
XV. Project Listings by State

Alabama

| | | |
|---------|-------------------------------------------------------------------------------------------------------------------------|------|
| II.I.7 | Production and Storage of Hydrogen from Coal Using C1 Chemistry | 207 |
| IV.B.5k | Main Group Element and Organic Chemistry for Hydrogen Storage and Activation | 514 |
| V.D.21 | Nanostructured Catalysts for Fuel Cells | 803 |
| V.M.2 | Membranes and MEA's for Dry, Hot Operating Conditions. | 885 |
| V.R.2 | Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization | 1042 |

Alaska

| | | |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| II.C.5 | Development of a Novel Efficient Solid-Oxide Hybrid for Co-Generation of Hydrogen and Electricity Using Nearby Resources for Local Application | 82 |
| V.I.1 | Development and Test of Low-Cost Co-Production of Hydrogen and Electricity | 858 |

Arizona

| | | |
|---------|-----------------------------------------------------------------------------------------------------------------------------------|-----|
| II.C.8 | Development of Water Splitting Catalysts Using a Novel Molecular Evolution Approach. | 94 |
| II.D.1 | Zeolite Membrane Reactor for Water-Gas Shift Reaction for Hydrogen Production | 99 |
| II.E.1 | One Step Biomass Gas Reforming-Shift Separation Membrane Reactor | 123 |
| IV.B.5j | Safety Analysis and Applied Research on the Use of Borane-Amines for Hydrogen Storage | 511 |
| V.B.2 | Nitrided Metallic Bipolar Plates. | 726 |
| V.D.16 | A Surface Stress Paradigm for Studying and Developing Catalyst and Storage Materials Relevant to the Hydrogen Economy. | 786 |
| V.M.12 | Protic Salt Polymer Membranes: High-Temperature Water-Free Proton-Conducting Membranes | 920 |

Arkansas

| | | |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| IV.G.3 | An Integrated Approach for Hydrogen Production and Storage in Complex Hydrides of Transitional Elements and Carbon-Based Nanostructural Materials | 654 |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|

California

| | | |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| II.A.4 | Integrated Short Contact Time Hydrogen Generator with GE's Staged Catalytic Partial Oxidation (SCPO) Technology. | 34 |
| II.C.6 | High Performance Flexible Reversible Solid Oxide Fuel Cell. | 87 |
| II.D.3 | High-Performance Palladium-Based Membrane for Hydrogen Separation and Purification. | 109 |
| II.F.1 | Development of Solar-Powered Thermochemical Production of Hydrogen from Water | 128 |
| II.G.4 | Photoelectrochemical Hydrogen Production: UNLV-SHGR Program Subtask. | 154 |
| II.G.5 | Solar Water Splitting: Photocatalyst Materials Discovery and Systems Development | 160 |
| II.G.7 | Photoelectrochemical Hydrogen Production Using a New Combinatorial Chemistry Derived Materials. | 168 |
| II.G.8 | Photoelectrochemical Hydrogen Production | 173 |
| II.H.3 | Maximizing Light Utilization Efficiency and Hydrogen Production in Microalgal Cultures. | 182 |
| II.J.10 | Nuclear Reactor/Hydrogen Process Interface including HyPEP Model Development | 246 |
| II.J.11 | Corrosion and Crack Growth Studies of Heat Exchanger Construction Materials for HI Decomposition in the Sulfur-Iodine Hydrogen Cycle | 251 |
| III.A.1 | Hydrogen Delivery Infrastructure Options Analysis. | 289 |
| III.D.1 | Inexpensive Delivery of Compressed Hydrogen with Advanced Vessel Technology. | 302 |
| IV.A.2 | Discovery of Novel Complex Metal Hydrides for Hydrogen Storage through Molecular Modeling and Combinatorial Methods | 345 |

California (Continued)

| | | |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| IV.A.3 | High Density Hydrogen Storage System Demonstration Using NaAlH ₄ Complex Compound Hydrides | 350 |
| IV.A.5 | DOE Metal Hydride Center of Excellence | 358 |
| IV.A.5a | Development of Metal Hydrides at Sandia National Laboratories | 362 |
| IV.A.5d | Thermodynamically Tuned Nanophase Materials for Reversible Hydrogen Storage | 382 |
| IV.A.5i | High Throughput Combinatorial Chemistry Development of Complex Hydrides | 401 |
| IV.A.5j | Thermodynamically Tuned Nanophase Materials for Reversible Hydrogen Storage: Structure and Kinetics of Nanoparticle and Model System Materials | 404 |
| IV.A.5l | Synthesis of Nanophase Materials for Thermodynamically Tuned Reversible Hydrogen Storage | 415 |
| IV.A.5o | Development and Evaluation of Advanced Hydride Systems for Reversible Hydrogen Storage | 433 |
| IV.A.5q | Catalyzed Nano-Framework Stabilized High Density Reversible Hydrogen Storage Systems | 444 |
| IV.B.4 | Development of Regenerable High Capacity Boron Nitrogen Hydrides as Hydrogen Storage Materials | 460 |
| IV.B.5i | Combinatorial Synthesis and High Throughput Screening of Effective Catalysts for Chemical Hydrides | 507 |
| IV.B.5l | Chemical Hydrogen Storage using Ultra-High Surface Area Main Group Materials and The Development of Efficient Amine-Borane Regeneration Cycles | 520 |
| IV.C.1e | Carbon Aerogels for Hydrogen Storage | 550 |
| IV.C.1m | Enhanced Hydrogen Dipole Physisorption | 582 |
| IV.D.1 | Hydrogen Storage Materials with Binding Intermediate between Physisorption and Chemisorption | 587 |
| IV.D.2 | Hydrogen Storage in Metal-Organic Frameworks | 593 |
| IV.D.3 | A Synergistic Approach to the Development of New Hydrogen Storage Materials (Part I) | 597 |
| IV.E.1 | Advanced Concepts for Containment of Hydrogen and Hydrogen Storage Materials | 605 |
| IV.E.2 | Low Cost, High Efficiency, High Pressure Hydrogen Storage | 608 |
| IV.F.4 | Best Practices for Characterizing Hydrogen Storage Properties of Materials | 625 |
| IV.F.7 | Safety Properties of Hydrogen Storage Materials | 635 |
| V.D.2 | Nanostructured Metal Carbide Catalysts for the Hydrogen Economy | 739 |
| V.D.3 | Development and Mechanistic Characterization of Alloy Fuel Cell Catalysts | 744 |
| V.E.3 | Combinatorial Method for Developing Cathode Catalysts for Fuel Cells | 829 |
| V.E.4 | Advanced Cathode Catalysts and Supports for PEM Fuel Cells | 833 |
| V.E.6 | Advanced Cathode Catalysts | 838 |
| V.E.7 | Non-Platinum Bimetallic Cathode Electrocatalysts | 843 |
| V.H.1 | Development and Demonstration of a New-Generation High Efficiency 2-5 kW Stationary Fuel Cell System | 856 |
| V.I.1 | Development and Test of Low-Cost Co-Production of Hydrogen and Electricity | 858 |
| V.M.3 | New Polyelectrolyte Materials for High Temperature Fuel Cells | 887 |
| V.N.3 | Nanocomposite Proton Conductors | 967 |
| V.N.7 | Polymer Functionalized Zeolite Proton Exchange Membrane (PFZ-PEM) for Medium Temperature (>120°C) Fuel Cells from Theory, Simulation, and Experiment | 982 |
| VI.A.3 | Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project | 1064 |
| VI.A.5 | California Hydrogen Infrastructure Project | 1071 |
| VI.A.6 | Storage of Hydrogen in Cryo-Compressed Vessels | 1075 |
| VI.A.8 | Fuelcell-Powered Underground Mine Loader Vehicle | 1079 |
| VI.A.9 | Fuelcell Prototype Locomotive | 1083 |

California (Continued)

| | | |
|--------|----------------------------------------------------------------------------------------------------------|------|
| VI.B.2 | Power Parks System Simulation. | 1091 |
| VII.3 | Hydrogen Safety, Codes and Standards R&D: Materials Compatibility. | 1150 |
| VII.4 | Hydrogen Optical Fiber Sensors | 1154 |
| VII.6 | IEA Hydrogen Task 18: Evaluation of Integrated Demonstration Systems | 1161 |
| VII.8 | Hydrogen Fuel Quality | 1169 |
| VII.9 | Hydrogen Safety, Codes and Standards R&D | 1175 |
| VII.10 | Hydrogen Safety Panel | 1179 |
| VIII.5 | Macro-System Model. | 1204 |
| IX.1 | Hydrogen Technology and Energy Curriculum (HyTEC). | 1251 |
| XI.4 | Photoelectrochemical System for Hydrogen Generation | 1279 |
| XI.14 | High-Volume Fabrication of Hydrogen Sensor Using Intrinsically Safe Optical Sensor Platform | 1284 |

Colorado

| | | |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------|
| II.B.3 | Distributed Bio-Oil Reforming. | 52 |
| II.C.1 | Renewable Electrolysis Integrated System Development and Testing. | 70 |
| II.C.4 | Advanced Alkaline Electrolysis | 79 |
| II.D.3 | High-Performance Palladium-Based Membrane for Hydrogen Separation and Purification. | 109 |
| II.F.1 | Development of Solar-Powered Thermochemical Production of Hydrogen from Water | 128 |
| II.F.2 | Fundamentals of a Solar-Thermal Hydrogen Production Process Using a Metal-Oxide Based Thermochemical Water Splitting Cycle | 136 |
| II.G.1 | Photoelectrochemical Systems for Hydrogen Production. | 140 |
| II.G.2 | Critical Research for Cost-Effective Photoelectrochemical Production of Hydrogen. | 145 |
| II.G.3 | University of Nevada, Reno Photo-Electrochemical Project | 150 |
| II.G.4 | Photoelectrochemical Hydrogen Production: UNLV-SHGR Program Subtask. | 154 |
| II.G.8 | Photoelectrochemical Hydrogen Production | 173 |
| II.H.2 | Biological Systems for Hydrogen Photoproduction. | 178 |
| II.H.6 | Fermentation Approaches to Hydrogen Production | 192 |
| II.I.1 | Scale-Up of Hydrogen Transport Membranes for IGCC and FutureGen Plants | 194 |
| II.I.2 | Cost-Effective Method for Producing Self-Supporting Pd Alloy Membrane for Use in the Efficient Production of Coal-Derived Hydrogen. | 196 |
| III.A.1 | Hydrogen Delivery Infrastructure Options Analysis. | 289 |
| IV.A.3 | High Density Hydrogen Storage System Demonstration Using NaAlH ₄ Complex Compound Hydrides | 350 |
| IV.C.1 | DOE Hydrogen Sorption Center of Excellence | 525 |
| IV.C.1a | NREL Research as Part of the Hydrogen Sorption Center of Excellence. | 531 |
| IV.G.4 | Purdue Hydrogen Systems Laboratory | 658 |
| V.M.2 | Membranes and MEA's for Dry, Hot Operating Conditions. | 885 |
| V.M.11 | Lead Research and Development Activity for DOE's High Temperature, Low Relative Humidity Membrane Program (HTMWG) Year 1 Annual Report | 916 |
| V.M.13 | Novel Approaches to Immobilized Heteropoly Acid (HPA) Systems for High Temperature, Low Relative Humidity Polymer-Type Membranes | 924 |
| V.N.13 | Carbon Nanotube Materials for Substrate Enhanced Control of Catalytic Activity. | 997 |
| VI.A.8 | Fuelcell-Powered Underground Mine Loader Vehicle. | 1079 |
| VI.A.9 | Fuelcell Prototype Locomotive | 1083 |
| VI.C.1 | Hydrogen Filling Station. | 1106 |

Colorado (Continued)

VI.D.1 Controlled Hydrogen Fleet and Infrastructure Analysis.1113

VI.D.2 Technology Validation: Fuel Cell Bus Evaluations1120

VI.D.3 Quantifying Consumer Sensitivity to Hydrogen Refueling Station Coverage1126

VII.1 Hydrogen Codes and Standards.1143

VII.2 Supporting the Consensus-Based Process for Hydrogen Codes and Standards.1147

VII.8 Hydrogen Fuel Quality1169

VIII.4 HyDRA: Hydrogen Demand and Resource Analysis Tool1201

VIII.5 Macro-System Model.1204

VIII.10 Hydrogen Technology Analysis: H2A Production Model Update1226

VIII.11 System Dynamics: HyDIVE (Hydrogen Dynamic Infrastructure and Vehicle Evolution) Model1229

VIII.13 Geographically-Based Hydrogen Demand and Infrastructure Deployment Scenario Analysis.1236

XI.6 Nanorod Array Photoelectrochemical Hydrogen Production1280

Connecticut

II.C.3 Hydrogen Generation from Electrolysis77

II.C.7 Vermont Hydrogen Electrolyzer Project.91

II.E.2 A Novel Slurry-Based Biomass Reforming Process125

II.I.1 Scale-Up of Hydrogen Transport Membranes for IGCC and FutureGen Plants194

II.I.3 Advanced Water-Gas Shift Membrane Reactor199

III.B.1 Innovative Hydrogen Liquefaction Cycle294

III.C.1 Reversible Liquid Carriers for an Integrated Production, Storage and Delivery of Hydrogen.298

IV.A.1 Complex Hydride Compounds with Enhanced Hydrogen Storage Capacity341

IV.A.3 High Density Hydrogen Storage System Demonstration Using NaAlH₄ Complex Compound Hydrides350

IV.A.4 Effects and Mechanisms of Mechanical Activation on Hydrogen Sorption/Desorption of Nanoscale Lithium Nitrides.354

IV.A.5q Catalyzed Nano-Framework Stabilized High Density Reversible Hydrogen Storage Systems444

IV.F.6 Planned Work under New DOE Hydrogen Storage Award for Storage Safety Testing and Analysis.633

V.A.11 PEM Fuel Cell Freeze Durability and Cold Start Project716

V.B.2 Nitrided Metallic Bipolar Plates.726

V.B.3 Carbon-Carbon Bipolar Plates.728

V.E.5 Highly Dispersed Alloy Cathode Catalyst for Durability836

V.J.1 Low Cost Durable Seals for PEMFC861

V.K.1 Effects of Impurities on Fuel Cell Performance and Durability.863

V.M.5 Development of a Low-Cost, Durable Membrane and Membrane Electrode Assembly for Stationary and Mobile Fuel Cell Application894

V.M.14 High Temperature Membrane With Humidification-Independent Cluster Structure928

VI.A.3 Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project1064

VI.B.1 Validation of an Integrated Hydrogen Energy Station1086

VI.C.1 Hydrogen Filling Station.1106

VII.2 Supporting the Consensus-Based Process for Hydrogen Codes and Standards.1147

VII.10 Hydrogen Safety Panel1179

XI.1 Development of a Highly Efficient Solid State Electrochemical Hydrogen Compressor1278

Delaware

| | | |
|--------|------------------------------------------------------------------------------------------------------------|------|
| IV.G.5 | Center for Hydrogen Storage Research at Delaware State University | 663 |
| V.D.24 | An Integrated Approach Toward Rational Nanocatalyst Design For Hydrogen Production | 813 |
| V.E.8 | Development of Alternative and Durable High Performance Cathode Supports for PEM Fuel Cells | 846 |
| V.P.1 | Platinum Recycling Technology Development | 1024 |
| V.Q.1 | CIRRUS - Subfreezing Start/Stop Protocol for an Advanced Metallic Open-Flowfield Fuel Cell Stack | 1037 |

Florida

| | | |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------|------|
| II.H.5 | Photobiological Hydrogen Research | 189 |
| II.K.2 | Hydrogen Production and Fuel Cell Research | 258 |
| IV.G.2 | Hydrogen Storage Research - 2007 Annual Report | 648 |
| V.M.6 | MEA and Stack Durability for PEM Fuel Cells | 898 |
| V.M.11 | Lead Research and Development Activity for DOE's High Temperature, Low Relative Humidity Membrane Program (HTMWG) Year 1 Annual Report | 916 |
| VI.C.1 | Hydrogen Filling Station | 1106 |
| VI.E.1 | Florida Hydrogen Initiative | 1130 |
| VII.10 | Hydrogen Safety Panel | 1179 |

Georgia

| | | |
|---------|---------------------------------------------------------------------------------------------------------------------------------------|------|
| III.E.2 | Materials Solutions for Hydrogen Delivery in Pipelines | 314 |
| V.E.5 | Highly Dispersed Alloy Cathode Catalyst for Durability | 836 |
| V.M.5 | Development of a Low-Cost, Durable Membrane and Membrane Electrode Assembly for Stationary and Mobile Fuel Cell Application | 894 |
| VIII.2 | Impact of Hydrogen Production on U.S. Energy Markets | 1193 |

Hawaii

| | | |
|---------|---------------------------------------------------------------------------------------------------------------------------------------|------|
| II.G.4 | Photoelectrochemical Hydrogen Production: UNLV-SHGR Program Subtask | 154 |
| II.G.8 | Photoelectrochemical Hydrogen Production | 173 |
| IV.A.2 | Discovery of Novel Complex Metal Hydrides for Hydrogen Storage through Molecular Modeling and Combinatorial Methods | 345 |
| IV.A.5e | Fundamental Studies of Advanced High-Capacity, Reversible Metal Hydrides | 386 |
| V.M.1 | Improved, Low-Cost, Durable Fuel Cell Membranes | 882 |
| V.M.5 | Development of a Low-Cost, Durable Membrane and Membrane Electrode Assembly for Stationary and Mobile Fuel Cell Application | 894 |
| VI.B.3 | Hawaii Hydrogen Center for Development and Deployment of Distributed Energy Systems | 1095 |
| VII.8 | Hydrogen Fuel Quality | 1169 |

Idaho

| | | |
|---------|----------------------------------------------------------------------------------------|-----|
| II.J.4 | NHI Catalyst and Membrane Studies for Thermochemical Cycles at INL | 220 |
| II.J.6 | Laboratory-Scale High Temperature Electrolysis System | 227 |
| II.J.10 | Nuclear Reactor/Hydrogen Process Interface including HyPEP Model Development | 246 |

Illinois

| | | |
|--------|---------------------------------------------------------------------------------------------------------------------------|----|
| II.A.4 | Integrated Short Contact Time Hydrogen Generator with GE's Staged Catalytic Partial Oxidation (SCPO) Technology | 34 |
| II.B.4 | Hydrogen Generation from Biomass-Derived Carbohydrates via the Aqueous-Phase Reforming (APR) Process | 56 |

Illinois (Continued)

| | | |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------|------|
| II.B.5 | High Pressure Distributed Ethanol Reforming | 60 |
| II.B.6 | Hydrogen Production by NG and Renewable Liquids Reforming using Dense Ceramic Membranes | 64 |
| II.E.1 | One Step Biomass Gas Reforming-Shift Separation Membrane Reactor | 123 |
| II.F.1 | Development of Solar-Powered Thermochemical Production of Hydrogen from Water | 128 |
| II.J.3 | High Temperature Thermochemical Processes | 216 |
| II.J.5 | Materials Issues and Experiments for HTE and SO ₃ Electrolysis | 224 |
| II.J.8 | SOEC Modeling, Electrode Characterization Studies, and Process Flowsheet Analysis in Support of HTE Development | 238 |
| III.A.1 | Hydrogen Delivery Infrastructure Options Analysis. | 289 |
| III.E.1 | Hydrogen Embrittlement of Pipelines: Fundamentals, Experiments, Modeling | 306 |
| IV.A.1 | Complex Hydride Compounds with Enhanced Hydrogen Storage Capacity | 341 |
| IV.A.2 | Discovery of Novel Complex Metal Hydrides for Hydrogen Storage through Molecular Modeling and Combinatorial Methods | 345 |
| IV.A.3 | High Density Hydrogen Storage System Demonstration Using NaAlH ₄ Complex Compound Hydrides | 350 |
| IV.A.5n | UIUC Progress in MHCoE: Reversible Hydrogen Storage Materials – Structure, Chemistry and Electronic Structure | 428 |
| IV.C.1o | Novel Hydrogen Storage Media through Nanostructured Polymeric Materials | 586 |
| IV.F.1 | System Level Analysis of Hydrogen Storage Options | 611 |
| V.A.1 | Fuel Cell Systems Analysis | 675 |
| V.A.2 | Neutron Imaging Study of the Water Transport in Operating Fuel Cells | 680 |
| V.A.9 | Fuel Cell Testing at Argonne National Laboratory | 708 |
| V.D.8 | Studies of Model Electrocatalysts for Fuel-Cell Cathodes | 760 |
| V.D.9 | High Performance Nano-Crystalline Oxide Fuel Cell Materials: Defects, Structures, Interfaces, Transport, and Electrochemistry | 764 |
| V.D.17 | Cathode Catalysis in Hydrogen/Oxygen Fuel Cells. | 790 |
| V.D.22 | Dehydrogenation of Boron Nanostructures | 807 |
| V.E.3 | Combinatorial Method for Developing Cathode Catalysts for Fuel Cells | 829 |
| V.E.4 | Advanced Cathode Catalysts and Supports for PEM Fuel Cells | 833 |
| V.E.6 | Advanced Cathode Catalysts | 838 |
| V.E.7 | Non-Platinum Bimetallic Cathode Electrocatalysts | 843 |
| V.L.5 | PEMFC Using Aligned Carbon Nanotubes as Electrodes in MEA | 880 |
| VI.A.1 | Hydrogen to the Highways - Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project. | 1055 |
| VI.A.2 | Ford & BP Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project | 1060 |
| VI.A.3 | Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project | 1064 |
| VI.A.8 | Fuelcell-Powered Underground Mine Loader Vehicle. | 1079 |
| VI.A.9 | Fuelcell Prototype Locomotive | 1083 |
| VII.2 | Supporting the Consensus-Based Process for Hydrogen Codes and Standards. | 1147 |
| VII.8 | Hydrogen Fuel Quality | 1169 |
| VIII.3 | Analysis of the Hydrogen Production and Delivery Infrastructure as a Complex Adaptive System. | 1197 |
| VIII.6 | Hydrogen Quality Issues for Fuel Cell Vehicles | 1208 |
| VIII.7 | Updated Well-to-Well Analysis of Energy and Emission Impacts of Fuel-Cell Vehicles. | 1212 |

Indiana

| | | |
|--------|--------------------------------------------------------------------------------|-----|
| IV.G.4 | Purdue Hydrogen Systems Laboratory | 658 |
| V.D.10 | Silane Activation by Transition Metal Catalysts for Hydrogen Storage | 767 |

Iowa

| | | |
|--------|------------------------------------------------------------------------------------------------|-----|
| II.I.5 | High Flux Metallic Membranes for Hydrogen Recovery and Membrane Reactors | 203 |
| V.N.5 | Water Nanochannels in Nafion [®] : Quantitative Scattering Analysis and NMR | 975 |

Kentucky

| | | |
|---------|---------------------------------------------------------------------------|-----|
| II.A.2 | Low-Cost Hydrogen Distributed Production System Development | 28 |
| II.I.7 | Production and Storage of Hydrogen from Coal Using C1 Chemistry | 207 |
| III.E.2 | Materials Solutions for Hydrogen Delivery in Pipelines | 314 |

Louisiana

| | | |
|---------|------------------------------------------------------------------------------------------------|-----|
| IV.A.1 | Complex Hydride Compounds with Enhanced Hydrogen Storage Capacity | 341 |
| IV.A.5q | Catalyzed Nano-Framework Stabilized High Density Reversible Hydrogen Storage Systems | 444 |

Maryland

| | | |
|---------|---------------------------------------------------------------------------------------------------------------|------|
| II.H.1 | Hydrogen from Water in a Novel Recombinant Oxygen-Tolerant Cyanobacteria System | 175 |
| IV.A.5p | Neutron Characterization and Calphad in Support of the Metal Hydride Center of Excellence. | 439 |
| IV.B.3 | Chemical Hydride Slurry for Hydrogen Production and Storage | 455 |
| IV.C.1h | Neutron Characterization in Support of the Hydrogen Sorption Center of Excellence | 563 |
| V.D.15 | Nanoporous Metal Membranes with Monolayer-Thick Precious Metal Catalyst Skins | 783 |
| V.Q.1 | CIRRUS - Subfreezing Start/Stop Protocol for an Advanced Metallic Open-Flowfield Fuel Cell Stack | 1037 |
| V.R.3 | Water Transport Exploratory Studies | 1044 |
| VII.10 | Hydrogen Safety Panel | 1179 |
| VIII.1 | Using HyPro to Evaluate Competing Hydrogen Pathways | 1189 |
| VIII.12 | Hydrogen Analysis Repository | 1233 |
| IX.2 | H2 Educate - Middle School Hydrogen Education Program | 1254 |
| IX.4 | Increasing H2IQ: A Public Information Program | 1260 |

Massachusetts

| | | |
|---------|----------------------------------------------------------------------------------------------------------------------------|-----|
| II.C.2 | Low-Cost, High-Pressure Hydrogen Generator | 74 |
| II.F.1 | Development of Solar-Powered Thermochemical Production of Hydrogen from Water | 128 |
| II.I.6 | Robust Low-Cost Water-Gas Shift Membrane Reactor for High-Purity Hydrogen Production from Coal-Derived Syngas | 205 |
| II.J.10 | Nuclear Reactor/Hydrogen Process Interface including HyPEP Model Development | 246 |
| II.K.3 | Distributed Energy Project | 264 |
| II.K.4 | Generation and Solid Oxide Fuel Cell Carbon Sequestration in Northwest Indiana | 268 |
| III.B.1 | Innovative Hydrogen Liquefaction Cycle | 294 |
| IV.B.3 | Chemical Hydride Slurry for Hydrogen Production and Storage | 455 |
| IV.B.5b | Novel Approaches to Hydrogen Storage: Conversion of Borates to Boron Hydrides | 476 |
| IV.F.2 | Cost Analysis of Hydrogen Storage Systems. | 616 |
| IV.F.6 | Planned Work under New DOE Hydrogen Storage Award for Storage Safety Testing and Analysis | 633 |
| V.A.5 | Cost Analysis of Fuel Cell Stack/Systems. | 695 |
| V.D.1 | Nanostructured, Metal-Ion Modified Ceria and Zirconia Oxidation Catalysts | 736 |

Massachusetts (Continued)

V.D.20 Instability of Noble Metal Catalysts in Proton Exchange Membrane Fuel Cells: Experiments and Theory799

V.E.2 Novel Non-Precious Metals Catalysts for PEMFC: Catalyst Selection through Molecular Modeling and Durability Studies825

V.M.17 Dimensionally Stable Membranes940

V.M.20 Dimensionally Stable High Performance Membrane952

V.Q.1 CIRRUS - Subfreezing Start/Stop Protocol for an Advanced Metallic Open-Flowfield Fuel Cell Stack1037

VI.A.8 Fuelcell-Powered Underground Mine Loader Vehicle.1079

VI.A.9 Fuelcell Prototype Locomotive1083

VII.2 Supporting the Consensus-Based Process for Hydrogen Codes and Standards.1147

VII.10 Hydrogen Safety Panel1179

VIII.9 Impact of Renewables on Hydrogen Transition Analysis1222

VIII.14 Analysis of Incentive Options for Hydrogen-Fueled Vehicles1239

XI.7 Hydrogen Delivery and Production; Off-Board Hydrogen Bulk Storage1281

Michigan

II.G.2 Critical Research for Cost-Effective Photoelectrochemical Production of Hydrogen145

II.I.5 High Flux Metallic Membranes for Hydrogen Recovery and Membrane Reactors203

IV.A.2 Discovery of Novel Complex Metal Hydrides for Hydrogen Storage through Molecular Modeling and Combinatorial Methods345

IV.C.1b Hydrogen Storage by Spillover539

IV.F.3 National Testing Laboratory for Solid-State Hydrogen Storage Technologies.621

V.A.10 Development of Novel Proton Conducting Membrane Materials and CFD Multi-Phase Porous Flow Models for PEM Fuel Cells711

V.J.1 Low Cost Durable Seals for PEMFC861

V.M.2 Membranes and MEA's for Dry, Hot Operating Conditions.885

V.M.10 Microstructural Design and Development of High Performance Polymer Electrolyte Membranes913

V.R.1 Visualization of Fuel Cell Water Transport and Performance Characterization under Freezing Conditions.1040

VI.A.1 Hydrogen to the Highways - Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project.1055

VI.A.2 Ford & BP Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project1060

VI.A.3 Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project1064

VI.A.4 Hydrogen Vehicle and Infrastructure Demonstration and Validation1067

VI.A.9 Fuelcell Prototype Locomotive1083

VI.B.4 NextEnergy Center Microgrid and Hydrogen Fueling Facility.1101

VII.2 Supporting the Consensus-Based Process for Hydrogen Codes and Standards.1147

VIII.3 Analysis of the Hydrogen Production and Delivery Infrastructure as a Complex Adaptive System.1197

X.1 Development of Advanced Manufacturing Technologies for Renewable Energy Applications1265

Minnesota

II.A.4 Integrated Short Contact Time Hydrogen Generator with GE's Staged Catalytic Partial Oxidation (SCPO) Technology.34

V.E.1 Novel Approach to Non-Precious Metal Catalysts820

Minnesota (Continued)

| | | |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------|-----|
| V.E.4 | Advanced Cathode Catalysts and Supports for PEM Fuel Cells | 833 |
| V.L.2 | Adaptive Stack With Subdivided Cells for Improved Stability, Reliability, and Durability Under Automotive Load Cycle | 874 |
| V.M.2 | Membranes and MEA's for Dry, Hot Operating Conditions. | 885 |
| V.M.3 | New Polyelectrolyte Materials for High Temperature Fuel Cells. | 887 |
| V.M.4 | Development of Polybenzimidazole-Based High Temperature Membrane and Electrode Assemblies for Stationary Applications. | 891 |
| V.M.6 | MEA and Stack Durability for PEM Fuel Cells | 898 |
| V.M.13 | Novel Approaches to Immobilized Heteropoly Acid (HPA) Systems for High Temperature, Low Relative Humidity Polymer-Type Membranes | 924 |

Mississippi

| | | |
|--------|----------------------------------------------------------------------------------------------|-----|
| II.C.4 | Advanced Alkaline Electrolysis | 79 |
| V.M.7 | Improved Membrane Materials for PEM Fuel Cell Applications. | 902 |
| V.M.9 | Poly(cyclohexadiene)-Based Polymer Electrolyte Membranes for Fuel Cell Applications. | 909 |

Missouri

| | | |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| II.C.5 | Development of a Novel Efficient Solid-Oxide Hybrid for Co-Generation of Hydrogen and Electricity Using Nearby Resources for Local Application. | 82 |
| IV.B.5d | University of Missouri-Columbia's Progress Towards Chemical Hydrogen Storage Using Polyhedral Borane Anion Salts | 484 |
| IV.D.4 | Glass Microspheres for Hydrogen Storage | 602 |
| VII.10 | Hydrogen Safety Panel | 1179 |

Montana

| | | |
|--------|---------------------------------------------------------------------------------------------------------------------------------|-----|
| II.D.8 | Montana Palladium Research Initiative - Palladium-Based Membrane on a Porous Stainless Steel Substrate | 120 |
| II.H.4 | Use of Biological Materials and Biologically Inspired Materials for H ₂ Catalysis. | 185 |
| V.A.8 | Montana Palladium Research Initiative: Detection of Trace Platinum Group Element Particulates with Laser Spectroscopy | 707 |
| V.A.12 | Montana Palladium Research Initiative: PEMFC Field Trials | 719 |

Nevada

| | | |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------|------|
| II.F.1 | Development of Solar-Powered Thermochemical Production of Hydrogen from Water | 128 |
| II.G.3 | University of Nevada, Reno Photo-Electrochemical Project | 150 |
| II.G.4 | Photoelectrochemical Hydrogen Production: UNLV-SHGR Program Subtask. | 154 |
| II.J.10 | Nuclear Reactor/Hydrogen Process Interface including HyPEP Model Development | 246 |
| II.J.11 | Corrosion and Crack Growth Studies of Heat Exchanger Construction Materials for HI Decomposition in the Sulfur-Iodine Hydrogen Cycle | 251 |
| IV.A.5m | Effect of Gaseous Impurities on Long-Term Thermal Cycling and Aging Properties of Complex Hydrides for Hydrogen Storage | 419 |
| IV.G.1 | Hydrogen Fuel Cells and Storage Technology Project (FCAST) | 638 |
| V.E.7 | Non-Platinum Bimetallic Cathode Electrocatalysts | 843 |
| VI.A.7 | Southern Nevada Alternative Fuels Demonstration Project | 1078 |
| VI.A.8 | Fuelcell-Powered Underground Mine Loader Vehicle. | 1079 |
| VI.A.9 | Fuelcell Prototype Locomotive | 1083 |
| VI.C.1 | Hydrogen Filling Station. | 1106 |
| IX.2 | H ₂ Educate - Middle School Hydrogen Education Program | 1254 |

New Jersey

II.A.3 Integrated Hydrogen Production, Purification and Compression System 31

IV.B.2 Process for the Regeneration of Sodium Borate to Sodium Borohydride for Use as
a Hydrogen Storage Source 450

IV.B.5a Development of an Advanced Chemical Hydrogen Storage and Generation System 470

IV.B.5c Electrochemical Hydrogen Storage Systems 480

V.D.19 Novel Reforming Catalysts 795

V.G.1 International Stationary Fuel Cell Demonstration 853

V.M.20 Dimensionally Stable High Performance Membrane 952

V.P.2 Platinum Group Metal Recycling Technology Development 1027

VI.A.1 Hydrogen to the Highways - Controlled Hydrogen Fleet and Infrastructure
Demonstration and Validation Project 1055

VI.A.8 Fuelcell-Powered Underground Mine Loader Vehicle 1079

VI.A.9 Fuelcell Prototype Locomotive 1083

New Mexico

II.D.7 Ultra-Thin Proton Conducting Membranes for H₂ Stream Purification with Protective
Getter Coatings 118

II.F.1 Development of Solar-Powered Thermochemical Production of Hydrogen from Water 128

II.I.5 High Flux Metallic Membranes for Hydrogen Recovery and Membrane Reactors 203

II.J.1 Sulfur-Iodine Thermochemical Cycle 209

IV.B.5 DOE Chemical Hydrogen Storage Center of Excellence 464

IV.B.5d University of Missouri-Columbia's Progress Towards Chemical Hydrogen Storage
Using Polyhedral Borane Anion Salts 484

IV.B.5g Chemical Hydrogen Storage Research at Los Alamos National Laboratory 496

V.A.4 Applied Science for Electrode Cost, Performance, and Durability 691

V.A.7 Component Benchmarking - Subtask Reported: USFCC Durability Protocol Development
and Technical Assistance to Fuel Cell Component Developers 705

V.D.13 Nanostructured Catalysts for Hydrogen Generation from Renewable Feedstocks 776

V.D.18 Hydrogen Storage Materials with Binding Intermediate Between Physisorption and
Chemisorption 792

V.E.6 Advanced Cathode Catalysts 838

V.E.7 Non-Platinum Bimetallic Cathode Electrocatalysts 843

V.K.3 Effects of Fuel and Air Impurities on PEM Fuel Cell Performance 869

V.M.3 New Polyelectrolyte Materials for High Temperature Fuel Cells 887

V.N.16 Fundamentals of Hydroxide Conducting Systems for Fuel Cells and Electrolyzers 1007

V.R.3 Water Transport Exploratory Studies 1044

VII.7 Global Technical Regulations 1166

New York

II.A.1 Low Cost Hydrogen Production Platform 23

II.A.5 Integrated Ceramic Membrane System for Hydrogen Production 40

II.C.4 Advanced Alkaline Electrolysis 79

II.D.3 High-Performance Palladium-Based Membrane for Hydrogen Separation and Purification 109

II.G.5 Solar Water Splitting: Photocatalyst Materials Discovery and Systems Development 160

III.E.2 Materials Solutions for Hydrogen Delivery in Pipelines 314

III.F.1 Hydrogen Regional Infrastructure Program in Pennsylvania 323

IV.A.5b GE Progress within the DOE Metal Hydride Center of Excellence for Hydrogen Storage
(Lightweight Intermetallics for Hydrogen Storage) 370

New York (Continued)

| | | |
|---------|-----------------------------------------------------------------------------------------------------------------------|------|
| IV.A.5f | Synthesis and Characterization of Alanes for Automotive Applications | 390 |
| IV.B.5b | Novel Approaches to Hydrogen Storage: Conversion of Borates to Boron Hydrides | 476 |
| IV.C.1a | NREL Research as Part of the Hydrogen Sorption Center of Excellence | 531 |
| IV.D.4 | Glass Microspheres for Hydrogen Storage | 602 |
| V.A.12 | Montana Palladium Research Initiative: PEMFC Field Trials | 719 |
| V.D.5 | Metal and Metal Oxide-Supported Platinum Monolayer Electrocatalysts for Oxygen Reduction | 751 |
| V.D.14 | Novel Intermetallic Catalysts to Enhance PEM Membrane Durability | 780 |
| V.E.5 | Highly Dispersed Alloy Cathode Catalyst for Durability | 836 |
| V.E.6 | Advanced Cathode Catalysts | 838 |
| V.G.1 | International Stationary Fuel Cell Demonstration | 853 |
| V.G.2 | Stationary Fuel Cell System Development/Demonstration | 855 |
| V.L.2 | Adaptive Stack With Subdivided Cells for Improved Stability, Reliability, and Durability Under Automotive Load Cycle | 874 |
| V.M.4 | Development of Polybenzimidazole-Based High Temperature Membrane and Electrode Assemblies for Stationary Applications | 891 |
| V.M.6 | MEA and Stack Durability for PEM Fuel Cells | 898 |
| V.M.15 | Design and Development of High Performance Polymer Fuel Cell Membranes | 932 |
| V.M.17 | Dimensionally Stable Membranes | 940 |
| V.N.1 | Transport Phenomena and Interfacial Kinetics in Planar Microfluidic Membraneless Fuel Cells | 960 |
| V.N.10 | Sol-Gel Based Polybenzimidazole Membranes for Hydrogen Pumping Devices | 988 |
| V.N.18 | Electrostatically Self-assembled Amphiphiles | 1011 |
| V.N.20 | Preparation of Composite Fuel Cell Membranes Containing Electric Field Aligned Inorganic Particles | 1017 |
| V.O.1 | Direct Methanol Fuel Cell Prototype Demonstration for Consumer Electronic Applications | 1020 |
| V.R.1 | Visualization of Fuel Cell Water Transport and Performance Characterization under Freezing Conditions | 1040 |
| VI.A.9 | Fuelcell Prototype Locomotive | 1083 |
| VII.2 | Supporting the Consensus-Based Process for Hydrogen Codes and Standards | 1147 |
| VIII.2 | Impact of Hydrogen Production on U.S. Energy Markets | 1193 |
| XI.3 | Advanced Sealing Technology for Hydrogen Compressores | 1279 |
| XI.9 | Development of Fuel Cell Cathodic Catalysts: Multimetallic Alloy Nanoparticles | 1282 |
| XI.11 | Advanced Coal Research, Hydrogen Production from Coal | 1283 |

North Carolina

| | | |
|---------|----------------------------------------------------------------------------------------------------------------------------------------|-----|
| II.C.4 | Advanced Alkaline Electrolysis | 79 |
| IV.B.4 | Development of Regenerable High Capacity Boron Nitrogen Hydrides as Hydrogen Storage Materials | 460 |
| IV.C.1j | Characterization of Hydrogen Adsorption by NMR | 570 |
| IV.C.1k | Controlling the Diameter of Single Walled Carbon Nanotubes for Hydrogen Storage | 574 |
| V.B.3 | Carbon-Carbon Bipolar Plates | 728 |
| V.K.2 | Effects of Impurities on Fuel Cell Performance and Durability | 865 |
| V.M.11 | Lead Research and Development Activity for DOE's High Temperature, Low Relative Humidity Membrane Program (HTMWG) Year 1 Annual Report | 916 |
| V.N.4 | Proton Exchange Membranes for Next Generation Fuel Cells | 971 |

North Carolina (Continued)

V.R.2 Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization1042

XI.16 Fuel Cell Membrane Measurement System for Manufacturing1284

North Dakota

II.E.2 A Novel Slurry-Based Biomass Reforming Process125

II.K.3 Distributed Energy Project264

Ohio

II.B.2 Investigation of Reaction Networks and Active Sites in Bio-Ethanol Steam Reforming Over Co-Based Catalysts47

II.D.1 Zeolite Membrane Reactor for Water-Gas Shift Reaction for Hydrogen Production99

II.G.2 Critical Research for Cost-Effective Photoelectrochemical Production of Hydrogen145

II.G.6 Production of Hydrogen for Clean and Renewable Sources of Energy for Fuel Cell Vehicles163

II.I.5 High Flux Metallic Membranes for Hydrogen Recovery and Membrane Reactors203

II.K.1 Adapting Planar Solid Oxide Fuel Cells for Distributed Power Generation.254

II.K.3 Distributed Energy Project264

II.K.5 Developing Improved Materials to Support the Hydrogen Economy271

IV.C.1n A Biomimetic Approach to New Adsorptive Hydrogen Storage Metal-Organic Frameworks585

V.B.1 Next Generation Bipolar Plates for Automotive PEM Fuel Cells.722

V.E.2 Novel Non-Precious Metals Catalysts for PEMFC: Catalyst Selection through Molecular Modeling and Durability Studies825

V.L.1 Development of a 5 kW Prototype Coal-Based Fuel Cell872

V.L.3 Light-Weight, Low Cost PEM Fuel Cell Stacks876

V.M.2 Membranes and MEA's for Dry, Hot Operating Conditions.885

V.M.6 MEA and Stack Durability for PEM Fuel Cells898

V.M.8 Poly(p-phenylene sulfonic acids): PEMs with Frozen-In Free Volume.906

V.M.10 Microstructural Design and Development of High Performance Polymer Electrolyte Membranes913

V.M.12 Protic Salt Polymer Membranes: High-Temperature Water-Free Proton-Conducting Membranes920

V.M.21 NanoCapillary Network Proton Conducting Membranes for High Temperature Hydrogen/Air Fuel Cells.955

V.N.19 Theory, Modeling, and Simulation of Ion Transport in Ionomer Membranes1014

V.P.3 Market Opportunity Assessment for Direct Hydrogen PEM Fuel Cells in Pre-Automotive Markets1031

V.R.3 Water Transport Exploratory Studies1044

VI.D.2 Technology Validation: Fuel Cell Bus Evaluations1120

VII.1 Safety, Codes, and Standards Introduction1143

VII.2 Supporting the Consensus-Based Process for Hydrogen Codes and Standards.1147

VII.10 Hydrogen Safety Panel1179

XI.8 Nanofiber Paper for Fuel Cells and Catalyst Supports1281

XI.10 Catalysis - Reactive Separations: Ceramic Proton-Conducting Membrane Reactor for Steam Methane Reforming1282

XI.15 Low-Cost Manufacturing of Sheet Molding Compound Bipolar Plates for PEM Fuel Cells1284

Oregon

| | | |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| II.E.1 | One Step Biomass Gas Reforming-Shift Separation Membrane Reactor | 123 |
| II.I.2 | Cost-Effective Method for Producing Self-Supporting Pd Alloy Membrane for Use in the Efficient Production of Coal-Derived Hydrogen | 196 |
| III.E.2 | Materials Solutions for Hydrogen Delivery in Pipelines | 314 |

Pennsylvania

| | | |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| II.D.2 | Water-Gas Shift Reaction via a Single-Stage Low-Temperature Membrane Reactor | 104 |
| II.E.1 | One Step Biomass Gas Reforming-Shift Separation Membrane Reactor | 123 |
| II.G.8 | Photoelectrochemical Hydrogen Production | 173 |
| II.H.6 | Fermentation Approaches to Hydrogen Production | 192 |
| II.I.7 | Production and Storage of Hydrogen from Coal Using C1 Chemistry | 207 |
| III.C.1 | Reversible Liquid Carriers for an Integrated Production, Storage and Delivery of Hydrogen | 298 |
| III.E.2 | Materials Solutions for Hydrogen Delivery in Pipelines | 314 |
| III.F.1 | Hydrogen Regional Infrastructure Program in Pennsylvania | 323 |
| IV.A.5c | First-Principles Modeling of Hydrogen Storage in Metal Hydride Systems | 375 |
| IV.A.5c | First-Principles Modeling of Hydrogen Storage in Metal Hydride Systems | 375 |
| IV.B.1 | Hydrogen Storage by Reversible Hydrogenation of Liquid-Phase Hydrogen Carriers | 445 |
| IV.B.5b | Novel Approaches to Hydrogen Storage: Conversion of Borates to Boron Hydrides | 476 |
| IV.B.5c | Electrochemical Hydrogen Storage Systems | 480 |
| IV.B.5d | University of Missouri-Columbia's Progress Towards Chemical Hydrogen Storage Using Polyhedral Borane Anion Salts | 484 |
| IV.B.5e | Amineborane Hydrogen Storage - New Methods for Promoting Amineborane Dehydrogenation/Regeneration Reactions | 488 |
| IV.C.1f | Enabling Discovery of Materials With a Practical Heat of Hydrogen Adsorption | 553 |
| IV.C.1g | Advanced Boron and Metal-Loaded High Porosity Carbons | 558 |
| IV.C.1i | Conducting Polymers as New Materials for Hydrogen Storage | 567 |
| V.B.2 | Nitrided Metallic Bipolar Plates | 726 |
| V.C.1 | Complex Coolant Fluid for PEM Fuel Cells | 732 |
| V.D.23 | Multiscale Tailoring of Highly Active and Stable Nanocomposite Catalysts for the Production of Clean Hydrogen Streams | 810 |
| V.D.25 | The Reactivity and Structural Dynamics of Supported Metal Nanoclusters Using Electron Microscopy, <i>in situ</i> X-Ray Spectroscopy, Electronic Structure Theories, and Molecular Dynamics Simulations | 817 |
| V.M.1 | Improved, Low-Cost, Durable Fuel Cell Membranes | 882 |
| V.M.5 | Development of a Low-Cost, Durable Membrane and Membrane Electrode Assembly for Stationary and Mobile Fuel Cell Application | 894 |
| V.M.18 | New Proton Conductive Composite Materials with Co-Continuous Phases Using Functionalized and Crosslinkable VDF/CTFE Fluoropolymers | 943 |
| V.N.2 | The Development of Nano-Composite Electrodes for Natural Gas-Assisted Steam Electrolysis for Hydrogen Production | 964 |
| V.N.9 | Porous and Glued Langmuir-Blodgett Membranes | 985 |
| V.N.17 | Ab Initio Screening of Ternary Alloys for Hydrogen Purification | 1009 |
| VI.A.5 | California Hydrogen Infrastructure Project | 1071 |
| VI.B.1 | Validation of an Integrated Hydrogen Energy Station | 1086 |
| VII.1 | Hydrogen Codes and Standards | 1143 |
| VII.10 | Hydrogen Safety Panel | 1179 |
| VIII.3 | Analysis of the Hydrogen Production and Delivery Infrastructure as a Complex Adaptive System | 1197 |

Rhode Island

II.A.1 Low Cost Hydrogen Production Platform. 23

South Carolina

II.D.5 Bulk Amorphous Hydrogen Purification/Separation Membranes 114
 II.J.2 Hybrid Sulfur Thermochemical Process Development 212
 III.F.1 Hydrogen Regional Infrastructure Program in Pennsylvania 323
 IV.A.1 Complex Hydride Compounds with Enhanced Hydrogen Storage Capacity 341
 IV.A.5k Metal Hydride Center of Excellence Work Performed at Savannah River National Laboratory 408
 IV.F.5 Safety Analysis of Solid State Hydride Materials. 628
 IV.G.6 Clean Energy Research 666
 V.E.2 Novel Non-Precious Metals Catalysts for PEMFC: Catalyst Selection through
 Molecular Modeling and Durability Studies. 825
 V.F.1 Fuel Cell Research at the University of South Carolina 848
 V.K.2 Effects of Impurities on Fuel Cell Performance and Durability. 865
 V.M.4 Development of Polybenzimidazole-Based High Temperature Membrane and Electrode
 Assemblies for Stationary Applications. 891
 V.M.16 Fluoroalkylphosphonic Acid-based Proton Conductors 936
 V.N.11 New Proton-Conducting Fluoropolymer Electrolytes for PEM Fuel Cells 990
 VI.A.8 Fuelcell-Powered Underground Mine Loader Vehicle. 1079
 VI.A.9 Fuelcell Prototype Locomotive 1083

Tennessee

II.D.3 High-Performance Palladium-Based Membrane for Hydrogen Separation and Purification. 109
 II.D.4 High-Performance, Durable, Pd-Alloy Membrane for Hydrogen Separation. 113
 II.D.6 Novel Low-Temperature Proton Transport Membranes 116
 II.J.9 Membrane Applications for Nuclear Hydrogen Production Processes 242
 III.E.2 Materials Solutions for Hydrogen Delivery in Pipelines 314
 III.E.3 Fiber-Reinforced Polymer Pipelines for Hydrogen Delivery. 319
 IV.A.5h Preparation and Reactions of Complex Hydrides for Hydrogen Storage: Studies of
 the $Al(BH_4)_3$ System 397
 IV.C.11 ORNL Progrss withing the DOE Center of Excellence for Hydrogen Sorption:
 Synthesis and Processing of Single-Wall Carbon Nanohorns for Metal-Catalyst
 Assisted Hydrogen Storage 577
 V.A.3 Microstructural Characterization of PEM Fuel Cell MEAs 685
 V.B.2 Nitrided Metallic Bipolar Plates. 726
 V.D.11 Nanoscale Building Blocks for Multi-Electron Electrocatalysis 770
 V.E.6 Advanced Cathode Catalysts 838
 V.E.7 Non-Platinum Bimetallic Cathode Electrocatalysts 843
 V.F.1 Fuel Cell Research at the University of South Carolina 848
 V.M.1 Improved, Low-Cost, Durable Fuel Cell Membranes 882
 V.M.9 Poly(cyclohexadiene)-Based Polymer Electrolyte Membranes for Fuel Cell Applications. 909
 V.N.14 Surface-Initiated Ionomer Films Based on Modified Poly(n-alkylnorbornene)s. 1001
 V.N.15 A Unified Computational, Theoretical and Experimental Investigation of Proton
 Transport through the Electrode/Electrolyte Interface of Proton Exchange Membrane
 Fuel Cell Systems 1003
 V.R.3 Water Transport Exploratory Studies 1044
 VIII.8 HyTrans Model: Analyzing the Transition to Hydrogen-Powered Transportation 1218

Texas

| | | |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------|------|
| II.G.8 | Photoelectrochemical Hydrogen Production | 173 |
| II.I.2 | Cost-Effective Method for Producing Self-Supporting Pd Alloy Membrane for Use in the Efficient Production of Coal-Derived Hydrogen | 196 |
| III.A.1 | Hydrogen Delivery Infrastructure Options Analysis. | 289 |
| IV.C.1c | Theoretical Models of H ₂ -Carbon Systems for Hydrogen Storage and Optimization of SWNT | 542 |
| IV.C.1d | Cloning Single Wall Carbon Nanotubes for Hydrogen Storage | 546 |
| IV.F.3 | National Testing Laboratory for Solid-State Hydrogen Storage Technologies. | 621 |
| V.B.1 | Next Generation Bipolar Plates for Automotive PEM Fuel Cells. | 722 |
| V.D.6 | Strategies for Probing Nanometer-Scale Electrocatalysts: From Single Particles to Catalyst-Membrane Architectures | 754 |
| V.D.7 | Reactivity and Stability of Multimetallic Nanocatalysts in Acid Medium | 757 |
| V.E.5 | Highly Dispersed Alloy Cathode Catalyst for Durability | 836 |
| V.N.12 | Hydrogen Purification Using Advanced Polymeric Membranes | 994 |
| V.R.2 | Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization | 1042 |
| VI.A.3 | Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project | 1064 |
| VI.A.4 | Hydrogen Vehicle and Infrastructure Demonstration and Validation | 1067 |
| VI.A.8 | Fuelcell-Powered Underground Mine Loader Vehicle. | 1079 |
| VI.A.9 | Fuelcell Prototype Locomotive | 1083 |
| VIII.1 | Using HyPro to Evaluate Competing Hydrogen Pathways | 1189 |

Utah

| | | |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| II.C.5 | Development of a Novel Efficient Solid-Oxide Hybrid for Co-Generation of Hydrogen and Electricity Using Nearby Resources for Local Application | 82 |
| II.I.7 | Production and Storage of Hydrogen from Coal Using C1 Chemistry | 207 |
| II.J.6 | Laboratory-Scale High Temperature Electrolysis System. | 227 |
| II.J.7 | Test of High Temperature Electrolysis ILS Half Module | 234 |
| II.J.10 | Nuclear Reactor/Hydrogen Process Interface including HyPEP Model Development | 246 |
| III.F.1 | Hydrogen Regional Infrastructure Program in Pennsylvania | 323 |
| IV.A.5g | Chemical Vapor Synthesis and Discovery of H ₂ Storage Materials: Li-Al-Mg-N-H System. | 393 |
| V.M.16 | Fluoroalkylphosphonic Acid-based Proton Conductors | 936 |
| V.N.8 | Computer Simulation of Proton Transport in Fuel Cell Membranes. | 984 |
| VI.A.9 | Fuelcell Prototype Locomotive | 1083 |
| XI.12 | Hydrogen Production from Coal | 1283 |

Vermont

| | | |
|--------|-------------------------------------------------|----|
| II.C.7 | EVERmont Hydrogen Electrolyzer Project. | 91 |
|--------|-------------------------------------------------|----|

Virginia

| | | |
|---------|--------------------------------------------------------------------------------------------------------------------------|-----|
| II.A.2 | Low-Cost Hydrogen Distributed Production System Development | 28 |
| II.B.7 | Cost Analysis of Distributed Bio-Derived Liquids Reforming | 68 |
| III.F.1 | Hydrogen Regional Infrastructure Program in Pennsylvania | 323 |
| V.A.6 | Mass Production Cost Estimation for Direct H ₂ PEM Fuel Cell Systems for Automotive Applications | 700 |
| V.J.1 | Low Cost Durable Seals for PEMFC | 861 |
| V.M.1 | Improved, Low-Cost, Durable Fuel Cell Membranes | 882 |
| V.M.19 | Advanced Materials for Proton Exchange Membranes | 946 |

Virginia (Continued)

V.O.1 Direct Methanol Fuel Cell Prototype Demonstration for Consumer Electronic Applications1020
 VII.2 Supporting the Consensus-Based Process for Hydrogen Codes and Standards. 1147
 VIII.1 Using HyPro to Evaluate Competing Hydrogen Pathways 1189
 VIII.2 Impact of Hydrogen Production on U.S. Energy Markets. 1193
 VIII.10 Hydrogen Technology Analysis: H2A Production Model Update1226
 IX.2 H2 Educate - Middle School Hydrogen Education Program1254
 XI.2 Nanocrystalline Photocatalysts for Hydrogen Production from Splitting of Water by Visible Light1278

Washington

II.B.1 Bio-Derived Liquids Reforming 44
 III.A.1 Hydrogen Delivery Infrastructure Options Analysis. 289
 III.C.1 Reversible Liquid Carriers for an Integrated Production, Storage and Delivery of Hydrogen 298
 III.E.2 Materials Solutions for Hydrogen Delivery in Pipelines 314
 IV.A.4 Effects and Mechanisms of Mechanical Activation on Hydrogen Sorption/Desorption of Nanoscale Lithium Nitrides 354
 IV.B.5f PNNL Progress within the DOE Center of Excellence for Chemical Hydrogen Storage 492
 IV.B.5h Kinetic and Mechanistic Studies of BN Hydrogenation/Dehydrogenation 503
 V.E.8 Development of Alternative and Durable High Performance Cathode Supports for PEM Fuel Cells. 846
 V.L.4 Low-Cost Manufacturable Microchannel Systems for Passive PEM Water Management 878
 V.N.6 Charge Transfer, Transport, and Reactivity in Complex Molecular Environments: Theoretical Studies for the Hydrogen Fuel Initiative. 979
 IX.3 Hydrogen Safety: First Responder Education.1257
 XI.5 Active Magnetic Regenerative Liquefier1280
 XI.13 Separation Membrane Structures for Hydrogen1284
 VII.5 H2 Incident Reporting Database and H2 Safety Best Practices Web Site1157

Washington, D.C.

VII.2 Supporting the Consensus-Based Process for Hydrogen Codes and Standards. 1147
 VII.10 Hydrogen Safety Panel 1179
 VIII.3 Analysis of the Hydrogen Production and Delivery Infrastructure as a Complex Adaptive System.1197
 IX.3 Hydrogen Safety: First Responder Education.1257

West Virginia

II.I.5 High Flux Metallic Membranes for Hydrogen Recovery and Membrane Reactors203
 II.I.7 Production and Storage of Hydrogen from Coal Using C1 Chemistry207

Wisconsin

II.B.4 Hydrogen Generation from Biomass-Derived Carbohydrates via the Aqueous-Phase Reforming (APR) Process. 56
 V.D.4 Atomic-Scale Design of a New Class of Alloy Catalysts for Reactions Involving Hydrogen: A Theoretical and Experimental Approach 748
 VI.A.8 Fuelcell-Powered Underground Mine Loader Vehicle.1079
 VI.A.9 Fuelcell Prototype Locomotive1083
 VI.D.3 Quantifying Consumer Sensitivity to Hydrogen Refueling Station Coverage1126
 VIII.11 System Dynamics: HyDIVE (Hydrogen Dynamic Infrastructure and Vehicle Evolution) Model1229

Wyoming

| | | |
|--------|----------------------------------------------------------------------------------------------------------------|-----|
| II.I.4 | Integration of a Structural Water-Gas Shift Catalyst with a Vanadium Alloy Hydrogen Transport Device | 201 |
| V.D.12 | eNMR for In-Situ Fuel Cell Catalyst Characterization | 773 |

Foreign Countries**Australia**

| | | |
|--------|-----------------------------------------------------------|------|
| VI.A.8 | Fuelcell-Powered Underground Mine Loader Vehicle. | 1079 |
|--------|-----------------------------------------------------------|------|

Canada

| | | |
|--------|-----------------------------------------------------------------------------------------------------------------------|------|
| II.A.3 | Integrated Hydrogen Production, Purification and Compression System | 31 |
| II.I.1 | Scale-Up of Hydrogen Transport Membranes for IGCC and FutureGen Plants | 194 |
| IV.B.3 | Chemical Hydride Slurry for Hydrogen Production and Storage | 455 |
| V.B.1 | Next Generation Bipolar Plates for Automotive PEM Fuel Cells. | 722 |
| V.E.1 | Novel Approach to Non-Precious Metal Catalysts | 820 |
| V.E.8 | Development of Alternative and Durable High Performance Cathode Supports for PEM Fuel Cells. | 846 |
| V.E.4 | Advanced Cathode Catalysts and Supports for PEM Fuel Cells | 833 |
| V.R.2 | Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization | 1042 |
| VI.A.1 | Hydrogen to the Highways - Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project. | 1055 |
| VI.A.8 | Fuelcell-Powered Underground Mine Loader Vehicle. | 1079 |

Germany

| | | |
|--------|--------------------------------------------------------------------------------------------------------------------------------|------|
| V.M.4 | Development of Polybenzimidazole-Based High Temperature Membrane and Electrode Assemblies for Stationary Applications. | 891 |
| V.Q.1 | CIRRUS - Subfreezing Start/Stop Protocol for an Advanced Metallic Open-Flowfield Fuel Cell Stack | 1037 |
| V.R.2 | Water Transport in PEM Fuel Cells: Advanced Modeling, Material Selection, Testing, and Design Optimization | 1042 |
| V.R.3 | Water Transport Exploratory Studies | 1044 |
| VI.A.1 | Hydrogen to the Highways - Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project. | 1055 |

Japan

| | | |
|--------|-----------------------------------------|------|
| VI.A.9 | Fuelcell Prototype Locomotive | 1083 |
|--------|-----------------------------------------|------|

Norway

| | | |
|--------|-----------------------------------------------------------------------------|-----|
| IV.A.1 | Complex Hydride Compounds with Enhanced Hydrogen Storage Capacity | 341 |
|--------|-----------------------------------------------------------------------------|-----|

Russia

| | | |
|--------|----------------------------------------------------------|-----|
| II.H.2 | Biological Systems for Hydrogen Photoproduction. | 178 |
|--------|----------------------------------------------------------|-----|

Singapore

| | | |
|---------|-------------------------------------------------------------------------|-----|
| IV.A.5a | Development of Metal Hydrides at Sandia National Laboratories | 362 |
|---------|-------------------------------------------------------------------------|-----|

South Korea

| | | |
|--------|---------------------------------------------------------------------------------------------|------|
| VI.A.3 | Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project | 1064 |
|--------|---------------------------------------------------------------------------------------------|------|

Switzerland

II.F.1 Development of Solar-Powered Thermochemical Production of Hydrogen from Water128

UK

V.E.5 Highly Dispersed Alloy Cathode Catalyst for Durability836