

# 2015 Annual Merit Review, Vehicle Technologies Office

Results Report

November 2015

Prepared by New West Technologies, LLC for the U.S. Department of Energy  
Vehicle Technologies Office

**(This page intentionally left blank)**

# Table of Contents

**Introduction..... xvii**

    Evaluation Criteria – Research & Development Subprogram Projects..... xvii

    Evaluation Criteria – Technology Integration Projects ..... xix

    Project Scoring..... xx

**1. Vehicle Systems ..... 1-1**

    Subprogram Overview Comments: David Anderson (U.S. Department of Energy) - vss000.....1-3

    Class 8 Truck Freight Efficiency Improvement Project: Derek Rotz (DTNA) - arravt080 .....1-14

    Plug-In Hybrid Medium-Duty Truck Demonstration and Evaluation Program: Matt Myasato (SCAQMD) - arravt083 ..... 1-16

    Medium and Heavy-Duty Vehicle Field Evaluations: Ken Kelly (National Renewable Energy Laboratory) - vss001 .....1-20

    DOE's Effort to Improve Heavy Vehicle Fuel Efficiency through Improved Aerodynamics: Kambiz Salari (Lawrence Livermore National Laboratory) - vss006 .....1-23

    Idaho National Laboratory Testing of Advanced Technology Vehicles: Matthew Shirk (Idaho National Laboratory) - vss021 .....1-27

    Advanced Vehicle Testing and Evaluation: Richard Jacobson (Intertek) - vss029 .....1-30

    Advanced Technology Vehicle Lab Benchmarking (L1 and L2): Kevin Stutenberg (Argonne National Laboratory) - vss030 .....1-34

    Development of High Power Density Driveline for Vehicles: Oyelayo Ajayi (Argonne National Laboratory) - vss058 .....1-37

    SuperTruck - Development and Demonstration of a Fuel-Efficient Class 8 Tractor and Trailer: Russ Zukouski (Navistar International Corporation) - vss064 .....1-39

    CoolCab Test and Evaluation and CoolCalc HVAC Tool Development: Jason Lustbader (National Renewable Energy Laboratory) - vss075 .....1-42

    A Complete Vehicle Approach to the SuperTruck Challenge: Pascal Amar (Volvo Trucks) - vss081 .....1-45

    EV - Smart Grid Research and Interoperability Activities: Keith Hardy (Argonne National Laboratory) - vss095 .....1-47

    Testing of Wireless Charging Systems for Codes and Standards Development: Barney Carlson (Idaho National Laboratory) - vss096 .....1-50

    Electric Drive Vehicle Climate Control Load Reduction: John Rugh (National Renewable Energy Laboratory) - vss097 .....1-53

High-Efficiency, Low-EMI and Positioning Tolerant Wireless Charging of EVs: Allan Lewis (Hyundai) - vss102 .....	1-55
Wireless Charging: Omer Onar (Oak Ridge National Laboratory) - vss103 .....	1-58
Zero-Emission Heavy-Duty Drayage Truck Demonstration: Brian Choe (SCAQMD) - vss115 .....	1-61
Zero-Emission Cargo Transport Deployment Projects: Nicholas Williams (Houston-Galveston Area Council) - vss116 .....	1-64
Thermal Control Projects: Dileep Singh (Argonne National Laboratory) - vss132 .....	1-67
Cummins Medium-Duty & Heavy-Duty Accessory Hybridization CRADA: Dean Deter (Oak Ridge National Laboratory) - vss133 .....	1-71
Vehicle Thermal Systems Modeling in Simulink: Jason Lustbader (National Renewable Energy Laboratory) - vss134 .....	1-75
Advanced Climate Control and Vehicle Preconditioning: John Meyer (Halla Visteon) - vss135 .....	1-78
Electric Phase Change Material Assisted Thermal Heating System (ePATHS): Mingyu Wang (Delphi Automotive Systems, LLC) - vss136.....	1-81
Impacts of Advanced Combustion Engines: Scott Curran (Oak Ridge National Laboratory) - vss140 .....	1-83
Powertrain Controls Optimization for Heavy-Duty Line-Haul Trucks: David Smith (Oak Ridge National Laboratory) - vss141 .....	1-86
Integration of PEVs with the Grid: Richard Pratt (Pacific Northwest National Laboratory) - vss142 .....	1-89
Powertrain Codes and Standards Development: Mike Duoba (Argonne National Laboratory) - vss143 .....	1-92
Green Racing Protocols and Technology Applications: Perry Jones (Oak Ridge National Laboratory) - vss144 .....	1-94
Technology Requirements for High-Power Applications of Wireless Power Transfer: Omer Onar (Oak Ridge National Laboratory) - vss152 .....	1-99
Accelerate the Development and Introduction of Advanced Technologies through Model-Based System Engineering: Aymeric Rousseau (Argonne National Laboratory) - vss153 .....	1-102
Fuel Displacement Potential of Advanced Technologies under Different Thermal Conditions: Aymeric Rousseau (Argonne National Laboratory) - vss154 .....	1-106
Analyzing Real-World Light-Duty Vehicle Efficiency Benefits: Jeff Gonder (National Renewable Energy Laboratory) - vss155 .....	1-110
Smart Grid Requirements Study: Tony Markel (National Renewable Energy Laboratory) - vss156 .....	1-113

Unitary Thermal Energy Management for Propulsion Range Augmentation (UTEMPRA): Sourav Chowdhury (Delphi Automotive Systems LLC) - vss157 .....1-116

Zero-Emission Cargo Transport Projects (ZECT): Nancy Cole (SCAQMD) - vss158 .....1-118

Medium-Duty ARRA Data Reporting and Analysis: Ken Kelly (National Renewable Energy Laboratory) - vss159 .....1-121

Fleet DNA Phase 1 Refinement and Phase 2 Implementation: Ken Kelly (National Renewable Energy Laboratory) - vss160 .....1-123

Multi-Speed Gearbox for Commercial Delivery Medium-Duty Plug-In Electric Drive Vehicles: Bulent Chavdar (Eaton Corporation) - vss161 .....1-126

Integrated Boosting and Hybridization for Extreme Fuel Economy and Downsizing: Vasilios Tsourapas (Eaton Corporation) - vss162 .....1-129

Advanced Bus and Truck Radial Materials for Fuel Efficiency: Justin Martin (PPG Industries, Inc.) - vss163 .....1-132

Evaluate VTO Benefits (BaSce): Neeraj Shidore (Argonne National Laboratory) - vss164 .....1-135

Design and Implementation of a Thermal Load Reduction System in a Hyundai PHEV to Improve Range: John Rugh (National Renewable Energy Laboratory) - vss165 .....1-138

Advanced Transmission Selection to Provide Accurate VTO Benefits: Neeraj Shidore (Argonne National Laboratory) - vss166 .....1-141

Integrated Network Testbed for Energy Grid Research and Technology Experimentation (INTEGRATE): Brian Hunter (National Renewable Energy Laboratory) - vss167 .....1-143

Accessory Loads Analysis: Richard Carlson (Idaho National Laboratory) - vss168 .....1-146

PEV-EVSE Interoperability Project: Richard Jacobson (Intertek) - vss169 .....1-148

Lessons Learned about Workplace Charging in The EV Project: John Smart (Idaho National Laboratory) - vss170 .....1-152

eVMT (Electric Vehicle Miles Traveled): Richard Carlson (Idaho National Laboratory) - vss171 .....1-155

**2. Electrochemical Energy Storage..... 2-1**

Subprogram Overview Comments: Peter Faguy (U.S. Department of Energy) - es000 .....2-4

Novel Cathode Materials and Processing Methods: Michael Thackeray (Argonne National Laboratory) - es049.....2-22

High-Capacity, High-Voltage Cathode Materials for Lithium-Ion Batteries: Arumugam Manthiram (University of Texas at Austin) - es051.....2-25

Design of High-Performance, High-Energy Cathode Materials: Marca Doeff (Lawrence Berkeley National Laboratory) - es052 .....2-28

First Principles Calculations of Existing and Novel Electrode Materials: Gerbrand Ceder (Massachusetts Institute of Technology) - es054 .....	2-31
First-Principles Calculations and NMR Spectroscopy of Electrode Materials: Clare Grey (University of Cambridge) - es055 .....	2-34
Development of High-Energy Cathode Materials: Jason Zhang (Pacific Northwest National Laboratory) - es056 .....	2-37
Advanced In-Situ Diagnostic Techniques for Battery Materials: Xiao-Qing Yang (Brookhaven National Laboratory) - es059 .....	2-41
Development of Novel Electrolytes and Catalysts for Li-Air Batteries: Khalil Amine (Argonne National Laboratory) - es066 .....	2-44
Design and Scalable Assembly of High-Density Low-Tortuosity Electrodes: Yet- Ming Chiang (Massachusetts Institute of Technology) - es071 .....	2-47
Interfacial Processes in EES Systems Advanced Diagnostics: Robert Kosteckii (Lawrence Berkeley National Laboratory) - es085 .....	2-50
Predicting and Understanding Novel Electrode Materials from First Principles: Kristin Persson (Lawrence Berkeley National Laboratory) - es091 .....	2-53
Studies on High-Capacity Cathodes for Advanced Lithium-Ion Systems: Jagjit Nanda (Oak Ridge National Laboratory) - es106 .....	2-56
PHEV and EV Battery Performance and Cost Assessment: Kevin Gallagher (Argonne National Laboratory) - es111.....	2-59
Open Architecture Software for CAEBAT: John Turner (Oak Ridge National Laboratory) - es121.....	2-62
Composite Electrolytes to Stabilize Metallic Lithium Anodes: Nancy Dudney (Oak Ridge National Laboratory) - es182 .....	2-65
In-Situ Solvothermal Synthesis of Novel High-Capacity Cathodes: Feng Wang (Brookhaven National Laboratory) - es183 .....	2-68
Lithium Bearing Mixed Polyanion Glasses as Cathode Materials: Andrew Kercher (Oak Ridge National Laboratory) - es184 .....	2-71
Significant Enhancement of Computational Efficiency in Nonlinear Multiscale Battery Model for Computer-Aided Engineering: Gi-Heon Kim (National Renewable Energy Laboratory) - es197 .....	2-74
Mechanistic Modeling Framework for Predicting Extreme Battery Response: Coupled Hierarchical Models for Thermal, Mechanical, Electrical and (Electro)Chemical Processes: Harry Moffat (Sandia National Laboratories) - es198 .....	2-77
Coupling Mechanical with Electrochemical-Thermal Models Batteries under Abuse: Ahmad Pesaran (National Renewable Energy Laboratory) - es199 .....	2-80
Efficient Safety and Degradation Modeling of Automotive Lithium-Ion Cells and Pack: Christian Shaffer (EC-Power) - es200.....	2-83

Electrochemical Performance Testing: Ira Bloom (Argonne National Laboratory) - es201 .....	2-86
INL Electrochemical Performance Testing: Jon Christophersen (Idaho National Laboratory) - es202 .....	2-88
Battery Safety Testing: Christopher Orendorff (Sandia National Laboratories) - es203 .....	2-90
Battery Thermal Characterization: Matthew Keyser (National Renewable Energy Laboratory) - es204 .....	2-92
New High-Energy Electrochemical Couple for Automotive Applications: Khalil Amine (Argonne National Laboratory) - es208.....	2-94
High-Energy High-Power Battery Exceeding PHEV-40 Requirements: Jane Rempel (TIAX) - es209 .....	2-98
Advanced High-Energy Lithium-Ion Cell for PHEV and EV Applications: Jagat Singh (3M) - es210 .....	2-102
High-Energy Lithium Batteries for PHEV Applications: Subramanian Venkatachala (Envia Systems) - es211 .....	2-105
High-Energy, Long Cycle Life Lithium-Ion Batteries for PHEV Applications: Donghai Wang (Pennsylvania State University) - es212 .....	2-108
High Energy Density Lithium-Ion Cells for EV's Based on Novel, High Voltage Cathode Material Systems: Keith Kepler (Farasis) - es213.....	2-112
First Principles Modeling of SEI Formation on Bare and Surface/Additive Modified Silicon Anodes: Perla Balbuena (Texas A&M University) - es214 .....	2-115
Analysis of Film Formation Chemistry on Silicon Anodes by Advanced In Situ and Operando Vibrational Spectroscopy: G. Somorjai (University of California, Berkeley) - es215 .....	2-118
Optimization of Ion Transport in High-Energy Composite Cathodes: Shirley Meng (University of California, San Diego) - es216.....	2-121
Daikin Advanced Lithium-Ion Battery Technology - High-voltage Electrolyte: Ron Hendershot (Daikin America) - es217 .....	2-125
Fluorinated Electrolyte for 5 V Lithium-Ion Chemistry: John Zhang (Argonne National Laboratory) - es218 .....	2-128
Novel Non-Carbonate Based Electrolytes for Silicon Anodes: Dee Strand (Wildcat Discovery) - es219.....	2-131
Predicting Microstructure and Performance for Optimal Cell Fabrication: Dean Wheeler (Brigham Young University) - es220 .....	2-134
A Combined Experimental and Modeling Approach for the Design of High Coulombic Efficiency Si Electrodes: Xingcheng Xiao (General Motors) - es221.....	2-137
Electrode Architecture-Assembly of Battery Materials and Electrodes: Karim Zaghib (Hydro Quebec) - es222 .....	2-140

Hierarchical Assembly of Inorganic/Organic Hybrid Si Negative Electrodes: Gao Liu (Lawrence Berkeley National Laboratory) - es223 .....	2-143
Simulations and X-ray Spectroscopy of Li-S Chemistry: Nitash Balsara (Lawrence Berkeley National Laboratory) - es224.....	2-146
Design and Synthesis of Advanced High-Energy Cathode Materials: Guoying Chen (Lawrence Berkeley National Laboratory) - es225.....	2-149
Microscopy Investigation on the Fading Mechanism of Electrode Materials: Chongmin Wang (Pacific Northwest National Laboratory) - es226 .....	2-152
BatPaC Model Development: Shabbir Ahmed (Argonne National Laboratory) - es228.....	2-155
Lithium-Ion Battery Production and Recycling Materials Issues: Linda Gaines (Argonne National Laboratory) - es229.....	2-159
Sulfur Cathode for Lithium-Sulfur Batteries: Yi Cui (Stanford University) - es230.....	2-163
High Energy Density Lithium Battery: Stanley Whittingham (Binghamton University) - es231.....	2-166
Electrode Fabrication and Performance Benchmarking: Vincent Battaglia (Lawrence Berkeley National Laboratory) - es232 .....	2-169
Efficient Rechargeable Li/O <sub>2</sub> Batteries Utilizing Stable Inorganic Molten Salt Electrolytes: Vincent Giordani (Liox) - es233.....	2-172
Continuum Modeling as a Guide to Developing New Battery Materials: Venkat Srinivasan (Lawrence Berkeley National Laboratory) - es234.....	2-175
Energy Storage Materials Research Using DOE's User Facilities: Michael Thackeray (Argonne National Laboratory) - es235.....	2-177
Crash Propagation Simulations and Validation: Shriram Santhanagopalan (National Renewable Energy Laboratory) - es236 .....	2-180
XG Sciences: Development of Silicon Graphene Composite Anode: Robert Privette (XG Sciences) - es237 .....	2-182
Low-Cost, High-Capacity Lithium-Ion Batteries through Modified Surface and Microstructure: Pu Zhang (Navitas Systems) - es238 .....	2-184
Scale-Up of Low-Cost Encapsulation Technologies for High-Capacity and High-Voltage Electrode Powders: David King (Pneumaticoat Technologies) - es239 .....	2-186
Development of Silicon Graphene Composite Anode: Samir Mayekar (Sinode Systems) - es240.....	2-188
A Disruptive Concept for a Whole Family of New Battery Systems: Farshid Rumi (Parthian Energy) - es242.....	2-190
Dramatically Improve the Safety Performance of Lithium-Ion Battery Separators and Reduce the Manufacturing Cost using Ultraviolet Curing and High Precision Coating Technologies: John Arnold (Miltec UV International) - es243.....	2-192



Low-Cost, High-Capacity Non-Intercalation Chemistry Automotive Cells: Alex Jacobs (Sila Nanotechnologies) - es244 .....	2-195
Low-Cost, Structurally Advanced Novel Electrode and Cell Manufacturing: Taison Tan (24M Technologies) - es245 .....	2-198
Advanced Drying Process for Lower Manufacturing Cost of Electrodes: Iftikhar Ahmad (Lambda Technologies) - es246.....	2-200
EV Battery Development: Herman Lopez (Envia Systems) - es247.....	2-203
Development of a PHEV Battery: John Busbee (Xerion Advanced Battery Corporation) - es248 .....	2-206
Battery Development: Mohamed Alamgir (LG Chem Power, Inc.) - es249.....	2-209
A Commercially Scalable Process for Silicon Anode Prelithiation: Ionel Stefan (Amprius) - es250.....	2-212
12 V SS Battery Development: Michael Everett (Maxwell) - es251.....	2-215
New High-Energy Electrochemical Couple for Automotive Application: Xiao-Qing Yang (Brookhaven National Laboratory) - es255.....	2-218
3M IC3P - Research Focus: Jagat Singh (3M) - es256 .....	2-221
Ion-Exchanged Derived Cathodes (IE-LL_NCM) for High-Energy Density Lithium-Ion Batteries: Christopher Johnson (Argonne National Laboratory) - es257 .....	2-224
Envia IC3P - Research Focus: Robert Kostecki (Lawrence Berkeley National Laboratory) - es258 .....	2-227
Prospects and Challenges of Nickel-Rich Layered Oxide Cathodes: Arumugam Manthiram (University of Texas at Austin) - es259.....	2-230
Materials Development for High-energy High Power Battery Exceeding PHEV-40 Requirements: Jane Rempel (TIAX) - es260 .....	2-233
<b>3. Electric Drive Technologies .....</b>	<b>3-1</b>
Subprogram Overview Comments: Steven Boyd (U.S. Department of Energy) - edt000.....	3-3
Benchmarking EV and HEV Technologies: Tim Burress (Oak Ridge National Laboratory) - edt006.....	3-17
DREAM (Development of Radically Enhanced Alnico Magnets): Iver Anderson (Ames National Laboratory) - edt015.....	3-22
North American Electric Traction Drive Supply Chain Analysis: Focus on Motors: Christopher Whaling (Synthesis Partners) - edt032.....	3-26
Next-Generation Inverter: Zilai Zhao (General Motors) - edt040.....	3-30
Unique Lanthide-Free Motor Construction: Alan Gilbert (UQM Technologies, Inc.) - edt044 .....	3-34

Alternative High-Performance Motors with Non-Rare Earth Materials: Ayman El-Refaie (General Electric) - edt045.....	3-38
Advanced Packaging Technologies and Designs: Zhenxian Liang (Oak Ridge National Laboratory) - edt049.....	3-42
Electric Drive Inverter Research and Development: Madhu Chinthavali (Oak Ridge National Laboratory) - edt053.....	3-47
Innovative Technologies for Converters and Chargers: Gui-Jia Su (Oak Ridge National Laboratory) - edt054.....	3-51
Advanced Low-Cost SiC and GaN Wide Bandgap Inverters for Under-the-Hood Electric Vehicle Traction Drives: Kraig Olejniczak (APEI, Inc.) - edt058.....	3-55
High-Temperature DC Bus Capacitors Cost Reduction and Performance Improvements: Angelo Yializis (Sigma Technologies International) - edt059.....	3-58
High-Performance DC Bus Film Capacitor: Dan Tan (General Electric) - edt060.....	3-63
Cost-Effective Fabrication of High-Temperature Ceramic Capacitors for Power Inverters: Balu Balachandran (Argonne National Laboratory) - edt061.....	3-68
Non-Rare Earth Motor Development: Tim Burress (Oak Ridge National Laboratory) - edt062.....	3-71
Performance and Reliability of Bonded Interfaces for High-Temperature Packaging: Doug DeVoto (National Renewable Energy Laboratory) - edt063.....	3-76
Electric Motor Thermal Management Research and Development: Kevin Bennion (National Renewable Energy Laboratory) - edt064.....	3-79
Brushless and Permanent Magnet Free Wound Field Synchronous Motor (WFSM): David Ludois (University of Wisconsin-Madison) - edt065.....	3-83
Traction Drive Systems with Integrated Wireless Charging: Gui-Jia Su (Oak Ridge National Laboratory) - edt066.....	3-88
High-Efficiency High-Density GaN-Based 6.6 kW Bidirectional On-Board Charger for PEVs: Charles Zhu (Delta Products Corporation) - edt067.....	3-91
Gate Driver Optimization for WBG Applications: Nance Ericson (Oak Ridge National Laboratory) - edt068.....	3-94
Power Electronics Thermal Management Research and Development: Kevin Bennion (National Renewable Energy Laboratory) - edt069.....	3-97
Thermal Performance Benchmarking: Gilbert Moreno (National Renewable Energy Laboratory) - edt070.....	3-100
Multi-Speed Range Electric Motor Research and Development: Lixin Tang (Oak Ridge National Laboratory) - edt071.....	3-103
30 kW Modular DC-DC System using Superjunction MOSFETs: Robert Erickson (University of Colorado) - edt072.....	3-107

Evaluation of an APEI 88 kW SiC Inverter with Next-Generation Cree 900 V SiC MOSFET Technology for Ford Automotive Systems: Jeffrey Casady (Cree, Inc.) - edt073.....3-110

**4. Advanced Combustion Engines ..... 4-1**

Subprogram Overview Comments: Gurpreet Singh (U.S. Department of Energy) - ace000 ..... 4-4

Heavy-Duty Low-Temperature and Diesel Combustion and Heavy-Duty Combustion Modeling: Mark Musculus (Sandia National Laboratories) - ace001.....4-17

Light-Duty Diesel Combustion: Stephen Busch (Sandia National Laboratories) - ace002.....4-22

Low-Temperature Gasoline Combustion (LTGC) Engine Research: John Dec (Sandia National Laboratories) - ace004.....4-26

Spray Combustion Cross-Cut Engine Research: Lyle Pickett (Sandia National Laboratories) - ace005..... 4-28

Automotive Low-Temperature Gasoline Combustion Engine Research: Isaac Ekoto (Sandia National Laboratories) - ace006..... 4-33

Large Eddy Simulation (LES) Applied to Advanced Engine Combustion Research: Joe Oefelein (Sandia National Laboratories) - ace007.....4-36

Fuel Injection and Spray Research Using X-Ray Diagnostics: Christopher Powell (Argonne National Laboratory) - ace010.....4-41

Use of Low-Cetane Fuel to Enable Low-Temperature Combustion: Steve Ciatti (Argonne National Laboratory) - ace011.....4-45

Model Development and Analysis of Clean and Efficient Engine Combustion: Russell Whitesides (Lawrence Livermore National Laboratory) - ace012..... 4-50

Chemical Kinetic Models for Advanced Engine Combustion: Bill Pitz (Lawrence Livermore National Laboratory) - ace013.....4-54

2015 KIVA-hpFE Development: A Robust and Accurate Engine Modeling Software: David Carrington (Los Alamos National Laboratory) - ace014.....4-57

Stretch Efficiency for Combustion Engines: Exploiting New Combustion Regimes: Stuart Daw (Oak Ridge National Laboratory) - ace015.....4-62

High-Efficiency Clean Combustion in Multi-Cylinder Light-Duty Engines: Scott Curran (Oak Ridge National Laboratory) - ace016.....4-67

Accelerating Predictive Simulation of Internal Combustion Engines with High Performance Computing: Kevin Edwards (Oak Ridge National Laboratory) - ace017 .....4-71

Joint Development and Coordination of Emissions Control Data and Models (CLEERS Analysis and Coordination): Stuart Daw (Oak Ridge National Laboratory) - ace022.....4-77

CLEERS: Aftertreatment Modeling and Analysis: Chuck Peden (Pacific Northwest National Laboratory) - ace023.....	4-81
Particulate Emissions Control by Advanced Filtration Systems for GDI Engines: Hee Je Seong (Argonne National Laboratory) - ace024.....	4-84
Enhanced High- and Low-Temperature Performance of NO <sub>x</sub> Reduction Materials: Feng Gao (Pacific Northwest National Laboratory) - ace026.....	4-86
Thermally Stable Ultra Low-Temperature Oxidation Catalysts: Abhijeet Karkamkar (Pacific Northwest National Laboratory) - ace027 .....	4-89
Cummins/ORNL-FEERC CRADA: NO <sub>x</sub> Control and Measurement Technology for Heavy-Duty Diesel Engines: Bill Partridge (Oak Ridge National Laboratory) - ace032 .....	4-93
Emissions Control for Lean Gasoline Engines: Jim Parks (Oak Ridge National Laboratory) - ace033 .....	4-97
Neutron Imaging of Advanced Transportation Technologies: Todd Toops (Oak Ridge National Laboratory) - ace052.....	4-101
RCM Studies to Enable Gasoline-Relevant Low-Temperature Combustion: Scott Goldsborough (Argonne National Laboratory) - ace054 .....	4-105
Fuel-Neutral Studies of Particulate Matter Transport Emissions: Mark Stewart (Pacific Northwest National Laboratory) - ace056.....	4-109
Cummins SuperTruck Program Technology and System Level Demonstration of Highly Efficient and Clean, Diesel Powered Class 8 Trucks: David Koeberlein (Cummins, Inc.) - ace057.....	4-112
SuperTruck Program: Engine Project Review: Sandeep Singh (Detroit Diesel) - ace058.....	4-117
Development and Demonstration of a Fuel-Efficient Class 8 Tractor and Trailer: Russ Zukouski (Navistar International Corporation) - ace059.....	4-122
Volvo SuperTruck - Powertrain Technologies for Efficiency Improvement: John Gible (Volvo) - ace060.....	4-126
ATP-LD; Cummins Next-Generation Tier 2 Bin 2 Diesel Engine: Michael Ruth (Cummins, Inc.) - ace061 .....	4-131
Advanced Gasoline Turbocharged Direct Injection (GTDI) Engine Development: Corey Weaver (Ford Motor Company) - ace065.....	4-135
Advancements in Fuel Spray and Combustion Modeling with High Performance Computing Resources: Sibendu Som (Argonne National Laboratory) - ace075.....	4-139
Improved Solvers for Advanced Engine Combustion Simulation: Matthew McNenly (Lawrence Livermore National Laboratory) - ace076.....	4-143
Cummins/ORNL-FEERC Combustion CRADA: Characterization and Reduction of Combustion Variations: Bill Partridge (Oak Ridge National Laboratory) - ace077 .....	4-147

Investigation of Mixed Oxide Catalysts for NO Oxidation: Janos Szanyi (Pacific Northwest National Laboratory) - ace078..... 4-151

Robust Nitrogen Oxide/Ammonia Sensors for Vehicle On-board Emissions Control: Rangachary Mukundan (Los Alamos National Laboratory) - ace079..... 4-154

High Efficiency GDI Engine Research, with Emphasis on Ignition Systems: Thomas Wallner (Argonne National Laboratory) - ace084..... 4-157

Low-Temperature Emission Control to Enable Fuel Efficient Engine Commercialization: Todd Toops (Oak Ridge National Laboratory) - ace085..... 4-161

Next-Generation Ultra-Lean Burn Powertrain: Mike Bunce (MAHLE Powertrain LLC) - ace087 ..... 4-164

Development of Radio Frequency Diesel Particulate Filter Sensor and Controls for Advanced Low-Pressure Drop Systems to Reduce Engine Fuel Consumption: Alexander Sappok (Filter Sensing Technologies, Inc.) - ace089..... 4-169

High-Dilution Stoichiometric Gasoline Direct-Injection (SGDI) Combustion Control Development: Brian Kaul (Oak Ridge National Laboratory) - ace090..... 4-173

Intake Air Oxygen Sensor: Claus Schnabel (Robert Bosch) - ace091..... 4-177

High-Efficiency VCR Engine with Variable Valve Actuation and New Supercharging Technology: Charles Mandler (Envera LLC) - ace092..... 4-181

Lean Miller Cycle System Development for Light-Duty Vehicles: David Sczomak (General Motors) - ace093 ..... 4-186

Ultra-Efficient Light-Duty Powertrain with Gasoline Low-Temperature Combustion: Keith Confer (Delphi Powertrain) - ace094..... 4-191

Metal Oxide Nano-Array Catalysts for Low-Temperature Diesel Oxidation: Pu-Xian Gao (University of Connecticut) - ace095..... 4-195

**5. Fuels and Lubricants Technologies..... 5-1**

Subprogram Overview Comments: Kevin Stork (U.S. Department of Energy) - ft000..... 5-4

Advanced Combustion and Fuels: Brad Zigler (National Renewable Energy Laboratory) - ft002..... 5-11

Performance of Biofuels and Biofuel Blends: Bob McCormick (National Renewable Energy Laboratory) - ft003..... 5-16

Fuel Effects on Mixing-Controlled Combustion Strategies for High-Efficiency Clean-Combustion Engines: Chuck Mueller (Sandia National Laboratories) - ft004..... 5-19

Advanced Lean-Burn DI Spark Ignition Fuels Research: Magnus Sjoberg (Sandia National Laboratories) - ft006 ..... 5-23

Fuel Effects on Emissions Control Technologies: Todd Toops (Oak Ridge National Laboratory) - ft007 ..... 5-27

Gasoline-Like Fuel Effects on Advanced Combustion Regimes: James Szybist (Oak Ridge National Laboratory) - ft008.....	5-31
Engine Friction Reduction Technologies: George Fenske (Argonne National Laboratory) - ft012 .....	5-35
Polyalkylene Glycol (PAG)-Based Lubricant for Light- and Medium-Duty Axles: Arup Gangopadhyay (Ford Motor Company) - ft023.....	5-38
A Novel Lubricant Formulation Scheme for 2% Fuel Efficiency Improvement: Q. Jane Wang (Northwestern University) - ft024 .....	5-41
Improve Fuel Economy through Formulation Design and Modeling: Gefei Wu (Ashland, Inc.) - ft025.....	5-44
Developing Kinetic Mechanisms for New Fuels and Biofuels: Bill Pitz (Lawrence Livermore National Laboratory) - ft026 .....	5-47
Unconventional and Alternate Fuels Research: Tim Bays (Pacific Northwest National Laboratory) - ft027.....	5-50
Additive and Basefluid Development: Oyelayo Ajayi (Argonne National Laboratory) - ft029 .....	5-53
<b>6. Lightweight Materials .....</b>	<b>6-1</b>
Subprogram Overview Comments: Will Joost (U.S. Department of Energy) - Im000.....	6-3
Advanced Oxidation and Stabilization of PAN-Based Carbon Precursor Fibers: Felix Paulauskas (Oak Ridge National Laboratory) - Im006 .....	6-9
Scale-Up of Magnesium Production by Fully Stabilized Zirconia Electrolysis: Adam Powell (INFINIUM, Inc.) - Im035 .....	6-11
Mechanistic-Based Ductility Prediction for Complex Magnesium Castings: Xin Sun (Pacific Northwest National Laboratory) - Im057.....	6-15
Multi-Material Lightweight Vehicles: Tim Skszek (Vehma) - Im072.....	6-18
SPR Process Simulation, Analyses, and Development for Magnesium Joints: Elizabeth Stephens (Pacific Northwest National Laboratory) - Im074 .....	6-21
Understanding Protective Film Formation by Magnesium Alloys in Automotive Applications: Mike Brady (Oak Ridge National Laboratory) - Im076.....	6-23
Magnesium-Intensive Front End Sub-Structure Development: Jim Quinn (United States Automotive Materials Partnership) - Im077.....	6-26
Aluminum Formability Extension through Superior Blank Processing: Xin Sun (Pacific Northwest National Laboratory) - Im078.....	6-29
Enhanced Room-Temperature Formability in High-Strength Aluminum Alloys through Pulse-Pressure Forming: Rich Davies (Pacific Northwest National Laboratory) - Im079.....	6-32

Integrated Computational Materials Engineering Approach to Development of Lightweight 3GAHSS Vehicle Assembly: Lou Hector (United States Automotive Materials Partnership) - Im080.....6-34

GATE Center of Excellence at UAB for Lightweight Materials and Manufacturing for Automotive, Truck and Mass Transit: Uday Vaidya (University of Alabama, Birmingham) - Im081.....6-37

Validation of Material Models for Automotive Carbon Fiber Composite Structures: Libby Berger (General Motors) - Im084..... 6-41

Collision Welding of Dissimilar Materials by Vaporizing Foil Actuator: Glenn Daehn (Ohio State University) - Im086 ..... 6-44

Active, Tailorable Adhesives for Dissimilar Material Bonding, Repair and Assembly: Mahmood Haq (Michigan State University) – Im087..... 6-46

High-Strength Electroformed Nanostructured Aluminum for Lightweight Automotive Applications: Shiyun Ruan (Xtallic Corporation) - Im089..... 6-49

Technical Cost Modeling for Vehicle Lightweighting: Tony Mascarin (IBIS Associates) - Im090.....6-53

Phase Transformation Kinetics and Alloy Microsegregation in High-Pressure Die Cast Magnesium Alloys: John Allison (University of Michigan) - Im091.....6-56

In-Situ Investigation of Microstructural Evolution During Solidification and Heat Treatment in a Die-Cast Magnesium Alloy: Aashish Rohatgi (Pacific Northwest National Laboratory) - Im092.....6-59

High-Throughput Study of Diffusion and Phase Transformation Kinetics of Magnesium-Based Systems For Automotive Cast Magnesium Alloys: Alan Lou (Ohio State University) - Im093..... 6-62

Microstructure and the Corrosion/Protection of Cast Magnesium Alloys: Karl Sieradzki (Arizona State University) - Im094.....6-65

A System Multiscale Modeling and Experimental Approach to Protect Grain Boundaries in Magnesium Alloys from Corrosion: Mark Horstemeyer (Mississippi State University) - Im095..... 6-68

Corrosivity and Passivity of Metastable Magnesium Alloys: Guang-Ling Song (Oak Ridge National Laboratory) - Im096..... 6-70

Laser-Assisted Joining Process of Aluminum and Carbon Fiber Components: Adrian Sabau (Oak Ridge National Laboratory) - Im097.....6-73

Brazing Dissimilar Metals with a Novel Composite Foil: Tim Weihs (Johns Hopkins University) - Im098 .....6-76

High Strength, Dissimilar Alloy Aluminum Tailor-Welded Blanks: Yuri Hovanski (Pacific Northwest National Laboratory) - Im099..... 6-78

Upset Protrusion Joining Techniques For Joining Dissimilar Metals: Steve Logan (Fiat Chrysler Automobiles US LLC) - Im100..... 6-80

**7. Propulsion Materials.....7-1**



Subprogram Overview Comments: Will Joost (U.S. Department of Energy) - Im000.....	7-3
Novel Manufacturing Technologies for High Power Induction and Permanent Magnet Electric Motors: Glenn Grant (Pacific Northwest National Laboratory) - pm004.....	7-8
Materials Issues Associated with EGR Systems: Michael Lance (Oak Ridge National Laboratory) - pm009.....	7-11
High-Temperature Aluminum Alloys (Agreement ID:24034) Project ID:18518: Stan Pitman (Pacific Northwest National Laboratory) - pm044.....	7-14
Tailored Materials for Improved Internal Combustion Engine Efficiency: Glenn Grant (Pacific Northwest National Laboratory) - pm048.....	7-17
High-Temperature Materials for High-Efficiency Engines: G. Muralidharan (Oak Ridge National Laboratory) - pm053.....	7-22
Enabling Materials for High-Temperature Power Electronics (Agreement ID:26461) Project ID:18516: Andrew Wereszczak (Oak Ridge National Laboratory) - pm054.....	7-26
Biofuel Impacts on Aftertreatment Devices (Agreement ID:26463) Project ID:18519: Michael Lance (Oak Ridge National Laboratory) - pm055.....	7-29
Applied Integrated Computational Materials Engineering for New Propulsion Materials: Charles Finney (Oak Ridge National Laboratory) - pm057.....	7-32
Development of Advanced High-Strength Cast Alloys for Heavy-Duty Engines: Rich Huff (Caterpillar, Inc.) - pm059.....	7-35
Integrated Computational Materials Engineering Guided Development of Advanced Cast Aluminum Alloys for Automotive Engine Applications: Mei Li (Ford Motor Company) - pm060.....	7-39
Computational Design and Development of a New, Lightweight Cast Alloy for Advanced Cylinder Heads in High-Efficiency, Light-Duty Engines FOA 648-3a: Mike Walker (General Motors) - pm061.....	7-43
High-Performance Cast Aluminum Alloys for Next Generation Passenger Vehicle Engines 2012 FOA 648 Topic 3a: Amit Shyam (Oak Ridge National Laboratory) - pm062.....	7-47
Alloy Development for High-Performance Cast Crankshafts: Rich Huff (Caterpillar, Inc.) - pm065.....	7-51
<b>8. Technology Integration.....</b>	<b>8-1</b>
Subprogram Overview Comments: Linda Bluestein (U.S. Department of Energy) - ti000.....	8-3
Fuel Economy Guide and fueleconomy.gov Website: Bo Saulsbury (Oak Ridge National Laboratory) - ti056.....	8-11



Fuel Economy Information Project - Research, Data Validation, and Technical Assistance Related to Collecting, Analyzing, and Disseminating Accurate Fuel Economy Information: Bo Saulsbury (Oak Ridge National Laboratory) - ti057 ..... 8-16

Alternative Fuel Station Locator: Andrew Hudgins (National Renewable Energy Laboratory) - ti058..... 8-21

Alternative Fuels Data Center and API: Johanna Levene (National Renewable Energy Laboratory) - ti059 .....8-25

Clean Cities Coordinator Resource Building and National Networking Activities: Wendy Dafoe (National Renewable Energy Laboratory) - ti060..... 8-29

Clean Cities "Tiger Team" Technical and Problem Solving Assistance: John Gonzales (National Renewable Energy Laboratory) - ti061.....8-32

Collegiate Programs: Advanced Vehicle Technology Competitions (AVTC), Graduate Research Assistants (GRCs), and Clean Cities University Workforce Development Program (CCUWDP): Marcy Rood (Argonne National Laboratory) - ti062.....8-35

Alternative Fuel Tools and Technical Assistance Activities: Marcy Rood (Argonne National Laboratory) - ti063.....8-38

**9. Vehicle Analysis..... 9-1**

Subprogram Overview Comments: Jacob Ward (U.S. Department of Energy) - van999.....9-3

Impact Analysis: VTO Baseline and Scenario (BaSce) Activities: Tom Stephens (Argonne National Laboratory) - van001.....9-12

Emissions Modeling: GREET Life-Cycle Analysis: Michael Wang (Argonne National Laboratory) - van002.....9-17

Consumer Vehicle Technology Data: Mark Singer (National Renewable Energy Laboratory) - van003.....9-22

Unified Modeling, Simulation, and Market Implications: FASTSim and ADOPT: Aaron Brooker (National Renewable Energy Laboratory) - van004.....9-27

Consumer-Segmented Vehicle Choice Modeling: the MA3T Model: Zhenhong Lin (Oak Ridge National Laboratory) - van005.....9-32

Parametric Vehicle Choice Modeling: ParaChoice: Dawn Manley (Sandia National Laboratories) - van014.....9-36

PEV Consumer Behavior in Practice (PCBIP): Mike Nicholas (University of California, Davis) - van015 ..... 9-41

**10.Acronyms..... 10-1**

**11. Cross-Reference of Project Investigators, Projects, and Organizations .....11-1**

**12. Project and Program Statistics Calculations Overview.....12-1**

Appendix A: 2015 Annual Merit Review Attendees.....A-1

# Introduction

The 2015 U.S. Department of Energy (DOE) Fuel Cell Technologies Office (FCTO) and Vehicle Technologies Office (VTO) Annual Merit Review and Peer Evaluation Meeting (AMR) was held June 8-12, 2015, in Arlington, Virginia. The review encompassed work done by the FCTO and the VTO: 258 individual activities were reviewed for VTO, by 170 reviewers. A total of 1,095 individual review responses were received for the VTO technical reviews.

The objective of the meeting was to review the accomplishments and plans for VTO over the previous 12 months, and provide an opportunity for industry, government, and academia to give inputs to DOE on the Office with a structured and formal methodology. The meeting also provided attendees with a forum for interaction and technology information transfer.

The peer review process followed the guidelines of the Peer Review Guide developed by the Office of Energy Efficiency and Renewable Energy (EERE). Each activity is reviewed every three years, at a minimum. However, the Office strives to have every activity reviewed every other year. The reviewers for the technical sessions were drawn from a wide variety of backgrounds, including current and former vehicle industry members, academia, government, and other expertise areas. Each reviewer was screened for conflicts of interest as prescribed by the Peer Review Guide. A complete list of the meeting participants is presented as Appendix A.

## Evaluation Criteria – Research & Development Subprogram Projects

In the technical research and development (R&D) subprogram sessions, these reviewers were asked to respond to a series of specific questions regarding the breadth, depth, and appropriateness of the VTO R&D activities. The technical questions are listed below, along with appropriate scoring metrics. These questions were used for all formal VTO project reviews, including any American Recovery and Reinvestment Act (ARRA) reviews.

**Question 1. Approach to performing the work—the degree to which technical barriers are addressed, the project is well-designed, feasible, and integrated with other efforts. (Scoring weight for overall average = 20%)**

- 4.0=outstanding (sharply focused on critical barriers; difficult to improve approach significantly).
- 3.5=excellent (effective; contributes to overcoming most barriers).
- 3.0=good (generally effective but could be improved; contributes to overcoming some barriers).
- 2.5=satisfactory (has some weaknesses; contributes to overcoming some barriers).
- 2.0=fair (has significant weaknesses; may have some impact on overcoming barriers).
- 1.5=poor (minimally responsive to project objectives; unlikely to contribute to overcoming the barriers).
- 1.0=unsatisfactory (not responsive to project objectives; unlikely to contribute to overcoming the barriers).

**Question 2. Technical accomplishments and progress toward overall project and DOE goals—the degree to which progress has been made, measured against performance indicators and demonstrated progress toward DOE goals. (Scoring weight for overall average = 40%)**

- 4.0=outstanding (sharply focused on critical barriers; difficult to improve significantly).

- 3.5=excellent (effective; contributes to overcoming most barriers).
- 3.0=good (generally effective but could be improved; contributes to overcoming some barriers).
- 2.5=satisfactory (has some weaknesses; contributes to overcoming some barriers) 2.0=fair (has significant weaknesses; may have some impact on overcoming barriers).
- 1.5=poor (minimally responsive to project objectives; unlikely to contribute to overcoming the barriers).
- 1.0=unsatisfactory (not responsive to project objectives; unlikely to contribute to overcoming the barriers).

**Question 3. Collaboration and coordination with other institutions. (Scoring weight for overall average = 10%)**

- 4.0=outstanding (close, appropriate collaboration with other institutions; partners are full participants and well-coordinated).
- 3.5=excellent (good collaboration; partners participate and are well-coordinated).
- 3.0=good (collaboration exists; partners are fairly well-coordinated).
- 2.5=satisfactory (some collaboration exists; coordination between partners could be significantly improved).
- 2.0=fair (a little collaboration exists; coordination between partners could be significantly improved).
- 1.5=poor (most work is done at the sponsoring organization with little outside collaboration; little or no apparent coordination with partners).
- 1.0=unsatisfactory (no apparent coordination with partners).

**Question 4. Proposed future research—the degree to which the project has effectively planned its future work in a logical manner by incorporating appropriate decision points, considering barriers to the realization of the proposed technology and, when sensible, mitigating risk by providing alternate development pathways. (Scoring weight for overall average = 10%)**

- 4.0=outstanding (sharply focused on critical barriers; difficult to improve significantly).
- 3.5=excellent (effective; contributes to overcoming most barriers).
- 3.0=good (generally effective but could be improved; contributes to overcoming some barriers).
- 2.5=satisfactory (has some weaknesses; contributes to overcoming some barriers).
- 2.0=fair (has significant weaknesses; may have some impact on overcoming barriers).
- 1.5=poor (minimally responsive to project objectives; unlikely to contribute to overcoming the barriers).
- 1.0=unsatisfactory (not responsive to project objectives; unlikely to contribute to overcoming the barriers).

**Question 5. Does this project support the overall DOE objectives of petroleum displacement? Why or why not? (Scoring weight, not included with overall average = 20%)**

- yes
- no

**Question 6. Resources: How sufficient are the resources for the project to achieve the stated milestones in a timely fashion?**

- excessive
- sufficient
- insufficient

### Evaluation Criteria – Technology Integration Projects

Reviewers for the Technology Integration (TI) technical session answered questions tailored to TI's 2015 AMR focus on petroleum reduction technologies and practices, alternative fuels, infrastructure, and related efforts. These technical questions are listed below, along with appropriate scoring metrics.

**Question 1. Project approach to supporting deployment of petroleum reduction technologies and practices, alternative fuel vehicles, infrastructure and related efforts—the degree to which the project is well-designed, feasible, and integrated with other efforts. (Scoring weight for overall average = 20%)**

- 4.0=outstanding (difficult to improve project approach significantly).
- 3.0=good (generally effective but could be improved).
- 2.0=fair (has significant weaknesses).
- 1.0=poor (not responsive to project objectives).

**Question 2. Project accomplishments and progress toward overall project and DOE goals—the degree to which progress/significant accomplishments have been achieved, measured against performance indicators and demonstrated progress toward project and DOE goals. (Scoring weight for overall average = 40%)**

- 4.0=outstanding (excellent progress toward objectives).
- 3.0=good (significant progress toward objectives).
- 2.0=fair (rate of progress has been slow).
- 1.0=poor (little or no progress towards objectives).

**Question 3. Collaboration and Coordination among the Project Team—the degree to which the appropriate team members and partners are involved in the project work and the effectiveness of collaboration between and among partners. (Scoring weight for overall average = 10%)**

- 4.0=outstanding (close, appropriate collaboration within project team; team members are well-suited to effectively carry out the work of the project).
- 3.0=good (some collaboration exists; team members are fairly well-suited to project work).

- 2.0=fair (a little collaboration exists; team membership could be improved).
- 1.0=poor (little or no apparent collaboration between team members; project team is lacking critical expertise to effectively carry out the work of the project).

**Question 4. Alternative Fuel Market Expansion and/or Petroleum Reduction Potential—the degree to which the project has the potential to contribute to a sustainable alternative fuel vehicle market and/or reduce petroleum dependence in the transportation sector, including the potential to reduce barriers to large scale alternative fuel vehicle market penetration and make information about alternative fuels and petroleum reduction opportunities widely available to target audiences. (Scoring weight for overall average = 10%)**

- 4.0=outstanding (Project clearly contributes to alternative fuel vehicle market expansion and/or petroleum reduction; project is sharply focused on barriers and provides highly effective and widely available information resources.).
- 3.0=good (project has the potential to contribute to alternative fuel vehicle market expansion and/or petroleum reduction; project generally addresses overcoming barriers and provide for public information needs.).
- 2.0=fair (Project may lead to market improvements and petroleum reduction, but needs better focus on overcoming barriers and providing information.).
- 1.0=poor (Project has little relevance toward advancing an alternative fuel vehicle market or reducing petroleum consumption; project fails to eliminate barriers or inform appropriate audiences).

**Question 5. Relevance—Does this project support the overall DOE objectives of reducing reliance on petroleum based fuels? Why or why not? (Scoring weight for overall average = 20%)**

- yes
- no

**Question 6. Use of resources—Are DOE funds being used wisely? Should DOE fund similar efforts in the future? If not, what would be a better use of DOE resources to achieve alternative fuel vehicle and infrastructure expansion?**

- yes
- maybe
- no

## Project Scoring

For R&D subprogram sessions, reviewers were asked to provide numeric scores (on a scale of 1.0-4.0 in one-half point increments, as indicated above) for Question 1 through Question 4 of each formally reviewed activity. For each reviewed project, the individual reviewer scores for Question 1 through Question 4 were averaged to provide information on the project's question-by-question scoring. Scores for each of these four criteria were weighted using the formula below to create a Weighted Average for each project. This allows a project's question-by-question and final overall scores to be meaningfully compared against another project:

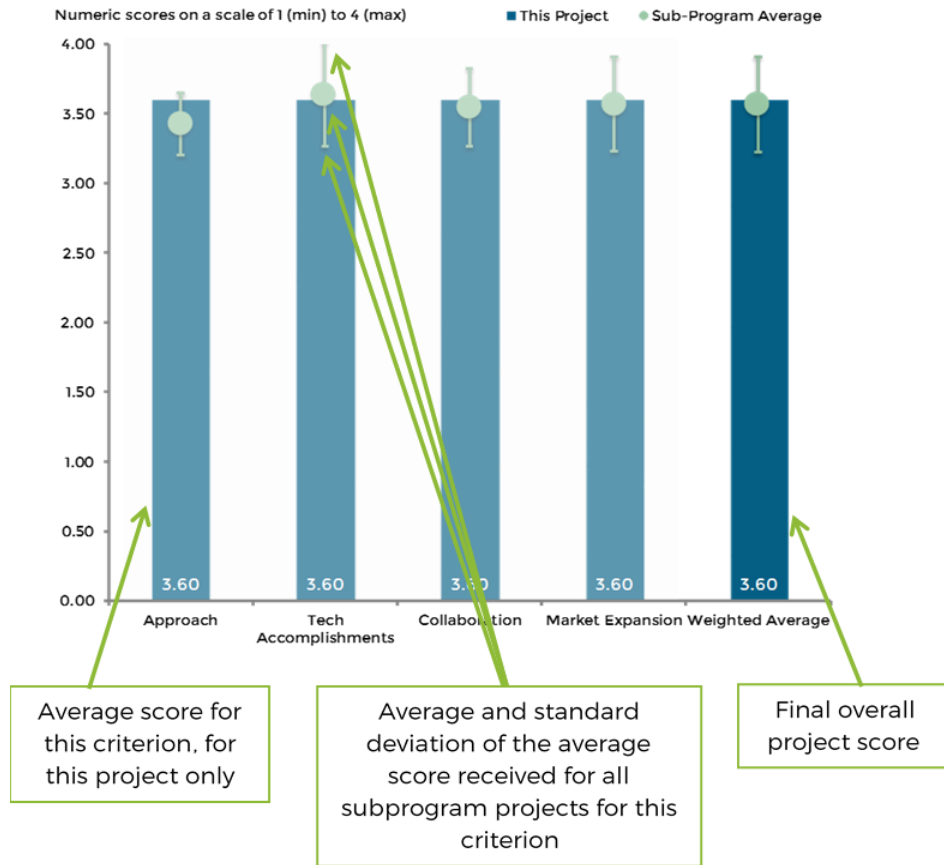


Figure 1: Sample Question 1 through Question 4 score averages, standard deviations, and overall Weighted Average for a TI project

Each reviewed activity has a corresponding bar chart representing that project’s average scores for each of the four designated criteria. As demonstrated in Figure 1, a bullet and red error line are included within the green bars representing the corresponding average and standard deviation of criteria scores for all of the reviewed projects in the same subprogram.

Reviewers were also asked to evaluate a given project’s relevance and funding through Question 5 and Question 6, which were each scored on a different scale than Question 1 through Question 4. For the R&D subprogram sessions, while Question 1 through Question 4 were rated on a 1.0 to 4.0 scale in one-half point increments, Question 5 was rated on a yes or no scale, and Question 6 was rated on an excessive, sufficient, or insufficient scale. Consequently, Question 5 and Question 6 results were excluded from the Weighted Average calculation because the scoring scales are incompatible. As demonstrated in Figure 2, each reviewed activity has pie charts representing that project’s population distributions for each reviewer rating associated with Question 5 and Question 6:

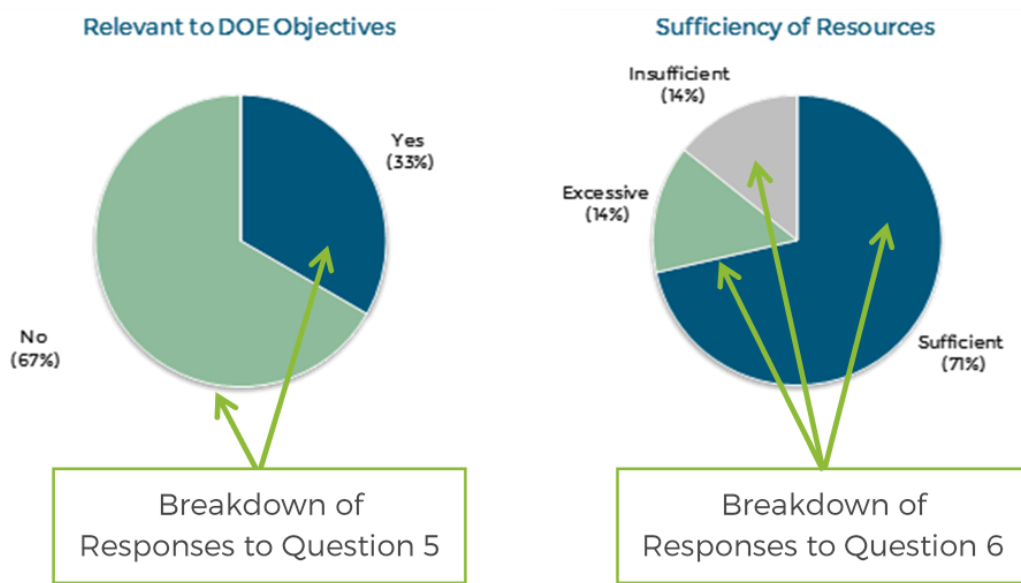


Figure 2: Sample Question 5 and Question 6 population distributions for R&D subprogram project

For TI projects, Question 1 through Question 4 were rated on a 1.0 to 4.0 scale in one-point increments, whereas Question 5 was rated on a yes or no scale, and Question 6 was rated on a yes, maybe, or no scale. Consequently, Question 5 and Question 6 results were excluded from the Weighted Average calculation because the scoring scales are incompatible. Similar to the R&D subprograms, each reviewed activity for TI projects has pie charts representing that project’s population distributions for each reviewer rating associated with Question 5 and Question 6.

Text responses and numeric scores to the questions were submitted electronically through a web-based software application, PeerNet, operated by Oak Ridge Associated Universities (ORAU). Database outputs from this software application were analyzed and summarized to collate the multiple-choice, text comments, and numeric scoring responses and produce the summary report.

Responses to the questions are summarized in this report, with summaries of numeric scores for each technical session, as well as text and graphical summaries of the responses for each individual technical activity. For each project, the reviewer sample size is identified.

Each reviewed activity is identified by the project title, followed by the Principal Investigator (PI), the PI’s organization, and the project identification (ID) number. For each subprogram area, reviewed activities are ordered numerically by project number. Figure 3, below, provides an example project title:

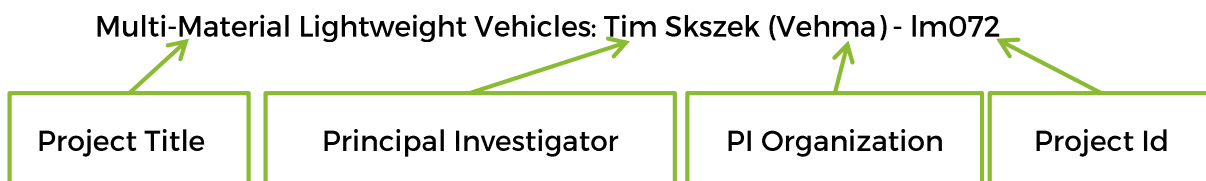


Figure 3: Sample project title with project title, PI, PI organization, and project number



For each project, in addition to the PI, the presenter at the AMR is identified, along with the reviewer sample size. For some projects, the presenter at the AMR was a project team member rather than the PI.

Individual reviewer comments for each question are identified under the heading Reviewer 1, Reviewer 2, etc. Note that for each question the order of reviewer comments may be different; for example, for each specific project the reviewer identified as Reviewer 1 in the first question may not be Reviewer 1 in the second question, etc. Not all reviewers provided a response to each question for a given project.

The report is organized by technical subprogram area. Each technical area section includes a summary of that subprogram, reviewer feedback received specific to the subprogram overview presentation(s) given by DOE, a subprogram activities score summary table (and page numbers), and project-specific reviewer evaluation comments with corresponding bar and pie charts.

(This page intentionally left blank)