
XVI. Project Listings by Organization

3M Company

| | | |
|--------|---|-------|
| II.B.2 | High-Performance, Long-Lifetime Catalysts for Proton Exchange Membrane Electrolysis | II-23 |
| V.B.1 | New Fuel Cell Membranes with Improved Durability and Performance | V-64 |
| V.B.2 | Advanced Hybrid Membranes for Next Generation PEMFC Automotive Applications | V-69 |
| V.C.1 | High Performance, Durable, Low Cost Membrane Electrode Assemblies for Transportation Applications | V-73 |
| V.C.4 | Advanced Ionomers & MEAs for Alkaline Membrane Fuel Cells | V-92 |
| V.E.2 | Fuel-Cell Fundamentals at Low and Subzero Temperatures | V-108 |

AccerlorMittal

| | | |
|-------|---|--------|
| III.8 | Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage | III-40 |
|-------|---|--------|

Adherent Technologies, Inc.

| | | |
|--------|---|--------|
| IV.D.7 | Optimizing the Cost and Performance of Composite Cylinders for H ₂ Storage using a Graded Construction | IV-138 |
|--------|---|--------|

Air Liquide

| | | |
|--------|--|---------|
| III.8 | Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage | III-40 |
| VIII.6 | Hydrogen Safety Panel, Safety Knowledge Tools and First Responder Training Resources | VIII-31 |

Air Products and Chemicals, Inc.

| | | |
|--------|---|---------|
| VII.9 | Validation of an Advanced High Pressure PEM Electrolyzer and Composite Hydrogen Storage, with Data Reporting, for SunHydro Stations | VII-44 |
| VIII.6 | Hydrogen Safety Panel, Safety Knowledge Tools and First Responder Training Resources | VIII-31 |

Ames Laboratory

| | | |
|--------|--|--------|
| IV.C.4 | High-Capacity Hydrogen Storage Systems via Mechanochemistry | IV-81 |
| IV.E.1 | Complex Hydrides - A New Frontier for Future Energy Applications | IV-143 |

AOC, LLC

| | | |
|--------|--|--------|
| IV.D.3 | Enhanced Materials and Design Parameters for Reducing the Cost of Hydrogen Storage Tanks | IV-118 |
|--------|--|--------|

Ardica Technologies

| | | |
|--------|---|-------|
| IV.C.6 | Low-Cost α -Alane for Hydrogen Storage | IV-88 |
|--------|---|-------|

Argonne National Laboratory

| | | |
|--------|---|--------|
| III.1 | Hydrogen Delivery Infrastructure Analysis | III-9 |
| III.11 | Reference Station Design | III-53 |
| III.12 | Hydrogen Fueling Station Pre-Cooling Analysis | III-57 |
| IV.A.1 | System Analysis of Physical and Materials-Based Hydrogen Storage | IV-11 |
| V.A.2 | Nanosegregated Cathode Alloy Catalysts with Ultra-Low Platinum Loading | V-13 |
| V.A.8 | High-Throughput Synthesis, ORR Activity Modeling, and Testing of non-PGM PEMFC Cathode Catalysts | V-51 |
| V.C.1 | High Performance, Durable, Low Cost Membrane Electrode Assemblies for Transportation Applications | V-73 |
| V.C.2 | Rationally Designed Catalyst Layers for PEMFC Performance Optimization | V-80 |
| V.E.1 | Durability Improvements Through Degradation Mechanism Studies | V-101 |

XVI. Project Listings by Organization

Argonne National Laboratory (Continued)

| | | |
|--------|---|-------|
| V.F.2 | Fuel Cells Systems Analysis | V-133 |
| V.F.12 | Novel Non-PGM Catalysts from Rationally Designed 3-D Precursors | V-184 |
| IX.1 | Impact of Fuel Cell System Peak Efficiency on Fuel Consumption and Cost | IX-13 |
| IX.4 | Performance and Cost Analysis for a 300 kW Tri-generation Molten Carbonate Fuel Cell System | IX-29 |
| IX.5 | Employment Impacts of Infrastructure Development for Hydrogen and Fuel Cell Technologies | IX-34 |
| IX.6 | Life-Cycle Analysis of Water Consumption for Hydrogen Production | IX-41 |
| IX.10 | Analysis of Incremental Fueling Pressure Cost | IX-54 |

Arizona State University

| | | |
|--------|--|-------|
| II.C.1 | High Efficiency Solar Thermochemical Reactor for Hydrogen Production | II-35 |
|--------|--|-------|

Ashok Saxena

| | | |
|-------|--|--------|
| III.9 | Low Cost Hydrogen Storage at 875 Bar Using Steel Liner and Steel Wire Wrap | III-45 |
|-------|--|--------|

Automotive Fuel Cell Corporation

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

Ballard Power Systems

| | | |
|-------|---|-------|
| V.D.1 | Roots Air Management System with Integrated Expander | V-96 |
| V.E.4 | The Effect of Airborne Contaminants on Fuel Cell Performance and Durability | V-119 |
| V.E.5 | Open Source Performance and Durability Model: Consideration of Membrane Properties on Cathode Degradation | V-125 |

BASF SE

| | | |
|--------|--|-------|
| IV.B.2 | Ford/BASF-SE/UM Activities in Support of the Hydrogen Storage Engineering Center of Excellence | IV-27 |
|--------|--|-------|

Battelle

| | | |
|-------|--|-------|
| V.F.6 | Stationary and Emerging Market Fuel Cell System Cost Analysis—Primary Power and Combined Heat and Power Applications | V-158 |
|-------|--|-------|

Becht Engineering

| | | |
|--------|--|---------|
| VIII.6 | Hydrogen Safety Panel, Safety Knowledge Tools and First Responder Training Resources | VIII-31 |
|--------|--|---------|

Bevilacqua Knight, Inc.

| | | |
|-------|---|--------|
| III.8 | Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage | III-40 |
|-------|---|--------|

BKi

| | | |
|--------|--|---------|
| VIII.6 | Hydrogen Safety Panel, Safety Knowledge Tools and First Responder Training Resources | VIII-31 |
|--------|--|---------|

Boston College

| | | |
|--------|--|-------|
| IV.C.7 | Novel Carbon(C)-Boron(B)-Nitrogen(N)-Containing H ₂ Storage Materials | IV-92 |
|--------|--|-------|

Branded by Media

| | | |
|--------|---|---------|
| VIII.7 | Fuel Cell Technologies National Codes and Standards Deployment and Outreach | VIII-38 |
|--------|---|---------|

Brookhaven National Laboratory

| | | |
|--------|---|-------|
| II.B.3 | Low-Noble-Metal-Content Catalysts/Electrodes for Hydrogen Production by Water Electrolysis | II-28 |
| V.A.3 | Contiguous Platinum Monolayer Oxygen Reduction Electrocatalysts on High-Stability-Low-Cost Supports | V-20 |

Brookhaven National Laboratory (Continued)

V.F.20 Semi-Automated MEA Fabrication with Ultra-Low Total PGM Loadings V-223

Bucknell University

II.C.1 High Efficiency Solar Thermochemical Reactor for Hydrogen Production II-35

C P Industries

III.9 Low Cost Hydrogen Storage at 875 Bar Using Steel Liner and Steel Wire Wrap. III-45

California Fuel Cell Partnership

VII.8 Station Operational Status System (SOSS) 3.0 Upgrade. VII-41

California Institute of Technology

IV.B.1 Hydrogen Storage Engineering Center of Excellence IV-22

California State University, Los Angeles

VII.12 CSULA Hydrogen Refueling Facility Performance Evaluation and Optimization VII-58

Carnegie Mellon University

V.A.7 Non-Precious Metal Fuel Cell Cathodes: Catalyst Development & Electrode Structure Design V-43

CellEra, Inc.

V.C.4 Advanced Ionomers & MEAs for Alkaline Membrane Fuel Cells V-92

Center for Transportation and the Environment

X.3 Fuel Cell Hybrid Electric Delivery Van Project X-14

City of Santa Fe Springs

VIII.6 Hydrogen Safety Panel, Safety Knowledge Tools and First Responder Training Resources VIII-31

Colorado School of Mines

II.C.1 High Efficiency Solar Thermochemical Reactor for Hydrogen Production II-35
 V.A.1 Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes. V-9
 V.B.2 Advanced Hybrid Membranes for Next Generation PEMFC Automotive Applications V-69
 V.C.4 Advanced Ionomers & MEAs for Alkaline Membrane Fuel Cells V-92
 V.E.3 Effect of System Contaminants on PEMFC Performance and Durability V-113
 VI.1 Fuel Cell Membrane Electrode Assembly Manufacturing R&D VI-7

Composite Technology Development

IV.D.7 Optimizing the Cost and Performance of Composite Cylinders for H₂ Storage using a Graded Construction. IV-138

Cormetech, Inc.

II.F.1 Monolithic Piston-Type Reactor for Hydrogen Production through Rapid Swing of Reforming/Combustion Reactions II-84

Custom Sensor Solutions

VIII.11 Hydrogen Safety, Codes and Standards: Sensors VIII-53

Dason Technology, Inc.

II.F.1 Monolithic Piston-Type Reactor for Hydrogen Production through Rapid Swing of Reforming/Combustion Reactions. II-84

XVI. Project Listings by Organization

DJW Technologies

VI.2 U.S. Clean Energy Hydrogen and Fuel Cell Technologies: A Competitiveness Analysis VI-12

E4tech

VI.2 U.S. Clean Energy Hydrogen and Fuel Cell Technologies: A Competitiveness Analysis VI-12

Eaton Corporation

V.D.1 Roots Air Management System with Integrated Expander V-96

Electricore, Inc.

V.D.1 Roots Air Management System with Integrated Expander V-96

Element One

VIII.5 NREL Hydrogen Sensor Testing Laboratory VIII-26

Emerald Energy NW LLC

III.14 Magnetocaloric Hydrogen Liquefaction III-65

eon™ Consultants Ltd.

VI.2 U.S. Clean Energy Hydrogen and Fuel Cell Technologies: A Competitiveness Analysis VI-12

Excelsior Design, Inc.

VIII.6 Hydrogen Safety Panel, Safety Knowledge Tools and First Responder Training Resources VIII-31

Firexplo

VIII.6 Hydrogen Safety Panel, Safety Knowledge Tools and First Responder Training Resources VIII-31

Fluer, Inc.

VIII.6 Hydrogen Safety Panel, Safety Knowledge Tools and First Responder Training Resources VIII-31

Ford Motor Company

IV.B.1 Hydrogen Storage Engineering Center of Excellence IV-22

IV.B.2 Ford/BASF-SE/UM Activities in Support of the Hydrogen Storage Engineering Center of Excellence IV-27

IV.D.3 Enhanced Materials and Design Parameters for Reducing the Cost of Hydrogen Storage Tanks IV-118

Fuel Cell & Hydrogen Energy Association

VIII.8 Fuel Cell & Hydrogen Energy Association Codes and Standards Support VIII-42

FuelCell Energy, Inc.

II.F.2 Reformer-Electrolyzer-Purifier (REP) for Production of Hydrogen II-90

III.10 Electrochemical Hydrogen Compressor III-50

V.F.9 Smart Matrix Development for Direct Carbonate Fuel Cell V-170

Gas Technology Institute

VII.10 Performance Evaluation of Delivered Hydrogen Fueling Stations VII-50

General Motors Company

IV.B.1 Hydrogen Storage Engineering Center of Excellence IV-22

IV.B.9 Testing, Modeling, and Evaluation of Innovative Hydrogen Storage System Designs IV-59

IV.C.1 Hydrogen Storage in Metal-Organic Frameworks IV-63

General Motors Company (Continued)

V.A.7 Non-Precious Metal Fuel Cell Cathodes: Catalyst Development & Electrode Structure Design V-43
 V.B.1 New Fuel Cell Membranes with Improved Durability and Performance V-64
 V.C.1 High Performance, Durable, Low Cost Membrane Electrode Assemblies for Transportation Applications V-73
 V.E.3 Effect of System Contaminants on PEMFC Performance and Durability V-113
 VI.1 Fuel Cell Membrane Electrode Assembly Manufacturing R&D VI-7

Giner Electrochemical Systems, LLC

II.B.4 High Temperature, High Pressure Electrolysis II-31

Giner, Inc.

II.B.2 High-Performance, Long-Lifetime Catalysts for Proton Exchange Membrane Electrolysis II-23
 V.F.11 Ionomer Dispersion Impact on Advanced Fuel Cell and Electrolyzer Performance and Durability V-179

Global Engineering and Technology, LLC

III.2 Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage III-13
 III.8 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage III-40

GLWN – Westside Industrial Retention & Expansion Network

VI.2 U.S. Clean Energy Hydrogen and Fuel Cell Technologies: A Competitiveness Analysis VI-12

GWS Solutions of Tolland, LLC

VIII.6 Hydrogen Safety Panel, Safety Knowledge Tools and First Responder Training Resources VIII-31

H2 Technology Consulting LLC

IV.C.2 Hydrogen Sorbent Measurement Qualification and Characterization IV-70

Hanson Pressure Pipe

III.2 Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage III-13
 III.8 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage III-40

Harris Thermal Transfer Products

III.2 Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage III-13

Hawaii Natural Energy Institute

V.E.4 The Effect of Airborne Contaminants on Fuel Cell Performance and Durability V-119
 X.4 Hydrogen Energy Systems as a Grid Management Tool X-18

Hexagon Lincoln

III.5 Development of High Pressure Hydrogen Storage Tank for Storage and Gaseous Truck Delivery III-25
 IV.B.1 Hydrogen Storage Engineering Center of Excellence IV-22
 IV.B.7 Development of Improved Composite Pressure Vessels for Hydrogen Storage IV-53
 IV.D.3 Enhanced Materials and Design Parameters for Reducing the Cost of Hydrogen Storage Tanks IV-118
 IV.D.6 Achieving Hydrogen Storage Goals through High-Strength Fiber Glass IV-134

HRL Laboratories, LLC

IV.C.8 Boron-Based Hydrogen Storage: Ternary Borides and Beyond IV-97
 VIII.11 Hydrogen Safety, Codes and Standards: Sensors VIII-53

XVI. Project Listings by Organization

Hydrogenics

| | | |
|--------|---|--------|
| VII.12 | CSULA Hydrogen Refueling Facility Performance Evaluation and Optimization | VII-58 |
| X.2 | Maritime Fuel Cell Generator Project | X-10 |
| X.3 | Fuel Cell Hybrid Electric Delivery Van Project | X-14 |

Hy-Performance Materials Testing LLC

| | | |
|--------|---|--------|
| IV.D.1 | Innovative Development, Selection and Testing to Reduce Cost and Weight of Materials for BOP Components | IV-108 |
|--------|---|--------|

Idaho National Laboratory

| | | |
|--------|---|--------|
| VII.14 | Dynamic Modeling and Validation of Electrolyzers in Real Time Grid Simulation | VII-65 |
|--------|---|--------|

Illinois Institute of Technology

| | | |
|-------|---|-------|
| V.A.4 | Synthesis and Characterization of Mixed-Conducting Corrosion Resistant Oxide Supports | V-25 |
| V.F.9 | Smart Matrix Development for Direct Carbonate Fuel Cell | V-170 |

Indiana University Purdue University

| | | |
|-------|--|------|
| V.C.2 | Rationally Designed Catalyst Layers for PEMFC Performance Optimization | V-80 |
|-------|--|------|

Ion Power

| | | |
|-------|---|-------|
| V.E.1 | Durability Improvements Through Degradation Mechanism Studies | V-101 |
| VI.1 | Fuel Cell Membrane Electrode Assembly Manufacturing R&D | VI-7 |

IRD Fuel Cells

| | | |
|-------|--|------|
| V.A.7 | Non-Precious Metal Fuel Cell Cathodes: Catalyst Development & Electrode Structure Design | V-43 |
|-------|--|------|

Jet Propulsion Laboratory

| | | |
|--------|---|-------|
| IV.B.1 | Hydrogen Storage Engineering Center of Excellence | IV-22 |
|--------|---|-------|

Johns Hopkins University

| | | |
|-------|---|------|
| V.C.1 | High Performance, Durable, Low Cost Membrane Electrode Assemblies for Transportation Applications . . . | V-73 |
|-------|---|------|

Johnson Matthey Fuel Cells

| | | |
|-------|--|------|
| V.C.2 | Rationally Designed Catalyst Layers for PEMFC Performance Optimization | V-80 |
|-------|--|------|

Kalibrate

| | | |
|-------|--|-------|
| IX.14 | Retail Marketing Analysis: Hydrogen Refueling Stations | IX-67 |
|-------|--|-------|

Kettering University

| | | |
|-------|--|------|
| V.D.1 | Roots Air Management System with Integrated Expander | V-96 |
|-------|--|------|

Kobe Steel, LTD

| | | |
|-------|--|--------|
| III.2 | Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage | III-13 |
|-------|--|--------|

Lawrence Berkeley National Laboratory

| | | |
|--------|---|-------|
| IV.C.1 | Hydrogen Storage in Metal-Organic Frameworks | IV-63 |
| V.C.1 | High Performance, Durable, Low Cost Membrane Electrode Assemblies for Transportation Applications . . . | V-73 |
| V.E.1 | Durability Improvements Through Degradation Mechanism Studies | V-101 |
| V.E.2 | Fuel-Cell Fundamentals at Low and Subzero Temperatures | V-108 |

Lawrence Berkeley National Laboratory (Continued)

| | | |
|--------|--|-------|
| V.F.7 | A Total Cost of Ownership Model for Design and Manufacturing Optimization of Fuel Cells in Stationary and Emerging Market Applications | V-162 |
| V.F.17 | Advanced Hydroxide Conducting Membranes | V-205 |
| V.F.19 | Engineered Low-Pt Catalyst Layers | V-218 |
| VI.1 | Fuel Cell Membrane Electrode Assembly Manufacturing R&D | VI-7 |

Lawrence Livermore National Laboratory

| | | |
|---------|--|---------|
| II.C.5 | Wide Bandgap Chalcopyrite Photoelectrodes for Direct Solar Water Splitting | II-56 |
| IV.C.9 | Improving the Kinetics and Thermodynamics of $Mg(BH_4)_2$ for Hydrogen Storage | IV-101 |
| IV.D.2 | Thermomechanical Cycling of Thin Liner High Fiber Fraction Cryogenic Pressure Vessels Rapidly Refueled by LH_2 Pump to 700 Bar | IV-113 |
| VII.2 | Performance and Durability Testing of Volumetrically Efficient Cryogenic Vessels and High Pressure Liquid Hydrogen Pump | VII-13 |
| VIII.11 | Hydrogen Safety, Codes and Standards: Sensors | VIII-53 |
| VIII.12 | Hands-on Hydrogen Safety Training | VIII-60 |

LightSail

| | | |
|-------|---|--------|
| III.8 | Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage | III-40 |
|-------|---|--------|

Linde Gas, LLC

| | | |
|--------|---|--------|
| VII.10 | Performance Evaluation of Delivered Hydrogen Fueling Stations | VII-50 |
|--------|---|--------|

Linde LLC

| | | |
|--------|--|--------|
| IV.D.2 | Thermomechanical Cycling of Thin Liner High Fiber Fraction Cryogenic Pressure Vessels Rapidly Refueled by LH_2 Pump to 700 Bar | IV-113 |
| VII.2 | Performance and Durability Testing of Volumetrically Efficient Cryogenic Vessels and High Pressure Liquid Hydrogen Pump | VII-13 |

Los Alamos National Laboratory

| | | |
|---------|---|---------|
| IV.B.1 | Hydrogen Storage Engineering Center of Excellence | IV-22 |
| IV.B.8 | Chemical Hydrogen Rate Modeling, Validation, and System Demonstration | IV-56 |
| IV.C.2 | Hydrogen Sorbent Measurement Qualification and Characterization | IV-70 |
| V.A.7 | Non-Precious Metal Fuel Cell Cathodes: Catalyst Development & Electrode Structure Design | V-43 |
| V.A.8 | High-Throughput Synthesis, ORR Activity Modeling, and Testing of non-PGM PEMFC Cathode Catalysts | V-51 |
| V.C.1 | High Performance, Durable, Low Cost Membrane Electrode Assemblies for Transportation Applications | V-73 |
| V.E.1 | Durability Improvements Through Degradation Mechanism Studies | V-101 |
| V.E.2 | Fuel-Cell Fundamentals at Low and Subzero Temperatures | V-108 |
| V.F.11 | Ionomer Dispersion Impact on Advanced Fuel Cell and Electrolyzer Performance and Durability | V-179 |
| V.F.14 | High Performance and Durable Low PGM Cathode Catalysts | V-194 |
| V.F.17 | Advanced Hydroxide Conducting Membranes | V-205 |
| V.F.19 | Engineered Low-Pt Catalyst Layers | V-218 |
| VIII.4 | Hydrogen Fuel Quality | VIII-21 |
| VIII.11 | Hydrogen Safety, Codes and Standards: Sensors | VIII-53 |

Materia

| | | |
|--------|---|--------|
| IV.D.4 | Next Generation Hydrogen Storage Vessels Enabled by Carbon Fiber Infusion with a Low Viscosity, High Toughness System | IV-122 |
|--------|---|--------|

XVI. Project Listings by Organization

MegaStir Technologies, LLC

- III.2 Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage III-13
- III.8 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage III-40

Michigan State University

- V.A.5 Development of Novel Non-PGM Electrocatalysts for Proton Exchange Membrane Fuel Cell Applications V-29

Michigan Technological University

- V.C.1 High Performance, Durable, Low Cost Membrane Electrode Assemblies for Transportation Applications . . . V-73

Montana State University

- IV.D.4 Next Generation Hydrogen Storage Vessels Enabled by Carbon Fiber Infusion with a Low Viscosity, High Toughness System IV-122

N & R Engineering

- III.9 Low Cost Hydrogen Storage at 875 Bar Using Steel Liner and Steel Wire Wrap III-45

Nanosonic

- III.6 Cryogenically Flexible, Low Permeability H₂ Delivery Hose III-28

National Institute of Standards and Technology

- IV.C.1 Hydrogen Storage in Metal-Organic Frameworks IV-63
- IV.C.2 Hydrogen Sorbent Measurement Qualification and Characterization IV-70
- IV.C.3 Neutron Characterization in Support of the DOE Hydrogen Storage Sub-Program IV-76
- V.F.5 Neutron Imaging Study of the Water Transport in Operating Fuel Cells V-152

National Renewable Energy Laboratory

- II.B.1 Renewable Electrolysis Integrated System Development and Testing II-18
- II.B.2 High-Performance, Long-Lifetime Catalysts for Proton Exchange Membrane Electrolysis II-23
- II.C.2 Flowing Particle Bed Solarthermal Redox Process to Split Water II-41
- II.C.4 High-Efficiency Tandem Absorbers for Economical Solar Hydrogen Production II-50
- II.C.5 Wide Bandgap Chalcopyrite Photoelectrodes for Direct Solar Water Splitting II-56
- II.E.1 Fermentation and Electrohydrogenic Approaches to Hydrogen Production II-76
- II.E.2 Improving Cyanobacterial O₂-Tolerance using CBS Hydrogenase for H₂ Production II-81
- III.6 Cryogenically Flexible, Low Permeability H₂ Delivery Hose III-28
- III.11 Reference Station Design III-53
- III.13 700-Bar Hydrogen Dispenser Hose Reliability Improvement III-60
- IV.B.1 Hydrogen Storage Engineering Center of Excellence IV-22
- IV.B.6 System Design, Analysis, and Modeling for Hydrogen Storage Systems IV-49
- IV.C.2 Hydrogen Sorbent Measurement Qualification and Characterization IV-7
- V.A.1 Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes V-9
- V.B.2 Advanced Hybrid Membranes for Next Generation PEMFC Automotive Applications V-69
- V.C.4 Advanced Ionomers & MEAs for Alkaline Membrane Fuel Cells V-92
- V.E.3 Effect of System Contaminants on PEMFC Performance and Durability V-113
- V.F.1 Optimal Stationary Fuel Cell Integration and Control V-130
- V.F.10 Fuel Cell Technology Status—Degradation V-174
- V.F.15 Magnetic Annealing of Pt-Alloy Nanostructured Thin Film Catalysts for Enhanced Activity V-198

National Renewable Energy Laboratory (Continued)

| | | |
|--------|--|---------|
| VI.1 | Fuel Cell Membrane Electrode Assembly Manufacturing R&D | VI-7 |
| VII.1 | Hydrogen Component Validation | VII-9 |
| VII.3 | FCTO INTEGRATE Stack Test Bed & Grid Interoperability | VII-17 |
| VII.4 | Fuel Cell Electric Vehicle Evaluation | VII-21 |
| VII.5 | Technology Validation: Fuel Cell Bus Evaluations | VII-26 |
| VII.6 | Material Handling Equipment Data Collection and Analysis | VII-31 |
| VII.11 | Hydrogen Station Data Collection and Analysis | VII-53 |
| VII.13 | Stationary Fuel Cell Evaluation | VII-61 |
| VIII.2 | Component Standard Research & Development | VIII-13 |
| VIII.5 | NREL Hydrogen Sensor Testing Laboratory | VIII-26 |
| VIII.7 | Fuel Cell Technologies National Codes and Standards Deployment and Outreach | VIII-38 |
| VIII.9 | Hydrogen Contaminant Detector | VIII-46 |
| IX.3 | Pathway Analysis: Projected Cost, Lifecycle Energy Use and Emissions of Emerging Hydrogen Technologies | IX-24 |
| IX.12 | Infrastructure Investment and Finance Scenario Analysis | IX-61 |

New England Wire Technologies

| | | |
|-------|---|--------|
| III.6 | Cryogenically Flexible, Low Permeability H ₂ Delivery Hose | III-28 |
|-------|---|--------|

New Jersey Institute of Technology

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

Nissan Technical Center, North America

| | | |
|-------|---|------|
| V.A.4 | Synthesis and Characterization of Mixed-Conducting Corrosion Resistant Oxide Supports | V-25 |
| V.A.5 | Development of Novel Non-PGM Electrocatalysts for Proton Exchange Membrane Fuel Cell Applications | V-29 |
| V.B.2 | Advanced Hybrid Membranes for Next Generation PEMFC Automotive Applications | V-69 |

Norm Shade

| | | |
|-------|--|--------|
| III.7 | Hydrogen Compression Application of the Linear Motor Reciprocating Compressor (LMRC) | III-33 |
|-------|--|--------|

Northeastern University

| | | |
|-------|---|------|
| V.A.5 | Development of Novel Non-PGM Electrocatalysts for Proton Exchange Membrane Fuel Cell Applications | V-29 |
|-------|---|------|

Northwestern University

| | | |
|--------|--|-------|
| II.C.1 | High Efficiency Solar Thermochemical Reactor for Hydrogen Production | II-35 |
| IX.5 | Employment Impacts of Infrastructure Development for Hydrogen and Fuel Cell Technologies | IX-34 |

Oak Ridge National Laboratory

| | | |
|--------|--|--------|
| III.2 | Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage | III-13 |
| III.8 | Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage | III-40 |
| III.9 | Low Cost Hydrogen Storage at 875 Bar Using Steel Liner and Steel Wire Wrap | III-45 |
| IV.D.5 | Melt Processable PAN Precursor for High Strength, Low-Cost Carbon Fibers (Phase II) | IV-126 |
| V.A.2 | Nanosegregated Cathode Alloy Catalysts with Ultra-Low Platinum Loading | V-13 |
| V.A.7 | Non-Precious Metal Fuel Cell Cathodes: Catalyst Development & Electrode Structure Design | V-43 |
| V.E.1 | Durability Improvements Through Degradation Mechanism Studies | V-101 |

XVI. Project Listings by Organization

Oak Ridge National Laboratory (Continued)

| | | |
|--------|---|-------|
| V.F.4 | Characterization of Fuel Cell Materials | V-147 |
| V.F.15 | Magnetic Annealing of Pt-Alloy Nanostructured Thin Film Catalysts for Enhanced Activity | V-198 |
| V.F.16 | High Conductivity Durable Anion Conducting Membranes | V-203 |
| V.F.18 | DOE's High Acid Content Diels Alder Poly(Phenylene)s for High Temperature and Low Humidity Applications | V-211 |
| V.F.19 | Engineered Low-Pt Catalyst Layers | V-218 |
| IX.2 | GPRA Analysis: Impact of Program Targets on Vehicle Penetration and Benefits | IX-19 |
| IX.11 | Analysis of Optimal On-Board Storage Pressure for Hydrogen Fuel Cell Vehicles | IX-58 |

Oregon State University

| | | |
|--------|--|-------|
| IV.B.1 | Hydrogen Storage Engineering Center of Excellence | IV-22 |
| IV.B.3 | Microscale Enhancement of Heat and Mass Transfer for Hydrogen Energy Storage | IV-32 |

Pacific Northwest National Laboratory

| | | |
|--------|---|---------|
| II.F.1 | Monolithic Piston-Type Reactor for Hydrogen Production through Rapid Swing of Reforming/Combustion Reactions | II-84 |
| III.14 | Magnetocaloric Hydrogen Liquefaction | III-65 |
| IV.B.1 | Hydrogen Storage Engineering Center of Excellence | IV-22 |
| IV.B.5 | Systems Engineering of Chemical Hydrogen Storage and Cryo-Sorbent Storage, Pressure Vessel, and Balance of Plant for Onboard Hydrogen Storage | IV-44 |
| IV.C.7 | Novel Carbon(C)-Boron(B)-Nitrogen(N)-Containing H ₂ Storage Materials | IV-92 |
| IV.D.3 | Enhanced Materials and Design Parameters for Reducing the Cost of Hydrogen Storage Tanks | IV-118 |
| IV.D.6 | Achieving Hydrogen Storage Goals through High-Strength Fiber Glass | IV-134 |
| V.F.14 | High Performance and Durable Low PGM Cathode Catalysts | V-194 |
| VIII.6 | Hydrogen Safety Panel, Safety Knowledge Tools and First Responder Training Resources | VIII-31 |

Pajarito Powder, LLC

| | | |
|-------|---|------|
| V.A.5 | Development of Novel Non-PGM Electrocatalysts for Proton Exchange Membrane Fuel Cell Applications | V-29 |
|-------|---|------|

Pennsylvania State University

| | | |
|--------|--|-------|
| II.E.1 | Fermentation and Electrohydrogenic Approaches to Hydrogen Production | II-76 |
|--------|--|-------|

pH Matter, LLC

| | | |
|--------|--|------|
| V.A.10 | Non-Precious Metal Bi-Functional Catalysts | V-60 |
|--------|--|------|

Plug Power

| | | |
|-----|--|-----|
| X.1 | Ground Support Equipment Demonstration | X-7 |
|-----|--|-----|

POSCO

| | | |
|-------|---|--------|
| III.8 | Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage | III-40 |
|-------|---|--------|

Powertech Labs, Inc.

| | | |
|-------|---|--------|
| VII.7 | Development of the Hydrogen Station Equipment Performance (HyStEP) Device | VII-36 |
|-------|---|--------|

PPG Industries, Inc.

| | | |
|--------|--|--------|
| IV.D.6 | Achieving Hydrogen Storage Goals through High-Strength Fiber Glass | IV-134 |
|--------|--|--------|

Pressure Science, Inc.

III.9 Low Cost Hydrogen Storage at 875 Bar Using Steel Liner and Steel Wire Wrap III-45

Proton Energy Systems d/b/a Proton OnSite

II.B.3 Low-Noble-Metal-Content Catalysts/Electrodes for Hydrogen Production by Water Electrolysis II-28
 V.A.9 Non-Platinum Group Metal OER/ORR Catalysts for Alkaline Membrane Fuel Cells and Electrolyzers V-56
 VII.9 Validation of an Advanced High Pressure PEM Electrolyzer and Composite Hydrogen Storage, with Data Reporting, for SunHydro Stations. VII-44
 VIII.6 Hydrogen Safety Panel, Safety Knowledge Tools and First Responder Training Resources VIII-31

Protonex Technology Corporation

IV.C.7 Novel Carbon(C)-Boron(B)-Nitrogen(N)-Containing H₂ Storage Materials IV-92

RCF Economic & Financial Consulting

IX.5 Employment Impacts of Infrastructure Development for Hydrogen and Fuel Cell Technologies IX-34

Redox Fuel Cells, Inc.

V.F.8 Affordable, High Performance, Intermediate Temperature Solid Oxide Fuel Cells. V-167

Rensselaer Polytechnic University

V.F.17 Advanced Hydroxide Conducting Membranes V-205

Rutgers, the State University of New Jersey

II.D.2 Tunable Photoanode-Photocathode-Catalyst Interface Systems for Efficient Solar Water Splitting II-72
 V.A.9 Non-Platinum Group Metal OER/ORR Catalysts for Alkaline Membrane Fuel Cells and Electrolyzers V-56

Sandia National Laboratories

II.C.1 High Efficiency Solar Thermochemical Reactor for Hydrogen Production II-35
 III.3 Hydrogen Embrittlement of Structural Steels III-18
 III.11 Reference Station Design. III-53
 IV.C.8 Boron-Based Hydrogen Storage: Ternary Borides and Beyond IV-97
 IV.C.9 Improving the Kinetics and Thermodynamics of Mg(BH₄)₂ for Hydrogen Storage. IV-101
 IV.D.1 Innovative Development, Selection and Testing to Reduce Cost and Weight of Materials for BOP Components IV-108
 V.F.17 Advanced Hydroxide Conducting Membranes V-205
 V.F.18 DOE's High Acid Content Diels Alder Poly(Phenylene)s for High Temperature and Low Humidity Applications V-211
 VII.7 Development of the Hydrogen Station Equipment Performance (HyStEP) Device VII-36
 VIII.1 Hydrogen behavior and Quantitative Risk Assessment. VIII-1
 VIII.3 R&D for Safety, Codes and Standards: Materials and Components Compatibility VIII-17
 VIII.10 Enabling Hydrogen Infrastructure Through Science-based Codes and Standards VIII-49
 IX.7 Hydrogen Analysis with the Sandia ParaChoice Model IX-44
 X.2 Maritime Fuel Cell Generator Project X-10

Savannah River Consultants

II.C.3 Electrolyzer Component Development for the HyS Thermochemical Cycle II-46

Savannah River National Laboratory

II.C.3 Electrolyzer Component Development for the HyS Thermochemical Cycle II-46
 III.4 Fiber Reinforced Composite Pipelines. III-22

XVI. Project Listings by Organization

Savannah River National Laboratory (Continued)

| | | |
|--------|--|--------|
| IV.B.1 | Hydrogen Storage Engineering Center of Excellence | IV-22 |
| IV.C.5 | Electrochemical Reversible Formation of α -Alane | IV-84 |
| IV.E.2 | Elucidation of Hydrogen Interaction Mechanisms with Metal-Doped Carbon Nanostructures. | IV-144 |
| V.F.13 | PGM Free Catalysts for PEMFC | V-189 |

Southwest Research Institute®

| | | |
|-------|--|--------|
| III.7 | Hydrogen Compression Application of the Linear Motor Reciprocating Compressor (LMRC) | III-33 |
|-------|--|--------|

Spectrum Automation Controls

| | | |
|--------|--|---------|
| II.B.1 | Renewable Electrolysis Integrated System Development and Testing | II-18 |
| III.13 | 700-Bar Hydrogen Dispenser Hose Reliability Improvement. | III-60 |
| VII.1 | Hydrogen Component Validation. | VII-9 |
| VII.3 | FCTO INTEGRATE Stack Test Bed & Grid Interoperability | VII-17 |
| VIII.2 | Component Standard Research & Development | VIII-13 |

Spencer Composites Corporation

| | | |
|--------|--|--------|
| IV.D.2 | Thermomechanical Cycling of Thin Liner High Fiber Fraction Cryogenic Pressure Vessels Rapidly Refueled by LH ₂ Pump to 700 Bar. | IV-113 |
| IV.D.4 | Next Generation Hydrogen Storage Vessels Enabled by Carbon Fiber Infusion with a Low Viscosity, High Toughness System. | IV-122 |
| VII.2 | Performance and Durability Testing of Volumetrically Efficient Cryogenic Vessels and High Pressure Liquid Hydrogen Pump | VII-13 |

SRI International

| | | |
|--------|---|-------|
| IV.C.6 | Low-Cost α -Alane for Hydrogen Storage | IV-88 |
|--------|---|-------|

Stanford University

| | | |
|--------|--|-------|
| II.C.1 | High Efficiency Solar Thermochemical Reactor for Hydrogen Production | II-35 |
| II.C.5 | Wide Bandgap Chalcopyrite Photoelectrodes for Direct Solar Water Splitting | II-56 |

Strategic Analysis, Inc.

| | | |
|--------|--|-------|
| II.A.1 | Hydrogen Pathways Analysis for Solid Oxide Fuel Cell (SOFC) and Dark Fermentation. | II-11 |
| IV.A.2 | Hydrogen Storage Cost Analysis | IV-17 |
| V.F.3 | Fuel Cell Vehicle and Bus Cost Analysis. | V-141 |
| V.F.7 | A Total Cost of Ownership Model for Design and Manufacturing Optimization of Fuel Cells in Stationary and Emerging Market Applications | V-162 |
| VI.2 | U.S. Clean Energy Hydrogen and Fuel Cell Technologies: A Competitiveness Analysis | VI-12 |

SunHydro LLC

| | | |
|-------|--|--------|
| VII.9 | Validation of an Advanced High Pressure PEM Electrolyzer and Composite Hydrogen Storage, with Data Reporting, for SunHydro Stations. | VII-44 |
|-------|--|--------|

Sustainable Innovations, LLC

| | | |
|--------|---|--------|
| III.10 | Electrochemical Hydrogen Compressor | III-50 |
|--------|---|--------|

SustainX

| | | |
|-------|---|--------|
| III.8 | Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage | III-40 |
|-------|---|--------|

Swagelok

- III.6 Cryogenically Flexible, Low Permeability H₂ Delivery Hose III-28

Temple University

- III.2 Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage III-13
 III.8 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage III-40

Texas A&M University

- IV.C.2 Hydrogen Sorbent Measurement Qualification and Characterization IV-70

The University of Alabama

- IV.C.7 Novel Carbon(C)-Boron(B)-Nitrogen(N)-Containing H₂ Storage Materials IV-92

Toray Composites America

- IV.D.3 Enhanced Materials and Design Parameters for Reducing the Cost of Hydrogen Storage Tanks IV-118

TreadStone Technologies, Inc.

- V.C.3 Novel Structured Metal Bipolar Plates for Low Cost Manufacturing. V-86

Unique Electric Solutions

- X.3 Fuel Cell Hybrid Electric Delivery Van Project X-14

United Parcel Service

- X.3 Fuel Cell Hybrid Electric Delivery Van Project X-14

United Technologies Research Center

- IV.B.1 Hydrogen Storage Engineering Center of Excellence IV-22
 IV.B.4 Advancement of Systems Designs and Key Engineering Technologies for Materials Based Hydrogen Storage IV-36
 V.C.2 Rationally Designed Catalyst Layers for PEMFC Performance Optimization. V-80
 V.E.2 Fuel-Cell Fundamentals at Low and Subzero Temperatures. V-108

University of Connecticut

- V.E.4 The Effect of Airborne Contaminants on Fuel Cell Performance and Durability V-119

University of Texas at Austin

- V.C.2 Rationally Designed Catalyst Layers for PEMFC Performance Optimization. V-80

Université du Québec à Trois-Rivières

- IV.B.1 Hydrogen Storage Engineering Center of Excellence IV-22

University of Calgary

- V.E.5 Open Source Performance and Durability Model: Consideration of Membrane Properties on Cathode Degradation V-125

University of California, Berkeley

- IV.C.2 Hydrogen Sorbent Measurement Qualification and Characterization IV-70
 V.F.7 A Total Cost of Ownership Model for Design and Manufacturing Optimization of Fuel Cells in Stationary and Emerging Market Applications V-162

XVI. Project Listings by Organization

University of California, Davis

- IV.E.3 Activation of Hydrogen Under Ambient Conditions by Main Group Molecules IV-145

University of California, Irvine

- II.F.2 Reformer-Electrolyzer-Purifier (REP) for Production of Hydrogen II-90
IX.9 Tri-Generation Fuel Cell Technologies for Location-Specific Applications (FY 2015) IX-54

University of California, San Diego

- IV.C.2 Hydrogen Sorbent Measurement Qualification and Characterization IV-70

University of Chicago

- IX.13 The Business Case for Hydrogen-powered Passenger Cars: Competition and Solving the Infrastructure
Puzzle IX-65

University of Colorado Boulder

- II.C.2 Flowing Particle Bed Solarthermal Redox Process to Split Water II-41
II.C.6 Accelerated Discovery of Advanced RedOX Materials for Solar Thermal Water Splitting to Produce
Renewable Hydrogen II-60

University of Connecticut

- V.F.9 Smart Matrix Development for Direct Carbonate Fuel Cell V-170

University of Delaware

- V.A.1 Extended, Continuous Pt Nanostructures in Thick, Dispersed Electrodes. V-9

University of Hawaii

- II.C.4 High-Efficiency Tandem Absorbers for Economical Solar Hydrogen Production II-50
II.C.5 Wide Bandgap Chalcopyrite Photoelectrodes for Direct Solar Water Splitting II-56
V.C.3 Novel Structured Metal Bipolar Plates for Low Cost Manufacturing. V-86

University of Maryland

- V.F.8 Affordable, High Performance, Intermediate Temperature Solid Oxide Fuel Cells. V-167

University of Michigan

- IV.B.1 Hydrogen Storage Engineering Center of Excellence IV-22
IV.B.2 Ford/BASF-SE/UM Activities in Support of the Hydrogen Storage Engineering Center of Excellence. IV-27
IV.C.9 Improving the Kinetics and Thermodynamics of $Mg(BH_4)_2$ for Hydrogen Storage. IV-101

University of Missouri

- IV.C.4 High-Capacity Hydrogen Storage Systems via Mechanochemistry IV-81
IV.C.8 Boron-Based Hydrogen Storage: Ternary Borides and Beyond IV-97

University of Nevada, Las Vegas

- II.C.4 High-Efficiency Tandem Absorbers for Economical Solar Hydrogen Production II-50
II.C.5 Wide Bandgap Chalcopyrite Photoelectrodes for Direct Solar Water Splitting II-56

University of New Mexico

- V.A.5 Development of Novel Non-PGM Electrocatalysts for Proton Exchange Membrane Fuel Cell Applications V-29
V.E.5 Open Source Performance and Durability Model: Consideration of Membrane Properties on Cathode
Degradation V-125

University of Rochester

V.A.7 Non-Precious Metal Fuel Cell Cathodes: Catalyst Development & Electrode Structure Design V-43

University of South Carolina

V.A.6 Development of Ultra-Low Doped-Pt Cathode Catalysts for PEM Fuel Cells V-37
 V.E.3 Effect of System Contaminants on PEMFC Performance and Durability V-113

University of Tennessee

IX.8 Status and Prospects of the N.A. Non-Automotive Fuel Cell Industry: 2014 Update. IX-48

University of Texas

X.3 Fuel Cell Hybrid Electric Delivery Van Project X-14

University of Toledo

II.D.1 New Metal Oxides for Efficient Hydrogen Production via Solar Water Splitting. II-67

University of Waterloo

V.A.7 Non-Precious Metal Fuel Cell Cathodes: Catalyst Development & Electrode Structure Design V-43

US Hybrid Corporation

X.5 Demonstration and Deployment of a Fuel Cell-Electric Refuse Truck for Waste Transportation X-21

Valence

X.3 Fuel Cell Hybrid Electric Delivery Van Project X-14

Vanderbilt University

V.B.1 New Fuel Cell Membranes with Improved Durability and Performance V-64

Virginia Commonwealth University

IV.E.4 Elucidation of Hydride Interaction Mechanisms with Carbon Nanostructures and the Formation of Novel Nanocomposites. IV-146

Virginia Polytechnic Institute

II.B.4 High Temperature, High Pressure Electrolysis II-31
 IV.D.5 Melt Processable PAN Precursor for High Strength, Low-Cost Carbon Fibers (Phase II) IV-126

W.L. Gore & Associates

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

Washington State University

II.F.1 Monolithic Piston-Type Reactor for Hydrogen Production through Rapid Swing of Reforming/Combustion Reactions II-84

WireTough Cylinders

III.8 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage III-40
 III.9 Low Cost Hydrogen Storage at 875 Bar Using Steel Liner and Steel Wire Wrap. III-45

WPCSOL

V.E.4 The Effect of Airborne Contaminants on Fuel Cell Performance and Durability V-119