EERE National Lab Impact Summit

Driving American Energy Innovation and Competitiveness

May 4, 2016 | 7:30 am—7:00 pm

National Renewable Energy Laboratory

Golden, Colorado

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

National Lab Impact Initiative

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DEPARTMENT OF ENERGY (DOE) NATIONAL LAB ABBREVIATIONS

National Lab	Abbreviation
Ames Laboratory	Ames
Argonne National Laboratory	ANL
Brookhaven National Laboratory	BNL
Fermi National Accelerator Laboratory	FNAL
Idaho National Laboratory	INL
Lawrence Berkeley National Laboratory	LBNL
Lawrence Livermore National Laboratory	LLNL
Los Alamos National Laboratory	LANL
National Energy Technology Laboratory	NETL
National Renewable Energy Laboratory	NREL
Oak Ridge National Laboratory	ORNL
Pacific Northwest National Laboratory	PNNL
Princeton Plasma Physics Laboratory	PPPL
Sandia National Laboratories	SNL
Savannah River National Laboratory	SRNL
SLAC National Accelerator Facility	SLAC
Thomas Jefferson National Accelerator Facility	TJNAF

WELCOME LETTER

Dear Lab Impact Summit Attendees,

Let me be the first to give you a warm welcome to the first-ever **U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) National Lab Impact Summit**.

We find ourselves at a critical moment in our nation's energy history. As we accelerate into the global clean energy economy, American businesses face a once-in-a-generation opportunity to lead the way in re-inventing our energy systems and establishing enduring competitive advantage and profitability in the process.

DOE's EERE Office is the largest government funder of clean-energy innovations in the world. This year alone, EERE will invest approximately $2 billion into partnerships with energy innovators all across the country. And a substantial portion of this investment will go into industry partnerships with our world-class National Labs. Industry, EERE, and the National Labs are already transforming the U.S. energy sector, with high-impact new Lab-industry partnerships on the rise. But it is time for us to take the number and intensity of these partnerships to the next level.

Now in its third year, **EERE's National Lab Impact Initiative** is dramatically increasing the commercial relevance and industrial accessibility of the Labs. The Labs are becoming must-have partners for top energy and industrial companies nationwide, giving these companies the innovative edge they need to compete and win in the global marketplace.

I'm so glad that you've joined us for the first EERE National Lab Impact Summit—hosted at the National Renewable Energy Laboratory (NREL) in Golden, Colorado—to learn how companies are building a competitive advantage by partnering with the National Labs and how your company can catch this wave.

This unique and exclusive event is bringing together more than 200 top private-sector executives, government officials, and Lab innovation leaders to:

- Create new private-sector and Lab partnerships for clean-energy innovation
- Showcase how private-sector and National Lab partnerships are successfully addressing critical technology challenges and achieving bottom-line results to improve the competitiveness of American businesses across the country
- Learn first-hand about the world-class innovation capabilities at the National Labs—and exciting new EERE-National Lab partnership programs
- Discover the most exciting and emerging, new technology solutions being created at the National Labs for tomorrow's clean-energy challenges

I have no doubt that the clean energy technologies of today and tomorrow can and will be invented and manufactured right here in America. If we continue working together to unlock the full potential of our National Labs, we can enhance the competitiveness of America's top energy and industrial companies—big and small.

To our industry attendees, I encourage you to "hug a Lab" today and leave this conference with one or more concrete, new, actionable partnerships that you can launch with the National Labs in the months ahead. I encourage you to feel a sense of urgency, as there is no time to waste.

I want to thank you all for being here today for this very important and unique event.

Now let's go change the world together.

All the best,

Dave

Dr. David Danielson
Assistant Secretary, Energy Efficiency and Renewable Energy (EERE)

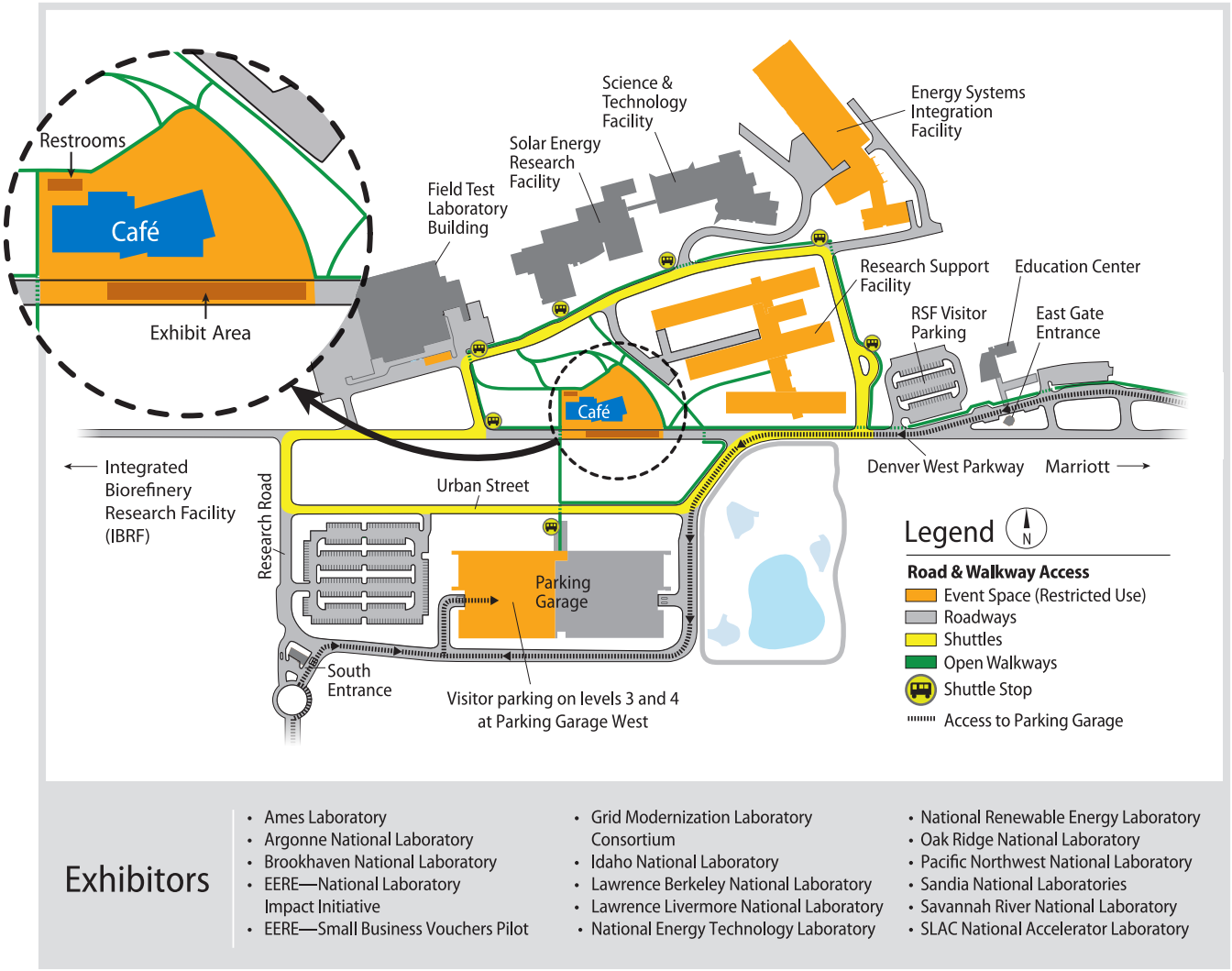
AGENDA

All sessions will be held in the NREL Café unless noted.

TIME	SESSION AND SPEAKERS
7:30am–8:00am	**Check-In and Continental Breakfast**
8:00–8:40	**Welcome and Opening Keynotes** Dr. Martin Keller, *Director, NREL* Dr. David Danielson, *Assistant Secretary, EERE*
8:40–9:10	**Keynote** Dr. Ken Washington, *Vice President, Research and Advanced Engineering, Ford Motor Company*
9:10-9:25	**Break**
9:25–10:15	**National Lab Directors Panel** Moderator: Dr. Martin Keller • Dr. Adam Schwartz, *Director, Ames* • Dr. Steven Ashby, *Director, PNNL* • Dr. Mark Peters, *Director, INL* • Dr. Thomas Zacharia, *Deputy Director for Science and Technology, ORNL*
10:15–11:15	**Impact of the National Labs: The Industry Perspective** Moderator: Dr. David Danielson • Jon Lauckner, *Chief Technology Officer, General Motors* • Dr. J. Michael McQuade, *Senior Vice President, Science and Technology, United Technologies Corporation* • Mike Rowand, *Director of Technology Development, Duke Energy* • Colton Ching, *Vice President of Energy Delivery, Hawaiian Electric Company*
11:15–11:45	**Keynote** TJ Glauthier, *President, TJG Energy Associates, and Co-Chair of the Commission to Review the Effectiveness of the National Energy Laboratories*
11:45am–1:15pm	**Lunch and Lab Showcase Exhibits**
1:15–1:45	**Keynote** Dr. Mark Little, *Chief Technology Officer, General Electric (retired)*
1:45–2:00	**Break**
2:00–3:00	**Break-Out Panels: Get to Know EERE's Major National Lab Initiatives and Capabilities** **Transportation and Fuels** (Location: NREL Cafe) Moderator and Opening Speaker: *Reuben Sarkar, Deputy Assistant Secretary for Transportation, EERE* **Electric Vehicles and Lightweighting** • Dr. Claus Daniel, *Acting Director, Sustainable Transportation Program, ORNL* • Dennis Townsend, *Chairman, Townsend Capital, LLC, Chairman of the Board of Directors, Xalt Energy* **Biofuels** • Dr. Adam Bratis, *Associate Lab Director, BioEnergy Science and Technology Directorate, NREL* • Dr. Bill Provine, *Director, Science and Engineering Global Operations, DuPont* **H2FIRST: Hydrogen Fueling Infrastructure Research and Station Technology** • Terry Johnson, *Distinguished Member of the Technical Staff, Energy Innovation Department, SNL* • Lance Atkins, *Principal Engineer, Zero Emission Research, Nissan Technical Center North America* **Power and the Grid** (Location: NREL RSF X320, Beaver Creek) Moderator and Opening Speaker: Margaret Schaus, *Senior Advisor, Office of the DAS for Renewable Power, EERE* **Energy Systems Integration** • Dr. Bryan Hannegan, *Associate Laboratory Director, Energy Systems Integration, NREL* • Robert G. Pratt, *GridWise Program Manager, PNNL* • Brian Fitzsimons, *Chief Executive Officer, Qado Energy*

TIME	SESSION AND SPEAKERS
2:00–3:00 (cont.)	**Power and the Grid (cont.)** **Solar** • Dr. Greg Wilson, *Director, Materials Applications and Performance Center, Co-Director, National Center for Photovoltaics (NCPV) NREL* • Dr. Mahesh Morjaria, *Vice President, PV Systems Development, First Solar* **Wind** • Juan Torres, *Deputy Director, Renewable Systems & Energy Infrastructure Program, SNL* **Advanced Materials, Manufacturing, and Efficient Building Technology** (Location: NREL RSF X344, San Juan) Moderator and Opening Speaker: Dr. Mark Johnson, *Director, Advanced Manufacturing Office, EERE* **IACMI: Institute for Advanced Composites Manufacturing Innovation** • Dr. Craig Blue, *Chief Executive Officer, IACMI* • Rick Neff, *Market Development Manager and BAAM Manager, Cincinnati, Inc.* **HPC4Mfg: High Performance Computing for Manufacturing** • Dr. Jeff Roberts, *Deputy Program Director, Energy, LLNL* • Dr. Phillip Yu, *Director, PPG Industries* **Friction Stir Welding** • Dr. William Joost, Technology Development Manager, *Vehicle Technologies Office, EERE* • John Carsley, Staff Researcher, *General Motors*
3:00–3:15	**Break**
3:15–4:15	**Strengthening the Lab-Industry Innovation Ecosystem—Lab Technology-to-Market Programs** **Opening Comments—The National Lab Impact Initiative** Victor Kane, *Director, National Lab Impact Initiative, EERE* **Lab-Corps** • Dr. Ralph Muehleisen, *Principal Building Scientist, ANL* • Ed Williams, *Lab-Corps Industry Mentor and Vice Chairman, Colorado Cleantech Industries Association* **Small Business Vouchers** • Dr. Johney Green, *Division Director for Energy and Transportation Science, ORNL* • Dr. Jeffrey Dietrich, *Chief Technology Officer and Founder, Lygos* **Cyclotron Road** • Dr. Ilan Gur, *Founding Director, Cyclotron Road* • Dr. Deepak Dugar, *Founder, Visolis* **Technologist-in-Residence** • Glenn Keller, *Principal Project Engineer and Acting Director of Vehicle Systems Group, ANL* • Gary Parker, *Director, Powertrain Systems, Cummins* **Closing Comments—Where Do We Go From Here?** Victor Kane, *Director, National Lab Impact Initiative, EERE*
4:15–4:55	**Converting Interest into Action—Partnering with the National Labs** Moderator: Bill Farris, *Associate Laboratory Director, NREL* • Scott Misage, *General Manager, High-Performance Computing, Hewlett-Packard* • Jay Rogers, *CEO and Co-Founder, Local Motors*
4:55–5:00	**Closing Comments** Dr. David Danielson
5:00–7:00	**Reception, Lab Showcase Exhibits, ESIF and NREL Campus Tours**

EVENT MAP



Exhibitors

- Ames Laboratory
- Argonne National Laboratory
- Brookhaven National Laboratory
- EERE—National Laboratory Impact Initiative
- EERE—Small Business Vouchers Pilot
- Grid Modernization Laboratory Consortium
- Idaho National Laboratory
- Lawrence Berkeley National Laboratory
- Lawrence Livermore National Laboratory
- National Energy Technology Laboratory
- National Renewable Energy Laboratory
- Oak Ridge National Laboratory
- Pacific Northwest National Laboratory
- Sandia National Laboratories
- Savannah River National Laboratory
- SLAC National Accelerator Laboratory

INFORMATION ABOUT THE NATIONAL LAB IMPACT SUMMIT

Keynotes

Dr. Martin Keller

Director
NREL

Dr. Keller became NREL's 10th director in November 2015. Keller joined NREL from Oak Ridge National Laboratory (ORNL) where he served as the associate laboratory director for energy and environmental sciences, which includes ORNL's programs in biosciences, environmental sciences, buildings technologies, transportation, climate change, manufacturing, and electrical and electronics systems. In 2006, Keller was recruited to ORNL from an industrial enzyme discovery and development company to lead the BioEnergy Science Center, supported by the Office of Science and in which NREL is also a partner. Keller earned his doctorate in microbiology from the University of Regensburg in Germany. He was appointed a fellow of the American Association for the Advancement of Science in 2013 and serves on multiple boards and advisory panels, including the Science Advisory Board for the Council on Competitiveness.

Dr. David Danielson

Assistant Secretary for Energy Efficiency and Renewable Energy (EERE)
U.S. Department of Energy (DOE)

As Assistant Secretary of the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE), Dr. Danielson leads the U.S. government's research, development, and demonstration (RD&D) efforts. With an annual budget of approximately $2 billion, EERE is the largest government investor in clean energy RD&D in the world. Danielson is recognized as a global expert in the creation and management of new R&D and organizational models for high-impact clean energy innovation. Prior to his appointment by President Obama and confirmation by the Senate for his current role, Danielson was employee #1 at DOE's Advanced Research Projects Agency–Energy (ARPA-E), where he developed and led R&D programs focused on high-risk, high-reward clean energy technologies. Before entering government service, Danielson was a clean energy venture capitalist at General Catalyst Partners. He holds a Ph.D. in materials science and engineering from the Massachusetts Institute of Technology, (MIT) where he was the founding president of the MIT Energy Club.

Dr. Ken Washington

Vice President, Research and Advanced Engineering
Ford Motor Company

Dr. Washington leads Ford's worldwide research organization, overseeing the development and implementation of the company's technology strategy and plans. Prior to joining Ford, he was Vice President (VP) of the Space Technology Advanced Research and Development Laboratories at Lockheed Martin Space Systems. He also served as Lockheed Martin's first chief privacy officer and was the VP and Chief Technology Officer (CTO) for Lockheed Martin's internal IT organization. Prior to joining Lockheed Martin, Washington served as chief information officer for Sandia National Laboratories, where he had previously served in a variety of technical, management, and program leadership positions. Washington holds bachelor's, master's, and doctorate degrees in nuclear engineering from Texas A&M University and is a fellow of the MIT Seminar XXI program on International Relations.

TJ Glauthier

President
TJG Energy Associates

Co-Chair
Commission to Review the Effectiveness of the National Energy Laboratories

TJ Glauthier is an advisor to energy and clean technology companies. He is co-chair of the Commission to Review the Effectiveness of the National Energy Laboratories. Glauthier held two presidential appointments in the Clinton Administration and served on President Obama's transition team. He was CEO of the Electricity Innovation Institute, an affiliate of EPRI, and spent 20 years in management consulting. Currently, Glauthier serves on the boards of two corporations: EnerNOC, a provider of energy intelligence software; and VIA Motors, a manufacturer of electric-drive pickup trucks and vans. He is a member of the Policy and Global Affairs Committee of the National Academy of Sciences, the Precourt Institute at Stanford University, and the Lawrence Berkeley National Laboratory Advisory Board. Glauthier is a graduate of Claremont McKenna College and the Harvard Business School.

Dr. Mark Little

CTO (retired)
General Electric

Senior Vice President (retired)
GE Global Research

Dr. Little served as the CTO of General Electric Company for 10 years until his retirement in October 2015. Concurrently, he was the CTO and senior vice president at GE Global Research. As such, he was responsible for leading one of the world's largest and most diversified industrial research and technology organizations. Little joined GE in 1978 in the company's turbine business. He held several management positions with GE Energy in engineering and business development prior to being named CTO. Little holds bachelor's and master's degrees in mechanical engineering from Tufts University and Northeastern University, respectively. He earned a doctorate in mechanical engineering from Rensselaer Polytechnic Institute. In 2009, Little became a fellow of the American Society of Mechanical Engineers.

Speakers

Dr. Steven Ashby

Director
PNNL

Under Dr. Ashby's leadership, PNNL is providing national leadership in climate science, the power grid, nuclear nonproliferation, and environmental remediation. Ashby previously served as PNNL's deputy director for science and technology and was responsible for integrating PNNL's science and technology capabilities to meet national needs. He led institutional strategic planning activities, stewarded an $80 million discretionary research portfolio, and promoted lab-wide efforts to elevate PNNL's standing in the broader scientific community. Before joining PNNL in 2008, Ashby spent nearly 21 years at LLNL. He earned a bachelor's degree in mathematics and computer science from the University of Santa Clara and master's and doctorate degrees in computer science from the University of Illinois at Urbana-Champaign.

Lance Atkins

Principal Engineer, Zero Emission Research
Nissan Technical Center North America

Lance Atkins conducts engineering research and tests fuel cell and battery electric vehicles at the Nissan Technical Center. He focuses particularly on infrastructure and overall vehicle performance, including taking low- and zero-emission transportation technologies from research to the commercial market. Atkins' specialties include electric vehicle charging and infrastructure, hydrogen infrastructure development, and fuel cell and electric vehicle testing. Atkins earned a bachelor's degree from California State University, Fresno.

Dr. Craig Blue

CEO
IACMI

Dr. Blue is the CEO of IACMI, a partnership of industry, universities, national laboratories, and federal, state, and local governments working together to benefit the nation's energy and economic security by sharing existing resources and co-investing to accelerate development and commercial deployment of advanced composites. The Institute is sponsored by a $70 million commitment from the U.S. Department of Energy and $189 million from IACMI's partners. IACMI is an institute within the National Network of Manufacturing Innovation, a White House initiative to help U.S. manufacturers employ leading-edge technology to become more competitive. Blue remains an advanced manufacturing executive leader at ORNL and is a recognized leader and champion of applied R&D.

Dr. Adam Bratis

Associate Lab Director, BioEnergy Science and Technology Directorate
NREL

Dr. Bratis' role as Associate Lab Director is to guide NREL's research to accomplish the objectives of DOE's Bioenergy Technologies Office, and to serve as a spokesperson for the bioenergy research effort at NREL, both internally and externally. This includes oversight of the Directorate and NREL's work in biochemical conversion, thermochemical conversion, algae, techno-economic and lifecycle analyses, and fuels and product testing.

Dr. John Carsley

Staff Researcher, Global R&D
General Motors

Dr. Carsley has been a staff researcher with GM for 19 years specializing in mechanical engineering, materials engineering, and manufacturing engineering. He holds a doctorate degree in metallurgy from Michigan Technological University.

Colton Ching

Vice President of Energy Delivery
Hawaiian Electric Company

Colton Ching leads the planning, design, construction and maintenance of Hawaiian Electric's transmission and distribution infrastructure. His role includes the technical and operational work required to integrate renewable-energy generation with Hawaii's electrical grids. Prior roles at Hawaiian Electric included VP of system operation and planning, in which Ching was responsible for the day-to-day operation of the electric grid on Oahu, as well as business, strategic, and resource planning for Hawaiian Electric, Maui Electric, and Hawaii Electric Light Companies. He also led strategic planning, integrated resource planning, generation planning, and sales forecasting for the same three companies. Ching earned a bachelor's degree in mechanical engineering from the University of Hawaii at Manoa and attended Stanford University's Graduate School of Business Executive Learn, Engage, Accelerate, Disrupt (LEAD) Program.

Dr. Claus Daniel

Deputy Program Director, Sustainable Transportation Program
ORNL

Dr. Daniel co-manages ORNL's $75 million Sustainable Transportation Program and is the founding director of the DOE Battery Manufacturing R&D Facility at ORNL. He has demonstrated experience in leading large research and proposal teams, including multiple organizations and heavy industry participation. Daniel's background is in material science, and he works on processing, manufacturing, and characterization development for automotive systems. He has expertise on industrial and biomedical materials, mechanical and functional properties, surface processing, and laser treatment. He has worked at companies such as Robert Bosch and Saint Gobain. Daniel holds a Ph.D. from the Saarland University in collaboration with the Max Planck Institute for Metals Research and two master of science degrees—one from the Saarland University and the other from the Lorraine National Polytechnic Institute.

Dr. Jeffrey Dietrich

Founder and CTO
Lygos

Dr. Dietrich's expertise lies in metabolic engineering and development of high-throughput screening methods for improving production of small molecules. At Lygos, he directs strain optimization efforts, identifies new product opportunities, develops Lygos' intellectual property portfolio, and conducts fundraising. Dietrich is currently the principal investigator on competitive grants totaling more than $5 million, including Small Business Innovation Research grants from the DOE, the Department of Agriculture, and the National Science Foundation. Dietrich earned a bachelor's degree in bioengineering from Rice University and a Ph.D. in the same field from the UC Berkeley–UC San Francisco Joint Graduate Program in Bioengineering. Also at UC Berkeley, Dietrich obtained a minor in business through the Haas School of Business.

Dr. Deepak Dugar

President
Visolis

Dr. Dugar is leading the Visolis project, working with a team of engineers and advisors. Previously, he worked as a management consultant at PwC Advisory helping clean technology clients with their commercialization efforts. He also worked on multiple projects in bioenergy, including biomass pretreatment technology for the production of ethanol and development of an algal photo-bioreactor for CO_2 sequestration and the production of biofuels. Dugar pursued these projects through work at NREL, Novartis, Harvard-MIT Health Sciences Technology (HST-MIT) and Max Planck Institute of Molecular Cell Biology and Genetics (MPI-CBG) in Germany. Dugar earned dual bachelor's degrees in biochemical engineering and biotechnology from the Indian Institute of Technology in Delhi, an M.B.A. from MIT's Sloan School of Management, and a Ph.D. in chemical engineering from MIT.

Bill Farris

Associate Laboratory Director
NREL

Bill Farris is the associate laboratory director in charge of NREL's Innovation, Partnering, and Outreach Directorate, and he has directed Commercialization & Technology Transfer since October 2008. In addition to leading all of the lab's internal and external communication and outreach, Bill directs NREL's efforts to accelerate commercialization and the transfer of laboratory technologies to the marketplace. He also oversees all licensing, sponsored research agreements, enterprise development, and innovation management functions at NREL. Farris earned bachelor's and master's degrees from the University of Washington in geological sciences and radiological sciences, respectively, and a master's degree in the management of technology from National Technological University.

Brian Fitzsimons

CEO
Qado Energy

In 2009, Brian Fitzsimons, a serial entrepreneur in enterprise software, founded Qado Energy to leverage his experience in other industries to help make global electricity systems more sustainable and renewable. Qado Energy provides electric distribution system analytics software to utilities, renewable energy developers, and other commercial clients. Qado Energy is a privately held corporation.

Dr. Johney Green

Division Director, Energy and Transportation Science
ORNL

As director of the Energy and Transportation Science Division, Dr. Green manages a science and technology organization that encompasses multiple scientific research areas and facilities. The division performs R&D that spans a wide variety of research missions in the areas of building technologies; sustainable industry and manufacturing; fuels, engines, emissions, transportation analysis; and vehicle systems integration. Green started work at ORNL in 1995 and has held several staff and leadership roles at the lab. He earned a bachelor's degree from the University of Memphis and holds master's and doctorate degrees from Georgia Institute of Technology, all in mechanical engineering.

Dr. Ilan Gur

Founding Director
Cyclotron Road

Dr. Gur founded Cyclotron Road to bridge a gap he observed in energy technology innovation over the past decade. Before launching the program, he served as program director at ARPA-E. At ARPA-E, he managed a $50 million portfolio of advanced R&D projects in the areas of energy storage, solar energy, and advanced materials. He was also a senior advisor and cofounder of ARPA-E's Technology-to-Market program, aimed at maximizing the commercial and societal impact of the agency's breakthrough R&D portfolio. Gur earned bachelor's, master's, and doctorate degrees from the University of California at Berkeley, all in materials science engineering.

Dr. Bryan Hannegan

Associate Laboratory Director, Energy Systems Integration
NREL

Dr. Hannegan leads a team working on the optimization of electrical, thermal and fuel energy systems across multiple pathways and scales to increase reliability and performance, reduce cost, and minimize environmental impacts. Prior to joining NREL, Hannegan served in multiple executive roles over seven years at the Electric Power Research Institute. Earlier, he contributed to U.S. and global energy and environmental policy, first as staff scientist to the U.S. Senate Committee on Energy and Natural Resources, then as associate director for Energy and Transportation (and later Chief of Staff) for the White House Council on Environmental Quality. He holds a doctorate in earth system science and a master's degree in engineering, both from the University of California, Irvine, and a bachelor's degree in meteorology from the University of Oklahoma.

Terry Johnson

Distinguished Member of the Technical Staff, Energy Innovation Department
SNL

Terry Johnson has worked at SNL for 18 years as an energy systems engineer and is currently leading the development of the Sandia Cooler, a new technology for air-cooled heat exchangers. He has also led development of a free piston engine/linear alternator and a hydrogen station test device to assess dispenser performance. Johnson's other recent work includes leading a team that developed a tritium-based radioisotope thermoelectric generator and a team that developed an advanced hydrogen storage system for General Motors. Prior to joining SNL, Johnson was a research assistant in the Mechanical Engineering Department at Washington State University. He received bachelor's and master's degrees in mechanical engineering at Washington State University in Pullman.

Glenn Keller

Principal Project Engineer and Acting Director, Vehicle Systems Group
ANL

Glenn Keller is the acting section manager for the Vehicle Systems Group for the Center for Transportation Research at ANL. He is also the program manager for the 21st Century Truck Partnership. Each of these activities is concerned with improving the fuel economy, safety, and exhaust emissions of our nation's transportation fleet. Before moving to ANL, Keller was involved with the automotive industry in engine design and development (while employed with Ford Motor Company), as well as with the heavy-duty vehicle industry (while serving as executive director of the Engine Manufacturers Association).

Jon Lauckner

Chief Technology Officer and Vice President
General Motors and General Motors Ventures

Jon Lauckner was named vice president and CTO of GM in 2012. He is responsible for leading GM's Global Research and Development organization. In addition to this role, Lauckner is president of GM Ventures, a separate subsidiary he started in 2010 to make equity investments in startup companies that are developing next-generation automotive technology. Lauckner joined GM in 1979 and held a number of positions in product and powertrain engineering, product development, and international assignments in South America and Europe. He was VP of both Global Product Planning and Global Program Management. Lauckner received a bachelor's degree in mechanical engineering from the University of Michigan. He earned a master's degree in management from Stanford Business School and attended the GM-Harvard Senior Executive Program.

Dr. J. Michael McQuade

Senior Vice President, Science and Technology
United Technologies Corporation

J. Michael McQuade is senior VP for Science & Technology at United Technologies Corporation. His responsibilities include providing strategic oversight and guidance for research, engineering, and development activities throughout the business units of the Corporation and at the United Technologies Research Center. He currently serves as a member of the Secretary of Energy Advisory Board and the President's Council of Advisors on Science and Technology and is a member of the Board of Trustees for Carnegie Mellon University, the Board of Directors of Project HOPE, and the Board of Trustees for Miss Porter's School. McQuade holds doctorate, master of science and bachelor of science degrees in physics from Carnegie Mellon University.

Scott Misage

General Manager, High-Performance Computing
Hewlett-Packard

Scott Misage manages HP's worldwide business for hardware, software, and solutions products for high-performance computing, including Infiniband and high-performance Ethernet fabrics. After joining the HP high-performance computing team in 2001, Misage held several management positions, developing and delivering supercomputing technology and implementations for industrial and academic customer environments. Misage and his team have placed systems among the world's five most powerful computers of their time, including systems in the U.S., India, Sweden, and Japan. Misage joined HP in 1998. He earned two master's degrees from Cornell University, a master of science and a master of engineering, both in electrical and electronics engineering.

Dr. Mahesh Morjaria

Vice President, PV Systems Development
First Solar

Dr. Morjaria leads a team at First Solar that is responsible for new products and grid integration capability for utility-scale PV plants. First Solar has developed, financed, engineered, constructed, and currently operates many of the world's largest grid-connected PV power plants. Morjaria has more than a decade of experience in controls and grid integration of renewable plants and more than 25 years of advanced development expertise, including leadership roles in solar and wind generation and grid integration. In an earlier role at GE Energy, Morjaria was the engineering leader for wind turbine and wind plant controls. He holds a bachelor of technology degree from IIT Bombay, India, and a doctorate from Cornell University.

Dr. Ralph Muehleisen

Principal Building Scientist
ANL

Dr. Muehleisen is the principal building scientist and the technical lead of the Building Energy Decision and Technology Research (BEDTR) program. The program focuses on the development of tools and technologies to increase the energy efficiency of buildings and enable the interaction of smart buildings with the smart grid. In this role, Muehleisen is responsible for helping lead research, development, and collaboration with DOE, industry, and academic partners to accelerate energy efficiency adoption throughout the U.S. Muehleisen received a bachelor's degree in electrical and computer engineering and physics from the University of Wisconsin–Madison, and a doctorate in acoustics from Penn State University.

Rick Neff

Market Development Manager and Big Area Additive Manufacturing (BAAM) Manager
Cincinnati, Inc.

Rick Neff is the manager of market development at Cincinnati, Inc., a manufacturer of press brakes, shears, lasers, material handling, and powdered metal compacting presses and software. He managed the introduction of fiber lasers, linear motor drives, PC controls, and modular material handling systems, enabling Cincinnati's laser customers to be globally competitive. He is a recognized expert on additive manufacturing, laser technology, and manufacturing innovation. Neff managed the development and introduction of BAAM systems, which use 3-D printing to make large-scale parts in production. Prior to joining Cincinnati, Neff worked for three Fortune 500 companies applying, selling, and marketing technology-driven products. He earned a bachelor's degree in mechanical engineering from Lehigh University.

Gary Parker

Director, Powertrain Systems
Cummins

Gary Parker is the technical director of Powertrain Systems at Cummins and serves as the technical lead for the product development program, where he leads the development of groundbreaking powertrain technologies. He has been recognized for his support of university-industry partnerships throughout his career. He has been an employee with Cummins for his entire career, holding roles in modeling, controls, integration, calibration development and general technical leadership. Parker received his bachelor's and master's degrees from the Ohio State University.

Dr. Mark Peters

Director and Alliance President
INL and Battelle Energy Alliance

Dr. Peters' experience includes leadership and management of large institutions focused on technology R&D. Prior to joining INL, he was the associate laboratory director for Energy and Global Security at ANL. Peters is a senior advisor to the Energy Department on nuclear energy technologies, R&D programs, and nuclear waste policy. He is frequently called upon to provide expert testimony to Congress and to advise in the formulation of policies for nuclear fuel cycles, nonproliferation, and nuclear waste disposal. Earlier in his career, Peters worked in science and research positions at LANL and the California Institute of Technology. Peters received his doctorate in geophysical sciences from the University of Chicago and a bachelor's degree in geology from Auburn University.

Robert Pratt

GridWise Program Manager
PNNL

Rob Pratt is one of the early thought leaders behind the smart grid, focused on an information-rich future for the power grid. He manages PNNL's GridWise™ program activities for DOE. He leads a team studying communications architecture, advanced control technology, and simulation of the combined engineering and economic aspects of the future grid, including the effect of plug-in hybrid electric vehicles. Pratt holds a bachelor's degree in ocean engineering from Florida Atlantic University and a master's degree in mechanical engineering from Colorado State University.

Dr. Bill Provine

Director, Science and Engineering Global Operations
DuPont

In his role as director of Science and Engineering Global Operations for DuPont, Dr. Provine is responsible for deploying strategies and programs to leverage DuPont's access to technical expertise available across DuPont's global network of regional laboratories in China, India, Japan, Singapore, Switzerland, Brazil, and throughout the U.S. He focuses on providing a world-class experience for DuPont customers and connects them with a science-based innovation ecosystem via DuPont's Innovation Centers. Provine joined DuPont in 1992 and has served in a variety of research, marketing, business development, and operations leadership roles, including oversight for commercialization efforts in DuPont BioFuels. He earned a bachelor's degree from the University of California, Berkeley, and a doctorate from the University of Delaware, both in chemical engineering.

Dr. Jeff Roberts

Deputy Program Director, Energy
LLNL

Dr. Roberts has worked at LLNL since 1992 and held a variety of positions as a research scientist in physical chemistry and laboratory geophysics as well as numerous leadership positions. Currently, he is responsible for program development and strategic investment in the areas of alternative resources, renewable energy, energy systems, materials for energy, and energy storage. Roberts earned a bachelor's degree in applied science from the University of Texas at San Antonio, and a doctorate in geophysics from Arizona State University.

Jay Rogers

CEO and Co-Founder
Local Motors

Jay Rogers is helping to build a game-changing American car company. Since 1988, he has worked on various vehicle projects from rebuilding antique cars, to automotive policy, to automotive start-up ideas, to printing the world's first road ready car. Rogers is relentlessly passionate about cars and the industry which surrounds them. Previously, John served for 6 years in the U.S. Marine Corps, where he was an Infantry Company Commander.

Mike Rowand

Director of Technology Development
Duke Energy

Mike Rowand is responsible for technology evaluation and development of distributed energy resources at Duke Energy—including energy storage, electric transportation, distributed generation, and other end-use energy systems and devices. He has 30 years of experience with Duke Energy in various aspects of the utility industry, including Transmission and Distribution Engineering, Customer Service, Rates and Regulatory processes, and Marketing. Prior to his current position, Rowand was responsible for Duke's strategy and planning related to electric transportation and customer-based distributed generation and energy storage. He is a graduate of the University of Florida with a degree in mechanical engineering, and is a licensed Professional Engineer in North Carolina and South Carolina as well as a Certified Energy Manager.

Dr. Adam Schwartz

Director
Ames

Dr. Schwartz was named director of the Ames Laboratory in 2014. Before that, he served as division leader of the Condensed Matter and Materials Division at LLNL. He coordinated LLNL's projects for the Critical Materials Institute, a $120 million DOE Energy Innovation Hub led by Ames, which is known for its work in materials science, computational chemistry, and condensed matter theory. Schwartzs' work has focused on plutonium aging and alloys, advanced characterization, and the dynamic properties of materials. Schwartz earned bachelor's and master's degrees in metallurgical engineering and a Ph.D. in materials science and engineering, all from the University of Pittsburgh.

Juan Torres

Deputy Director, Renewable Systems & Energy Infrastructure Program
SNL

Juan Torres is deputy director for the Renewable Systems and Energy Infrastructure Program at SNL where he has worked for 18 years in energy, information security, and critical infrastructure protection. He currently leads the Security and Resilience team for the DOE Grid Modernization Laboratory Consortium. He is also senior manager of the Renewable Energy Technologies Group at Sandia National Laboratories where he manages four departments (wind, water power, concentrating solar, and materials for renewables) and oversees Sandia's renewable energy research portfolio (wind, water, concentrating solar, photovoltaics, geothermal) of approximately $65M/yr. Torres earned a bachelor's degree in electronics engineering technology from the University of Southern Colorado, and a master's degree in electrical engineering from the University of New Mexico.

Dennis Townsend

Chairman
Townsend Capital, LLC

Chairman of the Board of Directors
Xalt Energy

Dennis Townsend founded Townsend Capital in 1975. Since then, Townsend Capital has evolved from a registered securities broker dealer and investment advisory firm to a company that invests primarily for its own account. Currently, Townsend is focusing on the energy field; new ventures include the acquisition of a lighting controls company and significant investments in domestic oil and natural gas exploration. Townsend Capital assembles a portfolio of companies to create synergies among its investments, which include XALT Energy, Energy Power Systems, and AllCell Technologies. XALT is an industry leader in advanced lithium-ion cell storage solutions and is capable of providing high-energy large-format and small-format cells for a wide array of high-demand applications and environments.

Ed Williams

Vice Chairman
Colorado Cleantech Industries Association

Ed Williams currently serves as Vice Chairman of the Colorado Clean Tech Industry Association and Energy Industry Advisor for the Blackstone Entrepreneurs Network, where he leads initiatives and strategies for next generation grid technology companies. Recently, as CEO for Novinda Corporation, he drove the turnaround of this advanced materials company, raising $24 million in capital and commercializing four award-winning products. Prior to Novinda Corporation, he was CEO for Firefly Energy, an energy storage technology company. Williams holds a bachelor's degree in accounting and economics and an M.B.A. in finance and marketing, both from the University of Detroit.

Dr. Greg Wilson

Director, Materials Applications and Performance Center
Co-Director, National Center for Photovoltaics (NCPV)
NREL

Dr. Wilson is responsible for NREL's capabilities in high-efficiency crystalline PV, PV cell and module performance, and PV reliability. He also shares the responsibility for continuing to develop the NCPV's many interfaces and partnerships with the global photovoltaics (PV) community. Prior to joining NREL, Wilson spent nearly 17 years at SunEdison (previously MEMC), where he directed the Epitaxial Silicon and New Materials R&D groups. In 2009, he joined the merger and acquisition team that acquired SunEdison and Solaicx. Wilson has more than 25 years of R&D experience and holds doctorate and master's degrees in chemical engineering from Washington University in St. Louis, Missouri, and a bachelor's degree in chemical engineering from the Missouri University of Science and Technology.

Dr. Phillip Yu

Director
PPG Industries

Dr. Yu is the Director of Corporate Science and Technology at PPG Industries. In this role he leads and manages organizations in technology development with the goal of commercializing new products aligned to customer and market needs. Prior to joining PPG in 1991, Yu was a researcher at LBNL. Yu holds a bachelor's degree from the University of California at Berkeley and a doctorate from Tufts University—both in chemistry.

Dr. Thomas Zacharia

Deputy Director for Science and Technology
ORNL

Dr. Zacharia oversees one of the nation's largest R&D programs, with an annual budget of more than $1.4 billion and a portfolio that spans physical sciences, energy and engineering sciences, computing and computational sciences, neutron sciences, and global security for DOE and other sponsors. Zacharia joined ORNL in 1987 as a postdoctoral researcher. From 2012 to 2015, he was the executive VP of R&D for the Qatar Foundation and returned to ORNL in 2015. Zacharia holds a bachelor's degree in mechanical engineering from the National Institute of Technology Karnataka, Surathkal, India, and a master's degree in materials science from the University of Mississippi in Oxford, Mississippi. He earned a Ph.D. in engineering science from Clarkson University in Potsdam, New York.

EERE Participants

Dr. Mark Johnson

Dr. Will Joost

Victor Kane

Reuben Sarkar

Margaret Schaus

Wireless Access on the NREL Campus

To access the NREL Wireless Network, select NREL_Wireless from the list of networks on your device. This network is provided to NREL's visitors for Internet access. This network does not provide any firewall or anti-virus protection. It is your sole responsibility to ensure you are running a personal firewall and antivirus software. Limited web-filtering is in place to protect the network from malicious content.

Additional Notes:

- If you have difficulty logging in please contact your sponsor or the Help Desk at extension 4171.
- To log out of NREL_Wireless, browse to https://wifi.nrel.gov/logout.html
- If you are unable to login with an iPhone or iPad, you may need to change two Safari settings:
  - Accept Cookies: Always
  - Block Pop-ups: Off

Account Information	
Username	labsummit
Password	nxf5tfU
SSID	NREL_Wireless
Valid To	05-May-2016 23:59

Accessing Today's EERE National Lab Impact Summit Materials

The DOE EERE and NREL thank you for participating in the inaugural EERE National Lab Impact Summit.

To access materials presented during today's Summit, please visit EERE's National Lab Impact Initiative page at http://energy.gov/eere/lab-impact/national-laboratory-impact-initiative. You may also submit feedback or send follow-up questions to EERELabImpact@ee.doe.gov.

Staying Involved After the Summit

We invite your continued participation in driving toward a clean energy future. Here are a few ways you can stay involved:

- Explore and create partnerships with the Labs by contacting the individuals listed on page 31.
- Build relationships with EERE's Technology Offices by contacting the directors listed on page 33.
- Email your ideas on how we can strengthen Lab-industry partnerships to EERELabImpact@ee.doe.gov.
- Get involved in EERE's National Lab Impact Initiative programs. To learn more, visit http://energy.gov/eere/lab-impact/national-laboratory-impact-initiative.

THE NATIONAL LAB IMPACT INITIATIVE: TAKING LAB-INDUSTRY IMPACT TO THE NEXT LEVEL

The United States has a proud history of pushing the boundaries of scientific discovery and impacting the world through cutting-edge inventions. One of its greatest strategic assets is the Department of Energy's (DOE) National Laboratory system, which has fueled breakthrough research and development (R&D) across many disciplines. As the world transitions to a low-carbon economy in response to urgent energy and climate challenges, the National Labs are playing—and must continue to play—a crucial role in strengthening U.S. competitiveness and partnering with industry to develop breakthrough energy technology innovations.

The DOE's Office of Energy Efficiency and Renewable Energy (EERE) is the largest government funder of clean energy innovation in the world, investing approximately $2 billion dollars in fiscal year 2016—with almost half of its R&D activities performed in partnership with the National Laboratories.

To take the impact of these investments to the next level, in 2013, EERE Assistant Secretary David Danielson launched the ***National Lab Impact Initiative***, a comprehensive EERE-wide effort to revamp the EERE-National Lab R&D model—with the goal of significantly increasing the industrial impact of EERE National Lab investments.

EERE's National Lab Impact Initiative is focused on three overarching goals:

1. Increase and enhance relationships between Labs and the private sector
2. Increase and streamline access to National Lab capabilities, enabling more businesses and entrepreneurs to take advantage of resources and expertise
3. Demonstrate the value of Lab-developed science and technology.

Developed and executed as a partnership between EERE, the National Labs, and industry, the National Lab Impact Initiative has already re-invented EERE's R&D model with its National

Lab-Corps Cohort 2's Saline Solutions team presents findings from their customer discovery activities during a Lab-Corps Workshop in March 2016. The team's desalination technology is designed to produce ultrapure water on demand using a flow-through electrode capacitive desalination (FTE-CD) method. **Photo Credit:** John De La Rosa/NREL

Labs. Through the National Lab Impact Initiative, EERE has developed core *EERE-National Lab Guiding Principles*, enacted a number of key policies to take the EERE-National Lab model to the next level of impact, and has invested in the creation of a much more commercially aware and relevant culture within our National Labs.

The core EERE-National Lab Guiding Principles are:

1. World Class Science and Technology
2. Long-Term Commitment and Stewardship
3. Mutual Accountability
4. Industry Engagement and Impact

In the spirit of these principles, EERE's National Lab Impact Initiative has established a number of new best practice policies for its work with the National Labs, including:

- Emphasizing long-term, critical-mass investments: EERE has doubled its average Lab R&D project size and moved from funding the Labs annually to multi-year (3+) project commitments
- Significantly increasing the number of large, multi-Lab R&D consortia (e.g., the Grid Modernization Laboratory Consortium, Energy Materials Network, and Atmosphere-to-Electrons Initiative)
- Conducting an external merit review of all Lab R&D proposals before funding
- Managing for results by reducing the number of project milestones by 80 percent, emphasizing outcomes focused on aggressive end-of-project goals, and instituting annual "go/no-go" milestones to ensure that projects result in measurable, industrially relevant impact
- Significantly increasing the number of Lab-industry partnerships
- Establishing a more commercially aware Lab R&D culture through developing new "technology-to-market" ecosystem-building institutions, and committing to invest at least one percent of EERE Lab funding into technology-to-market ecosystem activities.

The National Lab Impact Initiative is also transforming the way our Lab researchers approach their R&D research and develop partnerships with industry through four signature "technology-to-market" pilot programs:

- **Small Business Vouchers (SBV) Program** provides American small businesses with funding, technical assistance, and access to the Lab's state-of-the-art facilities and renowned technical experts.

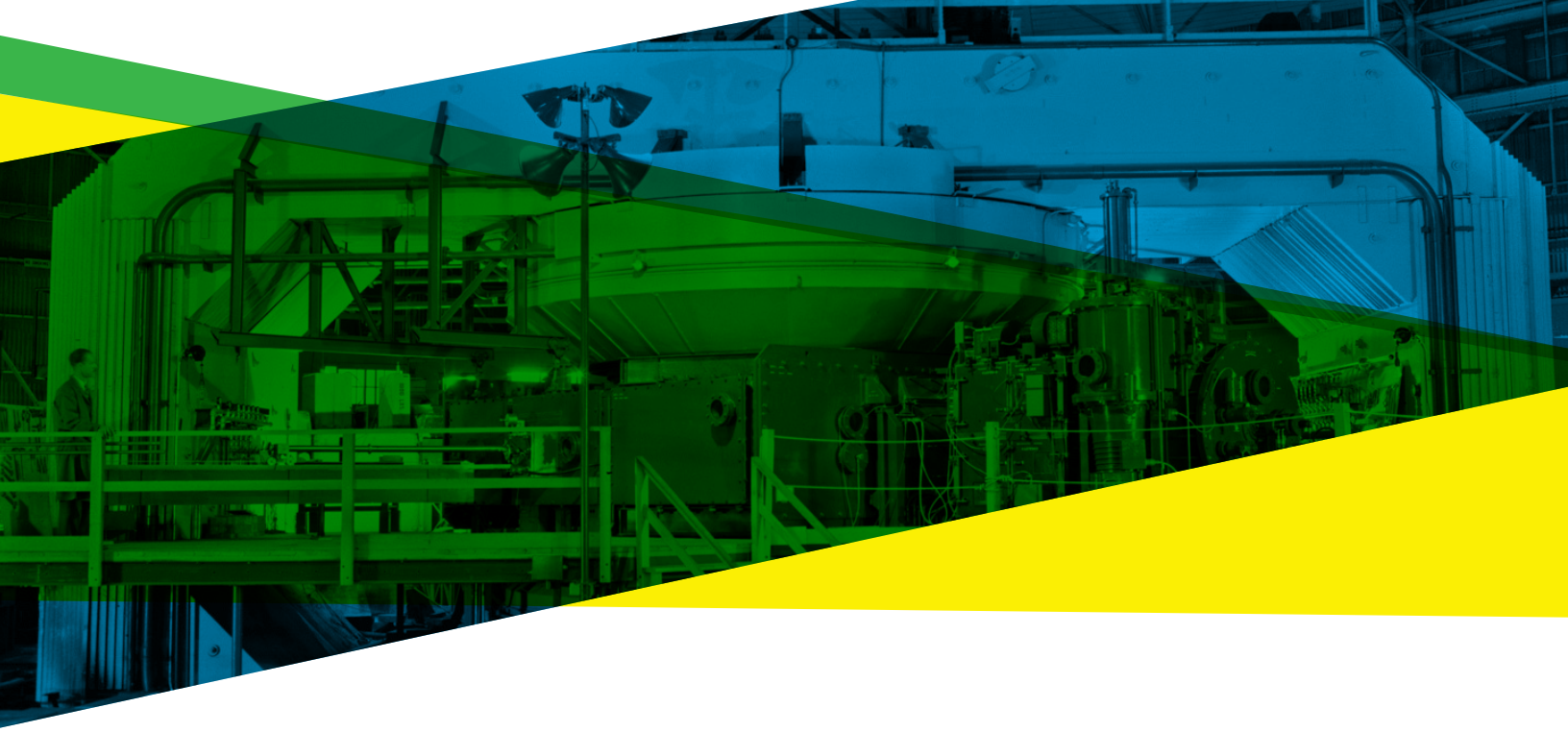
- **Lab-Corps Program** empowers Lab researchers and scientists with the tools, resources, and relationships necessary to commercialize their innovations.
- **Technologist-in-Residence (TIR) Program** fosters long-term, Lab-industry partnerships by pairing senior Lab technical staff with counterparts from large U.S. manufacturing companies to conduct collaborative research.
- **Cyclotron Road** provides entrepreneurs with seed research funding, lab space, and access to Lab resources to help them refine and translate their innovative ideas into commercial products.

In the Initiative's first year alone, (the only year for which there is currently data), the National Labs achieved a 27 percent increase in Cooperative Research and Development Agreements (CRADAs), including a 22 percent increase in such collaborations with small businesses; a 14 percent increase in licensed technologies; and a 25 percent increase in U.S. patents issued.

Via our EERE-National Lab R&D model and increasing Lab-industry engagement, the National Labs are now well positioned to achieve our goals of doubling their impact on industry and continuing to play a major role in helping industry tackle our toughest energy and climate challenges.

EERE's National Lab Impact Initiative—New Policies Implemented

- Instituted first-ever *EERE-National Lab Guiding Principles* to redefine the EERE-Lab relationship, centering around world-class science and technology, long-term commitment and stewardship, mutual accountability, and industry engagement and impact
- Defined National Lab Core Capabilities that EERE is committed to supporting throughout the next decade and beyond
- Created annual National Lab Big Ideas Summit, which has become a DOE-wide institution, highlighting collaborative and game-changing ideas
- Doubled average Lab project size, moved to multi-year (3+ year) projects, emphasized larger multi-Lab R&D consortia
- Introduced external merit review of National Lab projects prior to funding
- Reduced the number of National Lab R&D milestones by 80 percent, emphasizing more outcomes focused on aggressive end-of-project goals and annual go/no-go milestones
- Significantly increased number of industry partnerships
- EERE Technology Offices investing additional resources into innovative "tech-to-market" activities



CYCLOTRON ROAD: CREATING A HOME FOR EMERGING CLEAN ENERGY ENTREPRENEURS AT THE NATIONAL LABS

The Challenge: A Lost Generation of Clean Energy Entrepreneurs

Sand Hill Road in Palo Alto, California, has long been one of the most famous streets in Silicon Valley, home to the world's top venture capital investment firms that have brought many world-changing new startups to life.

However, the investors on Sand Hill Road are now hesitating to back potentially game-changing new clean energy technology startups. These startups are developing "hard" clean energy technologies—rooted in materials science, chemistry, and physics and requiring manufacturing—which need significantly more time and capital to develop, scale, and deploy than do software or consumer product investments. For venture capitalists looking for big financial returns in a very short time, these types of investments have fallen out of favor. After a brief investment boom in the mid-2000s, the clean energy sector has seen a precipitous decline in private sector early-stage venture capital support over the past five years.

The result: fewer and fewer technology entrepreneurs from America's top research institutions have been able to get the critical early-stage financial support required for them to dedicate their lives to developing the hard technologies we need for a clean energy future. **The nation risks a lost generation of clean energy entrepreneurs, at just the moment that we must be innovating at a rapid pace to transform our energy sector.**

The Solution: A Home for Top Energy Technology Entrepreneurs within our World-Class National Labs

Now, when the best and brightest hard-technology entrepreneurs find limited prospects on Sand Hill Road, they can turn to an innovative new EERE-supported program: **Cyclotron Road**, situated about 40 miles to the north at Lawrence Berkeley National Laboratory (LBNL). Named after the central road running through the heart of the LBNL campus, this program represents an exciting new paradigm for supporting the next generation of clean energy technology entrepreneurs.

This highly competitive program embeds entrepreneurial scientists and technologists at LBNL for two years, providing a platform for them to focus exclusively on the development of their hard clean energy technology startups. By "spinning in" these entrepreneurial researchers to the world-class National Lab network of facilities and experts, Cyclotron Road provides a home for the most promising new American clean energy technology entrepreneurs, and for their bold new ideas.

Cyclotron Road was established in 2014 as a public-private partnership led by LBNL and supported by the Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy's (EERE) Lab Impact Initiative and Advanced Manufacturing Office. The program is the brainchild of Dr. Ilan Gur. Gur brings diverse experience as a Ph.D. in Materials Science and Engineering, successful battery technology entrepreneur, and former Program Director at the DOE's Advanced Research Projects Agency-Energy (ARPA-E). Gur created the program based on hard-earned experience and wisdom gained from launching clean energy ventures as an entrepreneur and knows firsthand the challenges facing energy startups in the crucial early phases of development.

Cyclotron Road innovators receive a two-year fellowship to cover their living expenses, along with $100,000 in seed funding to be used at the Lab. Participants also receive intensive coaching through one-on-one meetings with program staff, formal training on how to build their businesses, and connections to mentors with deep industry experience. The program currently has two cohorts, with a total of 17 primary researchers comprising 12 teams. Their projects address a range of clean energy technology challenges—from catalysts that turn carbon dioxide (CO_2) into fuel to energy converters that harness ocean waves for electricity and clean water.

"Cyclotron Road selects early-stage technical founders with innovative ideas that can transform clean energy and advanced manufacturing," Gur said. "By supporting these risky, high-impact R&D and scale-up activities at LBNL, we're building a whole new model for clean energy entrepreneurship."

The program has seen tremendous initial results: the first cohort of eight participants across six teams has already attracted nearly $5 million in private sector investments, government R&D grants, and awards over the past year. Two teams, Spark Thermionics and polySpectra, were awarded funding by ARPA-E's highly competitive OPEN 2015 program and two members of the first cohort were included in Forbes Magazine's "30 Under 30" energy pioneers. With the program providing the platform and support they need to focus exclusively on developing hard technologies, Cyclotron Road entrepreneurs are forging a pathway to our clean energy future.

The program's second cohort is arriving at LBNL in spring 2016, and Cyclotron Road will seek applications for its third cohort of game-changing energy entrepreneurs in fall 2016. Meanwhile, the early success of the program suggests strong potential for expansion of the model to other Labs within the DOE complex. With 17 DOE National Labs, EERE plans to work with additional Lab

Cyclotron Road innovators work at LBNL to advance their early-stage clean energy technologies. Teams have access to world-class lab facilities and expertise to validate their technologies, leverage seed investment, and reduce the cost and technical risk of early-stage development. **Photo Credit:** LBNL

partners during 2016 to build more homes for emerging clean energy entrepreneurs at Labs across the country.

Highlight: Spark Thermionics

Jared Schwede and Daniel Riley are taking a technology concept that originated in the 1960s and modernizing it to transform the way the world generates electricity.

As Ph.D. students at Stanford University, the pair had spent years researching a non-traditional way of turning heat into electricity: thermionic energy conversion. Originally developed to convert heat from long-lived nuclear isotopes into electricity to power the exploration of our solar system, the field of thermionics had been largely ignored for decades since the end of the space-nuclear program in the 1970s. Schwede and Riley, however, rediscovered the potential of thermionic energy conversion. They are applying modern material and fabrication innovations to rejuvenate the field and bring its benefits to the 21st century energy transition.

Thermionic conversion generates electricity from heat using no moving parts. In a thermionic converter, electrons "boil off" of a specially designed hot plate and pass through a vacuum to a cold plate, thereby generating electric power. Schwede and Riley have set out to revolutionize this technology through the use of modern materials and microfabrication methods. They set their sights on building a compact thermionic device capable of up to 30 percent conversion efficiency. If they could pull it off, this converter would offer a modular and distributed power production alternative at efficiencies comparable to those of large-scale gas turbine plants.

Schwede and Riley quickly ran into a dead end: due to the technical and financial risks associated with developing the technology, prospective investors were adamant that the duo needed a demonstrated prototype if they hoped to garner any private sector investment for their new venture. Stranded without the necessary capital investments, Schwede and Riley were beginning to look at alternate career paths when they found Cyclotron Road.

At Cyclotron Road, Schwede and Riley's work with LBNL's top researchers in nanoscience, physics, and materials science has helped them make rapid progress toward building a next-generation thermionic device. Recently, Riley and Schwede's new startup company, Spark Thermionics, received part of a $3.8-million award from ARPA-E to build their game-changing new high-efficiency thermionic converter to produce clean power from any fuel source.

Deployed at scale, Schwede and Riley's small, modular thermionic converter could silently and efficiently convert heat into electricity

in a package that can scale from watts to megawatts, potentially displacing conventional power production and bringing electricity to the one billion people worldwide currently without reliable access to an electric grid. Without Cyclotron Road's support, this potentially transformative project may never have left the academic laboratory. Now Schwede and Riley are positioned to boldly drive their technology from lab to market and toward the future clean energy economy.

Highlight: Opus 12

Cyclotron Road Cohort 1 participant Etosha Cave grew up near an abandoned oil and gas site in Houston. Throughout her childhood, she had a firsthand look at the negative impact that our energy use can leave on the environment—from rusting eyesores to high cancer rates in her community, likely linked to waste leakage from abandoned energy production sites.

Determined to do her part in building a more sustainable future, Cave earned a doctorate in mechanical engineering from Stanford University, where she studied the conversion of CO_2, water, and electricity into high-value chemicals and fuels using metal catalysts. She joined forces with fellow Stanford classmates Kendra Kuhl and Nicholas Flanders to found a startup and named it Opus 12.

Through their participation in Cyclotron Road, the Opus 12 team is developing cutting-edge technology that could enable the conversion of waste CO_2 into carbon-neutral fuels to power our transportation sector. According to Flanders, this technology could offset one-third of global CO_2 emissions yearly when deployed at scale in the market.

But advancing the Opus 12 process to be cost-competitive with current processes will not be easy. It will require significant development and optimization of catalysts, electrodes, and membranes, integration of these components into an electrochemical reactor, and rapid iteration across a variety of electrochemical and design parameters. For this reason, access to the testing equipment and expertise in synthetic chemistry, materials science, and electrochemistry at LBNL has been invaluable to the group.

The Opus 12 Team—Kendra Kuhl (left), Nicholas Flanders (middle), and Etosha Cave (right)—are developing a revolutionary electrochemical process to recycle excess CO_2. This project was born from a shared vision to create molecules needed for biofuels and plastics in a sustainable way. **Photo Credit:** LBNL

"At LBNL, there are so many knowledgeable scientists with expertise in our field, so there are a lot of people to ask for help with different sorts of issues. From how to use certain equipment to the really difficult technical problems, there's a community at Cyclotron Road that helps you plug in," Kuhl said.

Cyclotron Road Cohort Teams

Cyclotron Road currently supports two cohorts of highly motivated entrepreneurs fully dedicated to building their hard-tech businesses. These teams include:

Cohort 1

- **Mosaic Materials**: Developing and scaling up low-cost synthetic methods for metal-organic framework adsorbents that reduce the cost and emissions impact of chemical separations. Team Lead: Thomas McDonald.
- **Visolis**: Creating and commercializing a high-yield process for producing bio-based, carbon-negative polymers, such as jet fuel, to replace current low-yield and petroleum-based processes. Team Lead: Deepak Dugar.
- **Opus 12**: Bringing to market a cutting-edge catalyst and electrochemical process to recycle CO_2 into chemicals and fuels used for other scientific applications. Team Leads: Etosha Cave and Kendra Kuhl.
- **Spark Thermionics**: Economically replacing conventional heat engines with compact, microfabricated thermionic devices that apply modern materials and wafer fabrication techniques to convert heat energy into electricity instantaneously. Team Leads: Daniel Riley and Jared Schwede.
- **CalWave**: Developing a simple, scalable Wave Energy Converter that will provide a dominant, comprehensive design for converting ocean waves into electricity and fresh water. Team Lead: Marcus Lehmann.
- **polySpectra**: Improving sustainable manufacturing through developing a functional lithography process to print tailored materials by rapidly hardening polymer resins with light. Team Lead: Raymond Weitekamp.

Cohort 2

- **Cuberg**: Developing and scaling solid-state batteries with improved performance, safety, and thermal stability for the electric vehicles of the future. Team Leads: Richard Wang and Mauro Pasta.
- **Synvitrobio**: Accelerating the development of next-generation bio-materials by utilizing a cell-free system as a prototyping environment for bio-engineering. Team Lead: Zachary Sun.
- **Mallinda**: Scaling up an advanced manufacturing technology that creates recyclable, malleable, and self-healing thermoset polymers. Team Leads: Philip Taynton and Chris Kaffer.
- **Iris PV**: Developing and commercializing a solar cell that integrates solution-deposited perovskite photovoltaics with existing silicon and cadmium telluride technology. Team Lead: Colin Bailie.
- **Sepion**: Commercializing a polymer membrane for use in low-cost, energy-dense lithium-sulfur batteries for electric vehicles. Team Lead: Peter Frischmann.
- **Feasible**: Taking to market a low-cost, non-destructive method of determining a closed battery's charge, state of health, and structure using acoustic analysis. Team Leads: Andrew Hsieh and Barry Van Tassell.

Cyclotron Road Quick Facts

- **What is Cyclotron Road?** An entrepreneurial training and mentored support program embedded within LBNL, supported by EERE's Lab Impact Initiative and Advanced Manufacturing Office. Cyclotron Road and Berkeley Lab provide innovator-entrepreneurs the facilities, time, and resources to develop potentially transformative clean energy technologies. Additionally, they provide critical training and mentoring to help entrepreneurs commercialize their products.
- **What are the benefits?** LBNL and Cyclotron Road are attracting the next generation of top U.S. clean energy technology entrepreneurs, giving them the financial support and tools to jumpstart early-stage development of game-changing new technologies. Participants receive the time, space, equipment, and funding support to pursue their research and development and the support to find viable pathways to market. By working side by side with LBNL scientists and accessing Cyclotron Road's networks of commercial contacts, these innovators are engaging with industry in ways that will improve their technology and attract external funding to move their innovations toward commercialization.
- **Who can apply to participate?** Cyclotron Road is geared toward early-stage first-time entrepreneurs. Applicants must be strong technical leads whose research is related to advanced materials or manufacturing for clean energy technologies. Selection is based first on the qualifications, drive, and spirit of the individuals or teams of innovators, and then on their proposed technology.
- **How can I get involved?** To learn more about Cyclotron Road, read team profiles, and sign up for the Cyclotron Road newsletter, visit http://www.cyclotronroad.org/home. Pre-applications for the upcoming Fall 2016 cohort, anticipated to include six teams with one to three project leads each, can be submitted at http://www.cyclotronroad.org/apply/.

LAB-CORPS: Connecting Top Lab Researchers with Entrepreneurial Training and the Marketplace

The Challenge: The Cultural Divide Between Lab Research and the Marketplace

The Department of Energy's (DOE) National Laboratory researchers are some of the greatest technical minds in the world, working on some of the most important and exciting science and technology challenges of our time. They work tirelessly to secure funding, publish in journals, and create new knowledge and technologies.

Within the Lab research culture, researchers are often so focused on the specific science and technology challenges in front of them that they aren't always aware of how their work relates to the needs of industry and the marketplace. Further, these researchers often aren't given the chance to step outside the Lab to gather the industry contacts and knowledge needed to tailor research for commercial impact. In an ever-changing market landscape, it is critical for National Lab research to be commercially relevant in order for Labs to remain high-value resources for the U.S. private sector.

The Solution: Building a Culture of Market Awareness at the National Labs

The Office of Energy Efficiency and Renewable Energy's (EERE) National Lab Impact Initiative has helped create a cultural shift throughout DOE's network of National Labs. Through the Initiative, Lab researchers are encouraged to rub shoulders with industry and focus on research informed by real-world challenges and opportunities.

Silicon Valley-based entrepreneur Steve Blank developed the LeanLaunchpad™ methodology in the 1990s to encapsulate strategies and techniques leveraged by countless entrepreneurs to achieve commercial success. Working with

Lab-Corps Cohort 2's Biolyst Renewables team receives feedback during Industry Night in March 2016. The team aims to replace petroleum-based adipic acid, a primary component of nylon, with bio-based adipic acid to reduce greenhouse gas emissions. **Photo Credit:** John De La Rosa/NREL

Blank, the National Science Foundation (NSF) adopted this curriculum for the highly successful I-Corps™ program, which provides entrepreneurial education to academic researchers and connects them to potential customers and industry partners, helping to close the knowledge gap between researchers and the marketplace.

Following the success of the I-Corps™ initiative, EERE sought to adapt the model for DOE National Lab researchers. Partnering with Blank, NSF, and NREL, EERE created Lab-Corps, a new program that provides commercialization training and a platform for customer and industry partner discovery for top National Lab researchers. The first Lab-Corps cohort launched in October 2015.

Each Lab-Corps cohort is made up of 14 teams, including at least one technical expert, an entrepreneurial lead, and an industry mentor. Over the course of two intensive months, each team participates in a variety of interactive workshops and market discovery activities designed to advance their entrepreneurial knowledge and map out potential paths toward commercialization. Leading minds from the entrepreneurial world and venture capital industry serve as instructors, imparting knowledge through lectures and assisting teams in crafting customer value propositions, identifying customer segments, understanding supply chains, and developing viable business plans.

Lab-Corps Quick Facts

- **What is Lab-Corps?**
  A specialized two-month training curriculum to train National Lab researchers to analyze and explore how their ideas can best meet market needs and be successfully commercialized. The program provides a set of proven training methods that equip DOE Lab scientists with a better understanding of the commercialization process.
- **What are the benefits?**
  Participating teams benefit not only from classes taught by experts, but also from more than 50 customer interviews with companies in fields related to their innovations.
- **Who can participate?**
  DOE National Lab researchers that meet the eligibility requirements are welcome to apply.
- **How can I learn more?**
  Contact lab-corps@NREL.gov.

The Lab-Corps curriculum emphasizes interactive market and customer discovery. Each team conducts more than 50 interviews with potential customers to better understand market needs and help shape their technology and product development plans to meet real-world commercial needs.

"Through Lab-Corps, I gained a new skill set for understanding the market for the technologies my team and I are developing. This allowed me to tailor the last stages of my research to better position the technologies for commercial adoption," said Ralph Muehleisen, Principal Building Scientist at Argonne National Laboratory (ANL), who served as principal investigator for Team SonicLQ, which has used sound waves to detect air leaks in buildings. "Perhaps more importantly, the methodology taught in Lab-Corps forces researchers 'out of the building' to directly talk to customers and end users within the marketplace. This interaction not only helps researchers better understand the end market for their technology, it also provides additional opportunities to talk to companies about how they can do business with the Lab."

Dr. Jon Winkler (left) and Dr. Chuck Booten (right) install an Eco-Snap AC unit, which they prototyped during Lab-Corps Cohort 1. The wall-mounted AC unit can be installed by a single person and performs up to 20 percent more efficiently than traditional window AC units. **Photo Credit**: Dennis Schroeder/NREL

Lab-Corps Support

- NREL leads Lab-Corps with the support of the Colorado Clean Tech Association.
- Other participating labs are
  - ANL
  - BNL
  - LBNL
  - LLNL
  - LANL
  - INL
  - ORNL
  - PNNL
  - SNL

Recent Lab-Corps participants are already making progress toward commercialization, with graduates exploring the possibility of a new startup, receiving an R&D 100 Award nomination, and placing as a finalist in the Chicago Clean Energy Trust Competition. Whether researchers spin out new businesses or return to the Lab with a new appreciation for market needs, Lab-Corps is beginning to transform the National Lab culture into one that is increasingly more commercially aware and impactful.

Lab-Corps continues to grow and change how Lab researchers think about their work. Lab-Corps will graduate its 2nd cohort in May 2016, will launch its 3rd cohort in 2016, and is

committed to supporting three more cohorts in 2017. One hundred and fifty Lab researchers are projected to go through the program from inception to the end of 2017. The sky is the limit for the game-changing innovations that these teams will shepherd out of the Lab toward market impact.

Lab-Corps Highlight: Cooling with a Snap

Dr. Chuck Booten and Dr. Jon Winkler from the National Renewable Energy Laboratory (NREL) decided to participate in Lab-Corps to explore the potential of their concept for an eco-friendly air conditioner. They called it Ecosnap-AC, inspired by the "snap" connection made between the evaporator and condenser parts of their product during installation. The duo knew that connecting through a wall rather than being window-mounted could solve a number of core problems with window cooling units, such as poor sealing and the obstruction of a window. It sounded like a great idea—but was there an actual market need?

Through their participation in Lab-Corps, Booten and Winkler conducted more than 50 customer interviews during the interactive discovery portion of the program. They learned that customers would be willing to replace their existing window AC units for a quieter and more aesthetically appealing version. They also met with representatives from leading appliance retailer Lowes, who confirmed that for years customers had been asking for an alternative to existing window AC units.

Testing revealed that the prototype performed up to 25 percent more efficiently than traditional window AC units. Since completing the Lab-Corps program, Booten and Winkler have continued to market their innovation in the hopes of securing licensing agreements with major retailers and commercializing their product within the next three years. The EcoSnap-AC technology was also nominated for a 2016 R&D 100 Award by *R&D Magazine*. Booten and Winkler credit Lab-Corps with giving them the tools, resources, and know-how to get their innovation on an accelerated path to commercialization.

Lab-Corps Teams Have Explored an Array of Market Opportunities Based on Lab Research

- Unmanned aerial vehicle inspections of wind turbines
- Optimized control technology for building efficiency
- Scalable nanostructured coatings for energy efficient windows
- Envelope recladding technology
- Photobioreactor co-culture platform
- Real-time control of physical vapor deposition sources for thin films
- Mini-split modular air conditioning solutions
- Network interchange forecasting in the power grid
- Flame design for near-zero emission combustion of natural gas
- Sounds waves to identify building envelope leaks
- Solar thermochemical production of fuels
- Forward osmosis for water desalination
- Zero touch audit software for building efficiency
- Wind system modeling software toolset

Small Business Vouchers: Doubling Down on Small Business Partnerships with Our National Labs

The Challenge: Small Businesses Often Find it Hard to Partner with National Labs, Resulting in Fewer Lab-Small Business Collaborations

Small businesses are the lifeblood of the U.S. economy, accounting for more than half of all U.S. private-sector jobs and 99 percent of all U.S. employers.[1] They create new products, services, and technologies that enrich our personal and professional lives. They have also long been home to some of America's brightest minds and most creative entrepreneurial spirits.

However, these innovative small businesses can face significant challenges when it comes to developing clean energy technologies in particular, which typically require significant investment over long periods of time to achieve successful commercialization. The world-class research and development (R&D) capabilities in the National Labs serve as a tremendous resource for the clean energy industry, but small businesses in this space often experience difficulty in navigating the Lab system, identifying specific collaboration opportunities, and establishing partnerships.

The Solution: Creating a Streamlined, User-Friendly National Lab Partnership Program for Small Businesses

To address this challenge, DOE EERE, through its National Lab Impact Initiative, launched its Small Business Vouchers (SBV) program. The SBV program helps small business innovators efficiently connect and establish funded partnerships with renowned scientists, engineers, and state-of-the art facilities at the National Labs.

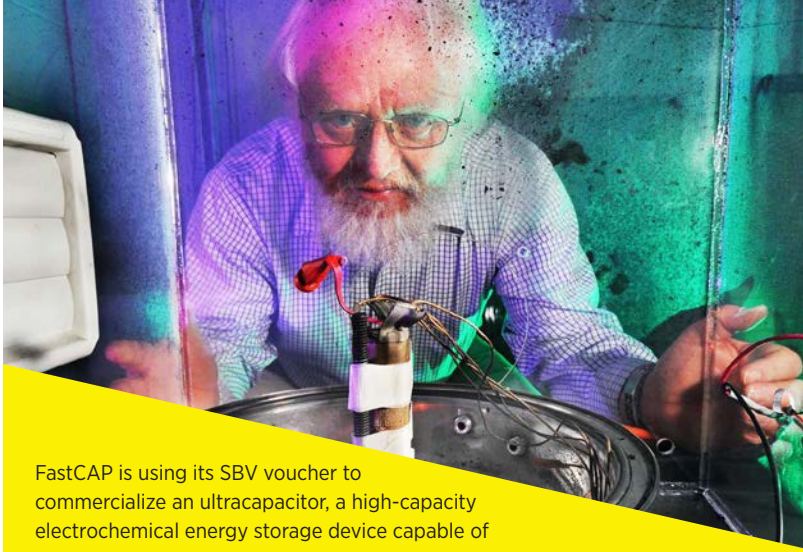
1 Available at: https://www.sba.gov/sites/default/files/FAQ_Sept_2012.pdf.

With a dedicated budget of $20 million in the first year of the program, SBV is committed to creating new Lab R&D partnerships with more than 100 small businesses to further develop and commercialize their technologies. SBV participants are competitively awarded funding of $50,000 to $300,000, which can be exchanged for technical assistance from the National Labs. The first round of 33 SBV small businesses have been awarded and are already hard at work on collaborative projects to scale up new biofuel processes, test cutting-edge solar technologies, and develop improved battery storage technologies, just to name a few.

The SBV program, supported by dedicated teams from the National Labs and a streamlined contracting process, has enabled the small business community to understand and access the National Lab system like never before.

"It can sometimes be difficult for small businesses to discover and access the great resources and capabilities at our National Labs," explained Alecia Ward, Director of Program and Business Development at Lawrence Berkeley National Lab (LBNL). "The streamlined assistance we are providing through SBV has fundamentally changed the way we interact with small businesses, opening up the Labs to them in new ways."

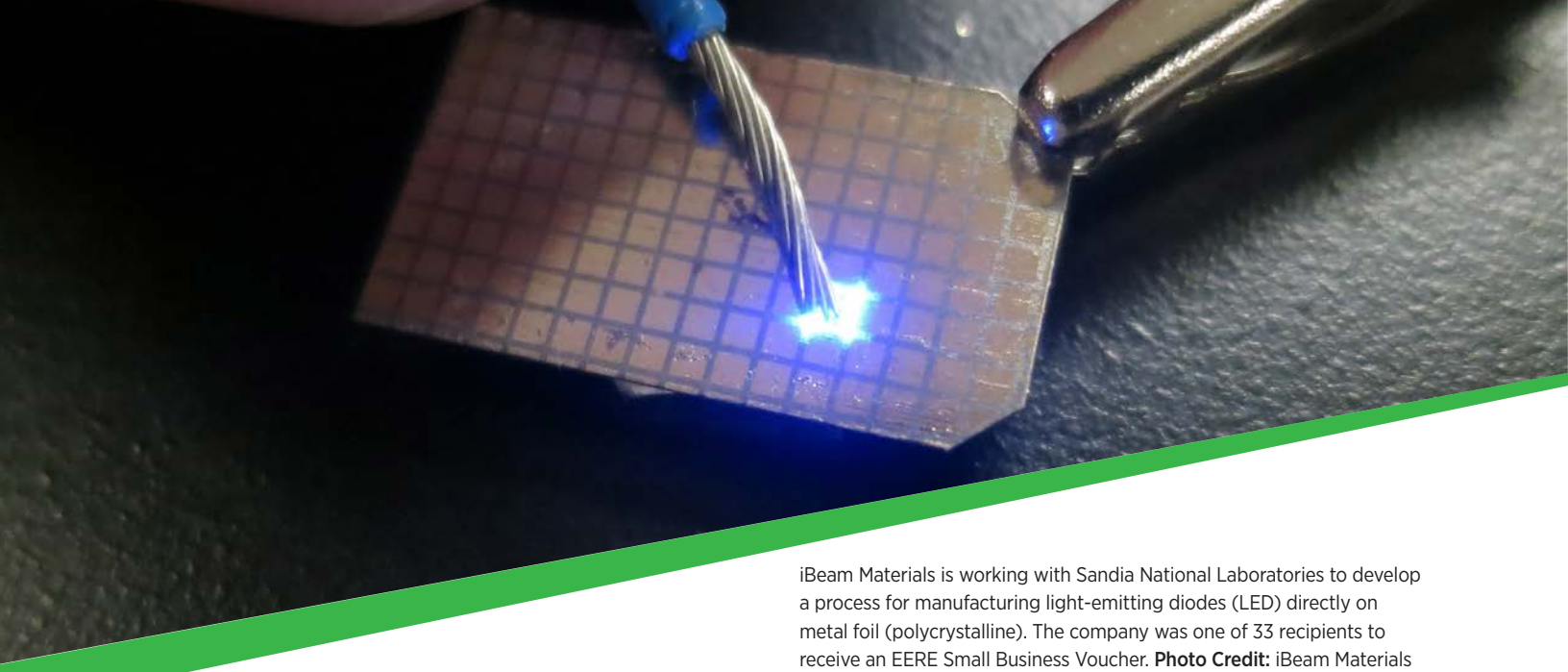
In building SBV, the program team at EERE and the National Labs developed sbv.org: a first-of-a-kind public website listing the Lab resources and capabilities on offer to small businesses in a user-friendly way. Through the first two of three rounds in its first year, SBV has received more than 800 collaboration requests from small businesses all across the country seeking opportunities for collaboration and assistance. In SBV's first round,



FastCAP is using its SBV voucher to commercialize an ultracapacitor, a high-capacity electrochemical energy storage device capable of operating at extreme temperatures. FastCAP will test its ultracapacitor at Sandia's Battery Abuse Testing Laboratory (BATLab). **Photo Credit:** DOE

SBV Quick Facts

- **What is the SBV pilot?** An EERE National Lab Impact Initiative pilot aimed at increasing small businesses' access to and support by DOE's National Labs. Participants are awarded vouchers worth $50,000 to $300,000 to access Lab resources matched to their needs.
- **What are the benefits?** With SBV, small businesses can access the state-of-the-art facilities, world-class expertise, and sophisticated testing instrumentation at the National Labs to further develop their technologies.
- **Who can participate?** U.S.-owned and U.S.-based for-profit businesses with fewer than 500 employees focused on clean energy technologies in EERE's program areas.
- **How can I learn more?** To learn more about the SBV pilot, please visit https://www.sbv.org or contact info@sbv.org.



iBeam Materials is working with Sandia National Laboratories to develop a process for manufacturing light-emitting diodes (LED) directly on metal foil (polycrystalline). The company was one of 33 recipients to receive an EERE Small Business Voucher. **Photo Credit:** iBeam Materials

33 of these businesses were selected to work with eight Labs on exciting projects spanning EERE's entire portfolio. The second round of the SBV competition is currently underway, with final selections scheduled for June 2016, and a third application window is scheduled to open in July 2016. In 2016, its first year, the SBV program is currently on track to double the number of new DOE National Lab Cooperative Research and Development Agreements (CRADAs) over the number from 2015.

The SBV program focuses on nine clean energy technical areas: advanced manufacturing, bioenergy, buildings, fuel cells, geothermal, solar, water, wind, and vehicle technologies. The initiative is led by five National Labs: Lawrence Berkeley National Laboratory (LBNL), the National Renewable Energy Laboratory (NREL), Oak Ridge National Laboratory (ORNL), Pacific Northwest National Laboratory (PNNL), and Sandia National Laboratories (SNL). Technical assistance can include expert support in the areas of prototyping, product testing and validation, modeling and analyses, engineering designs, access to unique materials, and guidance on how to scale up processes and commercialize technology innovations.

SBV Highlights: Advancing Energy Technology

FastCAP Systems Uses SNL's Battery Abuse Testing Laboratory (BATLab) to Advance Down-Hole Energy Storage for Geothermal Drilling

Based in Boston, FastCAP Systems is commercializing a game-changing new ultracapacitor technology based on carbon nanotube technology. FastCap's ultracapacitors have shown unique potential to operate at high power and high capacity in very harsh and high-temperature conditions. Spun out from CEO Riccardo Signorelli's Ph.D. thesis at MIT, FastCAP is using its small business voucher to leverage SNL's BATLab. The company will use the facility's resources to improve and validate their ultracapacitor's ability to power data transmission to the surface while handling the shocks typical in the high temperature geothermal down hole drilling environment. This improved capacitor holds tremendous promise to greatly improve power companies' ability to extract and store geothermal energy.

"When you're trying to do product qualification for geothermal drilling, you need quite a lot of infrastructure and monitoring equipment," said FastCAP CTO John Cooley. "SNL was a perfect fit."

iBeam Materials Works with SNL to Develop New Flexible LED Lighting Technology

Santa Fe-based iBeam Materials is developing an innovative process to efficiently produce even lower-cost LED lighting than is on the market today. iBeam Materials' process builds on previous thin-film deposition technologies developed through DOE support at the National Labs for the superconductor industry, using ion-beam technology to create high-performance semiconductor devices using advanced indium gallium nitride semiconductors.

This project will focus on utilizing facilities and expertise at SNL to accelerate light-emitting process technology developments, hopefully leading to the first-ever fabrication of LEDs directly on flexible metal foil. Cost-saving technologies in this field could affect LED lighting, wearable electronics, lighting and display markets, and others, currently valued at over $100 billion worldwide.

SBV Project Descriptions

Advanced Manufacturing

- **Glucan Biorenewables (with ORNL)**: Bio-Derived Replacement for Petrochemical-Based Products
- **Grid Logic, Inc. (with ORNL)**: Additive Manufacturing of Large Metal Components
- **GVD Corporation (with ORNL)**: Robust Seals for Hydrogen Processing Equipment
- **iBeam Materials, Inc. (with SNL)**: Low-Cost, Flexible LED Lighting
- **Mithra Technologies, Inc. (with INL)**: Catalyst Enhancement Using a Pulse Response System
- **Widetronix, Inc. (with LLNL)**: Betavoltaic Battery to Safely Power Our Military

Bioenergy

- **Lygos (with LBNL/NREL)**: Domestically-Derived Alternative Process for Producing Malonic Acid
- **Visolis (with PNNL)**: Sequestering Carbon in Bio-Based Structural Materials

Building Technologies

- **Be Power Tech, Inc. (with ORNL)**: Grid Stabilization Through Local Natural-Gas-Driven HVAC
- **KCF Technologies (with ORNL)**: Wireless Monitoring and Efficiency Improvement for Pumps
- **Lucid (with LBNL)**: Digital Algorithms for Building Energy Management Improvement
- **NorthWrite, Inc. (with PNNL)**: Improving HVAC Efficiency for Small Commercial Buildings

Fuel Cells

- **Altergy Systems (with SNL)**: Driving Fuel Cell Efficiency Improvements
- **Amsen Technologies (with LANL)**: Polymer Membranes to Reduce Fuel Cell Costs
- **Element One (with NREL)**: Advanced Hydrogen Detection for Safer Storage and Handling
- **KWJ Engineering (with LANL/NREL)**: Low-Cost Hydrogen Sensing Technology
- **Midwest Energy Group (with NREL)**: Commercialization of Lower-Cost Fuel Cell Membrane
- **Sustainable Innovations (with LANL)**: Hydrogen Purity Detector for Robust Fuel Cell Operation
- **Treadstone Technologies (with ORNL/LANL)**: Membranes for Highly Reliable and Robust Fuel Cells

Geothermal

- **FastCAP (with SNL)**: Advancing Higher Temperature Geothermal Energy
- **Geothermal Design Center (with ORNL)**: Testing Process Enabling Optimized Geothermal System Installation

Solar

- **Renewable Power Conversion (with SNL)**: Macro-Micro Inverter for PV Systems
- **SkySun, LLC (with SNL)**: Mirrors for Reducing Seasonal Variations at Solar Facilities

Vehicles

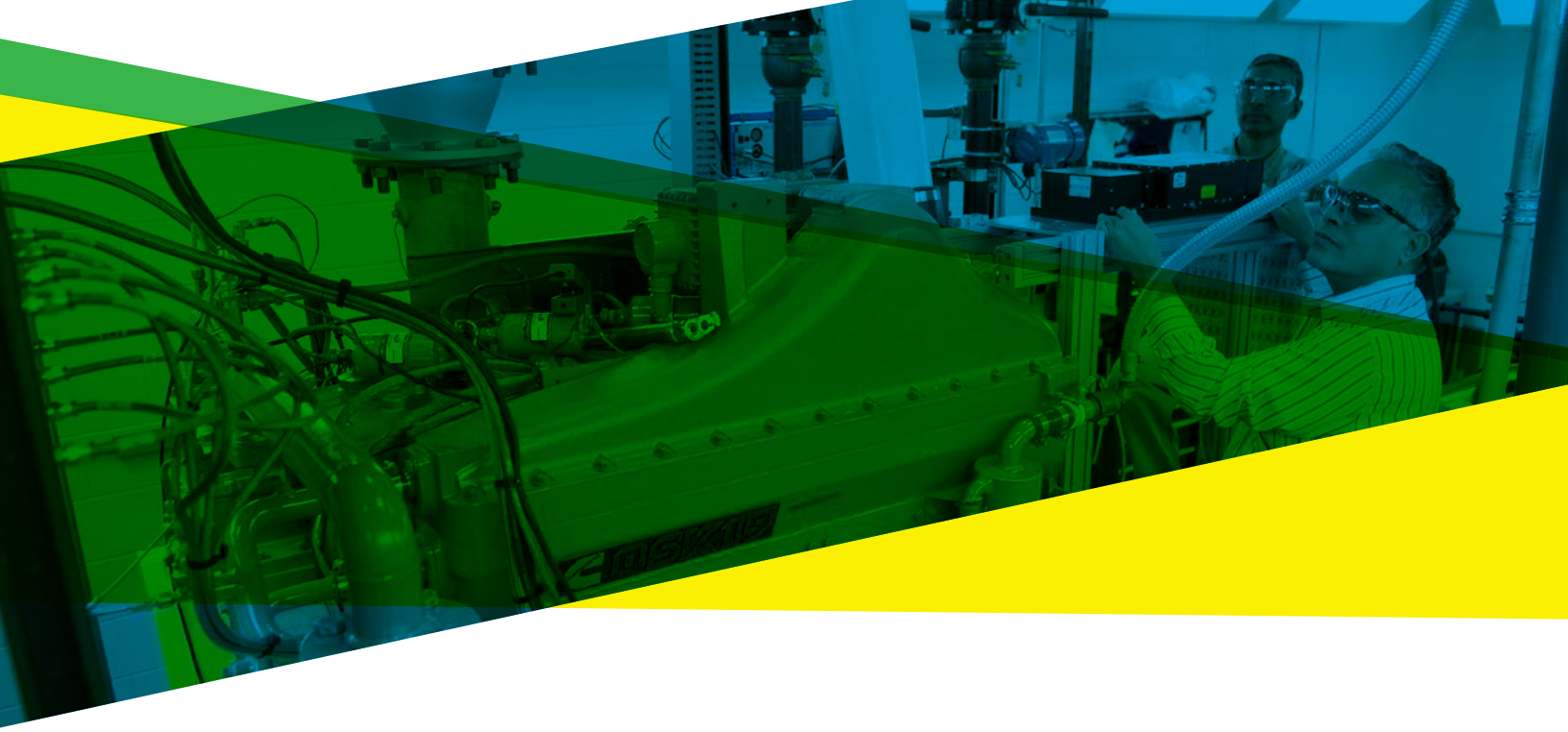
- **Big Delta Systems, Inc. (with ANL)**: New Method that Improves Lithium Ion Batteries
- **Connected Signals (with SNL)**: Real-Time, Predictive Traffic Signal Information for Vehicles
- **Cool-X, LLC (with ORNL)**: Keeping Car Engines Clear with Nanodiamonds
- **Envia Systems (with LBNL)**: Higher Energy-Density Lithium–Ion Batteries
- **Transient Plasma Systems (with ANL)**: Ignition System for Advanced Engine Designs
- **United Silicon Carbide (with ORNL)**: Power Electronics Advances for Electric Vehicles
- **XG Sciences, Inc. (with LBNL)**: New Nanotechnology for Improved Lithium Battery Designs

Water Power

- **Columbia Power Technologies (with NREL)**: Wave Energy Conversion System
- **Percheron Power (with PNNL)**: New, Lower-Cost Turbine Technology

Wind

- **Micron Optics (with SNL)**: Enhanced Wind Plant Efficiency With Optical Sensors



Technologist-In-Residence: Dynamic Duos from Lab and Industry Working Together to Discover High-Impact New R&D Partnership Opportunities

The Challenge: Connecting Industry to the National Lab Network

The Department of Energy's (DOE) 17 National Labs represent an unparalleled world-class American science and technology innovation network. Our National Labs have a rich history of industry partnerships and commercial impact. Yet there is little doubt that tremendous untapped energy remains to expand and intensify industry's engagement with our National Labs.

Significant opportunities exist to help the private sector to more efficiently find and connect with the best Lab R&D capabilities and expertise to help them solve their most important problems.

But what if there was a program to encourage industry partners to form lasting, strategic relationships with the National Labs? What if a high-level partnership opportunity existed where leading U.S. companies and Labs could work together to develop long-term trusting relationships and identify a comprehensive set of high-impact collaborative R&D opportunities?

There just hasn't been a "plug-and-play" platform through which Labs and companies can work together to share industry's most important challenges and connect them to the right Lab resources. Until now.

The Solution: Pairing Leading Industry and Lab Technologists

The EERE Technologist-in-Residence (TIR) program is an innovative pilot program that bridges this gap by pairing senior technical staff from manufacturing companies with leading technologists from the Labs, allowing Lab and industry researchers to work together to more deeply understand the true nature of industry's most important problems and the Lab capabilities that can best be brought to bear to solve them.

In TIR, DOE provides financial support for two senior technologists to spend up to two years serving "in-residence" within their counterparts' manufacturing and research facilities. Each technologist pair is given the freedom to chart their own course and determine how much time they will spend together each quarter at industry sites, at the Lab technologists' Lab, and visiting other Labs. The technologist pairs dive deeply into all of industry's applicable strategic challenges and conduct a mapping exercise to help explain where the National Labs can best contribute. From there, the technologist pair will propose collaborative R&D efforts to develop science-based solutions to the company's most strategic scientific, technological, and business issues.

The program is uniquely well-suited to serve large companies with diverse sets of R&D needs, while also holding enormous value for medium-sized companies and industry consortia.

In September 2015, seven initial pairings were announced following a call for proposals and extensive industry engagement. TIR matched top scientists from the National Labs with counterparts at leading American companies, including Procter & Gamble (P&G), Cummins, Hewlett Packard, and Alcoa. The TIR program currently operates at four National Labs—Argonne National Laboratory (ANL), Los Alamos National Laboratory (LANL), Oak Ridge National Laboratory (ORNL), and the National Renewable Energy Lab (NREL).

"The National Labs have unmatched facilities, resources, and infrastructure that are often cost-prohibitive for a company to set up on their own," said Eli Levine, Acting Director of the Clean Energy Manufacturing Initiative (CEMI), which oversees the TIR program. "Through EERE's TIR program, industry participants gain the opportunity to develop a long-term strategic partnership with the National Labs. In addition, the program is creating a network of leading technologists that allows industry to access Lab resources and expertise far beyond the single Lab they have partnered with. In return, the industry partners are helping provide scientists and researchers with a deeper understanding of critical market challenges and opportunities."

"Part of the relationship building is finding intersections where an industry problem and a national interest coincide in multiple disciplines of science," explained Steve Stringer, former LANL Industrial Fellow and an early champion for TIR. "When we can do that, the result is an increase in U.S. industrial competitiveness. Intellectual property is created and we are able to do things better, cheaper, and faster than we could before."

Highlight: LANL Partnership with P&G

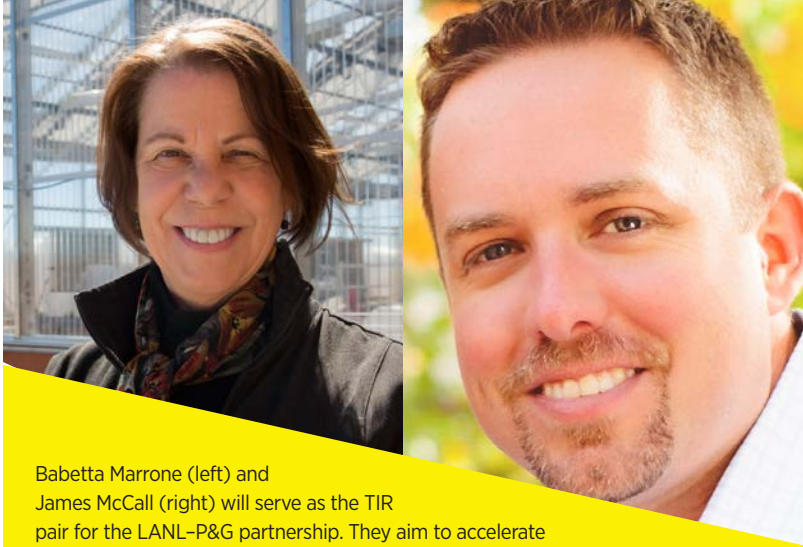
Through the TIR program, LANL Biofuels Program Manager Babetta Marrone is working hand-in-hand with James McCall, Global Product Supply Sustainability Leader at P&G. P&G had previously collaborated with LANL and other National Labs, but sought to expand its partnership by working collaboratively to improve sustainable manufacturing and distribution processes—specifically related to buildings, transportation, water, and waste. Though Marrone and McCall hail from very different professional worlds, they

shared a common commitment to strengthening American manufacturing through innovation in clean energy.

"For us, our ultimate goal is to reduce the overall footprint of our consumers, and manufacturing is one of the ways we can do it," McCall said. "We can improve the supply chain, manufacturing processes, chemical practices, and transportation algorithms—bringing the best world-class technology forward today."

P&G has set ambitious goals for reducing the environmental footprint of its 28 manufacturing facilities in the U.S. and 100 facilities worldwide. The company has committed to reduce facility energy use by 20 percent per production unit, reduce greenhouse gas emissions by 30 percent, and power its plants by 30 percent renewable energy by 2020. They also target zero consumer and manufacturing waste going to landfills. As an industry leader, P&G stands to set new benchmarks for sustainable manufacturing and distribution. But meeting these ambitious targets will require partnerships and collaborative work. The TIR program provides the entry point for a whole new set of partnerships and joint efforts with the Labs that collectively can set P&G on track to achieve its vision.

Even though they are just getting started with their partnership, P&G is already beginning to see how the National Labs can help address some of their most difficult challenges. Marrone first visited P&G to meet the Technology and Chemicals teams and better understand their needs. McCall and Marrone are now working to identify the Lab staff, expertise, and resources that can be leveraged to tackle P&G's sustainability challenges. Formal relationships and agreements will then be established between P&G and the applicable Lab, aiming for a streamlined two- to three-year implementation timeline that is much faster than the traditional R&D process.



Babetta Marrone (left) and James McCall (right) will serve as the TIR pair for the LANL–P&G partnership. They aim to accelerate sustainable manufacturing within P&G's 128 worldwide manufacturing sites and reduce the environmental footprint of P&G's consumer products. **Photo Credit:** LANL and P&G

TIR Quick Facts

- **What is the TIR program?** An "in-residence" program supported by both the EERE National Lab Impact Initiative and the Clean Energy Manufacturing Initiative. It helps build long-term relationships between senior technologists at manufacturing companies and the National Labs, promoting collaboration on innovative R&D.
- **What are the benefits?** The TIR program creates a streamlined process for companies to create deeper relationships and comprehensive partnerships with the National Labs.
- **How can I learn more?** To find more information on TIR, visit http://energy.gov/eere/cemi/technologist-residence-pilot or contact cleanenergymanufacturing@ee.doe.gov

STEPS TO ENGAGEMENT

Six Stellar Reasons to Work with the Department of Energy National Labs

In recent years, the Department of Energy (DOE) Labs have created approximately 1,600 new inventions, received more than 500 U.S. patents, and executed 5,500 license agreements per year. The capabilities and talent throughout the network of National Labs offer an enormous competitive advantage to business and industry partners who leverage them. Here are six of the top ways the National Labs can help your enterprise:

1. Multi-Disciplinary Advanced Science and Engineering

National Lab research draws on many diverse science and engineering disciplines—from plant biology applications to batteries to aerospace engineering to fiber-optics. The Labs' ongoing work across industry-relevant disciplines enables private sector entities to better explore the scientific fundamentals underpinning their products and leverage know-how outside their core areas of business.

2. Access to World-Class Talent

The National Labs' 30,000 researchers bring expertise from a range of disciplines, from advanced manufacturing to combustion to wind energy. Through the richness and depth of their technical assistance, expert advice, and interdisciplinary research, Lab researchers can serve as trusted advisors during all steps of the product development lifecycle. Further, the Labs' extended knowledge-sharing network, which includes academia and the private sector, provides invaluable reach back for collaboration and for solving industry-wide challenges.

3. Access to State-of-the-Art Facilities

Over 180 world-class National Lab facilities are available to industry partners to advance their innovation goals. The Labs boast top-of-the-line tools and equipment that augment private sector assets. From beam lines to grid-connected test sites, many facilities that would be impractical for individual private

An INL researcher studies ways to economically process, transport, and formulate raw biomass that will feed into a biofuels production facility. At INL's Biomass Feedstock National User Facility (BFNUF), researchers work with producers of their specific biofuels and bioproducts to reduce biomass feedstock variability and produce high-quality feedstock from grass, wood, and agricultural residues.
Photo Credit: INL

The Center for Functional Nanomaterials at BNL is an internationally recognized, user-oriented research facility. It serves as an open facility for the nanoscience and nanotechnology research communities and advances the science and technology of nanomaterials that address the nation's energy challenges.
Photo Credit: BNL

entity investments are available to partners via the Labs. The DOE Office of Technology Transitions Facilities Database (http://www.energy.gov/technologytransitions/technology-transitions-facilities-database) lists 187 specific research and development (R&D) assets, showing the wide range of Lab resources available for industry use to create, test, and enhance commercial products.

4. Computational Modeling and Simulation

Four of the world's six most powerful supercomputers reside in the National Labs. The expertise needed to leverage these assets in service of complex science and engineering problems is also housed at the Labs. Industry partners can engage Lab researchers to develop mathematical models of complex systems, create large-scale simulation codes, and perform high-fidelity simulations in service of engineering new products and achieving a better understanding of system dynamics. For example, Lawrence Livermore National Lab's High Performance Computing for Manufacturing program (HPC4Mfg) is allowing industry partners to harness world-class computing to advance innovation in manufacturing (such as through process optimization and failure prediction). Lawrence Berkeley and Oak Ridge National Laboratories are partners in the program, sponsored by the Advanced Manufacturing Office (AMO) within DOE's Energy Efficiency and Renewable Energy (EERE) Office.

5. Accelerated Path to Commercialization

Bridging the gap from idea to successful demonstration to commercial deployment is a major challenge for new innovations. The National Labs help reduce risks associated with early-stage technologies and fast-track them to commercialization.

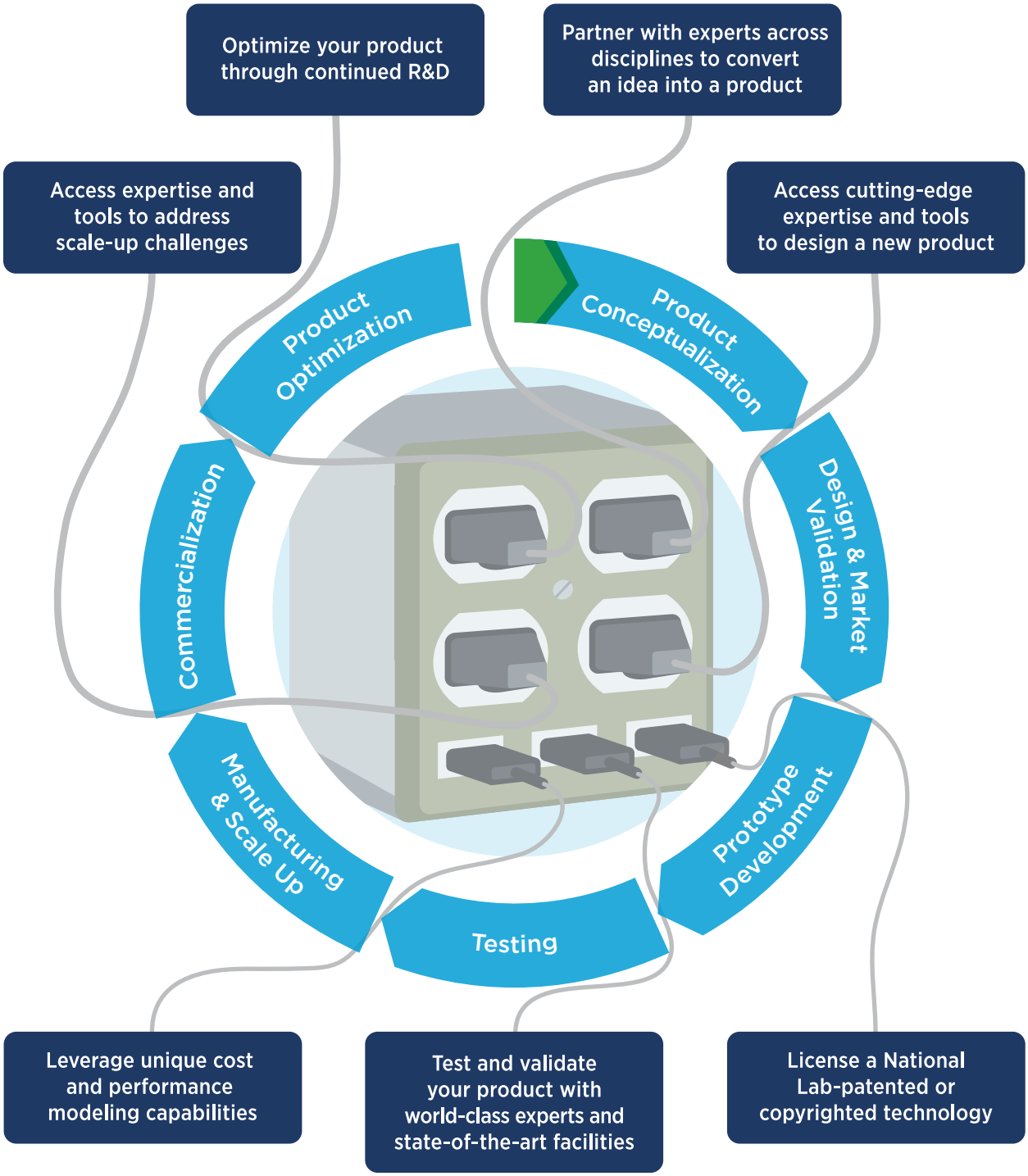
6. Advanced Testing and Validation

Unique tools and instrumentation at the National Labs enable researchers, innovators, and entrepreneurs to put their product or technology to the test, assuring their functionality and scalability before they hit the market. Lab testing facilities provide the opportunity for companies to understand how their technology interacts with different systems, delivering keen insights and distinct competitive advantages in the marketplace.

The Grid Modernization Laboratory Consortium is developing a multi-year plan for grid modernization. By merging the strengths of DOE headquarters and those of the Labs—which include their tremendous computational abilities, knowledge of cybersecurity systems, integration of renewable and energy efficient technologies, and command of sensing and control technologies—the Consortium will be poised to meet the challenges in achieving a modern grid, making a clean energy future possible. **Photo Credit:** LLNL

The National Energy Research Scientific Computing Center is the flagship scientific computing facility for the Office of Science within DOE and a world leader in accelerating scientific discovery through computation. The Cray XT4 supercomputer has 38,640 processor cores available for scientific applications, with a total 350 TB of usable disk space—which could hold 188 billion pages of text. **Photo Credit:** Roy Kaltschmidt/LBNL

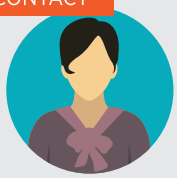
Plugging Into the National Labs Throughout the Product Development Process



Working with the National Labs: Partnering and Licensing Process

How to Partner with the Department of Energy National Labs

1 CONTACT



Contact the Technology Transfer representative at your respective Lab and get matched to researchers

2 DISCUSS

Hold informal discussions with researchers on technology and capabilities; sign NDA if needed

3 SCOPE

Determine appropriate contract vehicle, statement of work, estimated costs, and funding sources

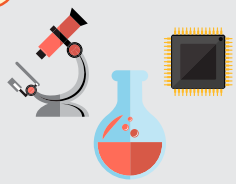
4 NEGOTIATE

Negotiate agreement and sign terms and conditions

5 FINALIZE

Obtain company, Lab, and DOE approvals and finalize agreement

6 EXECUTE



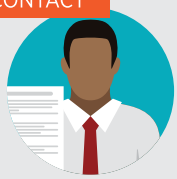
Execute work and evaluate results

How to License the Department of Energy National Lab Technologies

1 RESEARCH

Identify a licensing opportunity through respective Lab websites or the Energy Innovation Portal

2 CONTACT

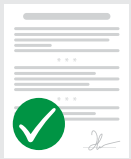


Contact Technology Transfer Representative about technology opportunity and fill out license application

3 NEGOTIATE

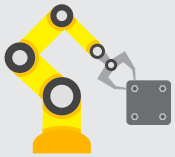
Negotiate the terms of the licensing agreement

4 APPROVE



Draft and approve the licensing agreement

5 COMMERCIALIZE



Integrate IP into new product and go to market

Technology Transfer Mechanisms at National Labs

Agreement	Use	Funding	Subject Inventions
Cooperative Research and Development Agreement (CRADA)	Collaborative research between DOE Lab and public and/or private entities for the mutual benefit of the parties	Private and/or Federal funds	Lab and Participant may elect their own inventions and Participant has right to negotiate exclusive license to Lab inventions
Strategic Partnership Project (SPP)	Work for businesses and other non-federal entities using highly specialized or unique DOE facilities, services or technical expertise	Private funds	Sponsor may elect title to Subject Inventions[1]
		Federal funds (e.g. grantee)	Lab may elect title to Subject Inventions of the Lab
Agreements for Commercializing Technology (ACT)	Work for businesses and other non-federal entities using highly specialized or unique DOE facilities, services or technical expertise	Private funds	Initial title to the designated IP Lead (ACT Participant or Lab Contractor)
Proprietary User Agreement	User may access designated facilities to conduct its own proprietary research	Private funds	User may elect title to its Subject Inventions
Non-Proprietary User Agreement	Non-proprietary research at designated facilities	n/a	Lab and User may elect their own Subject Inventions
Licensing	Private entity purchases rights to use Lab IP for their own purposes, such as the commercialization of a product	Private funds	User purchases rights to use Lab IP; Lab receives royalties

1 Certain exceptions or restrictions may apply (e.g., foreign WFO Sponsors may be granted the right to elect title to inventions and receive proprietary data protection but only after the approval of DOE field patent counsel and concurrence from the cognizant DOE program office).

2 Proprietary data protection may not be available at all facilities.

3 If the limited Gov. R&D license is utilized, data protection will be limited to 5 years.

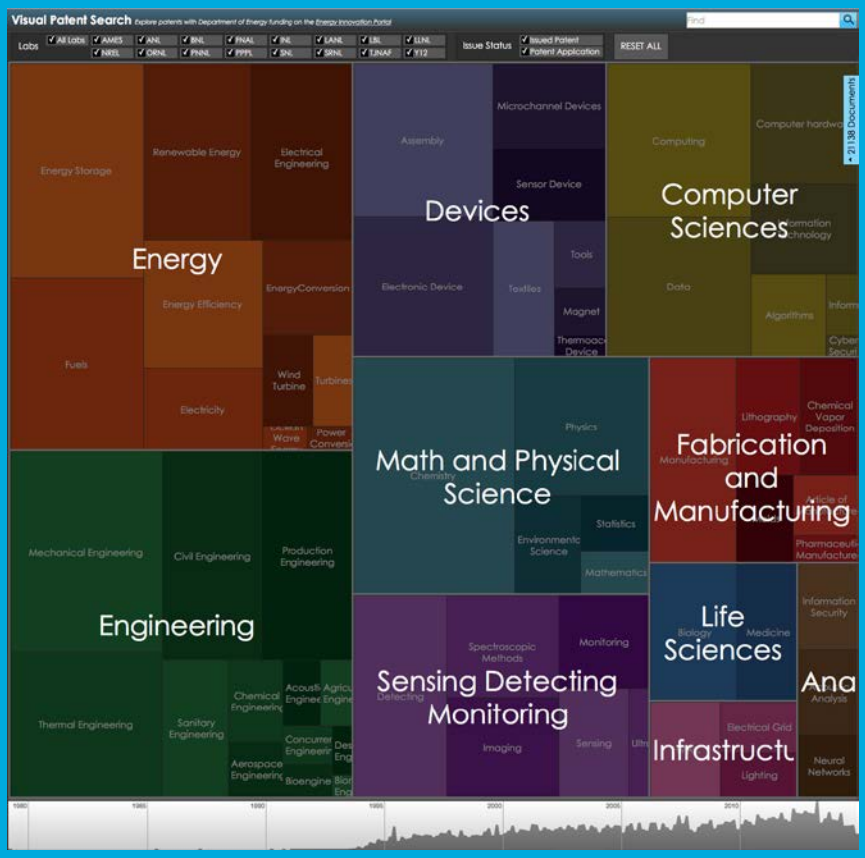
Generated Data	U.S. Competitiveness	Cost	Highlights
Protected for up to 5 years	Products embodying IP resulting from CRADA shall be manufactured substantially in the U.S.	Lab and Participant may share costs or Participant pays 100% funds-in	▸ Collaborative research ▸ 5 year data protection ▸ Designed for multi-party collaborative research
Protected as Sponsor's proprietary data w/limited exceptions[1,2,3]	U.S. Preference: Sponsor agrees not to grant any party exclusive right to use or sell products embodying Subject Inventions in the U.S. unless products are manufactured substantially in the U.S.	Sponsor pays full cost recovery	▸ Sponsor typically retains right to elect title to subject inventions ▸ Generated data treated as proprietary ▸ Option for limited Gov. R&D license[3]
Unlimited Gov. rights	U.S. Preference (see above)	Sponsor pays full cost recovery	▸ Access to unique facilities and expertise using federal funds
Protected as proprietary data w/ limited exceptions[1,2,3]	U.S. Preference (see above)	Participant pays full cost recovery plus additional negotiated compensation to the Contractor	▸ Flexible terms for IP, indemnity, adv. payment ▸ Optional performance guarantee ▸ Negotiable IP terms ▸ Option for limited Gov. R&D license[3]
User may protect as proprietary	n/a	User pays approved user rate	▸ Generated data treated as proprietary ▸ Merit based access to unique facilities
Unlimited Gov. Rights	U.S. Preference (see above)	Each party covers own cost	▸ Merit based access to unique facilities
User purchases rights to Lab IP	U.S. competitiveness and preference requirements in the lab management and operating contract apply.	Private entity	▸ Own the rights to use Lab's IP

Energy Innovation Portal Links Researchers with Cutting-Edge Department of Energy Technologies

The Office of Energy Efficiency and Renewable Energy's (EERE) Energy Innovation Portal is a one-stop resource that enables businesses and researchers to locate DOE-funded technologies available for licensing. Using the portal, you can:

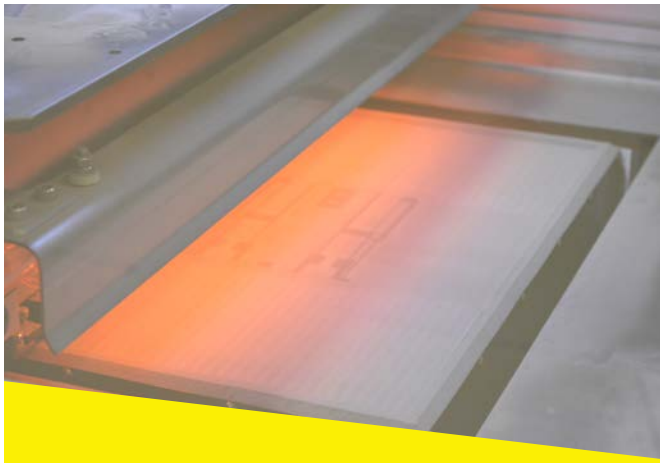
- **Explore more than 21,000 patent and application records and 900 market summaries** to find innovative energy technology snapshots and contact information for licensing representatives. Use keywords and search filters – which include the 17 National Labs and 16 technology categories – to narrow your search and find your licensing opportunity.
- **Use an interactive, user-friendly tool to customize your patent search. EERE's Visual Patent Search** (http://techportal.eere.energy.gov/VPS/) creates clusters of key terms based on their recurrence in patent records and applications. It's an efficient, effective, and simple method to move from searching for "renewable energy" patents to zeroing in on specific technologies, such as an innovative coating for lithium air batteries used in electric vehicles.

To get started on finding your next licensing opportunity, visit http://techportal.eere.energy.gov.



RESOURCE OVERVIEW
World-Class National Lab Facilities Available to You

The Department of Energy (DOE) National Labs boast nearly 200 state-of-the-art facilities that the private sector can leverage to create, innovate, test, and optimize their technologies. These facilities, developed largely through public investment, provide users with access to many of the world's most advanced technological capabilities. From high-powered beam lines to energy efficiency testing facilities, to advanced manufacturing capabilities, to many of the world's fastest supercomputers, the National Labs' incredible resources may offer just what your organization needs. For an overview of National Lab facilities that our partners frequently use, visit www.SBV.org. For a comprehensive list of DOE's National Laboratory facilities, visit the DOE Technology Transitions Facilities Database: http://www.energy.gov/technologytransitions/technology-transitions-facilities-database.



At the Manufacturing Demonstration Facility at ORNL, binder jetting technology is used to build successive layers of complex components by selectively depositing a liquid binding agent onto a metal powder bed. By shaping each layer at room temperature, thermal gradient effects are avoided, and virtually any material can be shaped despite any unique thermal properties. **Photo Credit**: ORNL

Here are just a few of the National Lab facilities that our partners use to augment their own research and development (R&D):

MDF: Improving Efficiency and Reducing Manufacturing Costs at Oak Ridge

The Manufacturing Demonstration Facility (MDF) at Oak Ridge National Laboratory (ORNL) helps industry incorporate new manufacturing technologies and optimize critical processes through the use of its advanced facilities, such as those focusing on Additive Manufacturing and Low-Cost Carbon Fiber. Among other advances facilitated at the ORNL MDF, researchers have access to technology and expertise to:

- **Create lightweight metal components** using unique powder processing, presses, and other advanced manufacturing tools
- **Reduce manufacturing costs for thin film electronics** using non-vacuum, low-temperature deposition techniques
- **Prototype, screen, and predict average lifetimes for battery materials** using advanced computational modeling

To learn more, visit http://web.ornl.gov/sci/manufacturing/mdf/.

ESIF: Testing Energy System Integration at NREL

From developing building efficiency strategies to integrating renewable energy into the grid, the National Renewable Energy Laboratory's (NREL) Energy Systems Integration Facility (ESIF) provides industry partners with the expertise, facilities, and instrumentation necessary to accelerate R&D and demonstration of energy systems. Using ESIF's specialized laboratories and infrastructure, industry partners can:

- **Test and validate** interconnection, interoperability, and integration scenarios for renewable energy and energy efficiency technologies
- **Develop comprehensive models, tools, and simulation capabilities** to help plan, operate, and manage energy systems
- **Access world-class capabilities** for systems integration, manufacturing and material diagnostics, and high-performance computing and analytics

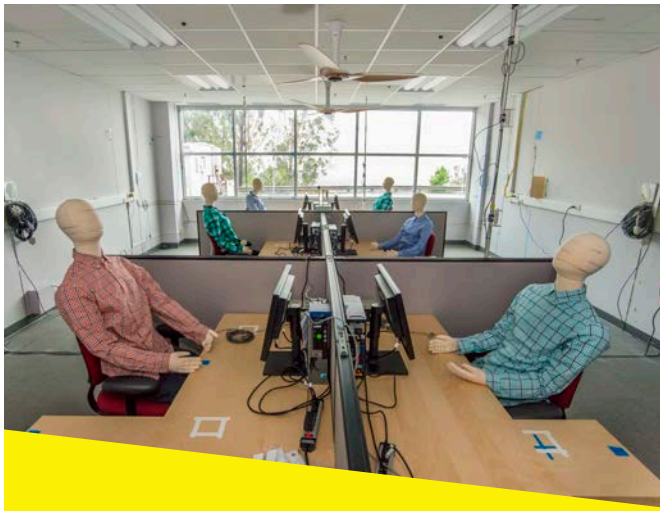
To learn more, visit http://www.nrel.gov/esif/.

FLEXLAB: Enhancing the Energy Efficiency of Building Energy Management Systems at Berkeley Lab

The Facility for Low-Energy Experiments in Buildings (FLEXLAB), located at the Lawrence Berkeley National Laboratory (Berkeley Lab), is the first testbed in the world that can comprehensively evaluate the energy efficiency of major building systems under real-world conditions. Using FLEXLAB, industry partners can evaluate energy-efficient building technologies individually, or as integrated systems, to:

- **Maximize energy savings** by optimizing integrated systems
- **Ensure user-friendliness** and occupant comfort
- **Assess interoperability** with other building technologies
- **Verify cost-benefit** numbers before expending significant capital
- **Train building operators** to run building systems effectively
- **Build confidence** in new technologies

To learn more, visit https://flexlab.lbl.gov/.



In FLEXLAB cell 3A, heat tape wrapped around thermal mannequins enables them to distribute heat the way a human body would. Inaugurated in 2014, FLEXLAB is the world's first testbed that can evaluate the energy efficiency of major building systems as an integrated system under real-world conditions. **Photo Credit**: Roy Kaltschmidt/LBNL

Senior Scientists Ross Larsen and Travis Kemper examine a molecular model of polymeric organic nitroxide radical film for battery applications using a 3D model at the Insight Collaboration Laboratory in NREL's ESIF. Researchers have used ESIF's unique visualization labs to enhance technology development across a range of fields, from batteries to wind turbines to energy grids. **Photo Credit**: Dennis Schroeder/NREL

National Lab* Capabilities and Technology Transfer Contacts

*Labs are ordered from most to least engagement with EERE, as measured by total EERE funding requested for Fiscal Year 2016.

National Lab	Capabilities	Address	Technology Transfer Contact
NREL NATIONAL RENEWABLE ENERGY LABORATORY	Advanced manufacturing, bioenergy, buildings, fuel cells, geothermal energy, solar energy, vehicles, water power, wind energy	15013 Denver West Pkwy., Golden, CO 80401	Kristin Gray, Director, Technology Transfer 303-275-3050 **kristin.gray@nrel.gov**
NETL National Energy Technology Laboratory	Buildings, smart grid, and vehicles	626 Cochrans Mill Rd., P.O. Box 10940, Pittsburgh, PA 15236	Jessica Sosenko, Technology Transfer Analyst 412-386-7417 **jessica.sosenko@netl.doe.gov**
OAK RIDGE National Laboratory Managed by UT-Battelle for the US Department of Energy	Advanced manufacturing, bioenergy, fuel cells, geothermal energy, vehicles, water power	1 Bethel Valley Rd., Oak Ridge, TN 37831	Mike Paulus, Director, Technology Transfer 865-574-1051 **paulusmj@ornl.gov**
BERKELEY LAB	Advanced manufacturing, bioenergy, buildings, fuel cells, geothermal energy, vehicles	1 Cyclotron Rd., Berkeley, CA 94720	Robin Johnston, Deputy Chief Technology Transfer Officer, Innovation and Partnerships Office 510-486-5947 **rjohnston@lbl.gov**
Pacific Northwest NATIONAL LABORATORY	Bioenergy, buildings, fuel cells, geothermal energy, solar energy, water power, wind energy	902 Battelle Blvd., Richland, WA 99354	Peter Christensen, Manager, Technology Commercialization 509-371-6159 **peter.christensen@pnnl.gov**
Argonne NATIONAL LABORATORY	Advanced manufacturing, bioenergy, buildings, fuel cells, geothermal technology, vehicles, water power, wind energy	9700 S. Cass Ave., Argonne, IL 60439	Suresh Sunderrajan, Division Director, Chief Technology and Commercialization Officer 630-252-8111 **ssunderrajan@anl.gov**
Sandia National Laboratories	Advanced manufacturing, bioenergy, buildings, fuel cells, geothermal energy, solar energy, water power, wind energy	1515 Eubank SE, Albuquerque, NM 87123	Amanda Spinney, Technical Business Development Specialist 505-844-1075 **aspinne@sandia.gov**
Los Alamos NATIONAL LABORATORY EST. 1943	Bioenergy, fuel cells, geothermal energy	P.O. Box 1663, Los Alamos, NM 87544	Laura J. Barber, Business Development Executive 505-667-9266 **ljbb@lanl.gov**

National Lab	Capabilities	Address	Technology Transfer Contact
AMES LABORATORY Creating Materials & Energy Solutions U.S. DEPARTMENT OF ENERGY	Advanced manufacturing and wind energy	311 TASF, 2408 Pammel Dr., Ames, IA 50011	Stacy Joiner, Manager, Technology Transfer 515-294-5932 **joiner@ameslab.gov**
INL Idaho National Laboratory	Advanced manufacturing, bioenergy, geothermal energy, vehicles, water power, wind energy	1955 Fremont, Idaho Falls, ID 83415	Tammie Borders, Industry Outreach & Data Science, Center for Advanced Energy Studies 208-526-3922 **tammie.borders@inl.gov**
Lawrence Livermore National Laboratory	Advanced manufacturing, fuel cells, geothermal energy, solar energy, wind energy	7000 East Ave., Livermore, CA 94550	Richard Rankin, Director, Industrial Partnerships Office 925-423-9353 **rankin8@llnl.gov**
Savannah River National Laboratory™ OPERATED BY SAVANNAH RIVER NUCLEAR SOLUTIONS	Advanced manufacturing and fuel cells	Savannah River Site, Aiken, SC 29808	Matthew J. Biasiny, Manager, Partnerships and Commercialization 803-725-0406 **matthew.biasiny@srs.gov**
BROOKHAVEN NATIONAL LABORATORY	Fuel cells and geothermal energy	2 Center St., Upton, NY 11973	Connie Cleary, Director, Technology Commercialization & Partnerships 631-344-4238 **ccleary@bnl.gov**
Fermilab	Particle accelerators and particle physics	Wilson St. and Kirk Rd., Batavia, IL 60510	Aaron Sauers, Patent and Licensing Executive, Office of Partnerships and Technology Transfer 630-840-4432 **asauers@fnal.gov**
PPPL PRINCETON PLASMA PHYSICS LABORATORY	Electronics, high-voltage power systems, materials science	100 Stellarator Rd., Princeton, NJ 08540	Laurie S. Bagley, Head, Technology Transfer 609-243-2425 **lbagley@pppl.gov**
SLAC NATIONAL ACCELERATOR LABORATORY	Advanced materials, fuel cells, solar energy	2575 Sand Hill Rd., Menlo Park, CA 94025	Michael Willardson, Chief, Technology Transfer 650-926-3580 **michaelw@slac.standford.edu**
Jefferson Lab Exploring the Nature of Matter	Accelerator science and nuclear physics	12000 Jefferson Ave., Newport News, VA 23606	Deborah Dowd, Technology Transfer Coordinator 757-269-7180 **dowd@jlab.org**

Office of Energy Efficiency and Renewable Energy (EERE) Technology Office Directors

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Solar Energy (SETO)	Lidija Sekaric (Acting)	**lidija.sekaric@ee.doe.gov**
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Advanced Manufacturing (AMO)	Mark Johnson	**mark.a.johnson@ee.doe.gov**
Buildings (BTO)	David Nemtzow (Acting)	**david.nemtzow@ee.doe.gov**

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Oak Ridge National Lab and Local Motors' Strati, the world's first printed, drivable vehicle. **Photo Credit:** Oak Ridge National Lab
Lab researchers work to find the next game-changing innovations. **Photo Credit:** Thinkstock
Maintenance on a large-scale wind turbine supports ongoing research and development. **Photo Credit:** National Renewable Energy Lab

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Cyclotron Road Polyspectra in Lab. **Photo Credit:** Roy Kaltschmidt/LBNL

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Cyclotron at Berkeley Lab. **Photo Credit:** LBNL

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Group Photo of Lab-Corps Cohort 2. **Photo Credit:** John De La Rosa/NREL

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ANL Advanced Li-Ion Battery. **Photo Credit:** ANL
Geothermal Drill Rig. **Photo Credit:** Craig Miller Productions and DOE
Hydroelectric Dam. **Photo Credit:** Grant County Public Utility District

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ANL and Cummins Engine 2011 collaboration. **Photo Credit:** ANL

Back Cover

National Lab researchers engage in foundational science to advance breakthroughs. **Photo Credit:** Thinkstock
Solar panels harness the sun to power our nation's energy grids. **Photo Credit:** Thinkstock

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

National Lab Impact Initiative

energy.gov/eere/lab-impact

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