V.P.17	Cornell University: Transport Phenomena and Interfacial Kinetics in Planar Microfluidic Membraneless Fuel Cells . . . . .	1072
V.P.19	Columbia University: Nanostructured, Metal-Modified Oxide Catalysts for Steam Reforming of Methanol and the Water-Gas Shift Reactions . . . . .	1078
V.P.23	Brookhaven National Laboratory: Metal- and Metal Oxide-Supported Platinum Monolayer Electrocatalysts for Oxygen Reduction. . . . .	1092
VI.5	Rensselaer Polytechnic Institute: Adaptive Process Controls and Ultrasonics for High Temperature PEM MEA Manufacture . . . . .	1144
VIII.4	General Motors Company: Hydrogen Vehicle and Infrastructure Demonstration and Validation. . . . .	1269
IX.2	American Society of Mechanical Engineers: Component Standard Research and Development . . .	1311
XI.1	MTI Micro Fuel Cells, Inc.: Commercialization Effort for 1 W Consumer Electronics Power Pack . . . . .	1443
XI.3	Plug Power Inc.: Highly Efficient, 5 kW CHP Fuel Cells Demonstrating Durability and Economic Value in Residential and Light Commercial Applications. . . . .	1449

**New York (Continued)**

XI.7	Plug Power Inc.: Accelerating Acceptance of Fuel Cell Backup Power Systems . . . . .	1460
XI.9	Plug Power Inc.: Fuel Cell-Powered Lift Truck FedEx Freight Fleet Deployment . . . . .	1466
XI.10	Plug Power Inc.: Fuel Cell-Powered Lift Truck Sysco Houston Fleet Deployment . . . . .	1468
XI.11	Plug Power Inc.: Fuel Cell-Powered Lift Truck GENCO Fleet Deployment . . . . .	1470

**North Carolina**

II.H.2	North Carolina State University: Biological Systems for Hydrogen Photoproduction . . . . .	198
V.B.2	Techverse: Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization . . . . .	711
V.C.2	John Deere: Fundamental Effects of Impurities on Fuel Cell Performance and Durability . . . . .	727
V.D.4	Scribner Associates, Inc.: Lead Research and Development Activity for DOE's High Temperature, Low Relative Humidity Membrane Program . . . . .	758
VI.2	Volvo Trucks North America: Solid Oxide Fuel Cell Development for Auxiliary Power in Heavy Duty Vehicle Applications . . . . .	907
V.O.7	Microcell Corporation: Martin County Hydrogen Fuel Cell Development . . . . .	1005
IX.1	Russell Hewett: National Codes and Standards Template . . . . .	1307
IX.3	Russell Hewett: Codes and Standards Training and Outreach and Education for Emerging Fuel Cell Technologies . . . . .	1315
X.2	Russell Hewett: Education for Emerging Fuel Cell Technologies . . . . .	1382
X.6	University of North Carolina at Charlotte: Bachelor of Science Engineering Technology Hydrogen and Fuel Cell Program Concentration . . . . .	1396
X.8	Carolina Tractor & Equipment Co. Inc.: Dedicated to The Continued Education, Training and Demonstration of PEM Fuel Cell Powered Lift Trucks In Real-World Applications . . . . .	1404

**North Dakota**

II.B.1	University of North Dakota: A Novel Slurry-Based Biomass Reforming Process . . . . .	46
X.7	University of North Dakota: Development of a Renewable Hydrogen Production and Fuel Cell Education Program . . . . .	1400

**Ohio**

II.A.1	Ohio State University: Investigation of Reaction Networks and Active Sites in Bio-Ethanol Steam Reforming over Co-based Catalysts . . . . .	23
II.C.3	University of Cincinnati: Zeolite Membrane Reactor for Water-Gas Shift Reaction for Hydrogen Production . . . . .	67
II.C.3	Ohio State University: Zeolite Membrane Reactor for Water-Gas Shift Reaction for Hydrogen Production . . . . .	67
II.D.1	Adsorption Research, Inc.: Composite Pd and Alloy Porous Stainless Steel Membranes for Hydrogen Production and Process Intensification . . . . .	74
II.G.10	Xunlight Corporation: Critical Research for Cost-Effective Photoelectrochemical Production of Hydrogen . . . . .	179
II.G.10	University of Toledo: Critical Research for Cost-Effective Photoelectrochemical Production of Hydrogen . . . . .	179
II.J.1	Edison Materials Technology Center: Developing Improved Materials to Support the Hydrogen Economy . . . . .	243
IV.A.1c	Ohio State University: Lightweight Metal Hydrides for Hydrogen Storage . . . . .	371
V.A.6	Battelle: Economic Analysis of Stationary PEM Fuel Cell Systems . . . . .	693
V.D.2	Case Western Reserve University: Membranes and MEAs for Dry, Hot Operating Conditions . . . . .	748
V.D.5	Case Western Reserve University: Poly(p-Phenylene Sulfonic Acids): PEMs with Frozen-In Free Volume . . . . .	761

**Ohio (Continued)**

V.D.6	Wright State University: NanoCapillary Network Proton Conducting Membranes for High Temperature Hydrogen/Air Fuel Cells . . . . .	767
V.D.10	University of Akron: Protic Salt Polymer Membranes: High-Temperature Water-Free Proton-Conducting Membranes . . . . .	786
V.O.3	University of Akron: Development of Kilowatt-Scale Coal-Based Fuel Cell Technology . . . . .	988
V.O.5	Rolls Royce Fuel Cell Systems Inc.: Extended Durability Testing of an External Fuel Processor for SOFC . . . . .	997
V.O.8	Stark State College of Technology: Fuel Cell Balance-of-Plant Reliability Testbed . . . . .	1007
V.O.8	Lockheed Martin-IDT: Fuel Cell Balance-of-Plant Reliability Testbed . . . . .	1007
V.P.3	Case Western Reserve University: Theory, Modeling, and Simulation of Ion Transport in Ionomer Membranes . . . . .	1023
V.P.12	Ohio State University: Investigation of the Oxygen Reduction Reaction Activity of Heteroatom-containing Carbon Nano-structures . . . . .	1055
VI.3	Cincinnati Test Systems: Modular, High-Volume Fuel Cell Leak-Test Suite and Process . . . . .	1135
VI.9	Case Western Reserve University: High-Speed, Low-Cost Fabrication of Gas Diffusion Electrodes for Membrane Electrode Assemblies . . . . .	1162
VIII.7	Battelle: Technology Validation: Fuel Cell Bus Evaluations . . . . .	1280
IX.1	CSA Standards: National Codes and Standards Template . . . . .	1307
IX.3	CSA Standards: Codes and Standards Training and Outreach and Education for Emerging Fuel Cell Technologies . . . . .	1315
IX.8	Powdermet Inc.: Hydrogen Safety Panel . . . . .	1338
X.2	CSA Standards: Education for Emerging Fuel Cell Technologies . . . . .	1382
X.13	Ohio Fuel Cell Coalition: Raising H <sub>2</sub> and Fuel Cell Awareness in Ohio . . . . .	1420
X.13	Edison Materials Technology Center: Raising H <sub>2</sub> and Fuel Cell Awareness in Ohio . . . . .	1420

**Oregon**

V.G.4	IdaTech, LLC: Research and Development for Off-Road Fuel Cell Applications . . . . .	873
II.B.3	ATI Wah Chang: One Step Biomass Gas Reforming-Shift Separation Membrane Reactor . . . . .	54
III.15	Evraz North America: Materials Solutions for Hydrogen Delivery in Pipelines . . . . .	318
IV.B.1b	University of Oregon: Hydrogen Storage by Novel CBN Heterocycle Materials . . . . .	443
IV.D.1a	Oregon State University: Hydrogen Storage Engineering Center of Excellence . . . . .	514
IV.D.1j	Oregon State University: Microscale Enhancement of Heat and Mass Transfer for Hydrogen Energy Storage . . . . .	560

**Pennsylvania**

II.B.3	National Energy Technology Laboratory: One Step Biomass Gas Reforming-Shift Separation Membrane Reactor . . . . .	54
II.B.3	Schott North America: One Step Biomass Gas Reforming-Shift Separation Membrane Reactor . . . . .	54
II.C.2	Media and Process Technology Inc.: Development of Hydrogen Selective Membranes/Modules as Reactors/Separators for Distributed Hydrogen Production . . . . .	62
II.D.2	National Energy Technology Laboratory: Development of Robust Hydrogen Separation Membranes . . . . .	79
II.D.5	Power+Energy, Inc.: Experimental Demonstration of Advanced Palladium Membrane Separators for Central High-Purity Hydrogen Production . . . . .	90
II.E.4	Pennsylvania State University: High-Performance, Low-Cost Hydrogen Generation from Renewable Energy . . . . .	112
II.H.3	Pennsylvania State University: Fermentation and Electrohydrogenic Approaches to Hydrogen Production . . . . .	203



**Pennsylvania (Continued)**

III.14	Air Products and Chemicals, Inc.: Reversible Liquid Carriers for an Integrated Production, Storage and Delivery of Hydrogen . . . . .	314
III.15	Schott North America: Materials Solutions for Hydrogen Delivery in Pipelines . . . . .	318
III.15	Reference Metals Company: Materials Solutions for Hydrogen Delivery in Pipelines . . . . .	318
IV.F.3	Pennsylvania State University: Hydrogen Trapping through Designer Hydrogen Spillover Molecules with Reversible Temperature and Pressure-Induced Switching . . . . .	605
V.D.9	Arkema Inc.: Improved, Low-Cost, Durable Fuel Cell Membranes . . . . .	782
V.J.2	Arkema Inc.: Novel Materials for High Efficiency Direct Methanol Fuel Cells. . . . .	915
V.M.2	Pennsylvania State University: Fuel Cell Fundamentals at Low and Subzero Temperatures . . . . .	948
V.M.3	Pennsylvania State University: Development and Validation of a Two-Phase, Three-dimensional Model for PEM Fuel Cells . . . . .	952
V.M.4	Pennsylvania State University: Transport Studies Enabling Efficiency Optimization of Cost-Competitive Fuel Cell Stacks . . . . .	956
V.O.10	Dynalene Inc.: Fuel Cell Coolant Optimization and Scale Up . . . . .	1015
V.O.10	Lehigh University: Fuel Cell Coolant Optimization and Scale Up . . . . .	1015
V.P.22	University of Pittsburgh: Multiscale Tailoring of Highly Active and Stable Nanocomposite Catalysts for the Production of Clean Hydrogen Streams. . . . .	1088
V.P.27	Lehigh University: Porous and Glued Ultrathin Membranes. . . . .	1106
V.P.28	University of Pennsylvania: The Development of Nano-Composite Electrodes for Solid Oxide Electrolyzers. . . . .	1109
VI.2	Pennsylvania State University: Reduction in Fabrication Costs of Gas Diffusion Layers . . . . .	1131
VIII.5	Air Products and Chemicals, Inc.: Validation of an Integrated Hydrogen Energy Station . . . . .	1273
VIII.6	Air Products and Chemicals, Inc.: California Hydrogen Infrastructure Project. . . . .	1277
IX.1	SAE International: National Codes and Standards Template . . . . .	1307
IX.1	Bethlehem Hydrogen: National Codes and Standards Template . . . . .	1307
IX.2	SAE International: Component Standard Research and Development . . . . .	1311
IX.3	SAE International: Codes and Standards Training and Outreach and Education for Emerging Fuel Cell Technologies. . . . .	1315
IX.3	Bethlehem Hydrogen: Codes and Standards Training and Outreach and Education for Emerging Fuel Cell Technologies. . . . .	1315
IX.8	Air Products and Chemicals, Inc.: Hydrogen Safety Panel . . . . .	1338
X.2	SAE International: Education for Emerging Fuel Cell Technologies . . . . .	1382
X.2	Bethlehem Hydrogen: Education for Emerging Fuel Cell Technologies. . . . .	1382
XI.6	Air Products and Chemicals, Inc.: PEM Fuel Cell Systems Providing Back-Up Power to Commercial Cellular Towers and an Electric Utility Communications Network . . . . .	1456
XI.9	Air Products and Chemicals, Inc.: Fuel Cell-Powered Lift Truck FedEx Freight Fleet Deployment. . . . .	1466
XI.10	Air Products and Chemicals, Inc.: Fuel Cell-Powered Lift Truck Sysco Houston Fleet Deployment. . . . .	1468
XI.11	GENCO: Fuel Cell-Powered Lift Truck GENCO Fleet Deployment . . . . .	1470
XI.11	Air Products and Chemicals, Inc.: Fuel Cell-Powered Lift Truck GENCO Fleet Deployment. . . . .	1470
XI.12	Air Products and Chemicals, Inc.: Demonstrating Economic and Operational Viability of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications on the Sprint Nextel Network. . . . .	1472

**Rhode Island**

V.E.8	Brown University: Nanosegregated Cathode Alloy Catalysts with Ultra-Low Platinum Loading . . . . .	835
-------	--	-----

**South Carolina**

III.9	Savannah River National Laboratory: Fiber Reinforced Composite Pipelines . . . . .	293
IV.A.1g	Savannah River National Laboratory: Electrochemical Reversible Formation of Alane . . . . .	394
IV.A.1k	Savannah River National Laboratory: Li-Mg-N Hydrogen Storage Materials . . . . .	413
IV.D.1a	Savannah River National Laboratory: Hydrogen Storage Engineering Center of Excellence . . . . .	514
IV.D.1h	Savannah River National Laboratory: SRNL Technical Work Scope for the Hydrogen Storage Engineering Center of Excellence . . . . .	551
IV.E.3	Savannah River National Laboratory: Fundamental Reactivity Testing and Analysis of Hydrogen Storage Materials . . . . .	576
V.C.2	Clemson University: Fundamental Effects of Impurities on Fuel Cell Performance and Durability . . . . .	727
V.C.2	Savannah River National Laboratory: Fundamental Effects of Impurities on Fuel Cell Performance and Durability . . . . .	727
V.C.4	University of South Carolina: Effect of System and Air Contaminants on PEMFC Performance and Durability . . . . .	737
V.M.5	University of South Carolina: Transport Studies and Modeling in PEM Fuel Cells . . . . .	960
V.O.1	Clemson University: Center for Fundamental and Applied Research in Nanostructured and Lightweight Materials . . . . .	978
V.O.6	University of South Carolina: Hydrogen Fuel Cell Development in Columbia (SC) . . . . .	1001
V.P.1	Clemson University: Fluoropolymers, Electrolytes, Composites and Electrodes . . . . .	1018
IX.1	University of South Carolina Research Foundation: National Codes and Standards Template . . . . .	1307
IX.3	University of South Carolina Research Foundation: Codes and Standards Training and Outreach and Education for Emerging Fuel Cell Technologies . . . . .	1315
X.2	University of South Carolina Research Foundation: Education for Emerging Fuel Cell Technologies . . . . .	1382
X.10	South Carolina Hydrogen and Fuel Cell Alliance: Development of Hydrogen Education Programs for Government Officials . . . . .	1411
X.10	Greenway Energy: Development of Hydrogen Education Programs for Government Officials . . . . .	1411

**Tennessee**

II.C.1	Oak Ridge National Laboratory: High-Performance Palladium-Based Membrane for Hydrogen Separation and Purification . . . . .	57
II.D.3	Eastman Chemical Company: Scale Up of Hydrogen Transport Membranes for IGCC and FutureGen Plants . . . . .	82
III.11	Oak Ridge National Laboratory: Composite Technology for Hydrogen Pipelines . . . . .	302
III.15	Advanced Technology Corporation: Materials Solutions for Hydrogen Delivery in Pipelines . . . . .	318
III.17	Oak Ridge National Laboratory: Hydrogen Permeability and Integrity of Steel Welds . . . . .	326
III.21	Oak Ridge National Laboratory: Range Optimization for Fuel Cell Vehicles . . . . .	344
IV.A.1i	Oak Ridge National Laboratory: Metal Borohydrides, Ammines, and Aluminum Hydrides as Hydrogen Storage Materials . . . . .	404
IV.G.2	Oak Ridge National Laboratory: Lifecycle Verification of Polymeric Storage Liners . . . . .	619
IV.G.3	Oak Ridge National Laboratory: High Strength Carbon Fibers . . . . .	622
V.A.4	Oak Ridge National Laboratory: Characterization of Fuel Cell Materials . . . . .	680
V.B.1	Oak Ridge National Laboratory: Water Transport Exploratory Studies . . . . .	706
V.B.1	University of Tennessee: Water Transport Exploratory Studies . . . . .	706
V.D.2	University of Tennessee: Membranes and MEAs for Dry, Hot Operating Conditions . . . . .	748
V.D.6	Vanderbilt University: NanoCapillary Network Proton Conducting Membranes for High Temperature Hydrogen/Air Fuel Cells . . . . .	767
V.D.9	Oak Ridge National Laboratory: Improved, Low-Cost, Durable Fuel Cell Membranes . . . . .	782

**Tennessee (Continued)**

V.E.3	Oak Ridge National Laboratory: Development of Alternative and Durable High Performance Cathode Supports for PEM Fuel Cells . . . . .	805
V.E.4	Oak Ridge National Laboratory: Non-Platinum Bimetallic Cathode Electrocatalysts . . . . .	811
V.E.5	Oak Ridge National Laboratory: Advanced Cathode Catalysts. . . . .	816
V.E.6	Oak Ridge National Laboratory: Durable Catalysts for Fuel Cell Protection during Transient Conditions. . . . .	825
V.E.7	Oak Ridge National Laboratory: Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes . . . . .	830
V.E.7	University of Tennessee: Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes . . . . .	830
V.E.8	Oak Ridge National Laboratory: Nanosegregated Cathode Alloy Catalysts with Ultra-Low Platinum Loading . . . . .	835
V.H.2	Oak Ridge National Laboratory: Durability Improvements through Degradation Mechanism Studies . . . . .	881
V.H.4	Oak Ridge National Laboratory: Improved Accelerated Stress Tests Based on Fuel Cell Vehicle Data . . . . .	890
V.H.5	Oak Ridge National Laboratory: Accelerated Testing Validation . . . . .	895
V.L.1	Oak Ridge National Laboratory: Nitrided Metallic Bipolar Plates . . . . .	925
V.N.3	Oak Ridge National Laboratory: Engineered Nano-Scale Ceramic Supports for PEM Fuel Cells. . . . .	971
V.P.4	University of Tennessee: The Study of Proton Transport Using Reactive Molecular Dynamics . . . .	1027
V.P.5	Vanderbilt University: Surface-Directed Fabrication of Integrated Membrane-Electrode Interfaces. . . . .	1029
VI.4	University of Tennessee: Manufacturing of Low-Cost, Durable Membrane Electrode Assemblies Engineered for Rapid Conditioning. . . . .	1139
VII.4	Oak Ridge National Laboratory: HyTrans Model: Analyzing the Potential for Stationary Fuel Cells to Augment Hydrogen Availability in the Transition to Hydrogen Vehicles . . . . .	1187
VII.4	University of Tennessee: HyTrans Model: Analyzing the Potential for Stationary Fuel Cells to Augment Hydrogen Availability in the Transition to Hydrogen Vehicles . . . . .	1187
VII.4	Econotech, LLC: HyTrans Model: Analyzing the Potential for Stationary Fuel Cells to Augment Hydrogen Availability in the Transition to Hydrogen Vehicles . . . . .	1187
IX.15	Oak Ridge National Laboratory: Optically Read MEMS Hydrogen Sensor . . . . .	1366
V.P.31	University of Tennessee: The Dielectric Response of Hydrated PFSA membranes – Measurements with Single Post Dielectric Resonators . . . . .	1118

**Texas**

II.D.4	Southwest Research Institute®: Amorphous Alloy Membranes for High Temperature Hydrogen Separation . . . . .	86
III.6	Lynntech, Inc.: Design, Optimization and Fabrication of a Home Hydrogen Fueling System . . . . .	232
III.4	Texas A&M University: Development of a Centrifugal Hydrogen Pipeline Gas Compressor. . . . .	267
IV.C.1b	Texas A&M University: A Biomimetic Approach to Metal-Organic Frameworks with High H <sub>2</sub> Uptake . . . . .	468
IV.H.1	University of Texas: NaSi and Na-SG Powder Hydrogen Fuel Cells . . . . .	628
IV.I.1	Southwest Research Institute®: Standardized Testing Program for Solid-State Hydrogen Storage Technologies . . . . .	647
V.B.1	University of Texas at Austin: Water Transport Exploratory Studies . . . . .	706
V.B.2	BCS Fuel Cells: Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization . . . . .	711
V.E.2	Texas A&M University: Highly Dispersed Alloy Catalyst for Durability . . . . .	799

**Texas (Continued)**

V.E.7	University of Texas at Austin: Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes . . . . .	830
V.H.1	University of Texas at Austin: Polymer Electrolyte Fuel Cell Lifetime Limitations: The Role of Electrocatalyst Degradation . . . . .	876
V.P.20	Texas Tech University: Strategies for Probing Nanometer-Scale Electrocatalysts: From Single Particles to Catalyst-Membrane Architectures. . . . .	1081
V.P.24	University of Houston: Development and Mechanistic Characterization of Alloy Fuel Cell Catalysts. . . . .	1095
V.P.25	Texas A&M University: Metal dissolution mechanisms in Pt-based alloys: Ideas for advanced PEM cathode design . . . . .	1099
VIII.2	Chevron Technology Ventures LLC: Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project . . . . .	1261
VIII.10	Texas H2 Coalition: Texas Hydrogen Highway. . . . .	1291
VIII.10	University of Texas at Austin: Texas Hydrogen Highway. . . . .	1291
VIII.10	Houston Advanced Research Center: Texas Hydrogen Highway . . . . .	1291
IX.8	William C. Fort: Hydrogen Safety Panel . . . . .	1338
X.9	Houston Advanced Research Center: Hydrogen Education in Texas . . . . .	1408
X.9	Texas H2 Coalition: Hydrogen Education in Texas . . . . .	1408
XI.10	Sysco of Houston: Fuel Cell-Powered Lift Truck Sysco Houston Fleet Deployment . . . . .	1468

**Utah**

II.E.1	HyPerComp Engineering, Inc.: High-Capacity, High-Pressure Electrolysis System with Renewable Power Sources. . . . .	99
II.I.8	Materials and Systems Research, Inc.: Development of a Hydrogen Home Fueling System . . . . .	240
V.P.26	University of Utah: Mechanism of Proton Transport in Proton Exchange Membranes: Insights from Computer Simulation . . . . .	1103

**Vermont**

II.D.5	Metal Hydride Technologies, Inc.: Experimental Demonstration of Advanced Palladium Membrane Separators for Central High-Purity Hydrogen Production . . . . .	90
X.15	Clean Energy States Alliance: Hydrogen Education State Partnership Program. . . . .	1426

**Virginia**

II.A.5	Directed Technologies, Inc.: Distributed Reforming of Renewable Liquids Using Oxygen Transport Membranes . . . . .	42
II.E.2	Virginia Polytechnic Institute and State University: PEM Electrolyzer Incorporating an Advanced Low-Cost Membrane . . . . .	103
II.I.3	Directed Technologies, Inc.: Aqueous Phase Base-Facilitated Reforming (BFR) of Renewable Fuels. . . . .	220
IV.G.3	Virginia Polytechnic Institute and State University: High Strength Carbon Fibers . . . . .	622
V.A.2	Directed Technologies, Inc.: Mass-Production Cost Estimation for Automotive Fuel Cell Systems . . . . .	667
V.D.9	Virginia Polytechnic Institute and State University: Improved, Low-Cost, Durable Fuel Cell Membranes . . . . .	782
V.L.4	Virginia Polytechnic Institute and State University: Low-Cost Durable Seals for PEMFCs. . . . .	939
V.M.5	Virginia Polytechnic Institute and State University: Transport Studies and Modeling in PEM Fuel Cells. . . . .	960
V.P.10	University of Virginia: Theoretical Insights Into Active and Durable Oxygen Reduction Catalysts. . . . .	1048
VII.10	Directed Technologies, Inc.: Macro System Model. . . . .	1213

**Virginia (Continued)**

X.11	Commonwealth of Virginia: VA-MD-DC Hydrogen Education for Decision Makers . . . . .	1414
X.17	National Energy Education Development Project: H <sub>2</sub> Educate – Middle School Hydrogen Education Program . . . . .	1432
XI.12	Sprint Nextel: Demonstrating Economic and Operational Viability of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications on the Sprint Nextel Network . . . . .	1472

**Washington**

II.A.2	Pacific Northwest National Laboratory: Distributed Hydrogen Production from Biomass Reforming . . . . .	29
III.6	Prometheus Energy: Active Magnetic Regenerative Liquefier . . . . .	278
III.14	Pacific Northwest National Laboratory: Reversible Liquid Carriers for an Integrated Production, Storage and Delivery of Hydrogen . . . . .	314
III.15	DGS Metallurgical Solutions, Inc: Materials Solutions for Hydrogen Delivery in Pipelines . . . . .	318
IV.B.1d	Pacific Northwest National Laboratory: Chemical Hydrogen Storage Research at PNNL . . . . .	453
IV.D.1a	Pacific Northwest National Laboratory: Hydrogen Storage Engineering Center of Excellence . . . . .	514
IV.D.1b	Pacific Northwest National Laboratory: Systems Engineering of Chemical Hydride, Pressure Vessel, and Balance of Plant for On-Board Hydrogen Storage . . . . .	519
V.E.3	Pacific Northwest National Laboratory: Development of Alternative and Durable High Performance Cathode Supports for PEM Fuel Cells . . . . .	805
V.I.2	PACCAR, Inc.: Solid Oxide Fuel Cell Development for Auxiliary Power in Heavy Duty Vehicle Applications . . . . .	907
V.P.14	Pacific Northwest National Laboratory: Bio-Inspired Molecular Catalysts for Hydrogen Oxidation and Hydrogen Production . . . . .	1062
V.P.29	Pacific Northwest National Laboratory: Charge Transfer, Transport, and Reactivity in Complex Molecular Environments: Theoretical Studies for the Hydrogen Fuel Initiative . . . . .	1112
VI.3	Pacific Northwest National Laboratory: Modular, High-Volume Fuel Cell Leak-Test Suite and Process . . . . .	1135
VI.10	Boeing Research and Technology: Development of Advanced Manufacturing Technologies for Low Cost Hydrogen Storage Vessels . . . . .	1165
VII.13	Pacific Northwest National Laboratory: Pathways to Commercial Success: Technologies and Products Supported by the FCT Program . . . . .	1228
IX.6	Pacific Northwest National Laboratory: Hydrogen Safety Knowledge Tools . . . . .	1332
IX.8	Pacific Northwest National Laboratory: Hydrogen Safety Panel . . . . .	1338
IX.13	Pacific Northwest National Laboratory: Hydrogen Safety Training for First Responders . . . . .	1360
IX.13	Volpentest HAMMER Training and Education Center: Hydrogen Safety Training for First Responders . . . . .	1360
X.1	Pacific Northwest National Laboratory: Hydrogen Safety Training for First Responders . . . . .	1379
X.1	Volpentest HAMMER Training and Education Center: Hydrogen Safety Training for First Responders . . . . .	1379
XI.2	PACCAR, Inc.: Solid Oxide Fuel Cell Diesel Auxiliary Power Unit Demonstration . . . . .	1446
XI.6	ReliOn, Inc.: PEM Fuel Cell Systems Providing Back-Up Power to Commercial Cellular Towers and an Electric Utility Communications Network . . . . .	1456
XI.12	ReliOn, Inc.: Demonstrating Economic and Operational Viability of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications on the Sprint Nextel Network . . . . .	1472

**Washington D.C.**

V.P.11	Georgetown University: An in situ Electrode-Potential-Controlled Nuclear Magnetic Resonance Investigation of Sulfur-Poisoning Effect on Pt-Based Mono- and Bi-metallic Nanoscale Electrocatalysts . . . . .	1051
--------	---	------



**Washington, D.C. (Continued)**

VII.4	ICF, International: HyTrans Model: Analyzing the Potential for Stationary Fuel Cells to Augment Hydrogen Availability in the Transition to Hydrogen Vehicles . . . . .	1187
VII.12	Brookhaven National Laboratory: CO2 Reduction Benefits Analysis for Fuel Cell Applications . . . . .	1223
X.14	Technology Transition Corporation: H2L3: Hydrogen Learning for Local Leaders . . . . .	1422
X.14	Public Technology Institute: H2L3: Hydrogen Learning for Local Leaders . . . . .	1422

**Wisconsin**

V.H.1	University of Wisconsin, Madison: Polymer Electrolyte Fuel Cell Lifetime Limitations: The Role of Electrocatalyst Degradation . . . . .	876
V.P.6	University of Wisconsin, Madison: Activity and Stability of Nanoscale Pt-based Catalysts . . . . .	1033
V.P.21	University of Wisconsin, Madison: Atomic-scale Design of a New Class of Alloy Catalysts for Reactions Involving Hydrogen: A Theoretical and Experimental Approach. . . . .	1084

**Wyoming**

II.D.4	Western Research Institute: Amorphous Alloy Membranes for High Temperature Hydrogen Separation . . . . .	86
II.J.2	University of Wyoming: Purdue Hydrogen Systems Laboratory: Hydrogen Production. . . . .	245
IV.H.2	University of Wyoming: Purdue Hydrogen Systems Laboratory: Hydrogen Storage. . . . .	632

**Foreign Countries****Canada**

IV.A.1b	University of New Brunswick: Fundamental Studies of Advanced High-Capacity, Reversible Metal Hydrides . . . . .	364
IV.D.1a	University of Québec: Hydrogen Storage Engineering Center of Excellence. . . . .	514
IV.D.1c	HSM Systems, Inc.: Advancement of Systems Designs and Key Engineering Technologies for Materials-Based Hydrogen Storage. . . . .	524
IV.D.1h	Université du Québec à Trois-Rivières: SRNL Technical Work Scope for the Hydrogen Storage Engineering Center of Excellence . . . . .	551
V.B.2	Ballard Power Systems: Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization . . . . .	711
V.B.2	University of Victoria: Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization . . . . .	711
V.E.1	Dalhousie University: Advanced Cathode Catalysts and Supports for PEM Fuel Cells . . . . .	790
V.E.3	AFCC Automotive Fuel Cell Cooperation Corporation: Development of Alternative and Durable High Performance Cathode Supports for PEM Fuel Cells . . . . .	805
V.E.6	Dalhousie University: Durable Catalysts for Fuel Cell Protection during Transient Conditions . . . . .	825
V.H.2	Ballard Power Systems: Durability Improvements through Degradation Mechanism Studies . . . . .	881
V.H.5	Ballard Power Systems: Accelerated Testing Validation. . . . .	895
V.H.6	Ballard Power Systems: Development of Micro-Structural Mitigation Strategies for PEM Fuel Cells: Morphological Simulations and Experimental Approaches. . . . .	899
V.H.6	Queen's University: Development of Micro-Structural Mitigation Strategies for PEM Fuel Cells: Morphological Simulations and Experimental Approaches. . . . .	899
V.K.2	dPoint Technologies, Inc.: Materials and Modules for Low-Cost, High-Performance Fuel Cell Humidifiers . . . . .	922
V.M.1	Ballard Power Systems: Air-Cooled Stack Freeze Tolerance . . . . .	943
V.M.3	Ballard Power Systems: Development and Validation of a Two-Phase, Three-dimensional Model for PEM Fuel Cells. . . . .	952
VI.2	Ballard Power Systems: Reduction in Fabrication Costs of Gas Diffusion Layers. . . . .	1131

**Canada (Continued)**

- X.8 Hydrogenics: Dedicated to The Continued Education, Training and Demonstration of PEM Fuel Cell Powered Lift Trucks In Real-World Applications .....1404

**Germany**

- IV.D.1a BASF GmbH: Hydrogen Storage Engineering Center of Excellence ..... 514
- IV.D.1g BASF-SE: Ford/BASF-SE/UM Activities in Support of the Hydrogen Storage Engineering Center of Excellence. .... 546
- V.B.1 SGL Technologies GmbH: Water Transport Exploratory Studies. .... 706
- V.B.2 SGL Carbon: Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization ..... 711
- V.F.1 SGL Carbon: CIRRUS: Cell Ice Regulation & Removal Upon Start-Up ..... 857
- VIII.3 Daimler: Hydrogen to the Highways ..... 1264

**Greece**

- IV.C.1e Thanos Stubos: NREL Research as Part of the Hydrogen Sorption Center of Excellence ..... 486

**Japan**

- III.3 Mitsubishi Heavy Industries, Ltd: Oil-Free Centrifugal Hydrogen Compression Technology Demonstration ..... 263

**Portugal**

- IV.G.3 Fibras Sinteticas de Portugal, SA: High Strength Carbon Fibers ..... 622

**Russia**

- II.H.2 Institute of Basic Biological Problems: Biological Systems for Hydrogen Photoproduction ..... 198

**South Korea**

- VIII.2 Hyundai Motor Company: Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project ..... 1261
- VIII.2 Kia Motors Corporation: Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project ..... 1261

**UK**

- II.E.2 Parker Hannifin Ltd: PEM Electrolyzer Incorporating an Advanced Low-Cost Membrane ..... 103
- V.D.9 Johnson-Matthey Fuel Cells: Improved, Low-Cost, Durable Fuel Cell Membranes ..... 782
- V.E.2 Johnson-Matthey Fuel Cells: Highly Dispersed Alloy Catalyst for Durability ..... 799
- V.E.9 Johnson Matthey Fuel Cells: Contiguous Platinum Monolayer Oxygen Reduction Electrocatalysts on High-Stability Low-Cost Supports ..... 841
- V.H.1 Johnson Matthey Fuel Cells: Polymer Electrolyte Fuel Cell Lifetime Limitations: The Role of Electrocatalyst Degradation ..... 876
- V.J.3 Johnson Matthey Fuel Cells: New MEA Materials for Improved DMFC Performance, Durability, and Cost ..... 917
- V.M.4 Johnson Matthey Fuel Cells: Transport Studies Enabling Efficiency Optimization of Cost-Competitive Fuel Cell Stacks ..... 956