
XVI. Project Listings by Organization

3M Company

- V.A.7 Highly Active, Durable, and Ultra-low PGM NSTF Thin Film ORR Catalysts and Supports
- V.A.8 Highly-Accessible Catalysts for Durable High-Power Performance
- V.B.4 FC-PAD: Ionomer, GDLs, Interfaces
- V.C.1 New Fuel Cell Membranes with Improved Durability and Performance
- V.C.2 Advanced Hybrid Membranes for Next Generation PEMFC Automotive Applications
- V.C.7 Advanced Ionomers and MEAs for Alkaline Membrane Fuel Cells
- V.D.1 High Performance, Durable, Low Cost Membrane Electrode Assemblies for Transportation Applications
- VI.1 Fuel Cell Membrane Electrode Assembly Manufacturing R&D

AccerlorMittal

- III.5 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage

ACI Services

- III.4 Hydrogen Compression Application of the Linear Motor Reciprocating Compressor (LMRC)

Adaptive Intelligent Systems LLC

- III.5 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage

Adherent Technologies, Inc.

- IV.D.5 Optimizing the Cost and Performance of Composite Cylinders for H₂ Storage using a Graded Construction

Advent Technologies Inc.

- V.D.5 Facilitated Direct Liquid Fuel Cells with High Temperature Membrane Electrode Assemblies

Air Liquide

- III.5 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage
- VIII.6 Hydrogen Safety Panel, Safety Knowledge Tools and First Responder Training Resources

Air Products and Chemicals, Inc.

- VII.B.3 Validation of an Advanced High Pressure PEM Electrolyzer and Composite Hydrogen Storage, with Data Reporting, for SunHydro Stations
- VII.C.3 Advanced Hydrogen Fueling Station Supply: Tube Trailers
- VIII.6 Hydrogen Safety Panel, Safety Knowledge Tools and First Responder Training Resources

ALD Nanosolutions

- V.A.6 Extended Surface Electrocatalyst Development

Ames Laboratory

- IV.C.6 High-capacity Hydrogen Storage Systems via Mechanochemistry

Amsen Technologies LLC

- V.C.9 Low-Cost Proton Conducting Membranes for PEM Fuel Cells

Anderson Burton

- VII.B.5 Brentwood Case Study

AOC, LLC

IV.D.1 Enhanced Materials and Design Parameters for Reducing the Cost of Hydrogen Storage Tanks

Ardica Technologies, Inc.

IV.C.12 Low-Cost α -Alane for Hydrogen Storage

Argonne National Laboratory

III.1 Hydrogen Delivery Infrastructure Analysis

III.13 Hydrogen Fueling Station Precooling Analysis

IV.A.1 System Analysis of Physical and Materials-Based Hydrogen Storage

IV.C.9 High-Capacity and Low-Cost Hydrogen-Storage Sorbents for Automotive Applications

V.A.4 Tailored High Performance Low-PGM Alloy Cathode Catalysts

V.A.7 Highly Active, Durable, and Ultra-low PGM NSTF Thin Film ORR Catalysts and Supports

V.B.1 Fuel Cell-Performance and Durability (FC-PAD) Consortium Overview

V.B.2 FC-PAD Fuel Cell-Performance and Durability Electrocatalysts and Supports

V.B.3 FC-PAD: Electrode Layer Integration

V.B.4 FC-PAD: Ionomer, GDLs, Interfaces

V.B.5 FC-PAD: Modeling, Evaluation, Characterization

V.C.6 Advanced Materials for Fully-Integrated MEAs in AEMFCs

V.D.1 High Performance, Durable, Low Cost Membrane Electrode Assemblies for Transportation Applications

V.D.3 Rationally Designed Catalyst Layers for PEMFC Performance Optimization

V.F.5 Performance and Durability of Advanced Automotive Fuel Cell Stacks and Systems with Nanostructured Thin Film Catalyst Based Membrane Electrode Assemblies

VII.A.3 Fuel Cell Electric Truck (FCET) Component Sizing

IX.1 Employment Impacts of Hydrogen and Fuel Cell Technologies

IX.2 Life-Cycle Analysis of Water Consumption for Hydrogen Production

IX.3 Impact of Fuel Cell and H₂ Storage Improvements on FCEVs

IX.5 Life Cycle Analysis of Emerging Hydrogen Production Technologies

Arizona State University

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

ASTM International

VIII.3 Hydrogen Fuel Quality

Automated Dynamics

VI.5 Continuous Fiber Composite Electrofusion Coupler

A.V. Tchouvelev & Associates

VIII.1 National Codes and Standards Deployment and Outreach

Ballard Power Systems

V.B.7 The Effect of Airborne Contaminants on Fuel Cell Performance and Durability

X.4 Demonstration of Fuel Cell Auxiliary Power Units (APUs) to Power Transport Refrigeration Units (TRUs) in Refrigerated Trucks

Battelle

V.F.7 Stationary and Emerging Market Fuel Cell System Cost Analysis—Primary Power and Combined Heat and Power Applications

Becht Engineering

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

Ben C. Gerwick, Inc.

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

Bevilacqua Knight Inc.

III.5 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage

Birch Studio

VI.3 Fuel Cell and Hydrogen Opportunity Center, www.hfcnexus.com

Bki

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

Bloomfield Automation

VIII.7 NREL Hydrogen Sensor Testing Laboratory

BMW

IV.D.2 Thermomechanical Cycling of Thin Liner High Fiber Fraction Cryogenic Pressure Vessels Rapidly Refueled by Liquid Hydrogen Pump to 700 bar

Bowen Liu

VI.4 U.S. Clean Energy Hydrogen and Fuel Cell Technologies: A Competiveness Analysis

Branded by Media

VIII.1 National Codes and Standards Deployment and Outreach

Breakthrough Technologies Institute

VI.3 Fuel Cell and Hydrogen Opportunity Center, www.hfcnexus.com

Brookhaven National Laboratory

V.A.5 Platinum Monolayer Electrocatalysts

V.G.1 Structure and Function in Electrocatalysis of Reactions for Direct Energy Conversion

V.G.2 Catalysis and Electrocatalysis for Advanced Fuel Synthesis: Hydrogen Production and the Water-Gas Shift

Bucknell University

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

California Fuel Cell Partnership

VII.C.6 Station Operational Status System (SOSS) 3.0 Implementation, SOSS 3.1 Upgrade, and Station Map Upgrade Project

California Institute of Technology

II.D.3 Tandem Particle-Slurry Batch Reactors for Solar Water Splitting

IV.B.1 Hydrogen Storage Engineering Center of Excellence

IV.C.8 Design and Synthesis of Materials with High Capacities for Hydrogen Physisorption

California State University, Los Angeles

VII.B.4 CSULA Hydrogen Refueling Facility Performance Evaluation and Optimization

Carnegie Mellon University

- V.A.1 Non-Precious Metal Fuel Cell Cathodes: Catalyst Development and Electrode Structure Design
- V.A.8 Highly-Accessible Catalysts for Durable High-Power Performance

Center for Transportation and the Environment

- IV.D.3 Conformable Hydrogen Storage Pressure Vessel Project
- VII.A.4 Fuel Cell Hybrid Electric Delivery Van Project

Central Michigan University

- V.G.14 Element Specific Atomic Arrangement of Binary and Ternary Alloy Nanosized Catalysts in As-Prepared and Active State

City of Santa Fe Springs

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

Colorado School of Mines

- II.C.1 High Efficiency Solar Thermochemical Reactor for Hydrogen Production
- III.2 Fatigue Performance of High-Strength Pipeline Steels and Their Welds in Hydrogen Gas Service
- V.A.6 Extended Surface Electrocatalyst Development
- V.B.4 FC-PAD: Ionomer, GDLs, Interfaces
- V.C.2 Advanced Hybrid Membranes for Next Generation PEMFC Automotive Applications
- V.C.7 Advanced Ionomers and MEAs for Alkaline Membrane Fuel Cells
- VI.1 Fuel Cell Membrane Electrode Assembly Manufacturing R&D

Commissariat a l'energie atomique et aux energies alternatives

- VIII.3 Hydrogen Fuel Quality

Composite Technology Development, Inc.

- IV.D.5 Optimizing the Cost and Performance of Composite Cylinders for H₂ Storage using a Graded Construction

Connecticut Center for Advanced Technology

- VI.2 Clean Energy Supply Chain and Manufacturing Competitiveness Analysis for Hydrogen and Fuel Cell Technologies

Cornell University

- V.A.8 Highly-Accessible Catalysts for Durable High-Power Performance

CP Industries

- III.6 Low Cost Hydrogen Storage at 875 bar Using Steel Liner and Steel Wire Wrap

CSA Group

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

Dason Technology

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

DJW Technology, LLC

- VI.2 Clean Energy Supply Chain and Manufacturing Competitiveness Analysis for Hydrogen and Fuel Cell Technologies
- VI.4 U.S. Clean Energy Hydrogen and Fuel Cell Technologies: A Competiveness Analysis

Drexel University

V.A.8 Highly-Accessible Catalysts for Durable High-Power Performance

e4tech

VI.4 U.S. Clean Energy Hydrogen and Fuel Cell Technologies: A Competiveness Analysis

ElectroChem, Inc.

V.C.11 Novel Nanocomposite Polymer Electrolyte Membranes for Fuel Cells

Element One

VIII.7 NREL Hydrogen Sensor Testing Laboratory

Emerald Energy NW LLC

III.10 Magnetocaloric Hydrogen Liquefaction

Energetics, Inc.

IX.1 Employment Impacts of Hydrogen and Fuel Cell Technologies

Excelsior Design, Inc.

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

Federal Express Corporation

X.5 FedEx Express Hydrogen Fuel Cell Extended-Range Battery Electric Vehicles

Firexplo

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

Florida State University

VII.D.3 Dynamic Modeling and Validation of Electrolyzers in Real Time Grid Simulation

Fluer, Inc.

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

Ford Motor Company

IV.B.1 Hydrogen Storage Engineering Center of Excellence

IV.C.10 Hydrogen Adsorbents with High Volumetric Density: New Materials and System Projections

IV.D.1 Enhanced Materials and Design Parameters for Reducing the Cost of Hydrogen Storage Tanks

VIII.9 Compatibility of Polymeric Materials Used in the Hydrogen Infrastructure

Forterra Water Pipe

III.5 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage

Fuel Cell & Hydrogen Energy Association

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

FuelCell Energy

II.B.5 Solid Oxide Based Electrolysis and Stack Technology with Ultra-High Electrolysis Current Density ($>3 \text{ A/cm}^2$) and Efficiency

II.F.2 Reformer-Electrolyzer-Purifier (REP) for Production of Hydrogen [CO₂ Pump]

V.A.3 Innovative Non-PGM Catalysts for High-Temperature PEMFCs

V.C.3 Smart Matrix Development for Direct Carbonate Fuel Cell

Gas Technology Institute

- III.7 Compressor-Less Hydrogen Refueling Station Using Thermal Compression
- VII.B.2 Performance Evaluation of Delivered Hydrogen Fueling Stations

General Motors Company

- IV.B.1 Hydrogen Storage Engineering Center of Excellence
- V.A.1 Non-Precious Metal Fuel Cell Cathodes: Catalyst Development and Electrode Structure Design
- V.A.8 Highly-Accessible Catalysts for Durable High-Power Performance
- V.C.1 New Fuel Cell Membranes with Improved Durability and Performance
- V.D.1 High Performance, Durable, Low Cost Membrane Electrode Assemblies for Transportation Applications
- VI.1 Fuel Cell Membrane Electrode Assembly Manufacturing R&D

Georgia Institute of Technology

- II.B.6 Economical Production of Hydrogen Through Development of Novel, High Efficiency Electrocatalysts for Alkaline Membrane Electrolysis
- V.G.10 Atomic-Scale Design of Metal and Alloy Catalysts: A Combined Theoretical and Experimental Approach
- VI.1 Fuel Cell Membrane Electrode Assembly Manufacturing R&D

Giner, Inc.

- II.B.2 High-Performance, Long-Lifetime Catalysts for Proton Exchange Membrane Electrolysis
- II.B.4 High Temperature, High Pressure Electrolysis
- V.C.4 Ionomer Dispersion Impact on Fuel Cell and Electrolyzer Performance and Durability
- V.C.8 Dimensionally Stable High Performance Membranes
- V.D.6 Advanced Catalysts and Membrane Electrode Assemblies (MEAs) for Reversible Alkaline Membrane Fuel Cells
- V.E.1 Regenerative Fuel Cell System

Global Engineering and Technology, LLC

- III.3 Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage
- III.5 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage

GLWN, Westside Industrial Retention & Expansion Network

- VI.4 U.S. Clean Energy Hydrogen and Fuel Cell Technologies: A Competitiveness Analysis

GVD Corporation

- III.8 Advanced Barrier Coatings for Harsh Environments

GWS Solutions of Tolland, LLC

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

Hanson Pressure Pipe

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

Harris Thermal Transfer Products

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

Hawaii Natural Energy Institute

- V.B.7 The Effect of Airborne Contaminants on Fuel Cell Performance and Durability
- X.1 Hydrogen Energy Systems as a Grid Management Tool

Hexagon Lincoln

- IV.B.1 Hydrogen Storage Engineering Center of Excellence
- IV.D.1 Enhanced Materials and Design Parameters for Reducing the Cost of Hydrogen Storage Tanks
- IV.D.6 Achieving Hydrogen Storage Goals through High-Strength Fiber Glass

High Energy Coil Reservoirs, LLC

- IV.D.3 Conformable Hydrogen Storage Pressure Vessel Project

Humboldt State University

- VII.D.3 Dynamic Modeling and Validation of Electrolyzers in Real Time Grid Simulation

Hydrogenics

- VII.A.4 Fuel Cell Hybrid Electric Delivery Van Project
- VII.B.4 CSULA Hydrogen Refueling Facility Performance Evaluation and Optimization
- X.3 Maritime Fuel Cell Generator Project

Hy-Performance Materials Testing, LLC

- III.6 Low Cost Hydrogen Storage at 875 bar Using Steel Liner and Steel Wire Wrap
- IV.D.8 Innovative Development, Selection and Testing to Reduce Cost and Weight of Materials for BOP Components

Idaho National Laboratory

- VII.D.3 Dynamic Modeling and Validation of Electrolyzers in Real Time Grid Simulation

Illinois Institute of Technology

- V.A.9 Corrosion-Resistant Non-Carbon Electrocatalyst Supports for PEFCs
- V.C.3 Smart Matrix Development for Direct Carbonate Fuel Cell

Indiana University-Purdue University Indianapolis

- V.D.3 Rationally Designed Catalyst Layers for PEMFC Performance Optimization

IRD Fuel Cells

- V.A.1 Non-Precious Metal Fuel Cell Cathodes: Catalyst Development and Electrode Structure Design
- V.A.2 Development of PGM-free Catalysts for Hydrogen Oxidation Reaction in Alkaline Media

Japan Automotive Research Institute

- VIII.3 Hydrogen Fuel Quality

Jet Propulsion Laboratory

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

Johns Hopkins University

- V.A.7 Highly Active, Durable, and Ultra-low PGM NSTF Thin Film ORR Catalysts and Supports
- V.D.1 High Performance, Durable, Low Cost Membrane Electrode Assemblies for Transportation Applications
- V.G.3 Control of Reactivity in Nanoporous Metal/Ionic Liquid Composite Catalysts

Johnson Matthey Fuel Cells

- V.D.3 Rationally Designed Catalyst Layers for PEMFC Performance Optimization

Kobe Steel, LTD.

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

Lawrence Berkeley National Laboratory

- II.D.3 Tandem Particle-Slurry Batch Reactors for Solar Water Splitting
- II.E.1 Biomass to Hydrogen
- IV.C.4 HyMARC: A Consortium for Advancing Solid-State Hydrogen Storage Materials
- IV.C.7 H₂ Storage Characterization and Optimization Research Efforts
- V.A.4 Tailored High Performance Low-PGM Alloy Cathode Catalysts
- V.B.1 Fuel Cell-Performance and Durability (FC-PAD) Consortium Overview
- V.B.3 FC-PAD: Electrode Layer Integration
- V.B.4 FC-PAD: Ionomer, GDLs, Interfaces
- V.B.5 FC-PAD: Modeling, Evaluation, Characterization
- V.B.6 Multiscale Modeling of Fuel Cell Membranes
- V.C.7 Advanced Ionomers and MEAs for Alkaline Membrane Fuel Cells
- V.D.1 High Performance, Durable, Low Cost Membrane Electrode Assemblies for Transportation Applications
- V.F.8 A Total Cost of Ownership Model for Design and Manufacturing Optimization of Fuel Cells in Stationary and Emerging Market Applications
- VI.1 Fuel Cell Membrane Electrode Assembly Manufacturing R&D

Lawrence Livermore National Laboratory

- II.D.2 Wide Bandgap Chalcopyrite Photoelectrodes for Direct Solar Water Splitting
- III.15 Cryo-Compressed Pathway Analysis (2016)
- IV.C.3 HyMARC: Hydrogen Storage Materials Advanced Research Consortium (LLNL Effort)
- IV.C.4 HyMARC: A Consortium for Advancing Solid-State Hydrogen Storage Materials
- IV.C.5 Improving the Kinetics and Thermodynamics of Mg(BH₄)₂ for Hydrogen Storage
- IV.C.8 Design and Synthesis of Materials with High Capacities for Hydrogen Physisorption
- IV.D.2 Thermomechanical Cycling of Thin Liner High Fiber Fraction Cryogenic Pressure Vessels Rapidly Refueled by Liquid Hydrogen Pump to 700 bar
- VII.C.4 Performance and Durability Testing of Volumetrically Efficient Cryogenic Vessels and High Pressure Liquid Hydrogen Pump

Lexidyne, LLC

- IX.11 National FCEV and Hydrogen Refueling Station Scenarios

LightSail

- III.5 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage

Linde LLC

- IV.D.2 Thermomechanical Cycling of Thin Liner High Fiber Fraction Cryogenic Pressure Vessels Rapidly Refueled by LH₂ Pump to 700 bar
- VII.B.2 Performance Evaluation of Delivered Hydrogen Fueling Stations
- VII.C.4 Performance and Durability Testing of Volumetrically Efficient Cryogenic Vessels and High Pressure Liquid Hydrogen Pump

Los Alamos National Laboratory

- IV.B.1 Hydrogen Storage Engineering Center of Excellence
- V.A.1 Non-Precious Metal Fuel Cell Cathodes: Catalyst Development and Electrode Structure Design
- V.A.2 Development of PGM-free Catalysts for Hydrogen Oxidation Reaction in Alkaline Media
- V.A.4 Tailored High Performance Low-PGM Alloy Cathode Catalysts

Los Alamos National Laboratory (Continued)

- V.A.5 Platinum Monolayer Electrocatalysts
- V.B.1 Fuel Cell-Performance and Durability (FC-PAD) Consortium Overview
- V.B.2 FC-PAD Fuel Cell-Performance and Durability Electrocatalysts and Supports
- V.B.3 FC-PAD: Electrode Layer Integration
- V.B.4 FC-PAD: Ionomer, GDLs, Interfaces
- V.B.5 FC-PAD: Modeling, Evaluation, Characterization
- V.C.4 Ionomer Dispersion Impact on Fuel Cell and Electrolyzer Performance and Durability
- V.C.6 Advanced Materials for Fully-Integrated MEAs in AEMFCs
- V.D.1 High Performance, Durable, Low Cost Membrane Electrode Assemblies for Transportation Applications
- V.D.5 Facilitated Direct Liquid Fuel Cells with High Temperature Membrane Electrode Assemblies
- V.F.3 Technical Assistance to Developers
- VIII.3 Hydrogen Fuel Quality

Mainstream Engineering

- VI.1 Fuel Cell Membrane Electrode Assembly Manufacturing R&D
- VI.6 In-line Quality Control of PEM Materials

Materia, Inc.

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

MegaStir Technologies LLC

- III.3 Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage
- III.5 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage

Michigan Technological University

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

Montana State University

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

N&R Engineering

- III.6 Low Cost Hydrogen Storage at 875 bar Using Steel Liner and Steel Wire Wrap

NanoSonic, Inc.

- III.12 Cryogenically Flexible, Low Permeability H₂ Delivery Hose
- V.C.10 Novel Hydrocarbon Ionomers for Durable Proton Exchange Membranes

National Fuel Cell Research Center

- VI.2 Clean Energy Supply Chain and Manufacturing Competitiveness Analysis for Hydrogen and Fuel Cell Technologies

National Institute of Standards and Technology

- III.2 Fatigue Performance of High-Strength Pipeline Steels and Their Welds in Hydrogen Gas Service
- IV.C.7 H₂ Storage Characterization and Optimization Research Efforts
- V.F.2 Neutron Imaging Study of the Water Transport in Operating Fuel Cells

National Renewable Energy Laboratory

- II.B.1 Renewable Electrolysis Integrated System Development and Testing
- II.B.2 High-Performance, Long-Lifetime Catalysts for Proton Exchange Membrane Electrolysis
- II.C.2 Flowing Particle Bed Solarthermal RedOx Process to Split Water
- II.D.1 High-Efficiency Tandem Absorbers for Economical Solar Hydrogen Production
- II.D.2 Wide Bandgap Chalcopyrite Photoelectrodes for Direct Solar Water Splitting
- II.E.1 Biomass to Hydrogen
- III.9 Improved Hydrogen Liquefaction through Heisenberg Vortex Separation of Para- and Orthohydrogen
- III.11 700 bar Hydrogen Dispenser Hose Reliability Improvement
- III.12 Cryogenically Flexible, Low Permeability H₂ Delivery Hose
- III.14 H2FIRST—Consolidation
- IV.B.1 Hydrogen Storage Engineering Center of Excellence
- IV.B.2 Hydrogen Storage System Modeling: Public Access, Maintenance, and Enhancements
- IV.C.7 H₂ Storage Characterization and Optimization Research Efforts
- V.A.6 Extended Surface Electrocatalyst Development
- V.A.8 Highly-Accessible Catalysts for Durable High-Power Performance
- V.B.1 Fuel Cell-Performance and Durability (FC-PAD) Consortium Overview
- V.B.2 FC-PAD Fuel Cell-Performance and Durability Electrocatalysts and Supports
- V.B.3 FC-PAD: Electrode Layer Integration
- V.B.4 FC-PAD: Ionomer, GDLs, Interfaces
- V.B.5 FC-PAD: Modeling, Evaluation, Characterization
- V.C.2 Advanced Hybrid Membranes for Next Generation PEMFC Automotive Applications
- V.C.5 Highly Stable Anion-Exchange Membranes for High-Voltage Redox-Flow Batteries
- V.C.7 Advanced Ionomers and MEAs for Alkaline Membrane Fuel Cells
- V.D.6 Advanced Catalysts and Membrane Electrode Assemblies (MEAs) for Reversible Alkaline Membrane Fuel Cells
- V.E.1 Regenerative Fuel Cell System
- V.F.4 Fuel Cell Technology Status: Degradation
- V.G.17 Hydroxide Conductors for Energy Conversion Devices
- VI.1 Fuel Cell Membrane Electrode Assembly Manufacturing R&D
- VI.2 Clean Energy Supply Chain and Manufacturing Competitiveness Analysis for Hydrogen and Fuel Cell Technologies
- VI.6 In-line Quality Control of PEM Materials
- VI.7 Manufacturing Competitiveness Analysis for Hydrogen Refueling Stations
- VII.A.1 Fuel Cell Electric Vehicle Evaluation
- VII.A.2 Technology Validation: Fuel Cell Bus Evaluations
- VII.B.1 Hydrogen Station Data Collection and Analysis
- VII.B.5 Brentwood Case Study
- VII.C.1 Hydrogen Component Validation
- VII.C.5 Hydrogen Meter Benchmark Testing
- VII.D.1 Stationary Fuel Cell Evaluation
- VII.D.2 Material Handling Equipment Data Collection and Analysis
- VIII.1 National Codes and Standards Deployment and Outreach
- VIII.7 NREL Hydrogen Sensor Testing Laboratory
- IX.7 Sustainability Analysis of Hydrogen Supply and Stationary Fuel Cell Systems Using the Hydrogen Regional Sustainability (HyReS) Framework

National Renewable Energy Laboratory (Continued)

- IX.8 Evaluation of Technology Status Compared to Program Targets
- IX.9 Expanded Capabilities for the Hydrogen Financial Analysis Scenario Tool
- IX.11 National FCEV and Hydrogen Refueling Station Scenarios

NEI Corporation

- V.C.11 Novel Nanocomposite Polymer Electrolyte Membranes for Fuel Cells

New England Wire Technologies, Inc.

- III.12 Cryogenically Flexible, Low Permeability H₂ Delivery Hose

Nissan Technical Center, North America

- V.A.9 Corrosion-Resistant Non-Carbon Electrocatalyst Supports for PEFCs
- V.C.2 Advanced Hybrid Membranes for Next Generation PEMFC Automotive Applications

Northeastern University

- II.B.3 High Performance Platinum Group Metal Free Membrane Electrode Assemblies through Control of Interfacial Processes
- V.A.3 Innovative Non-PGM Catalysts for High-Temperature PEMFCs

Northwestern University

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

NOV Fiberglass Systems

- VI.5 Continuous Fiber Composite Electrofusion Coupler

Nuvera Fuel Cells

- X.4 Demonstration of Fuel Cell Auxiliary Power Units (APUs) to Power Transport Refrigeration Units (TRUs) in Refrigerated Trucks

Oak Ridge National Laboratory

- III.2 Fatigue Performance of High-Strength Pipeline Steels and Their Welds in Hydrogen Gas Service
- III.3 Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage
- III.5 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage
- III.6 Low Cost Hydrogen Storage at 875 bar Using Steel Liner and Steel Wire Wrap
- IV.D.5 Optimizing the Cost and Performance of Composite Cylinders for H₂ Storage using a Graded Construction
- IV.D.7 Melt Processable PAN Precursor for High Strength, Low-Cost Carbon Fibers (Phase II)
- V.A.1 Non-Precious Metal Fuel Cell Cathodes: Catalyst Development and Electrode Structure Design
- V.A.4 Tailored High Performance Low-PGM Alloy Cathode Catalysts
- V.A.7 Highly Active, Durable, and Ultra-low PGM NSTF Thin Film ORR Catalysts and Supports
- V.B.1 Fuel Cell-Performance and Durability (FC-PAD) Consortium Overview
- V.B.2 FC-PAD Fuel Cell-Performance and Durability Electrocatalysts and Supports
- V.B.3 FC-PAD: Electrode Layer Integration
- V.B.4 FC-PAD: Ionomer, GDLs, Interfaces
- V.B.5 FC-PAD: Modeling, Evaluation, Characterization
- V.C.7 Advanced Ionomers and MEAs for Alkaline Membrane Fuel Cells
- V.F.1 New Fuel Cell Materials: Characterization and Method Development
- V.G.12 Fundamentals of Catalysis and Chemical Transformations

Ohio Fuel Cell Coalition

- VI.2 Clean Energy Supply Chain and Manufacturing Competitiveness Analysis for Hydrogen and Fuel Cell Technologies

Oregon State University

- II.E.3 Novel Hybrid Microbial Electrochemical System for Efficient Hydrogen Generation from Biomass
- IV.B.1 Hydrogen Storage Engineering Center of Excellence

Pacific Northwest National Laboratory

- II.E.3 Novel Hybrid Microbial Electrochemical System for Efficient Hydrogen Generation from Biomass
- II.F.1 Monolithic Piston-Type Reactor for Hydrogen Production through Rapid Swing of Reforming/Combustion Reactions
- III.10 Magnetocaloric Hydrogen Liquefaction
- IV.B.1 Hydrogen Storage Engineering Center of Excellence
- IV.B.2 Hydrogen Storage System Modeling: Public Access, Maintenance, and Enhancements
- IV.C.7 H₂ Storage Characterization and Optimization Research Efforts
- IV.D.1 Enhanced Materials and Design Parameters for Reducing the Cost of Hydrogen Storage Tanks
- IV.D.6 Achieving Hydrogen Storage Goals through High-Strength Fiber Glass
- V.G.4 Multifunctional Catalysis to Synthesize and Utilize Energy Carriers
- VIII.6 Hydrogen Safety Panel, Safety Knowledge Tools and First Responder Training Resources
- VIII.9 Compatibility of Polymeric Materials Used in the Hydrogen Infrastructure
- X.4 Demonstration of Fuel Cell Auxiliary Power Units (APUs) to Power Transport Refrigeration Units (TRUs) in Refrigerated Trucks

Pajarito Powder

- II.B.6 Economical Production of Hydrogen through Development of Novel, High Efficiency Electrocatalysts for Alkaline Membrane Electrolysis
- V.A.2 Development of PGM-free Catalysts for Hydrogen Oxidation Reaction in Alkaline Media
- V.A.3 Innovative Non-PGM Catalysts for High-Temperature PEMFCs

Paul Scherrer Institute

- V.B.4 FC-PAD: Ionomer, GDLs, Interfaces

PDC Machines

- III.14 H2FIRST—Consolidation

The Pennsylvania State University

- II.B.3 High Performance Platinum Group Metal Free Membrane Electrode Assemblies through Control of Interfacial Processes
- II.E.1 Biomass to Hydrogen

pH Matter, LLC

- V.E.1 Regenerative Fuel Cell System

Plug Power

- X.2 Ground Support Equipment Demonstration
- X.5 FedEx Express Hydrogen Fuel Cell Extended-Range Battery Electric Vehicles

POSCO

- III.5 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage

Powertech

VII.C.2 Development of the Hydrogen Station Equipment Performance (HyStEP) Device

PPG Industries

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

Proton OnSite

II.B.3 High Performance Platinum Group Metal Free Membrane Electrode Assemblies through Control of Interfacial Processes

II.B.6 Economical Production of Hydrogen through Development of Novel, High Efficiency Electrocatalysts for Alkaline Membrane Electrolysis

II.B.7 New Approaches to Improved PEM Electrolyzer Ion Exchange Membranes

VII.B.3 Validation of an Advanced High Pressure PEM Electrolyzer and Composite Hydrogen Storage, with Data Reporting, for SunHydro Stations

VII.B.5 Brentwood Case Study

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

Purdue University

V.A.7 Highly Active, Durable, and Ultra-low PGM NSTF Thin Film ORR Catalysts and Supports

RCF Economic and Financial Consulting, Inc.

IX.1 Employment Impacts of Hydrogen and Fuel Cell Technologies

Redox Power Systems

V.D.4 Affordable, High Performance, Intermediate Temperature Solid Oxide Fuel Cells

Rensselaer Polytechnic University

V.C.6 Advanced Materials for Fully-Integrated MEAs in AEMFCs

V.C.8 Dimensionally Stable High Performance Membranes

SAE International

VIII.3 Hydrogen Fuel Quality

Sandia National Laboratories

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

II.E.1 Biomass to Hydrogen

III.2 Fatigue Performance of High-Strength Pipeline Steels and Their Welds in Hydrogen Gas Service

IV.C.1 HyMARC: A Consortium for Advancing Solid-State Hydrogen Storage Materials

IV.C.2 Hydrogen Storage Materials Advanced Research Consortium: Sandia Effort

IV.C.4 HyMARC: A Consortium for Advancing Solid-State Hydrogen Storage Materials

IV.C.5 Improving the Kinetics and Thermodynamics of $\text{Mg}(\text{BH}_4)_2$ for Hydrogen Storage

IV.D.8 Innovative Development, Selection and Testing to Reduce Cost and Weight of Materials for BOP Components

V.C.6 Advanced Materials for Fully-Integrated MEAs in AEMFCs

VII.C.2 Development of the Hydrogen Station Equipment Performance (HyStEP) Device

VIII.2 R&D for Safety, Codes and Standards: Materials and Components Compatibility

VIII.4 R&D for Safety, Codes and Standards: Hydrogen Behavior

VIII.5 Hydrogen Quantitative Risk Assessment

VIII.10 Enabling Hydrogen Infrastructure Through Science-Based Codes and Standards

IX.4 Hydrogen Analysis with the Sandia ParaChoice Model

X.3 Maritime Fuel Cell Generator Project

Savannah River Consulting LLC

- II.C.3 Electrolyzer Component Development for the HyS Thermochemical Cycle
- IV.B.3 Investigation of Metal and Chemical Hydrides for Hydrogen Storage in Novel Fuel Cell Systems

Savannah River National Laboratory

- II.C.3 Electrolyzer Component Development for the HyS Thermochemical Cycle
- IV.B.1 Hydrogen Storage Engineering Center of Excellence
- IV.B.2 Hydrogen Storage System Modeling: Public Access, Maintenance, and Enhancements
- IV.B.3 Investigation of Metal and Chemical Hydrides for Hydrogen Storage in Novel Fuel Cell Systems
- IV.C.11 Electrochemical Reversible Formation of Alane
- VI.5 Continuous Fiber Composite Electrofusion Coupler

Smart Chemistry

- VIII.3 Hydrogen Fuel Quality

Southwest Research Institute®

- III.4 Hydrogen Compression Application of the Linear Motor Reciprocating Compressor (LMRC)

Spectrum Automation Controls

- II.B.1 Renewable Electrolysis Integrated System Development and Testing
- III.11 700 bar Hydrogen Dispenser Hose Reliability Improvement
- VII.C.1 Hydrogen Component Validation
- VII.C.5 Hydrogen Meter Benchmark Testing

Spencer Composites Corporation

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

SRI International

- IV.C.12 Low-Cost α -Alane for Hydrogen Storage

Stanford University

- II.C.1 High Efficiency Solar Thermochemical Reactor for Hydrogen Production
- II.D.2 Wide Bandgap Chalcopyrite Photoelectrodes for Direct Solar Water Splitting

Strategic Analysis, Inc.

- II.A.1 Hydrogen Pathways Analysis for Hydrogen Production via a Monolithic Piston Reforming Reactor and Reformer-Electrolyzer-Purifier Technology
- IV.A.2 Hydrogen Storage Cost Analysis
- V.F.6 Fuel Cell Vehicle and Bus Cost Analysis
- V.F.8 A Total Cost of Ownership Model for Design and Manufacturing Optimization of Fuel Cells in Stationary and Emerging Market Applications
- VI.4 U.S. Clean Energy Hydrogen and Fuel Cell Technologies: A Competitiveness Analysis

Structural Integrity Associates, Inc.

- III.6 Low Cost Hydrogen Storage at 875 bar Using Steel Liner and Steel Wire Wrap

SunHydro LLC

- VII.B.3 Validation of an Advanced High Pressure PEM Electrolyzer and Composite Hydrogen Storage, with Data Reporting, for SunHydro Stations

Sustain X

- III.5 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage

Swagelok

- III.12 Cryogenically Flexible, Low Permeability H₂ Delivery Hose

Temple University

- III.3 Vessel Design and Fabrication Technology for Stationary High-Pressure Hydrogen Storage
- III.5 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage

Tetramer Technologies, LLC

- II.B.7 New Approaches to Improved PEM Electrolyzer Ion Exchange Membranes

Texas A&M University

- IV.C.9 High-Capacity and Low-Cost Hydrogen-Storage Sorbents for Automotive Applications
- V.G.5 Modeling Catalyzed Growth of Single Walled Carbon Nanotubes

Toray Composites America

- IV.D.1 Enhanced Materials and Design Parameters for Reducing the Cost of Hydrogen Storage Tanks

TreadStone Technologies, Inc.

- V.D.2 Novel Structured Metal Bipolar Plates for Low Cost Manufacturing

Tufts University

- V.B.4 FC-PAD: Ionomer, GDLs, Interfaces

Unique Electric Solutions

- VII.A.4 Fuel Cell Hybrid Electric Delivery Van Project

United Parcel Services

- VII.A.4 Fuel Cell Hybrid Electric Delivery Van Project

United Technologies Research Center

- IV.B.1 Hydrogen Storage Engineering Center of Excellence
- V.D.3 Rationally Designed Catalyst Layers for PEMFC Performance Optimization

Université du Québec à Trois-Rivières

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

University at Buffalo-SUNY

- V.D.6 Advanced Catalysts and Membrane Electrode Assemblies (MEAs) for Reversible Alkaline Membrane Fuel Cells

University of California, Berkeley

- V.F.8 A Total Cost of Ownership Model for Design and Manufacturing Optimization of Fuel Cells in Stationary and Emerging Market Applications

University of California, Irvine

- II.D.3 Tandem Particle-Slurry Batch Reactors for Solar Water Splitting
- II.F.2 Reformer-Electrolyzer-Purifier (REP) for Production of Hydrogen [CO₂ Pump]

University of Chicago

- V.G.16 Computer Simulation of Proton Transport in Fuel Cell Membranes
- IX.10 The Business Case for Hydrogen-powered Passenger Cars: Competition and Solving the Infrastructure Puzzle

University of Colorado Boulder

- II.C.2 Flowing Particle Bed Solarthermal RedOx Process to Split Water
- II.C.4 NSF/DOE Solar Hydrogen Fuel: Accelerated Discovery of Advanced RedOx Materials for Solar Thermal Water Splitting to Produce Renewable Hydrogen
- V.A.6 Extended Surface Electrocatalyst Development
- V.G.8 Analysis of the Mechanisms of Electrochemical Oxygen Reduction and Development of Ag-alloy and Pt-alloy Electrocatalysis for Low Temperature Fuel Cells

University of Connecticut

- V.B.7 The Effect of Airborne Contaminants on Fuel Cell Performance and Durability
- V.C.3 Smart Matrix Development for Direct Carbonate Fuel Cell
- V.G.6 Room Temperature Electrochemical Upgrading of Methane to Oxygenate Fuels

University of Delaware

- V.A.6 Extended Surface Electrocatalyst Development
- V.B.4 FC-PAD: Ionomer, GDLs, Interfaces
- V.C.5 Highly Stable Anion-Exchange Membranes for High-Voltage Redox-Flow Batteries

University of Georgia

- II.E.2 Sweet Hydrogen: High-Yield Production of Hydrogen from Biomass Sugars Catalyzed by in vitro Synthetic Biosystems

University of Hawaii

- II.D.1 High-Efficiency Tandem Absorbers for Economical Solar Hydrogen Production
- II.D.2 Wide Bandgap Chalcopyrite Photoelectrodes for Direct Solar Water Splitting
- IV.C.7 H₂ Storage Characterization and Optimization Research Efforts
- V.D.2 Novel Structured Metal Bipolar Plates for Low Cost Manufacturing

University of Houston

- V.G.11 Dual Site Requirements for Hydrogenoxygenation of Model Biomass Compounds

University of Maryland

- V.D.4 Affordable, High Performance, Intermediate Temperature Solid Oxide Fuel Cells

University of Massachusetts Amherst

- V.G.9 Computational Design of Graphene-Nanoparticle Catalysts

University of Michigan

- IV.B.1 Hydrogen Storage Engineering Center of Excellence
- IV.C.5 Improving the Kinetics and Thermodynamics of Mg(BH₄)₂ for Hydrogen Storage
- IV.C.10 Hydrogen Adsorbents with High Volumetric Density: New Materials and System Projections

University of Michigan (Continued)

- V.G.8 Analysis of the Mechanisms of Electrochemical Oxygen Reduction and Development of Ag-alloy and Pt-alloy Electrocatalysis for Low Temperature Fuel Cells

University of Missouri

- IV.C.6 High-capacity Hydrogen Storage Systems via Mechanochemistry

University of Nevada

- II.D.1 High-Efficiency Tandem Absorbers for Economical Solar Hydrogen Production
II.D.2 Wide Bandgap Chalcopyrite Photoelectrodes for Direct Solar Water Splitting

University of New Mexico

- II.B.3 High Performance Platinum Group Metal Free Membrane Electrode Assemblies through Control of Interfacial Processes
V.A.2 Development of PGM-free Catalysts for Hydrogen Oxidation Reaction in Alkaline Media
V.A.3 Innovative Non-PGM Catalysts for High-Temperature PEMFCs
V.A.9 Corrosion-Resistant Non-Carbon Electrocatalyst Supports for PEFCs
V.G.13 Sub Nanometer Sized Clusters for Heterogeneous Catalysis

University of Rochester

- V.A.1 Non-Precious Metal Fuel Cell Cathodes: Catalyst Development and Electrode Structure Design

University of Tennessee

- IX.6 Policies to Promote Alternative Fuel Vehicles

University of Texas at Austin

- IV.D.3 Conformable Hydrogen Storage Pressure Vessel Project
V.D.3 Rationally Designed Catalyst Layers for PEMFC Performance Optimization
VII.A.4 Fuel Cell Hybrid Electric Delivery Van Project

University of Utah

- V.G.15 Thermodynamic, Kinetic and Electrochemical Studies on Mixed Proton, Oxygen Ion and Electron (Hole) Conductors

University of Waterloo

- V.A.1 Non-Precious Metal Fuel Cell Cathodes: Catalyst Development and Electrode Structure Design

University of Wisconsin-Madison

- V.G.10 Atomic-Scale Design of Metal and Alloy Catalysts: A Combined Theoretical and Experimental Approach

Valence Technology

- VII.A.4 Fuel Cell Hybrid Electric Delivery Van Project

Vanderbilt University

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

Versa Power Systems, Ltd.

- II.B.5 Solid Oxide Based Electrolysis and Stack Technology with Ultra-High Electrolysis Current Density ($>3 \text{ A/cm}^2$) and Efficiency

Virginia Clean Cities at James Madison University

VI.3 Fuel Cell and Hydrogen Opportunity Center, www.hfcnexus.com

Virginia Polytechnic Institute and State University

II.B.4 High Temperature, High Pressure Electrolysis

II.E.2 Sweet Hydrogen: High-Yield Production of Hydrogen from Biomass Sugars Catalyzed by in vitro Synthetic Biosystems

IV.D.7 Melt Processable PAN Precursor for High Strength, Low-Cost Carbon Fibers (Phase II)

V.G.8 Analysis of the Mechanisms of Electrochemical Oxygen Reduction and Development of Ag-alloy and Pt-alloy Electrocatalysis for Low Temperature Fuel Cells

VTT

VIII.3 Hydrogen Fuel Quality

Washington State University

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

III.9 Improved Hydrogen Liquefaction through Heisenberg Vortex Separation of Para- and Orthohydrogen

V.G.13 Sub Nanometer Sized Clusters for Heterogeneous Catalysis

Washington University

II.B.6 Economical Production of Hydrogen through Development of Novel, High Efficiency Electrocatalysts for Alkaline Membrane Electrolysis

Wayne State University

V.G.7 Nanostructured, Targeted Layered Metal Oxides as Active and Selective Heterogeneous Electrocatalysts for Oxygen Evolution

Werken

VII.B.5 Brentwood Case Study

Wiretough Cylinders

III.5 Steel Concrete Composite Vessel for 875 bar Stationary Hydrogen Storage

III.6 Low Cost Hydrogen Storage at 875 bar Using Steel Liner and Steel Wire Wrap

Witte Engineered Gases

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

Workhorse Technologies Inc.

X.5 FedEx Express Hydrogen Fuel Cell Extended-Range Battery Electric Vehicles

Worthington Cylinder Corporation

VII.C.3 Advanced Hydrogen Fueling Station Supply: Tube Trailers

WPCSOL

V.B.7 The Effect of Airborne Contaminants on Fuel Cell Performance and Durability