

Peer Review and Update Meeting 2014 — U.S. Department of Energy

Energy Storage Systems Program (ESSP) Peer Review

Renaissance Washington Hotel, 999 Ninth Street, Washington, DC 20001

September 16 - 19, 2014

Tuesday, September 16

4:00 - 6:00pm Early Registration

Wednesday, September 17

| | | | | |
|---------|---------|--|------------------|--|
| 7:00 AM | 8:00 AM | Registration (all-day) | | |
| 7:00 AM | 8:00 AM | Sponsored Breakfast | | |
| 8:00 AM | 8:05 AM | Welcome | Amanda Spinney | Sandia National Laboratories |
| 8:05 AM | 8:20 AM | Welcome and DOE Perspective DOE / OE Program Overview | Dr. Imre Gyuk | US Department of Energy/Office of Electricity Delivery and Energy Reliability |
| 8:20 AM | 8:35 AM | DOE / ARPA-E Program Overview | Dr. Reid Heffner | US Department of Energy / Advanced Research Projects Agency–ENERGY |
| 8:35 AM | 8:45 AM | DOE / ARRA / NETL Program Overview | Ron Staubly | US Department of Energy / American Recovery and Reinvestment Act |
| 8:45 AM | 8:55 AM | DOE / OE / SNL Program Overview | Sean J. Hearne | Sandia National Laboratories |
| 8:55 AM | 9:05 AM | DOE / OE / PNNL Program Overview | Vincent Sprenkle | Pacific Northwest National Laboratory |
| 9:05 AM | 9:15 AM | DOE / OE / ORNL Program Overview | George Andrews | Oak Ridge National Laboratory |

9:15 AM 9:35 AM BREAK

Session 2 - George Andrews

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|----------|----------|---|-----------------|---------------------------------------|
| 9:35 AM | 9:55 AM | Energy Storage Safety | Sean J. Hearne | Sandia National Laboratories |
| 9:55 AM | 10:15 AM | Advances in PNNL's Mixed Acid Redox Flow Battery Stack | David Reed | Pacific Northwest National Laboratory |
| 10:15 AM | 10:35 AM | Redox Flow Battery Optimization | Tom Zawodzinski | Oak Ridge National Laboratory |
| 10:35 AM | 10:55 AM | Ionic Liquid Flow Battery | Travis Anderson | Sandia National Laboratories |
| 10:55 AM | 11:15 AM | Advanced Membranes for Flow Batteries | Cy Fujimoto | Sandia National Laboratories |
| 11:15 AM | 11:35 AM | Next Generation Aqueous Redox Flow Battery Development | Wei Wang | Pacific Northwest National Laboratory |

11:35 AM 12:50 PM LUNCH On Your Own

Session 3 - Wei Wang

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|----------|---------|--|-----------------|---------------------------------------|
| 12:50 PM | 1:10 PM | Organic Flow Battery Development | Wei Wang | Pacific Northwest National Laboratory |
| 1:10 PM | 1:30 PM | Iron Based Flow Batteries for Low Cost Grid Level Energy Storage | Jesse Wainright | Case Western Reserve University |
| 1:30 PM | 1:50 PM | High Voltage, High Capacity, Room Temperature Sodium Flow Batteries | Leon Shaw | Illinois Institute of Technology |
| 1:50 PM | 2:10 PM | Sodium-based Battery Development | Dave Ingersoll | Sandia National Laboratories |
| 2:10 PM | 2:30 PM | Room temperature Na-ion battery development | Xiaolin Li | Pacific Northwest National Laboratory |
| 2:30 PM | 2:50 PM | Na-ion Anode Development | Donghai Wang | Pennsylvania State University |

2:50 PM 3:05 PM BREAK

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Poster Session 4 - Reid Heffner

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|---------|---------|---|---|---|
| 3:05 PM | 5:05 PM | Manufacturing Cost Model Tool for Redox Flow Battery Stacks | Scott Whalen | Pacific Northwest National Laboratory |
| | | Redox Flow Battery Membrane Development | Xiaoliang Wei | Pacific Northwest National Laboratory |
| | | Catalyst Development for V/V Redox Flow Battery | Bin Li | Pacific Northwest National Laboratory |
| | | A Single Substance Organic Redox Flow Battery | Paul Rasmussen | Vinazene, Inc. |
| | | Flow Battery Structures to Improve Performance and Reduce Manufacturing Cost | Heather McCrabb | Faraday Technology, Inc. |
| | | Small Organic Molecule Based Flow Battery for Grid Storage | Michael Aziz | Harvard University, School of Engineering and Applied Sciences |
| | | 2.5kW/10kWh Redox Flow Battery (RFB) with Low-cost Electrolyte and Membrane Technologies | Thomas Kodenkandath | ITN Energy |
| | | Rechargeable Zinc Manganese Battery for Grid Scale Application Commercialization Pathway | Sanjoy Banerjee & Alex Couzis, with Valerio De Angelis, Melissa Menard, Mike Schmukler | The City University of New York Energy Institute and Urban Electric; Power, LLC |
| | | Rechargeable Zinc Anode Stationary Battery Developments | Sanjoy Banerjee, with Niles Ingale, Josh Galloway, Damon Turney, Stoyan Bliznakov, Gautam Yadav, Michael Nyce | The City University of New York Energy Institute |
| | | Low-Cost Sodium-Ion Battery to Enable Grid Scale Energy Storage: Prussian Blue-Derived Cathode and Complete Battery Integration | Jong-Jan Lee | Sharp Labs of America |
| | | Advanced Sodium Batteries with Enhanced Safety and Low-Cost Processing | Joonho Koh | Materials & Systems Research, Inc. |
| | | A Robust and Inexpensive Iron-Air Battery for Grid-Scale Energy Storage | Sri Narayan | University of Southern California |
| | | An Inexpensive Metal-free Organic Redox Flow Battery for Grid-scale Storage | Sri Narayan | University of Southern California |
| | | High Energy Storage Capacity Low-Cost Iron Flow Battery | Robert Savinell | Case Western University |
| | | Quaternary Phosphonium Based Hydroxide Exchange Membranes | Yushan Yan | University of Delaware |
| | | High-Voltage and Low-Crossover Redox Flow Batteries for Economical and Efficient Renewable Electricity Storage | Yushan Yan | University of Delaware |
| | | Energy Storage Integration With Renewables, Demonstration and Testing in a Microgrid Setting | Bill Torre | University of California, San Diego |
| | | Development of NaSICON Membrane Based Sodium-Iodine Battery | Sai Bhavaraju | Ceramatec Inc. |
| | | Commissioning | Dan Borneo | Sandia National Laboratories |

5:35 PM

Sponsored Reception

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Thursday, September 18

7:00 AM 8:00 AM Registration (all day)

Session 5 - Sean Hearne

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|---------|---------|---|---------------------------------|--|
| 8:00 AM | 8:05 AM | Welcome to Day 2 | Amanda Spinney | |
| 8:05 AM | 8:25 AM | ASU-ISU Low Temperature, High Energy Density, High Efficiency Liquid Alkali Metal Storage Cells | Austen Angell & Steve W. Martin | Arizona State University / Iowa State University |
| 8:25 AM | 8:45 AM | Na-metal halide battery development | Jin Y. Kim | Pacific Northwest National Laboratory |
| 8:45 AM | 9:05 AM | Nitrogen/Oxygen Battery - A Transformational Architecture for Large Scale Energy Storage | Frank Delnick | Sandia National Laboratories |
| 9:05 AM | 9:25 AM | Magnetic Alignment of Nanoparticles | Jim Martin | Sandia National Laboratories |
| 9:25 AM | 9:45 AM | Flywheel Materials Development | Tim Boyle | Sandia National Laboratories |

9:45 AM 10:05 AM BREAK

Session 6 - Stan Atcitty

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|----------|----------|---|--------------------|--|
| 10:05 AM | 10:25 AM | Development of Electrode Architectures for High Energy Density Electrochemical Capacitors | Bruce Dunn | University of California, Los Angeles |
| 10:25 AM | 10:45 AM | Novel Dielectrics | Geoffrey Brennecka | Sandia National Laboratories |
| 10:45 AM | 11:05 AM | Reliability Characterization of Wide-Band Gap Semiconductor Switches | Robert J. Kaplar | Sandia National Laboratories |
| 11:05 AM | 11:25 AM | Highly Efficient, High Power Density GaN-based DC-DC Converters | Daniel Martin | Arkansas Power Electronics International |
| 11:25 AM | 11:45 AM | 60kW DC-AC Inverter with Internal Isolation using GaN Devices | Frank Hoffmann | Princeton Power Systems, Inc. |

11:45 AM 1:00 PM LUNCH On Your Own

Session 7 - Landis Kannberg

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|---------|---------|--|--------------------------------------|----------------------------------|
| 1:00 PM | 1:20 PM | Flow Battery Solution for Smart Grid Renewable Energy Applications | Craig Horne | EnerVault |
| 1:20 PM | 1:40 PM | 20 MW Flywheel Frequency Regulation Plant (Hazle Spindle) | Jim Arseneaux | Beacon Power |
| 1:40 PM | 2:00 PM | PG&E's Compressed Air Energy Storage Project | Robert Booth | Pacific Gas and Electric Company |
| 2:00 PM | 2:20 PM | Isothermal CAES: Fuel-free, site-flexible energy storage for renewables integration and T&D substitution | Ben Bollinger & Dax Kepshire | SustainX |
| 2:20 PM | 2:40 PM | Detroit Edison's Advanced Implementation of community Energy Storage Systems for Grid Support | Nicholas Carlson & Haukur Asgeirsson | DTE Energy |
| 2:40 PM | 3:00 PM | Grid-Scale Energy Storage Demonstration for Ancillary Services Using Ultrabattery | Jason Hoffman | Ecoult / East Penn Manufacturing |

3:00 PM 3:30 PM BREAK

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Poster Session 8 - Ron Staubly

| 3:30 PM | 5:30 PM | | | |
|---------|--|--|--|--|
| | Energy Storage Analysis Laboratory - Cell Testing | | David Rosewater | Sandia National Laboratories |
| | Multi-Objective Optimization for Power Electronics Used in Grid Tied Energy Storage Systems | | Sarah Hambridge | Sandia National Laboratories |
| | Impact of Value-Added Functionality on Inverters | | Eric Green | North Carolina State University |
| | Reliable High Performance Gate Oxides for Wide Band Gap Devices | | Jon Ihlefeld | Sandia National Laboratories |
| | Development of a Monolithically Integrated SiC Semiconductor Switch | | Ranbir Singh | GeneSiC Semiconductor |
| | Superconducting Magnet Energy Storage System with Direct Power Electronics Interface | | V.R. Ramanan | ABB |
| | High Energy Lithium-Sulfur Batteries | | Chengdu Liang | Oak Ridge National Laboratory |
| | Lower Cost Carbon-fiber for Flywheel Applications | | Robert E. Norris | Oak Ridge National Laboratory |
| | Sandia's Demonstration with Duke Energy | | Dave Schoenwald | Sandia National Laboratories |
| | High Frequency Link Converters using Advanced Magnetics | | Josh Yee | University of California, Davis |
| | Realization of Large Footprint Multilayer High Temperature Capacitors Incorporating Novel Dielectric Materials and Rapid Thermal Spray Deposition Routes | | Clive Randall, Eugene Furman, Rashmi Dixit | Penn State University & DRS Research |
| | 6.5 kV Silicon Carbide Half-Bridge Power Switch Module for Energy Storage System Applications | | John Hostetler | United Silicon Carbide, Inc. |
| | Design and Development of a Low Cost, Manufacturable High Voltage Power Module for Energy Storage Systems | | Brandon Passmore | Arkansas Power Electronics International, Inc. |
| | High Voltage Capacitors for DC-Link Applications | | Angelo Yializis | Sigma Technologies International, Inc. |
| | Real-Time In-Situ Metrology for Lithium-Ion Battery R&D and Manufacturing | | Jong Yoo | Applied Spectra, Inc. |
| | Status of International Energy Storage Working Group | | Vish Vishwanathan | Pacific Northwest National Laboratory |
| | Amber Kinetics Flywheel Energy Storage Demonstration | | Seth Sanders | Amber Kinetics |
| | Development of a 100 kWh/100 kw Flywheel Energy Storage Module | | Jim Arseneaux | Beacon Power |
| | Semi-Solid Rechargeable Power Sources-Flexible, High Performance Storage for Vehicles at Ultra-Low Cost | | Taison Tan | 24 M Technologies, Inc. |
| | ES Market Structures | | Cesar Silva Monroy | Sandia National Laboratories |
| | Wind Integration in West Texas: 1 MW / 1 MWh Lithium-Ion Battery System | | Elizabeth Endler | Shell International Exploration & Production (US) Inc. |

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Friday, September 19

7:30 AM 8:30 AM Registration (all day)

Session 9 - Vincent Sprenkle

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|---------|----------|---------------------------------------|-----------------|---------------------------------------|
| 8:30 AM | 8:35 AM | Welcome to Day 3 | Amanda Spinney | |
| 8:35 AM | 8:55 AM | ESS Performance Protocol Development | Dave Schoenwald | Sandia National Laboratories |
| 8:55 AM | 9:15 AM | National Model Codes and Standards | Dave Conover | Pacific Northwest National Laboratory |
| 9:15 AM | 9:35 AM | DOE Global Energy Storage Database | Georgianne Huff | Sandia National Laboratories |
| 9:35 AM | 9:55 AM | DOE/EPRI Electricity Storage Handbook | Abbas Akhil | Sandia National Laboratories |
| 9:55 AM | 10:15 AM | Notrees Energy Storage Project | Jeff Gates | Duke Energy |

10:15 AM 10:35 AM BREAK

Session 10 - Maddi Sánchez Argoitia

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|----------|----------|--|------------------|---------------------------------------|
| 10:35 AM | 10:55 AM | The Architectural Diversity of Metal Oxide nanostructures: An opportunity for the Rational Optimization of Group II Cation Based Batteries | Esther Takeuchi | Stony Brook University |
| 10:55 AM | 11:15 AM | Tehachapi Wind Energy Storage Project | Loic Gaillac | Southern California Edison |
| 11:15 AM | 11:35 AM | BPA - Damping Control | Dave Schoenwald | Sandia National Laboratories |
| 11:35 AM | 11:55 AM | A Modular and Dispatchable Battery Storage System | Vish Viswanathan | Pacific Northwest National Laboratory |
| 11:55 AM | 12:15 PM | Washington State Clean Energy Funds - Grid Storage | Landis Kannberg | Pacific Northwest National Laboratory |

12:15 PM 1:30 PM LUNCH On Your Own

Session 11 - Dan Borneo

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|---------|---------|---|----------------------|---|
| 1:30 PM | 1:50 PM | Demonstrations Overview | Dan Borneo | Sandia National Laboratories |
| 1:50 PM | 2:10 PM | Demonstration of Modular Energy Storage in the Northwest | Patrick Balducci | Pacific Northwest National Laboratory |
| 2:10 PM | 2:30 PM | Secondary-Use Battery Energy Storage Systems | Michael Starke | Oak Ridge National Laboratory |
| 2:30 PM | 2:50 PM | Energy Storage Demonstrations & Evaluation | Ben Schenkman | Sandia National Laboratories |
| 2:50 PM | 3:10 PM | Energy Storage Technical Partnerships | Jacquelyne Hernández | Sandia National Laboratories |
| 3:10 PM | 3:30 PM | State & Federal Energy Storage Technology Advancement Partnership | Todd Olinsky-Paul | Clean Energy States Alliance |
| 3:30 PM | 3:50 PM | Energy Storage Test Pad - System Testing | David Rosewater | Sandia National Laboratories |
| 3:50 PM | 4:10 PM | Closing Remarks | Dr. Imre Gyuk | US Department of Energy/Office of Electricity Delivery and Energy Reliability |