# XVIII. Project Listings by Organization


**3M Company**

II.D.5 Low-Cost Large-Scale PEM Electrolysis for Renewable Energy Storage . . . . . II-46
V.D.1 Advanced Cathode Catalysts and Supports for PEM Fuel Cells . . . . . V-84
V.D.3 Durable Catalysts for Fuel Cell Protection during Transient Conditions . . . . . V-100
V.D.5 Nanosegregated Cathode Catalysts with Ultra-Low Platinum Loading . . . . . V-111
V.F.2 Fuel Cell Fundamentals at Low and Subzero Temperatures . . . . . V-211

**Acumentrics Corporation**

V.J.2 Development of a Low-Cost 3-10 kW Tubular SOFC Power System . . . . . V-277

**Addison Bain**

VIII.10 Hydrogen Safety Panel . . . . . VIII-45

**Advanced Technology International**

IX.1 Development of Hydrogen Education Programs for Government Officials . . . . . IX-7
X.4 Landfill Gas-to-Hydrogen . . . . . XI-1

**Air Products and Chemicals, Inc.**

VII.2 Validation of an Integrated Hydrogen Energy Station . . . . . VII-18
VII.4 California Hydrogen Infrastructure Project . . . . . VII-26
VIII.10 Hydrogen Safety Panel . . . . . VIII-45
XII.2 Demonstrating Economic and Operational Viability of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications on the Sprint Nextel Network . . . . . XII-12
XII.4 Fuel Cell-Powered Lift Truck FedEx Freight Fleet Deployment . . . . . XII-21
XII.5 Fuel Cell-Powered Lift Truck Sysco Houston Fleet Deployment . . . . . XII-24
XII.6 GENCO Fuel Cell-Powered Lift Truck Fleet Deployment . . . . . XII-28

**Altergy Systems**

XII.2 Demonstrating Economic and Operational Viability of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications on the Sprint Nextel Network . . . . . XII-12

**Ames Laboratory**

IV.H.11 Complex Hydrides - A New Frontier for Future Energy Applications . . . . . IV-245

**Argonne National Laboratory**

II.E.2 Membrane/Electrolyzer Development in the Cu-Cl Thermochemical Cycle . . . . . II-56
III.2 Hydrogen Delivery Infrastructure Analysis . . . . . III-13
IV.E.1 System Level Analysis of Hydrogen Storage Options . . . . . IV-164
IV.H.7 New Pathways and Metrics for Enhanced, Reversible Hydrogen Storage in Boron-Doped Carbon Nanospaces . . . . . IV-233
V.A.4 Performance of Automotive Fuel Cell Systems with Low-Pt Nanostructured Thin Film Catalysts at High Power Densities . . . . . V-25
V.D.1 Advanced Cathode Catalysts and Supports for PEM Fuel Cells . . . . . V-84
V.D.5 Nanosegregated Cathode Catalysts with Ultra-Low Platinum Loading . . . . . V-111
V.E.1 Polymer Electrolyte Fuel Cell Lifetime Limitations: The Role of Electrocatalyst Degradation . . . . . V-168
V.E.2 Durability Improvements through Degradation Mechanism Studies . . . . . V-175

**Argonne National Laboratory (Continued)**

V.E.3 Durability of Low Platinum Fuel Cells Operating at High Power Density . . . . . V-182
XI.2 Life-Cycle Analysis of Vehicle and Fuel Systems with the GREET Model . . . . . XI-15
XI.11 Employment Impacts of Early Markets for Hydrogen and Fuel Cell Technologies . . . . . XI-52

**Arizona State University**

VI.3 Adaptive Process Controls and Ultrasonics for High-Temperature PEM MEA Manufacture . . . . . VI-17

**Arkema Inc.**

V.G.1 Novel Materials for High Efficiency Direct Methanol Fuel Cells . . . . . V-242

**ATI Wah Chang**

II.B.1 One Step Biomass Gas Reforming-Shift Separation Membrane Reactor . . . . . II-19

**Automotive Fuel Cell Cooperation**

V.D.3 Durable Catalysts for Fuel Cell Protection during Transient Conditions . . . . . V-100
V.D.15 Development of Alternative and Durable High Performance Cathode Supports for PEM Fuel Cells . . . . . V-162

**Ballard Fuel Cells**

V.D.7 The Science and Engineering of Durable Ultralow PGM Catalysts . . . . . V-121

**Ballard Material Products, Inc.**

V.F.6 Transport in PEMFC Stacks . . . . . V-230

**Ballard Power Systems**

V.A.10 A Total Cost of Ownership Model for Design and Manufacturing Optimization of Fuel Cells in Stationary and Emerging Market Applications . . . . . V-53
V.B.2 The Effect of Airborne Contaminants on Fuel Cell Performance and Durability . . . . . V-63
V.E.2 Durability Improvements through Degradation Mechanism Studies . . . . . V-175
V.E.5 Accelerated Testing Validation . . . . . V-190
V.E.6 Development of Micro-Structural Mitigation Strategies for PEM Fuel Cells: Morphological Simulations and Experimental Approaches . . . . . V-195
V.F.1 Air-Cooled Stack Freeze Tolerance . . . . . V-206
V.F.3 Development and Validation of a Two-Phase, Three-Dimensional Model for PEM Fuel Cells . . . . . V-217
V.F.5 Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization . . . . . V-226

**BASF Fuel Cell**

V.D.11 Development of Novel Non-PGM Electrocatalysts for Proton Exchange Membrane Fuel Cell Applications . . . . . V-143
VI.5 High Speed, Low Cost Fabrication of Gas Diffusion Electrodes for Membrane Electrode Assemblies . . . . . VI-28

**BASF-SE**

IV.D.8 Ford/BASF SE/UM Activities in Support of the Hydrogen Storage Engineering Center of Excellence . . . . . IV-151

**Battelle**

V.A.9 Stationery and Emerging Market Fuel Cell System Cost Analysis . . . . . V-51
VII.3 Technology Validation: Fuel Cell Bus Evaluations . . . . . VII-22

**BCS Fuel Cells**

V.F.5 Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization. . . . . V-226

**Becht Engineering**

VIII.10 Hydrogen Safety Panel . . . . . VIII-45

**Ben C. Gerwick Inc.**

III.3 Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage . . . . . III-17

**Big-D Construction**

XII.5 Fuel Cell-Powered Lift Truck Sysco Houston Fleet Deployment . . . . . XII-24

**Bing Energy, Inc.**

VII.6 Florida Hydrogen Initiative (FHI) . . . . . VII-33

**Black & Veatch Corporation**

XII.2 Demonstrating Economic and Operational Viability of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications on the Sprint Nextel Network . . . . . XII-12

**Board of Trustees of the Leland Stanford Junior University**

II.F.1 Directed Nano-Scale and Macro-Scale Architectures for Semiconductor Absorbers and Transparent Conducting Substrates for Photoelectrochemical Water Splitting . . . . . II-68

**Boeing Research and Technology**

VI.6 Development of Advanced Manufacturing Technologies for Low Cost Hydrogen Storage Vessels . . . . . VI-31

**Brookhaven National Laboratory**

IV.A.5 Aluminum Hydride . . . . . IV-31

IV.H.12 Atomistic Transport Mechanisms in Aluminum-Based Hydrides . . . . . IV-249

V.D.2 Highly Dispersed Alloy Catalyst for Durability . . . . . V-95

V.D.6 Contiguous Platinum Monolayer Oxygen Reduction Electrocatalysts on High-Stability Low-Cost Supports. . . . . V-117

V.G.3 Advanced Materials and Concepts for Portable Power Fuel Cells . . . . . V-250

**Brown University**

V.D.5 Nanosegregated Cathode Catalysts with Ultra-Low Platinum Loading . . . . . V-111

**Bucknell University**

II.E.3 Solar Hydrogen Production with a Metal Oxide-Based Thermochemical Cycle . . . . . II-60

**Burns & McDonnell Engineering Co., Inc.**

XII.2 Demonstrating Economic and Operational Viability of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications on the Sprint Nextel Network . . . . . XII-12

**California Fuel Cell Partnership**

VIII.12 Hydrogen Emergency Response Training for First Responders . . . . . VIII-52

**California Institute of Technology**

IV.D.1 Hydrogen Storage Engineering Center of Excellence . . . . . IV-114

**California Institute of Technology (Continued)**

IV.D.4 Key Technologies, Thermal Management, and Prototype Testing for Advanced Solid-State Hydrogen Storage Systems . . . . . IV-129

**California State University, Los Angeles**

VII.7 Sustainable Hydrogen Fueling Station, California State University, Los Angeles . . . . . VII-38

**Carnegie Institute of Washington**

IV.H.8 Novel Molecular Materials for Hydrogen Storage Applications . . . . . IV-236

**Case Western Reserve University**

VI.5 High Speed, Low Cost Fabrication of Gas Diffusion Electrodes for Membrane Electrode Assemblies . . . . . VI-28

**CFD Research Corporation**

V.F.5 Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization. . . . . V-226

**City of Santa Fe Springs**

VIII.10 Hydrogen Safety Panel . . . . . VIII-45

**ClearEdge Power**

X.2 Fuel Cell Combined Heat and Power Industrial Demonstration . . . . . X-10

XII.7 Highly Efficient, 5-kW CHP Fuel Cells Demonstrating Durability and Economic Value in Residential and Light Commercial Applications . . . . . XII-30

**Colorado School of Mines**

IV.H.9 Metastability of Clathrate Hydrates for Energy Storage . . . . . IV-239

V.B.1 Effect of System Contaminants on PEMFC Performance and Durability . . . . . V-57

V.D.9 Tungsten Oxide and Heteropoly Acid Based System for Ultra-High Activity and Stability of Pt Catalysts in PEM Fuel Cell Cathodes . . . . . V-133

V.K.3 Biomass Fuel Cell Systems . . . . . V-305

**Concepts NREC**

III.7 Development of a Centrifugal Hydrogen Pipeline Gas Compressor. . . . . III-35

**Connecticut Center for Advanced Technology, Inc.**

IX.4 State and Local Government Partnership . . . . . IX-16

**CSA Standards**

VIII.6 National Codes and Standards Coordination. . . . . VIII-28

**Dalhousie University**

V.D.1 Advanced Cathode Catalysts and Supports for PEM Fuel Cells . . . . . V-84

V.D.3 Durable Catalysts for Fuel Cell Protection during Transient Conditions . . . . . V-100

**Delaware State University**

IV.A.7 Hydrogen Storage Materials for Fuel Cell-Powered Vehicles . . . . . IV-39

**Delphi Automotive Systems, LLC**

XII.1 Solid Oxide Fuel Cell Diesel Auxiliary Power Unit Demonstration. . . . . XII-9

**dPoint Technologies, Inc.**
V.I.1 Materials and Modules for Low-Cost, High-Performance Fuel Cell Humidifiers . . . . . V-261

**Dynalene Inc.**
V.I.2 Large Scale Testing, Demonstration and Commercialization of the Nanoparticle-Based Fuel Cell Coolant (SBIR Phase III) . . . . . V-266

**E. I. du Pont de Nemours and Company**
V.E.7 Analysis of Durability of MEAs in Automotive PEMFC Applications . . . . . V-201

**Edison Material Technology Center**
IX.2 Raising H2 and Fuel Cell Awareness in Ohio . . . . . IX-11

**Electricore, Inc.**
XII.1 Solid Oxide Fuel Cell Diesel Auxiliary Power Unit Demonstration. . . . . XII-9

**Electrolytic Technologies Corporation**
VII.6 Florida Hydrogen Initiative (FHI) . . . . . VII-33

**Electrosynthesis Co. Inc.**
II.E.1 Solar High-Temperature Water Splitting Cycle with Quantum Boost . . . . . II-49

**EnerFuels, Inc.**
VII.6 Florida Hydrogen Initiative (FHI) . . . . . VII-33

**Energetics, Inc.**
VIII.10 Hydrogen Safety Panel. . . . . VIII-45

**Engineering, Procurement & Construction**
III.11 LLNL/Linde 875 bar Liquid Hydrogen Pump for High Density Cryogenic Vessel Refueling . . . . . III-51

**Entegris, Inc.**
II.D.2 High Performance, Low Cost Hydrogen Generation from Renewable Energy . . . . . II-35

**Ericsson Services, Inc.**
XII.2 Demonstrating Economic and Operational Viability of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications on the Sprint Nextel Network . . . . . XII-12

**ESI US R&D**
V.F.5 Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization. . . . . V-226

**FedEx Freight**
XII.4 Fuel Cell-Powered Lift Truck FedEx Freight Fleet Deployment. . . . . XII-21

**Fibras Sinteticas de Portugal, SA**
IV.F.1 High Strength Carbon Fibers . . . . . IV-191

**Firexplo**
VIII.10 Hydrogen Safety Panel. . . . . VIII-45

**Florida Atlantic University**
VII.6 Florida Hydrogen Initiative (FHI) . . . . . VII-33

**Florida Institute of Technology**
VII.6 Florida Hydrogen Initiative (FHI) . . . . . VII-33

**Florida International University**
IV.H.19 Influence of Pressure on Physical Property of Ammonia Borane and its Re-Hydrogenation . . . . . IV-274

**Florida Solar Energy Center**
VII.6 Florida Hydrogen Initiative (FHI) . . . . . VII-33

**Florida State University**
VII.6 Florida Hydrogen Initiative (FHI) . . . . . VII-33

**Ford Motor Company**
IV.D.1 Hydrogen Storage Engineering Center of Excellence . . . . . IV-114
IV.D.8 Ford/BASF SE/UM Activities in Support of the Hydrogen Storage Engineering Center of Excellence . . . . . IV-151
V.H.1 Low-Cost PEM Fuel Cell Metal Bipolar Plates . . . . . V-257

**FP2 Fire Protection Engineering**
VIII.6 National Codes and Standards Coordination. . . . . VIII-28

**FuelCell Energy, Inc.**
III.9 Electrochemical Hydrogen Compressor . . . . . III-44
V.C.3 High-Temperature Membrane with Humidification-Independent Cluster Structure . . . . . V-76
VII.2 Validation of an Integrated Hydrogen Energy Station . . . . . VII-18

**Gas Technology Institute**
II.B.1 One Step Biomass Gas Reforming-Shift Separation Membrane Reactor. . . . . II-19
II.E.2 Membrane/Electrolyzer Development in the Cu-Cl Thermochemical Cycle . . . . . II-56
V.H.1 Low-Cost PEM Fuel Cell Metal Bipolar Plates . . . . . V-257

**GENCO Infrastructure Solutions**
XII.6 GENCO Fuel Cell-Powered Lift Truck Fleet Deployment . . . . . XII-28

**General Motors Company**
IV.C.8 Hydrogen Storage in Metal-Organic Frameworks. . . . . IV-97
IV.D.1 Hydrogen Storage Engineering Center of Excellence . . . . . IV-114
IV.D.7 Thermal Management of Onboard Cryogenic Hydrogen Storage Systems . . . . . IV-147
V.B.1 Effect of System Contaminants on PEMFC Performance and Durability . . . . . V-57
V.C.4 Corrugated Membrane Fuel Cell Structures . . . . . V-80
V.D.1 Advanced Cathode Catalysts and Supports for PEM Fuel Cells. . . . . V-84
V.D.12 High-Activity Dealloyed Catalysts . . . . . V-149
V.F.7 Investigation of Micro- and Macro-Scale Transport Processes for Improved Fuel Cell Performance. . . . . V-235
VIII.10 Hydrogen Safety Panel. . . . . VIII-45
VII.7 Sustainable Hydrogen Fueling Station, California State University, Los Angeles. . . . . VII-38

**George Washington University**
V.D.12 High-Activity Dealloyed Catalysts . . . . . V-149

**Georgia Institute of Technology**
V.E.6 Development of Micro-Structural Mitigation Strategies for PEM Fuel Cells: Morphological Simulations and Experimental Approaches . . . . . V-195

**Giner Electrochemical Systems, LLC**
II.D.1 PEM Electrolyzer Incorporating an Advanced Low-Cost Membrane . . . . . II-31
II.H.1 Unitized Design for Home Refueling Appliance for Hydrogen Generation to 5,000 psi . . . . . II-122
V.C.2 Dimensionally Stable High Performance Membrane (SBIR Phase III) . . . . . V-71
V.F.6 Transport in PEMFC Stacks . . . . . V-230

**Global Engineering and Technology**
III.3 Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage . . . . . III-17

**Graftech International Holdings Inc.**
V.C.4 Corrugated Membrane Fuel Cell Structures . . . . . V-80

**Greenway Energy**
IX.1 Development of Hydrogen Education Programs for Government Officials . . . . . IX-7

**GWS Solutions of Tolland, LLC**
VIII.6 National Codes and Standards Coordination . . . . . VIII-28
VIII.10 Hydrogen Safety Panel . . . . . VIII-45

**H2 Technology Consulting LLC**
IV.C.6 Weak Chemisorption Validation . . . . . IV-89
IV.C.11 Hydrogen Sorbent Measurement Qualification and Characterization . . . . . IV-109
IV.E.2 Best Practices for Characterizing Engineering Properties of Hydrogen Storage Materials . . . . . IV-170

**H2Pump, LLC**
II.C.2 Process Intensification of Hydrogen Unit Operations Using an Electrochemical Device . . . . . II-28

**Hanford Fire Department**
VIII.12 Hydrogen Emergency Response Training for First Responders . . . . . VIII-52

**Hawaii Hydrogen Carriers, LLC**
IV.B.4 Development of a Practical Hydrogen Storage System Based on Liquid Organic Hydrogen Carriers and a Homogeneous Catalyst . . . . . IV-55

**Hawaii Natural Energy Institute**
V.B.2 The Effect of Airborne Contaminants on Fuel Cell Performance and Durability . . . . . V-63
VII.5 Hawaii Hydrogen Power Park . . . . . VII-30
X.1 Hydrogen Energy Systems as a Grid Management Tool . . . . . X-7

**Hazardous Materials Management and Emergency Response Training and Eduction Center**
VIII.12 Hydrogen Emergency Response Training for First Responders . . . . . VIII-52

**HRL Laboratories, LLC**
IV.C.7 Room Temperature Hydrogen Storage in Nano-Confined Liquids . . . . . IV-95

**Humboldt State University**
IX.3 Hydrogen Technology and Energy Curriculum (HyTEC) . . . . . IX-13

**HyGen Industries**
III.7 Development of a Centrifugal Hydrogen Pipeline Gas Compressor . . . . . III-35

**IBIS Associates, Inc.**
V.H.1 Low-Cost PEM Fuel Cell Metal Bipolar Plates . . . . . V-257

**IdaTech, LLC**
V.J.5 Research and Development for Off-Road Fuel Cell Applications . . . . . V-289
XII.8 Accelerating Acceptance of Fuel Cell Backup Power Systems . . . . . XII-34

**IDC Energy Insights**
XI.3 Hydrogen Refueling Infrastructure Cost Analysis . . . . . XI-19

**Illinois Institute of Technology**
V.D.10 Synthesis and Characterization of Mixed-Conducting Corrosion Resistant Oxide Supports . . . . . V-138
V.E.7 Analysis of Durability of MEAs in Automotive PEMFC Applications . . . . . V-201
V.G.1 Novel Materials for High Efficiency Direct Methanol Fuel Cells . . . . . V-242

**InnovaTek**
V.J.4 Power Generation from an Integrated Biomass Reformer and Solid Oxide Fuel Cell (SBIR Phase III) . . . . . V-285

**Institut de Chimie et des Matériaux**
IV.C.6 Weak Chemisorption Validation . . . . . IV-89

**Institute of Basic Biological Problems**
II.G.1 Biological Systems for Hydrogen Photoproduction . . . . . II-103

**Intelligent Energy**
V.J.1 Development and Demonstration of a New-Generation High Efficiency 10-kW Stationary Fuel Cell System . . . . . V-272

**Ion Power Inc.**
V.C.4 Corrugated Membrane Fuel Cell Structures . . . . . V-80
V.E.2 Durability Improvements through Degradation Mechanism Studies . . . . . V-175
V.E.5 Accelerated Testing Validation . . . . . V-190

**J. Craig Venter Institute**
II.G.3 Hydrogen from Water in a Novel Recombinant Oxygen-Tolerant Cyanobacterial System . . . . . II-113

**Jet Propulsion Laboratory**
IV.D.1 Hydrogen Storage Engineering Center of Excellence . . . . . IV-114
IV.D.4 Key Technologies, Thermal Management, and Prototype Testing for Advanced Solid-State Hydrogen Storage Systems . . . . . IV-129
V.D.1 Advanced Cathode Catalysts and Supports for PEM Fuel Cells . . . . . V-84
V.D.5 Nanosegregated Cathode Catalysts with Ultra-Low Platinum Loading . . . . . V-111

**Johns Hopkins University**

II.G.1 Biological Systems for Hydrogen Photoproduction . . . . . II-103

**Johnson Matthey Fuel Cells**

V.D.2 Highly Dispersed Alloy Catalyst for Durability . . . . . V-95

V.D.6 Contiguous Platinum Monolayer Oxygen Reduction Electrocatalysts on High-Stability Low-Cost Supports . . . . . V-117

V.D.12 High-Activity Dealloyed Catalysts . . . . . V-149

V.E.1 Polymer Electrolyte Fuel Cell Lifetime Limitations: The Role of Electrocatalyst Degradation . . . . . V-168

V.F.4 Transport Studies Enabling Efficiency Optimization of Cost-Competitive Fuel Cell Stacks . . . . . V-222

V.G.2 New MEA Materials for Improved Direct Methanol Fuel Cell (DMFC) Performance, Durability, and Cost . . . . . V-246

V.G.3 Advanced Materials and Concepts for Portable Power Fuel Cells . . . . . V-250

**Kelvin Hecht**

VIII.6 National Codes and Standards Coordination . . . . . VIII-28

**Lawrence Berkeley National Laboratory**

IV.C.8 Hydrogen Storage in Metal-Organic Frameworks . . . . . IV-97

V.A.10 A Total Cost of Ownership Model for Design and Manufacturing Optimization of Fuel Cells in Stationary and Emerging Market Applications . . . . . V-53

V.D.8 Molecular-Scale, Three-Dimensional Non-Platinum Group Metal Electrodes for Catalysis of Fuel Cell Reactions . . . . . V-126

V.E.2 Durability Improvements through Degradation Mechanism Studies . . . . . V-175

V.E.5 Accelerated Testing Validation . . . . . V-190

V.F.2 Fuel Cell Fundamentals at Low and Subzero Temperatures . . . . . V-211

V.F.4 Transport Studies Enabling Efficiency Optimization of Cost-Competitive Fuel Cell Stacks . . . . . V-222

**Lawrence Livermore National Laboratory**

II.F.3 Characterization and Optimization of Photoelectrode Surfaces for Solar-to-Chemical Fuel Conversion . . . . . II-79

III.4 Failure Analysis, Permeation, and Toughness of Glass Fiber Composite Pressure Vessels for Inexpensive Delivery of Cold Hydrogen . . . . . III-22

III.11 LLNL/Linde 875 bar Liquid Hydrogen Pump for High Density Cryogenic Vessel Refueling . . . . . III-51

**Lincoln Composites, Inc.**

III.6 Development of High Pressure Hydrogen Storage Tank for Storage and Gaseous Truck Delivery . . . . . III-32

IV.D.1 Hydrogen Storage Engineering Center of Excellence . . . . . IV-114

IV.D.10 Development of Improved Composite Pressure Vessels for Hydrogen Storage . . . . . IV-160

**Linde LLC**

III.11 LLNL/Linde 875 bar Liquid Hydrogen Pump for High Density Cryogenic Vessel Refueling . . . . . III-51

**Linde North America**

XII.6 GENCO Fuel Cell-Powered Lift Truck Fleet Deployment . . . . . XII-28

**Los Alamos National Laboratory**

IV.B.2 Fluid Phase Chemical Hydrogen Storage Materials . . . . . IV-48

IV.D.1 Hydrogen Storage Engineering Center of Excellence . . . . . IV-114

IV.D.3 Chemical Hydride Rate Modeling, Validation, and System Demonstration . . . . . IV-126

**Los Alamos National Laboratory (Continued)**


V.A.7 Technical Assistance to Developers. . . . . V-43
V.B.1 Effect of System Contaminants on PEMFC Performance and Durability . . . . . V-57
V.D.4 Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes. . . . . V-107
V.D.7 The Science and Engineering of Durable Ultralow PGM Catalysts . . . . . V-121
V.D.11 Development of Novel Non-PGM Electrocatalysts for Proton Exchange Membrane Fuel Cell Applications . . . . . V-143
V.E.2 Durability Improvements through Degradation Mechanism Studies . . . . . V-175
V.E.3 Durability of Low Platinum Fuel Cells Operating at High Power Density. . . . . V-182
V.E.4 Improved Accelerated Stress Tests Based on Fuel Cell Vehicle Data. . . . . V-186
V.E.5 Accelerated Testing Validation . . . . . V-190
V.E.6 Development of Micro-Structural Mitigation Strategies for PEM Fuel Cells: Morphological Simulations and Experimental Approaches. . . . . V-195
V.F.2 Fuel Cell Fundamentals at Low and Subzero Temperatures . . . . . V-211
V.F.3 Development and Validation of a Two-Phase, Three-Dimensional Model for PEM Fuel Cells . . . . . V-217
V.G.3 Advanced Materials and Concepts for Portable Power Fuel Cells . . . . . V-250
VI.7 Cause and Effect: Flow Field Plate Manufacturing Variability and its Impact on Performance . . . . . VI-36
VIII.8 Leak Detection and H2 Sensor Development for Hydrogen Applications . . . . . VIII-36
VIII.9 Hydrogen Fuel Quality Research and Development . . . . . VIII-42
XI.1 Infrastructure Analysis of Early Market Transition of Fuel Cell Vehicles . . . . . XI-11


**Massachusetts Institute of Technology**


V.D.6 Contiguous Platinum Monolayer Oxygen Reduction Electrocatalysts on High-Stability Low-Cost Supports. . . . . V-117
V.D.12 High-Activity Dealloyed Catalysts . . . . . V-149
V.E.1 Polymer Electrolyte Fuel Cell Lifetime Limitations: The Role of Electrocatalyst Degradation . . . . . V-168


**Max Planck Institute**


IV.C.6 Weak Chemisorption Validation . . . . . IV-89


**Media and Process Technology Inc.**


II.C.1 Development of Hydrogen Selective Membranes/Modules as Reactors/Separators for Distributed Hydrogen Production . . . . . II-23


**MegaStir Technologies**


III.3 Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage . . . . . III-17


**Michigan State University**


V.D.11 Development of Novel Non-PGM Electrocatalysts for Proton Exchange Membrane Fuel Cell Applications V-143


**Michigan Technological University**


V.E.6 Development of Micro-Structural Mitigation Strategies for PEM Fuel Cells: Morphological Simulations and Experimental Approaches. . . . . V-195


**Midwest Optoelectronics, LLC**


II.F.6 Critical Research for Cost-Effective Photoelectrochemical Production of Hydrogen . . . . . II-93


**Midwest Research Institute**


IV.C.3 Multiply Surface-Functionalized Nanoporous Carbon for Vehicular Hydrogen Storage. . . . . IV-72

**Mitsubishi Compressor Company**

III.8 Oil-Free Centrifugal Hydrogen Compression Technology Demonstration. . . . . III-40

**Mohawk Innovative Technologies, Inc.**

III.8 Oil-Free Centrifugal Hydrogen Compression Technology Demonstration. . . . . III-40

**MorEvents**

VIII.6 National Codes and Standards Coordination. . . . . VIII-28

VIII.7 Codes and Standards Outreach for Emerging Fuel Cell Technologies . . . . . VIII-33

**MVSystems, Incorporated**

II.F.5 Photoelectrochemical Hydrogen Production . . . . . II-89

**National Energy Technology Laboratory**

II.B.1 One Step Biomass Gas Reforming-Shift Separation Membrane Reactor. . . . . II-19

**National Fuel Cell Research Center**

VII.4 California Hydrogen Infrastructure Project . . . . . .VII-26

**National Institute of Standards and Technology**

IV.C.8 Hydrogen Storage in Metal-Organic Frameworks. . . . . IV-97

IV.E.3 Neutron Characterization in Support of the DOE Hydrogen Storage Sub-Program . . . . . .IV-176

V.A.6 Neutron Imaging Study of the Water Transport in Operating Fuel Cells . . . . . V-37

VI.4 Non-Contact Sensor Evaluation for Bipolar Plate Manufacturing Process Control and Smart Assembly of Fuel Cell Stacks . . . . . VI-24

VI.7 Cause and Effect: Flow Field Plate Manufacturing Variability and its Impact on Performance . . . . . VI-36

VI.8 Optical Scatterfield Metrology for Online Catalyst Coating Inspection of PEM (Fuel Cell) Soft Goods . . . . VI-41

**National Renewable Energy Laboratory**

II.A.2 Distributed Bio-Oil Reforming . . . . . II-15

II.D.3 Renewable Electrolysis Integrated Systems Development and Testing . . . . . II-39

II.D.4 Hour-by-Hour Cost Modeling of Optimized Central Wind-Based Water Electrolysis Production . . . . . II-43

II.F.2 Semiconductor Materials for Photoelectrolysis. . . . . II-74

II.F.6 Critical Research for Cost-Effective Photoelectrochemical Production of Hydrogen . . . . . II-93

II.G.1 Biological Systems for Hydrogen Photoproduction. . . . . II-103

II.G.2 Fermentation and Electrohydrogenic Approaches to Hydrogen Production. . . . . II-108

IV.C.6 Weak Chemisorption Validation . . . . . IV-89

IV.C.11 Hydrogen Sorbent Measurement Qualification and Characterization . . . . . IV-109

IV.D.1 Hydrogen Storage Engineering Center of Excellence . . . . . .IV-114

IV.D.2 System Design, Analysis, Modeling, and Media Engineering Properties for Hydrogen Energy Storage . . . .IV-119

V.A.1 Analysis of Laboratory Fuel Cell Technology Status – Voltage Degradation . . . . . V-11

V.A.8 Enlarging the Potential Market for Stationary Fuel Cells Through System Design Optimization . . . . . V-47

V.B.1 Effect of System Contaminants on PEMFC Performance and Durability . . . . . V-57

V.D.4 Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes. . . . . V-107

V.D.9 Tungsten Oxide and Heteropoly Acid Based System for Ultra-High Activity and Stability of Pt Catalysts in PEM Fuel Cell Cathodes . . . . . V-133

V.D.14 High Aspect Ratio Nano-Structured Pt-based PEM Fuel Cell Catalysts (EERE Post-Doc Fellowship) . . . . . V-159

VI.1 Fuel Cell Membrane Electrode Assembly Manufacturing R&D . . . . . VI-7

**National Renewable Energy Laboratory (Continued)**


VII.1 Controlled Hydrogen Fleet and Infrastructure Analysis . . . VII-11
VII.3 Technology Validation: Fuel Cell Bus Evaluations . . . VII-22
VII.8 Renewable Electrolysis Integrated System Development and Testing . . . VII-40
VII.9 Stationary Fuel Cell Evaluation . . . VII-44
VII.10 Next Generation H2 Station Analysis . . . VII-46
VIII.3 Component Standard Research and Development . . . VIII-18
VIII.6 National Codes and Standards Coordination . . . VIII-28
VIII.7 Codes and Standards Outreach for Emerging Fuel Cell Technologies . . . VIII-33
X.3 Direct Methanol Fuel Cell Material Handling Equipment Demonstration . . . X-15
XI.1 Infrastructure Analysis of Early Market Transition of Fuel Cell Vehicles . . . XI-11
XI.3 Hydrogen Refueling Infrastructure Cost Analysis . . . XI-19
XI.4 Comparing Infrastructure Costs for Hydrogen and Electricity . . . XI-23
XI.5 Infrastructure Costs Associated with Central Hydrogen Production from Biomass and Coal . . . XI-27
XI.7 Effects of Technology Cost Parameters on Hydrogen Pathway Succession . . . XI-35
XI.9 Resource Analysis for Hydrogen Production . . . XI-43
XI.10 Cost, Energy Use, and Emissions of Tri-Generation Systems . . . XI-47
XII.3 Analysis Results for ARRA Projects: Enabling Fuel Cell Market Transformation . . . XII-16


**Nissan Technical Center**


V.D.10 Synthesis and Characterization of Mixed-Conducting Corrosion Resistant Oxide Supports . . . V-138
V.D.11 Development of Novel Non-PGM Electrocatalysts for Proton Exchange Membrane Fuel Cell Applications . . . V-143
V.E.7 Analysis of Durability of MEAs in Automotive PEMFC Applications . . . V-201


**Northeastern University**


V.D.11 Development of Novel Non-PGM Electrocatalysts for Proton Exchange Membrane Fuel Cell Applications . . . V-143
V.D.12 High-Activity Dealloyed Catalysts . . . V-149
V.G.2 New MEA Materials for Improved Direct Methanol Fuel Cell (DMFC) Performance, Durability, and Cost . . . V-246
IV.A.1 Efficient Discovery of Novel Multicomponent Mixtures for Hydrogen Storage: A Combined Computational/Experimental Approach . . . IV-11
IV.C.4 New Carbon-Based Porous Materials with Increased Heats of Adsorption for Hydrogen Storage . . . IV-78
IV.C.10 Metal- and Cluster-Modified Ultrahigh-Area Materials for the Ambient Temperature Storage of Molecular Hydrogen . . . IV-105
IV.H.13 Theory of Hydrogen Storage in Complex Hydrides . . . IV-253


**Nuvera Fuel Cells, Inc.**


V.E.3 Durability of Low Platinum Fuel Cells Operating at High Power Density . . . V-182
V.F.4 Transport Studies Enabling Efficiency Optimization of Cost-Competitive Fuel Cell Stacks . . . V-222


**Oak Ridge National Laboratory**


II.D.2 High Performance, Low Cost Hydrogen Generation from Renewable Energy . . . II-35
III.3 Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage . . . III-17
III.10 Composite Technology for Hydrogen Pipelines . . . III-47
IV.C.9 The Quantum Effects of Pore Structure on Hydrogen Adsorption . . . IV-100

**Oak Ridge National Laboratory (Continued)**

IV.F.1 High Strength Carbon Fibers . . . . . IV-191
IV.F.2 Lifecycle Verification of Polymeric Storage Tank Liners . . . . . IV-197
IV.F.3 Development of Low-Cost, High Strength Commercial Textile Precursor (PAN-MA) . . . . . IV-200
IV.H.4 Atomistic Mechanisms of Metal-Assisted Hydrogen Storage in Nanostructured Carbons . . . . . IV-220
IV.H.7 New Pathways and Metrics for Enhanced, Reversible Hydrogen Storage in Boron-Doped Carbon Nanospaces . . . . . IV-233
V.A.5 Characterization of Fuel Cell Materials . . . . . V-32
V.D.3 Durable Catalysts for Fuel Cell Protection during Transient Conditions . . . . . V-100
V.D.4 Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes . . . . . V-107
V.D.5 Nanosegregated Cathode Catalysts with Ultra-Low Platinum Loading . . . . . V-111
V.E.2 Durability Improvements through Degradation Mechanism Studies . . . . . V-175
V.E.4 Improved Accelerated Stress Tests Based on Fuel Cell Vehicle Data . . . . . V-186
V.E.5 Accelerated Testing Validation . . . . . V-190
V.G.3 Advanced Materials and Concepts for Portable Power Fuel Cells . . . . . V-250
XI.6 Sensitivity Analysis of H2-Vehicles' Market Prospects, Costs and Benefits . . . . . XI-31
XI.8 Impact of DOE Program Goals on Hydrogen Vehicles: Market Prospect, Costs, and Benefits . . . . . XI-39

**Ohio Fuel Cell Coalition**

IX.2 Raising H2 and Fuel Cell Awareness in Ohio . . . . . IX-11

**Ohio State University**

IV.A.3 Lightweight Metal Hydrides for Hydrogen Storage . . . . . IV-22

**Oorja Protonics, Inc.**

X.3 Direct Methanol Fuel Cell Material Handling Equipment Demonstration . . . . . X-15

**Oregon State University**

IV.D.1 Hydrogen Storage Engineering Center of Excellence . . . . . IV-114
IV.D.9 Microscale Enhancement of Heat and Mass Transfer for Hydrogen Energy Storage . . . . . IV-156

**PACCAR, Inc.**

XII.1 Solid Oxide Fuel Cell Diesel Auxiliary Power Unit Demonstration . . . . . XII-9

**Pacific Northwest National Laboratory**

II.A.1 Biomass-Derived Liquids Distributed (Aqueous Phase) Reforming . . . . . II-11
IV.D.1 Hydrogen Storage Engineering Center of Excellence . . . . . IV-114
IV.D.5 Systems Engineering of Chemical Hydride, Pressure Vessel, and Balance of Plant for Onboard Hydrogen Storage . . . . . IV-134
IV.E.5 Early Market TRL/MRL Analysis . . . . . IV-186
IV.F.4 Synergistically Enhanced Materials and Design Parameters for Reducing the Cost of Hydrogen Storage Tanks . . . . . IV-205
IV.H.16 Activation of Hydrogen with Bi-Functional Ambiphillic Catalyst Complexes . . . . . IV-263
V.D.15 Development of Alternative and Durable High Performance Cathode Supports for PEM Fuel Cells . . . . . V-162
VI.6 Development of Advanced Manufacturing Technologies for Low Cost Hydrogen Storage Vessels . . . . . VI-31
VIII.10 Hydrogen Safety Panel . . . . . VIII-45
VIII.11 Hydrogen Safety Knowledge Tools . . . . . VIII-49
VIII.12 Hydrogen Emergency Response Training for First Responders . . . . . VIII-52

**Pacific Northwest National Laboratory (Continued)**

X.2 Fuel Cell Combined Heat and Power Industrial Demonstration . . . . . X-10
XII.3 Analysis Results for ARRA Projects: Enabling Fuel Cell Market Transformation . . . . . XII-16

**Parker Hannifin Ltd domnick hunter Division**

II.D.1 PEM Electrolyzer Incorporating an Advanced Low-Cost Membrane . . . . . II-31

**PBI Performance Products, Inc.**

II.C.2 Process Intensification of Hydrogen Unit Operations Using an Electrochemical Device . . . . . II-28

**Pennsylvania State University**

II.D.2 High Performance, Low Cost Hydrogen Generation from Renewable Energy . . . . . II-35
II.E.2 Membrane/Electrolyzer Development in the Cu-Cl Thermochemical Cycle . . . . . II-56
II.G.2 Fermentation and Electrohydrogenic Approaches to Hydrogen Production. . . . . II-108
IV.C.5 Hydrogen Trapping through Designer Hydrogen Spillover Molecules with Reversible Temperature and Pressure-Induced Switching . . . . . IV-82
IV.H.10 Exploration of Novel Carbon-Hydrogen Interactions . . . . . IV-243
V.F.2 Fuel Cell Fundamentals at Low and Subzero Temperatures . . . . . V-211
V.F.3 Development and Validation of a Two-Phase, Three-Dimensional Model for PEM Fuel Cells . . . . . V-217
V.F.4 Transport Studies Enabling Efficiency Optimization of Cost-Competitive Fuel Cell Stacks . . . . . V-222
V.F.7 Investigation of Micro- and Macro-Scale Transport Processes for Improved Fuel Cell Performance. . . . . V-235

**Plug Power Inc.**

V.F.1 Air-Cooled Stack Freeze Tolerance . . . . . V-206
XII.4 Fuel Cell-Powered Lift Truck FedEx Freight Fleet Deployment. . . . . XII-21
XII.5 Fuel Cell-Powered Lift Truck Sysco Houston Fleet Deployment . . . . . XII-24
XII.6 GENCO Fuel Cell-Powered Lift Truck Fleet Deployment . . . . . XII-28
XII.7 Highly Efficient, 5-kW CHP Fuel Cells Demonstrating Durability and Economic Value in Residential and Light Commercial Applications . . . . . XII-30
XII.8 Accelerating Acceptance of Fuel Cell Backup Power Systems. . . . . XII-34

**Powdermet Inc.**

VIII.10 Hydrogen Safety Panel. . . . . VIII-45

**Proton Energy Systems**

II.H.2 Hydrogen by Wire - Home Fueling System. . . . . II-126

**Proton OnSite**

II.D.2 High Performance, Low Cost Hydrogen Generation from Renewable Energy . . . . . II-35
II.D.5 Low-Cost Large-Scale PEM Electrolysis for Renewable Energy Storage . . . . . II-46

**Protonex Inc.**

V.I.2 Large Scale Testing, Demonstration and Commercialization of the Nanoparticle-Based Fuel Cell Coolant (SBIR Phase III) . . . . . V-266

**Quantum Fuel Systems Technologies Worldwide, Inc.**

VI.6 Development of Advanced Manufacturing Technologies for Low Cost Hydrogen Storage Vessels . . . . . VI-31

**Queen's University**

V.E.6 Development of Micro-Structural Mitigation Strategies for PEM Fuel Cells: Morphological Simulations and Experimental Approaches . . . V-195

**RCF Economic and Financial Consulting, Inc.**

XI.11 Employment Impacts of Early Markets for Hydrogen and Fuel Cell Technologies . . . XI-52

**ReliOn, Inc.**

XII.2 Demonstrating Economic and Operational Viability of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications on the Sprint Nextel Network . . . XII-12

**Rensselaer Polytechnic Institute**

VI.3 Adaptive Process Controls and Ultrasonics for High-Temperature PEM MEA Manufacture . . . VI-17

**Rochester Institute of Technology**

V.F.7 Investigation of Micro- and Macro-Scale Transport Processes for Improved Fuel Cell Performance . . . V-235

**Rutgers University**

IV.C.5 Hydrogen Trapping through Designer Hydrogen Spillover Molecules with Reversible Temperature and Pressure-Induced Switching . . . IV-82

IV.H.2 Novel theoretical and experimental approaches for understanding and optimizing hydrogen-sorbent interactions in metal organic framework materials . . . IV-213

**SAE International**

VIII.3 Component Standard Research and Development . . . VIII-18

VIII.6 National Codes and Standards Coordination . . . VIII-28

**Sandia National Laboratories**

II.E.3 Solar Hydrogen Production with a Metal Oxide-Based Thermochemical Cycle . . . II-60

III.1 Hydrogen Embrittlement of Structural Steels . . . III-9

V.F.3 Development and Validation of a Two-Phase, Three-Dimensional Model for PEM Fuel Cells . . . V-217

VIII.1 Hydrogen Safety, Codes and Standards R&D – Release Behavior . . . VIII-9

VIII.2 Risk-Informed Safety Requirements for H2 Codes and Standards Development . . . VIII-15

VIII.4 Hydrogen Materials and Components Compatibility . . . VIII-22

VIII.5 Component Testing for Industrial Trucks and Early Market Applications . . . VIII-25

**Savannah River National Laboratory**

III.5 Fiber Reinforced Composite Pipeline . . . III-27

IV.A.6 Electrochemical Reversible Formation of Alane . . . IV-35

IV.D.1 Hydrogen Storage Engineering Center of Excellence . . . IV-114

IV.H.5 Elucidation of Hydrogen Interaction Mechanisms with Metal-Doped Carbon Nanostructures . . . IV-226

**Schott North America**

II.B.1 One Step Biomass Gas Reforming-Shift Separation Membrane Reactor . . . II-19

**Science Applications International Corporation**

II.E.1 Solar High-Temperature Water Splitting Cycle with Quantum Boost . . . II-49

**Scribner Associates, Inc.**

V.C.1 Lead Research and Development Activity for DOE's High Temperature, Low Relative Humidity Membrane Program . . . V-68

**SFC Energy**

V.G.3 Advanced Materials and Concepts for Portable Power Fuel Cells . . . V-250

**SGL Carbon**

V.F.5 Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization. . . . V-226

**Sloane Solutions**

VIII.6 National Codes and Standards Coordination. . . . VIII-28

**South Carolina Hydrogen and Fuel Cell Alliance**

IX.1 Development of Hydrogen Education Programs for Government Officials . . . IX-7

X.4 Landfill Gas-to-Hydrogen . . . XI-1

**Spectrum Automation Controls**

II.D.3 Renewable Electrolysis Integrated Systems Development and Testing . . . II-39

VII.8 Renewable Electrolysis Integrated Systems Development and Testing . . . VII-40

**Spencer Composites Corporation**

III.4 Failure Analysis, Permeation, and Toughness of Glass Fiber Composite Pressure Vessels for Inexpensive Delivery of Cold Hydrogen . . . III-22

**Sprint Nextel**

XII.2 Demonstrating Economic and Operational Viability of 72-Hour Hydrogen PEM Fuel Cell Systems to Support Emergency Communications on the Sprint Nextel Network . . . XII-12

**SRT Group, Inc.**

VII.6 Florida Hydrogen Initiative (FHI) . . . VII-33

**Stanford University**

II.F.1 Directed Nano-Scale and Macro-Scale Architectures for Semiconductor Absorbers and Transparent Conducting Substrates for Photoelectrochemical Water Splitting . . . II-68

II.F.2 Semiconductor Materials for Photoelectrolysis . . . II-74

IV.H.19 Influence of Pressure on Physical Property of Ammonia Borane and its Re-Hydrogenation . . . IV-274

V.D.4 Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes. . . . V-107

**State University of New York, Albany**

V.D.4 Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes. . . . V-107

**State University of New York, Stony Brook**

V.H.1 Low-Cost PEM Fuel Cell Metal Bipolar Plates . . . V-257

**Steele Consulting**

VIII.6 National Codes and Standards Coordination. . . . VIII-28

**Strategic Analysis, Inc.**

IV.E.4 Hydrogen Storage Cost Analysis, Preliminary Results. . . . IV-182

**Strategic Analysis, Inc. (Continued)**
V.A.2 Mass-Production Cost Estimation for Automotive Fuel Cell Systems . . . . . V-16
V.A.3 Stationary Fuel Cell System Cost Analysis . . . . . V-20
XI.7 Effects of Technology Cost Parameters on Hydrogen Pathway Succession . . . . . XI-35

**Sustainable Innovations, LLC**
III.9 Electrochemical Hydrogen Compressor . . . . . III-44

**Sysco of Houston**
XII.5 Fuel Cell-Powered Lift Truck Sysco Houston Fleet Deployment . . . . . XII-24

**TDA Research, Inc.**
XII.1 Solid Oxide Fuel Cell Diesel Auxiliary Power Unit Demonstration . . . . . XII-9

**Tech-Etch**
V.F.6 Transport in PEMFC Stacks . . . . . V-230

**Technical University Berlin**
V.D.12 High-Activity Dealloyed Catalysts . . . . . V-149

**Techverse**
V.F.5 Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization. . . . . V-226

**Tetramer Technologies, LLC**
V.I.3 New High Performance Water Vapor Membranes to Improve Fuel Cell Balance of Plant Efficiency and Lower Costs (SBIR Phase I) . . . . . V-270

**Texas A&M University**
III.7 Development of a Centrifugal Hydrogen Pipeline Gas Compressor . . . . . III-35
IV.C.1 A Biomimetic Approach to Metal-Organic Frameworks with High H2 Uptake . . . . . IV-60
V.D.2 Highly Dispersed Alloy Catalyst for Durability . . . . . V-95

**The Toro Company**
V.J.5 Research and Development for Off-Road Fuel Cell Applications . . . . . V-289

**Thermochemical Engineering Solutions**
II.E.1 Solar High-Temperature Water Splitting Cycle with Quantum Boost . . . . . II-49

**TIAX, LLC**
XI.4 Comparing Infrastructure Costs for Hydrogen and Electricity . . . . . XI-23

**TreadStone Technologies, Inc.**
V.H.1 Low-Cost PEM Fuel Cell Metal Bipolar Plates . . . . . V-257

**United Technologies Research Center**
IV.D.1 Hydrogen Storage Engineering Center of Excellence . . . . . IV-114
IV.D.6 Advancement of Systems Designs and Key Engineering Technologies for Materials-Based Hydrogen Storage . . . . . IV-140
V.E.1 Polymer Electrolyte Fuel Cell Lifetime Limitations: The Role of Electrocatalyst Degradation . . . . . V-168
V.E.4 Improved Accelerated Stress Tests Based on Fuel Cell Vehicle Data . . . . . V-186

**United Technologies Research Center (Continued)**

V.F.2 Fuel Cell Fundamentals at Low and Subzero Temperatures . . . . . V-211

**Université Aix-Marseille**

IV.H.7 New Pathways and Metrics for Enhanced, Reversible Hydrogen Storage in Boron-Doped Carbon Nanospaces . . . . . IV-233

**Université du Québec à Trois-Rivières**

IV.D.1 Hydrogen Storage Engineering Center of Excellence . . . . . IV-114

**University Montpellier 2**

IV.H.7 New Pathways and Metrics for Enhanced, Reversible Hydrogen Storage in Boron-Doped Carbon Nanospaces . . . . . IV-233

**University of Akron**

V.K.1 Development of Kilowatt-Scale Coal Fuel Cell Technology . . . . . V-295

**University of California, Berkeley**

II.G.4 Maximizing Light Utilization Efficiency and Hydrogen Production in Microalgal Cultures . . . . . II-118

V.A.10 A Total Cost of Ownership Model for Design and Manufacturing Optimization of Fuel Cells in Stationary and Emerging Market Applications . . . . . V-53

IX.3 Hydrogen Technology and Energy Curriculum (HyTEC) . . . . . IX-13

**University of California, Davis**

IV.H.17 Heavy Cycloadditions: Reactions of Diagailene with Cyclic Polyolefins . . . . . IV-267

V.J.5 Research and Development for Off-Road Fuel Cell Applications . . . . . V-289

**University of California, Irvine**

V.A.8 Enlarging the Potential Market for Stationary Fuel Cells Through System Design Optimization . . . . . V-47

VII.4 California Hydrogen Infrastructure Project . . . . . VII-26

**University of California, Los Angeles**

IV.C.2 A Joint Theory and Experimental Project in the Synthesis and Testing of Porous COFs for Onboard Vehicular Hydrogen Storage . . . . . IV-67

IV.H.13 Theory of Hydrogen Storage in Complex Hydrides . . . . . IV-253

**University of California, Riverside**

IV.H.6 Synthetic Design of New Metal-Organic Framework Materials for Hydrogen Storage . . . . . IV-229

V.D.7 The Science and Engineering of Durable Ultralow PGM Catalysts . . . . . V-121

**University of California, San Diego**

II.E.1 Solar High-Temperature Water Splitting Cycle with Quantum Boost . . . . . II-49

**University of California, Santa Barbara**

IV.H.14 Computational studies of hydrogen interactions with storage materials . . . . . IV-256

**University of Central Florida**

V.C.1 Lead Research and Development Activity for DOE's High Temperature, Low Relative Humidity Membrane Program . . . . . V-68

VII.6 Florida Hydrogen Initiative (FHI) . . . . . VII-33

**University of Colorado**

II.E.3 Solar Hydrogen Production with a Metal Oxide-Based Thermochemical Cycle . . . . . II-60
II.E.4 Solar-Thermal ALD Ferrite-Based Water Splitting Cycle. . . . . II-64

**University of Colorado, Boulder**

V.D.9 Tungsten Oxide and Heteropoly Acid Based System for Ultra-High Activity and Stability of Pt Catalysts in PEM Fuel Cell Cathodes . . . . . V-133

**University of Connecticut**

V.B.2 The Effect of Airborne Contaminants on Fuel Cell Performance and Durability . . . . . V-63
V.K.4 Improving Reliability and Durability of Efficient and Clean Energy Systems. . . . . V-310

**University of Delaware**

V.D.4 Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes. . . . . V-107
V.G.3 Advanced Materials and Concepts for Portable Power Fuel Cells . . . . . V-250
VI.2 Manufacturing of Low-Cost, Durable Membrane Electrode Assemblies Engineered for Rapid Conditioning. . . . . VI-11

**University of Florida**

V.G.2 New MEA Materials for Improved Direct Methanol Fuel Cell (DMFC) Performance, Durability, and Cost . . . . . V-246

**University of Hawaii**

IV.A.2 Fundamental Studies of Advanced High-Capacity, Reversible Metal Hydrides . . . . . .IV-18
IV.C.6 Weak Chemisorption Validation . . . . . IV-89
V.B.1 Effect of System Contaminants on PEMFC Performance and Durability . . . . . V-57

**University of Hawaii at Manoa**

II.F.5 Photoelectrochemical Hydrogen Production . . . . . II-89

**University of Illinois at Urbana-Champaign**

IV.A.4 Reversible Hydrogen Storage Materials - Structure, Chemistry, and Electronic Structure . . . . . IV-27

**University of Michigan**

IV.D.1 Hydrogen Storage Engineering Center of Excellence . . . . . .IV-114
IV.D.8 Ford/BASF SE/UM Activities in Support of the Hydrogen Storage Engineering Center of Excellence . . . . .IV-151
III.3 Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage . . . . . .III-17

**University of Minnesota**

II.A.2 Distributed Bio-Oil Reforming . . . . . II-15

**University of Missouri**

IV.C.3 Multiply Surface-Functionalized Nanoporous Carbon for Vehicular Hydrogen Storage. . . . . IV-72
IV.H.7 New Pathways and Metrics for Enhanced, Reversible Hydrogen Storage in Boron-Doped Carbon Nanospaces. . . . . IV-233

**University of Nevada, Las Vegas**

II.F.2 Semiconductor Materials for Photoelectrolysis . . . . . II-74
II.F.4 Characterization of Materials for Photoelectrochemical (PEC) Hydrogen Production . . . . . II-84
IV.G.1 HGMS: Glasses and Nanocomposites for Hydrogen Storage . . . . . IV-208

**University of New Mexico**

IV.C.6 Weak Chemisorption Validation . . . . . IV-89
V.D.7 The Science and Engineering of Durable Ultralow PGM Catalysts . . . . . V-121
V.D.11 Development of Novel Non-PGM Electrocatalysts for Proton Exchange Membrane Fuel Cell Applications . . . . . V-143
V.E.2 Durability Improvements through Degradation Mechanism Studies . . . . . V-175
V.E.6 Development of Micro-Structural Mitigation Strategies for PEM Fuel Cells: Morphological Simulations and Experimental Approaches . . . . . V-195

**University of North Florida**

V.G.2 New MEA Materials for Improved Direct Methanol Fuel Cell (DMFC) Performance, Durability, and Cost . . . . . V-246

**University of Oregon**

IV.B.1 Hydrogen Storage by Novel CBN Heterocycle Materials . . . . . IV-44
IV.B.3 Novel Carbon(C)-Boron(B)-Nitrogen(N)-Containing H2 Storage Materials . . . . . IV-51

**University of Ottawa**

IV.H.18 Mechanistic Studies of Activated Hydrogen Release from Ammonia-Borane . . . . . IV-270

**University of Pennsylvania**

IV.H.1 From Fundamental Understanding to Predicting New Nanomaterials for High-Capacity Hydrogen Storage IV-210
IV.H.18 Mechanistic Studies of Activated Hydrogen Release from Ammonia-Borane . . . . . IV-270

**University of Pittsburgh**

V.D.5 Nanosegregated Cathode Catalysts with Ultra-Low Platinum Loading . . . . . V-111

**University of Rochester**

V.F.7 Investigation of Micro- and Macro-Scale Transport Processes for Improved Fuel Cell Performance . . . . . V-235

**University of South Carolina**

V.B.1 Effect of System Contaminants on PEMFC Performance and Durability . . . . . V-57
V.D.13 Development of Ultra-Low Platinum Alloy Cathode Catalyst for PEM Fuel Cells . . . . . V-153
V.F.6 Transport in PEMFC Stacks . . . . . V-230

**University of South Florida**

VII.6 Florida Hydrogen Initiative (FHI) . . . . . VII-33

**University of Southern California**

II.C.1 Development of Hydrogen Selective Membranes/Modules as Reactors/Separators for Distributed Hydrogen Production . . . . . II-23

**University of Southern Mississippi**

V.K.2 Alternative Fuel Cell Membranes for Energy Independence . . . . . V-300

**University of Tennessee**

V.D.4 Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes . . . . . V-107
V.D.11 Development of Novel Non-PGM Electrocatalysts for Proton Exchange Membrane Fuel Cell Applications . . . . . V-143
V.F.7 Investigation of Micro- and Macro-Scale Transport Processes for Improved Fuel Cell Performance . . . . . V-235

**University of Tennessee (Continued)**

VI.2 Manufacturing of Low-Cost, Durable Membrane Electrode Assemblies Engineered for Rapid Conditioning . . . VI-11

**University of Tennessee, Knoxville**

V.I.2 Large Scale Testing, Demonstration and Commercialization of the Nanoparticle-Based Fuel Cell Coolant (SBIR Phase III) . . . V-266

XI.6 Sensitivity Analysis of H2-Vehicles' Market Prospects, Costs and Benefits . . . XI-31

**University of Texas at Arlington**

II.F.7 Photoelectrochemical Materials: Theory and Modeling . . . II-98

**University of Texas at Austin**

V.D.4 Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes . . . V-107

V.E.1 Polymer Electrolyte Fuel Cell Lifetime Limitations: The Role of Electrocatalyst Degradation . . . V-168

**University of Texas, Dallas**

IV.H.2 Novel theoretical and experimental approaches for understanding and optimizing hydrogen-sorbent interactions in metal organic framework materials . . . IV-213

IV.H.12 Atomistic Transport Mechanisms in Aluminum-Based Hydrides . . . IV-249

**University of Toledo**

II.F.6 Critical Research for Cost-Effective Photoelectrochemical Production of Hydrogen . . . II-93

**University of Victoria**

V.F.5 Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization . . . V-226

**University of Wisconsin, Madison**

V.E.1 Polymer Electrolyte Fuel Cell Lifetime Limitations: The Role of Electrocatalyst Degradation . . . V-168

**University of Wyoming**

II.D.5 Low-Cost Large-Scale PEM Electrolysis for Renewable Energy Storage . . . II-46

**UTC Power**

V.B.2 The Effect of Airborne Contaminants on Fuel Cell Performance and Durability . . . V-63

V.D.2 Highly Dispersed Alloy Catalyst for Durability . . . V-95

V.E.4 Improved Accelerated Stress Tests Based on Fuel Cell Vehicle Data . . . V-186

V.J.6 150 kW PEM Stationary Power Plant Operating on Natural Gas . . . V-291

VI.2 Manufacturing of Low-Cost, Durable Membrane Electrode Assemblies Engineered for Rapid Conditioning . . . VI-11

**Versa Power Systems**

V.J.3 Advanced Materials for Reversible Solid Oxide Fuel Cell (RSOFC), Dual-Mode Operation with Low Degradation . . . V-281

**Virginia Commonwealth University**

IV.H.3 Design and Synthesis of Chemically and Electronically Tunable Nanoporous Organic Polymers for Use in Hydrogen Storage Applications . . . IV-216

**Virginia Polytechnic Institute and State University**

II.D.1 PEM Electrolyzer Incorporating an Advanced Low-Cost Membrane . . . . . II-31
IV.F.1 High Strength Carbon Fibers . . . . . IV-191
V.F.6 Transport in PEMFC Stacks . . . . . V-230
V.G.3 Advanced Materials and Concepts for Portable Power Fuel Cells . . . . . V-250

**W.L. Gore & Associates, Inc.**

V.I.1 Materials and Modules for Low-Cost, High-Performance Fuel Cell Humidifiers . . . . . V-261
VI.2 Manufacturing of Low-Cost, Durable Membrane Electrode Assemblies Engineered for Rapid Conditioning . . . . . VI-11

**Wake Forest University**

IV.H.2 Novel theoretical and experimental approaches for understanding and optimizing hydrogen-sorbent interactions in metal organic framework materials . . . . . IV-213

**Washington University**

IV.H.15 In Situ NMR Studies of Hydrogen Storage Systems . . . . . IV-259

**Weaver Construction**

VII.7 Sustainable Hydrogen Fueling Station, California State University, Los Angeles . . . . . VII-38

**William C. Fort**

VIII.10 Hydrogen Safety Panel . . . . . VIII-45

**Xunlight Corporation**

II.F.6 Critical Research for Cost-Effective Photoelectrochemical Production of Hydrogen . . . . . II-93

**Yonsei University**

V.D.13 Development of Ultra-Low Platinum Alloy Cathode Catalyst for PEM Fuel Cells . . . . . V-153