SECOND CONFERENCE ON ENERGY STORAGE TRENDS AND OPPORTUNITIES

Sheraton Kona at Keauhou Bay & NELHA

Kailua-Kona, Hawaii

December 5-6, 2018

SECOND CONFERENCE ON

ENERGY STORAGE TRENDS

AND OPPORTUNITIES

SHERATON KONA AT KEAUHOU BAY & NELHA
KAILUA-KONA, HAWAII
DECEMBER 5-6, 2018

OVERVIEW

The Natural Energy Laboratory of Hawaii Authority (NELHA) appreciates your participation in this Second NELHA Energy Storage Conference.

The State of Hawaii is striving to reach 100% clean energy by 2045. In doing so, it is securing a position of leadership in the clean energy economy, including the use of energy storage to address increasing amounts of variable resources brought into the grid. This conference will bring together experts from US National Laboratories, academia, government and industry to present energy storage technologies and applications and consider opportunities and challenges.

In addition to examining world and national trends, this event will focus on Hawaii issues and opportunities. The event will also focus on resiliency in force majeure situations of geophysical and atmospheric nature. The meeting will include presentations by leaders in the field as well as site visits to installations.

Conference Goals

- Present the latest information on the state of energy storage, grid reliability and resiliency;
- Assess and compare progress of energy storage demonstrations and implementations in Hawaii with those in other parts of the country;
- Discuss resiliency in force majeure situations;
- Examine the economics of energy storage;
- Discuss opportunities for projects within the State of Hawaii, the Island of Hawaii; and

- Discuss regulatory and policy issues affecting the implementation of energy storage in Hawaii.

The conference includes one full day of presentations and panel discussions which will consider existing case studies to examine issues of reliability, power quality, distribution, generating capacity and resiliency. The second day of the conference includes visits to site demonstrations at NELHA, the inauguration of a grid scale battery, and a regulatory and policy workshop. The site visits will include NELHA's energy storage test bed, its ocean thermal energy conversion (OTEC) facility, a CSP/desalination project and the H2 generation and distribution facility.

Wednesday–December 5, 2018 at Sheraton Kona

6:30AM	Registration Opens
7:00 – 8:00	Breakfast
8:00 - 8:15	**Traditional Hawaiian Welcome**
8:15 – 8:45	**Welcome Remarks** Introductions: Natural Energy Laboratory of Hawai'i Authority (NELHA) Board Chairperson Linda Rosehill Remarks: Acting DBEDT Director, May Alice Evans State Energy Office Administrator, Carilyn Shon
8:45 – 9:15	**The State of Energy Storage: Overview by Key Note Speaker** Dr. Imre Gyuk, Program Manager Energy Storage, U.S. Department of Energy
9:15 – 9:45	**Hawaii System Issues and Opportunities** Dr. Terry Surles, Senior Advisor, California Institute for Energy and Environment and Former Interim Administrator for the Hawaii State Energy Office, and Gregory Barbour, Executive Director, NELHA

9:45 – 10:00 Break

10:00 – 11:00 **Advances in Energy Storage** - Panel Discussion –
Chair: Dr. Rick Rocheleau, Director, Hawaii Natural Energy Institute

- Dr. Erik Spoerke, Sandia National Laboratories Energy Systems Integration
- Rick Winter, President and CEO, UniEnergy Technologies
- John Wood, CEO, Ecoult

11:00- 12:00 **Storage for Grid Reliability** - Panel Discussion -
Chair: Raymond Byrne, Sandia National Laboratories

- Jordan Little, Elemental Excellerator
- Matthieu Dubarry, Hawaii Natural Energy Institute
- Charlie Vartanian, Pacific Northwest National Laboratory

12:15 – 1:45 Lunch Speaker: Jennifer Potter, Hawaii PUC Commissioner

1:45 – 3:30 **Resiliency in Force Majeure Situations such as Lava and Hurricanes** - Panel Discussion -
Chair: Dan Borneo, Sandia National Laboratories

- Kyle Datta, New Energy Partners
- Bill Parks, Former Chair Grid Modernization Initiative at US Department of Energy
- Jay Ignacio, President, HELCO
- Feng Qiu, Argonne National Laboratory

3:30 – 3:45 Break

3:45 – 4:30 **Advances in Deployment - Streamlining Interconnections by Example**
Richard Vetter, Kauai Island Utility Cooperative
Mike Gravely, California Energy Commission, and Terry Surles, California Institute for Energy and Environment
Rick Rocheleau, Hawaii Natural Energy Institute (Molokai Project)

4:30 – 4:45 Announcements

6:00- 8:00 Networking Reception

Thursday–December 6, 2018 at NELHA and Sheraton Kona

8:30 – 9:30 Breakfast

9:30 – 10:00 Bus departs from Sheraton Kona at Keauhou Bay to NELHA

10:00 – 11:20 Gateway Center – UET Demonstration Project Blessing

- Intro and Master of Ceremonies: Greg Barbour
- Speeches by Dignitaries: State Representative Nicole Lowen, NELHA Chair Linda Rosehill, Imre Gyuk (US DOE), Jay Ignacio (HELCO), Tee Suntharo (Ulupono)
- Traditional Hawaiian Blessing
- Tour of system: Rick Winter (UET)

11:20-1:00 Lunch Reception – Gateway Building

Lunch Speaker: Dr. Jud Virden, Pacific Northwest National Laboratory

TRACK 1: POLICY AND REGULATORY WORKSHOP

1:15- 1:30 Bus departs to NELHA Research campus

1:30 – 4:30 Workshop Organizers: Rebecca O'Neil, Jeremy Twitchell
All presenters are from Pacific Northwest National Laboratory.

1:30 – Welcome and Overview (Jeremy Twitchell)

1:40 – IEEE 1547-2018 DER Interconnection Standard Revision: Implications and Applications for Evolving Interconnection Needs (Charlie Vartanian)

2:40 – Hawaii's Rule 14 and IEEE 1547 (Charlie Vartanian)

3:10 – Break

3:20 – Planning for Resilience (Rebecca O'Neil and Jeremy Twitchell)

3:50 – Energy Resilience Measures Tool (Sarah Newman)

4:20 – Wrap up and Next Steps

TRACK 2: NELHA PROJECTS AND HYDROGEN

1:00 – 3:00 Presentations and Tour at Gateway Center

1:00 – 1:30 CSP SITE TOUR

- CSP-Desalination Project: John Webly (Trevis Systems) and Dr. Alex Leonard (NELHA)

1:30 – 3:00 H2 PRESENTATIONS

Session Chair: Mitch Ewan (Hawaii Natural Energy Institute)

- Hydrogen at Scale: Pete Devlin and Shuk Han Chun (US Department of Energy)
- Grid-scale Electrolyzers for Producing Hydrogen at Scale for Energy Storage, the Electrification of Transportation, and Supporting the Grid: Steve Szymanski (Nel Hydrogen)
- Hydrogen Energy Storage on Renewable Energy Microgrids and Grids: Stan Osserman (HTDC)
- Hydrogen and Batteries - The Perfect Marriage: Paul Ponthieux (Blue Planet Research)

3:00- 3:15 Bus departs to NELHA Research campus

3:15 – 3:30 Break

3:30 – 4:30 RESEARCH CAMPUS TOURS – Organizers: Greg Barbour/Laurence Sombardier (NELHA)

- Ecoult Lead Acid Battery demonstration in NELHA ESS test bed: John Wood (Ecoult)
- Ocean Thermal Energy Conversion (OTEC) Facility: Mike Eldred (Makai Ocean Engineering)
- NELHA H2 Facility: Mitch Ewan (HNEI)

4:30 -5:00 Bus departs from NELHA to Sheraton Kona at Keauhou Bay

5:00 – 6:00 Pau Hana Networking Event at Sheraton Kona at Keauhou Bay

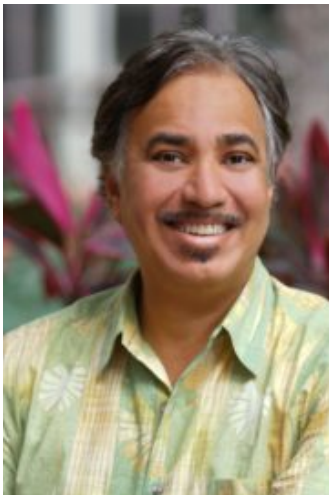
SPEAKER BIOS

Gregory Paul Barbour: Natural Energy Laboratory of Hawaii Authority (NELHA)
Gregory Barbour is the Executive Director of the Natural Energy Laboratory of Hawaii Authority (NELHA). Barbour has been involved in economic development in Hawaii for the past 35 years. Barbour was appointed as Executive Director of NELHA in 2011. At NELHA, he is responsible for the operation, maintenance, development and expansion of the Hawaii Ocean Science and Technology Park (HOST Park). The 870-acre HOST Park is home to 50 businesses involved in aquaculture, nutraceuticals, desalination, ocean science and advanced energy. These businesses account for over 600 jobs in Hawaii's economy and generate over $120 million in annual economic impact. NELHA has seen very strong growth during Barbour's tenure at NELHA and he received the President's "E" Award for Export Services in Washington D.C. in May 2016.

Daniel Borneo: Sandia National Laboratories
Daniel Borneo is an Engineering Program/Project Lead at Sandia National Laboratory (SNL) where he leads a projects team that is part of Sandia's Stationary Electrical Energy Storage Program. The main emphasis of Dan's work is to collaborate with utilities, industry partners, academia, and state Energy offices to develop Energy Storage (ES) projects and bring innovative electrical energy storage technologies to commercialization. He also specializes in the commissioning of ES systems and does work both Nationally and Internationally. Dan earned his bachelor's and master's degrees in Electrical Engineering from the University of New Mexico, focusing on power and controls. He holds a professional engineering license in the state of New Mexico.

Ray Byrne: Sandia National Laboratories

Ray Byrne is manager of the Electric Power System Research department at Sandia National Laboratories, where he has been employed since 1989. He holds a Ph.D. in electrical engineering from the University of New Mexico, an M.S. in electrical engineering from the University of Colorado, Boulder, and a B.S. in electrical engineering from the University of Virginia. He also completed an M.S. in financial mathematics at the University of Chicago. Previously, he was a distinguished member of the technical staff at Sandia. Awards include Time Magazine Invention of the Year in 2001 for a miniature mobile robot, the IEEE millennium medal, and the Prize Paper award at the 2016 IEEE Power and Energy Society general meeting. He was elevated to IEEE Fellow in 2017 for contributions to miniature robotics and grid integration of energy storage. He serves as team lead for the Equitable Regulatory Environment thrust area of the Sandia energy storage program. He has been active with the Albuquerque IEEE section since 1991, serving as chair in 1993, 2007-2008, and 2010-2011.



Kyle Datta: New Energy Partners

Kyle Datta, from New Energy Partners, recently retired from Ulupono Initiative where he had been a General Partner since it was founded in 2009. At Ulupono Initiative, Kyle was responsible for developing partnerships with stakeholders, policy makers and community organizations. He also oversaw the organization's systems-thinking approach to strategy development and transformation. Kyle received a master's degree in public and private management from the Yale School of Organization and Management, as well as a master's degree in environmental science in resource economics from the Yale School of Forestry and Environmental Studies. His previous positions include CEO of U.S. Biodiesel Group; managing director of research and consulting at the Rocky Mountain Institute; and a vice president at Booz Allen Hamilton, where he served as managing director of the Asia energy practice and the U.S. utility practice. He currently serves on the boards of directors for Blue Planet Foundation and the Johnson Ohana Charitable Foundation, and the steering committee of the Sustainable Agriculture and Food Systems Funders. In 2017, Kyle was named to the new Transformation Advisory Council of the Puerto Rico Energy Power Association, which will assist in the development of a long-term vision and transformation execution plan for the power system in Puerto Rico following the devastation of Hurricane Maria.

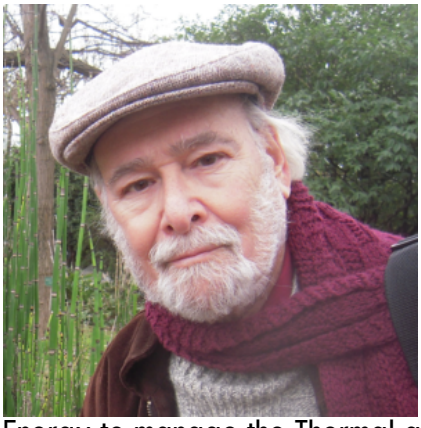
Matthieu Dubarry: Hawaii Natural Energy Institute (HNEI)
Matthieu Dubarry (PhD, Electrochemistry & Solid-State Science, University of Nantes), has over 15 years of experience in renewable energy, with an emphasis in the area of lithium ion batteries. Following his PhD on the synthesis and characterization of materials for lithium batteries, Dr. Dubarry joined the Hawaii Natural Energy Institute at the University of Hawaii at Mānoa as a post-doctoral fellow in 2005 to work on the analysis of the usage of a fleet of electric vehicles. He was later appointed a faculty position in 2010 with a focus on battery testing, modeling and simulation. While working for HNEI, Dr. Dubarry pioneered the use of new techniques for the analysis of the degradation of Li-ion cells and developed numerous software tools facilitating the prognosis of Li-ion battery degradation both at the single cell and the battery pack level. Current projects include the evaluation of grid scale Li-ion battery energy storage systems; the evaluation of the impact of vehicle-to-grid strategies on electric vehicle battery pack degradation; and the testing of emerging battery technologies for grid-connected and transportation applications.

Pete Delvin: DOE Energy Efficiency and Renewable Energy Fuel Cell Technologies Office (FCTO)
As Technology Development and Intergovernmental Coordination Manager for DOE FCTO, Pete works on hydrogen and fuel cell technology research and provides support to government agencies in their technology development and deployment activities. Pete is specifically responsible for managing DOE research projects for hydrogen infrastructure technologies. Prior to his current work, Pete was responsible for advanced technology development for fuel cell vehicles, hydrogen production R & D, and advanced combustion engine and fuels for a total of nineteen years at DOE. For his first eight years at DOE he worked on defense and environmental remediation missions. Pete spent the first 12 years of his career in private industry developing advanced propulsion and power generation systems from alternative fuel sources. Trained and educated as an industrial engineer, Pete received a Bachelor of Science from Virginia Polytechnic Institute in 1979.

Michael Eldred: **Makai Ocean Engineering**
Mr. Michael Eldred holds a B.S. in Mechanical Engineering from Iowa State University and has been employed by Makai for 10 years. He was responsible for the overall design of the OTEC Research facility located at NELHA. As part of the same effort, Mr. Eldred developed and presently manages an aluminum corrosion test lab at NELHA to support ongoing OTEC heat exchanger research. Mr. Eldred previously developed the mechanical system for the laser guide star adaptive optics instrument at the Subaru Telescope on Mauna Kea. He has a passion for the natural world and is motivated by a sustainable future.

Mitch Ewan: **Hawaii Natural Energy Institute (HNEI)**
Mr. Ewan is a graduate of the Royal Military College of Canada. After a successful naval career that included command of submarines and a destroyer, Mr. Ewan entered private industry where he has served in a variety of senior executive positions including senior management of publicly traded companies. His hydrogen and fuel cell career spans over 25 years. He led the team that designed and built the "Green Car", the world's first PEM fuel cell powered automobile. Mr. Ewan is the former Vice Chairman of the United States National Hydrogen Association and has served on the Business Advisory Board of the Florida Solar Energy Center. For the past 17 years Mr. Ewan has been on the staff of the University of Hawaii's Hawaii Natural Energy Institute ("HNEI") as the Hydrogen Systems Program Manager where he is helping to develop HNEI's hydrogen and fuel cell programs. Major projects currently underway include a hydrogen production and fueling station located at Marine Corps Base Hawaii, and a hydrogen production station and fueling station located at NELHA on the Island of Hawaii, and a hydrogen fueling station at Hawaii Volcanoes National Park.

Mike Gravely: California Energy Commission
Mike Gravely is the Team Leader for Energy Technology Systems Integration for the Energy Research and Development Division at the California Energy Commission. In this role, he oversees the full spectrum of research activities to improve the California Electric Grid including: implementing the California Smart Grid, assessing future energy storage needs for California, determining the benefit and value of microgrids and distributed energy resources, addressing the grid related issues associated with integrating higher concentrations of renewables, evaluating new advanced generation systems, expanding demand response solutions for California, and addressing natural gas infrastructure safety and reliability. His team is managing over $250 million in microgrid and energy storage research and demonstration projects. In his over 15 years at the California Energy Commission, he has held key roles as a scientist, supervisor, office manager, deputy division chief and senior engineer/team leader addressing the wide range of energy issues facing California and the Nation. Over his years with the Commission, he has worked on addressing the challenges facing the electric grid as California transitions to a new world of higher and higher concentration of renewables. He has also worked actively with the government offices of the Department of Energy, Department of Defense, Department of Transportation and other state energy offices such as New York, Massachusetts, Minnesota, and Washington to share information and develop partnerships. He has had the pleasure of overseeing hundreds of research grants to move energy technologies from the laboratory to the field and eventually to commercial success. Mike has over 30 years of engineering and integration experience in the energy, aerospace and communications fields. Prior to the Energy Commission, Mike served in executive positions in the Federal Government and private industry including managing research, testing and fielding of distributed generation and energy storage systems for the Department of Defense, addressing the business challenges of a startup energy storage company and overseeing a staffing and training company that specialized in serving the utility industry. Mike Gravely has a BSEE from the Virginia Military Institute and an MSEE from California State University at Sacramento.



Dr. Imre Gyuk, Director: U.S. Department of Energy
Dr. Guyuk is the Director of Energy Storage Research in the Office of Electricity at the U.S. Department of Energy. After taking a B.S. from Fordham University, Dr. Gyuk did graduate work at Brown University on Superconductivity. Having received a Ph.D. in Theoretical Particle Physics from Purdue University he became a Research Associate at Syracuse. As an Assistant Professor he taught Physics, Civil Engineering, and Environmental Architecture at the University of Wisconsin. Dr. Gyuk became an Associate Professor in the Department of Physics at Kuwait University where he became interested in issues of sustainability. Dr. Gyuk joined the Department of Energy to manage the Thermal and Physical Storage program. For the past two decades he has

directed the Electrical Energy Storage research program in the Office of Electricity, developing a wide portfolio of storage technologies for a broad spectrum of applications. He supervised the $185M ARRA stimulus funding for Grid Scale Energy Storage Demonstrations and is now partnering with the States on storage projects for grid resilience. His work has led to 11 R&D 100 awards and a Lifetime Achievement Award. He is internationally recognized as a leader in the energy storage field.

Jay Ignacio: Hawai'i Electric Light Company

Born and raised in Hilo, Jay Ignacio has been the president of Hawai'i Electric Light Company since March 2008. He holds a Bachelor of Science degree in electrical engineering from the University of Hawai'i at Mānoa and is registered as a Professional Engineer in the state of Hawai'i. He joined Hawai'i Electric Light in 1990 as a substation design engineer and was promoted to superintendent of Construction and Maintenance in 1994. In 1996, he became the manager of the Transmission and Distribution Department where he stayed for 12 years. Prior to working at Hawai'i Electric Light, Jay held positions as an outside plant engineer at GTE Hawaiian Telephone and a satellite test engineer at Lockheed Missiles and Space Company. He also was a small business entrepreneur. Jay is actively engaged in the Hawai'i Island community. He is a board member of the Hawai'I Island United Way, Hawai'i Island Economic Development Board, Hawai'i Island Adult Care, and Hilo Medical Center Foundation. He also is a member of the Waiākea Lions Club and has been an active supporter of the Marine Corps Toys for Tots program for more than 10 years. In 2012, he served as co-chair of the American Heart Association's Hilo Heart & Stroke Walk.

Alexander Leonard: Natural Energy Laboratory of Hawaii Authority (NELHA)

Alex Leonard serves as Chief Projects Officer at the Natural Energy Laboratory of Hawaii Authority (NELHA). He brings with him 20 years of experience in construction in West Hawaii – managing over $130Mn of finished projects ranging from State and County roadways, airport facilities, civil infrastructure, commercial developments and private residences. Despite this career history, Alex introduces himself as a scientist – he received a bachelor's degree in Natural Sciences at Trinity College Dublin, and earned a Doctorate in Marine Biology from Scripps Institution of Oceanography. He has published several per-reviewed scientific articles and shares 2 patents related to mass-scale production of micro-algae. At NELHA, Alex has found a niche in between his two career paths, relying on both for implementing capital improvements and assisting client businesses at the marine-resource-driven economic development technology park, where, over the last 4 years, he has managed the design, and implementation of new roadways, building remodels, a Hydrogen fueling test-bed, freshwater resource development and is NELHA's project lead on a US-DOE SUNSHOT grant to implement a first-of-its-kind solar-powered forward osmosis seawater desalination facility.

Jordan Little: Elemental Excelerator
As a Portfolio Manager, Jordan works directly with Elemental Excelerator portfolio companies to help them implement successful projects, find follow-on funders and customers, and scale in Hawaii and beyond. Prior to Elemental Excelerator, Jordan served as an Applications Engineer for SimpliPhi Power leading the efforts to deploy over 4 MWh of distributed behind-the-meter energy storage projects within the state of Hawaii. Jordan previously led the commercial division for Hawaii's number one EPC, helped facilitate an energy storage startup acquisition, and oversaw all projects under Georgia Power's Rooftop Solar program. Jordan graduated in Electrical Engineering from Auburn University and is a NABCEP Certified Installer and Certified Energy Manager.

Dr. Sarah Newman: Pacific Northwest National Lab (PNNL)
Dr. Newman is a data scientist in the Buildings and Connected Systems group at Pacific Northwest National Lab (PNNL). She works on applying data analysis and machine learning techniques to improve the energy efficiency and resiliency of buildings. Her projects include creating tools to design microgrids for resiliency, developing a web app to quantify the impacts of efficiency and generation projects on the electricity grid, deployment of machine learning techniques on real-time building systems data to improve efficiency and operations, and analysis of fault prevalence in commercial buildings. Before joining PNNL in 2018, Sarah received her PhD in Astrophysics from UC Berkeley in 2013, and then transitioned to energy research, creating software to size microgrids for remote off-grid and intermittent-grid locations, developing machine learning models to improve efficiency and comfort in multifamily buildings, and analyzing retrofit opportunities and impacts for NYC's building stock.

Rebecca O'Neil: Pacific Northwest National Laboratory (PNNL)
Ms. Rebecca O'Neil is a program manager for Pacific Northwest National Laboratory (PNNL), serving as the lab relationship manager for the US DOE EERE Renewable Energy portfolio and conducting research related to energy storage, electricity market design, sustainable hydropower and marine energy development. Currently Rebecca is on rotation to US DOE's Water Power Technologies Office to stand up a new research initiative on the grid value of hydropower resources. She joined PNNL in 2015 from the Oregon Department of Energy, where she represented the agency on energy storage, marine energy, the renewable portfolio standard, environmental commodities and a multi-million-dollar portfolio of federal grants ranging from agricultural efficiency to woodstove replacement. Before her state service, she managed a utility energy efficiency program and represented a coalition of river conservation

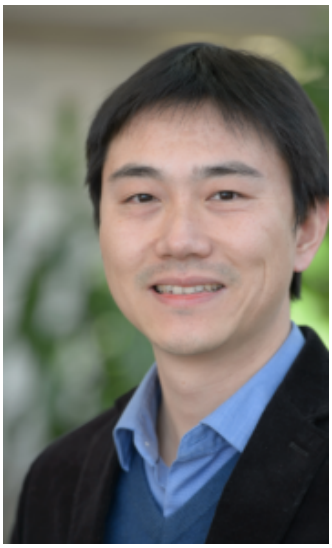
and recreation organizations in federal hydropower dam licensing. She serves on multiple organizational boards and advisory groups related to renewable energy.

Stan Osserman: High Technology Development Corporation
Stan Osserman (Brig. Gen. Retired), former commander of the Hawaii Air National Guard, retired after 35 years in the HIANG in 2014 and joined the Hawaii Center for Advanced Transportation Technologies (State of Hawaii Dept. of Business, Economic Development and Tourism). He has been involved extensively with Hawaii's energy community for almost a decade after being appointed by Governor Linda Lingle to coordinate implementation of the Hawaii Clean Energy Initiative with U.S. Pacific Command. The general leverages his extensive military experience in managing a $22M portfolio of renewable energy and alternative fuel transportation projects for the U.S. Air Force Research Lab at Joint Base Pearl Harbor-Hickam. Since taking the helm at HCATT he has worked closely with federal, state and county agencies, the military, academia, non-profit organizations and industry stakeholders on a wide variety of renewable energy and clean transportation initiatives. In 2015, the Hawaii State Legislature passed HB 1296 which designated General Osserman the "State Hydrogen Implementation Coordinator", signed into law by Governor Ige as Act 98. He hosts a weekly show ("Stan the Energy Man") on "Think Tech Hawaii" showcasing the state's efforts in clean energy. He remains closely engaged with the Hawaii Congressional Delegation and State Legislators, as well as other policy makers to help craft viable legislation related to clean transportation and energy infrastructure. The general is an avid surfer and deep-sea fisherman and is also a licensed cabinetmaker.

William Parks: U.S. Department of Energy
Mr. Parks has forty-one years of experience working on energy technology, policy and regulatory issues in the public and private sectors. A former member of the senior executive service, his experience includes 28 years at the U.S. Department of Energy in a variety of leadership and management roles. In 2018 He led the development of a long-term grid recovery plan for Puerto Rico. From 2014-2018 He was the Chair of the Department of Energy's Grid Modernization Initiative working in partnership with the national laboratories, states and industry. In 2008, Mr Parks was a principal developer of the Hawaii Clean Energy Initiative while seconded to the state of Hawaii. For DOE he led national technology development roadmaps in Electricity and Hydrogen. In 2018 he received the Secretary of Energy's Exceptional Career Achievement Award and in 2005 a life time award from industry for contributions to the development of distributed energy resources.

Vincent Paul Ponthieux: Blue Planet Research
Paul Ponthieux is the Director and CTO of Blue Planet Research, LLC located on the Big Island of Hawaii. He is also President of EMC2 Technologies, LLC who are the creators of EMCc, an Environment Monitoring and Control Center which runs the Mars Habitat. From an architectural and engineering background he has been involved with sustainability issues throughout the Pacific for the past 25 years. In 2010 he co-founded Blue Planet Research to promote distributed generation micro grids through the use of renewable energy technologies. BPR has been conducting real-world testing of renewable energy generation and storage technologies along with micro-grid design since its inception. BPR installed the first Vanadium Redox Flow Battery in the state, and were the first private facility to generate, store and utilize renewable solar hydrogen. Using advanced battery technologies and hydrogen they have demonstrated the feasibility of being fossil fuel free and energy independent with a hybrid system approach on their 32-acre microgrid testbed. BPR created the ultra-safe Blue Ion line of lithium ferrous phosphate energy storage systems ranging from residential to megawatt scale applications. BPR designed and built the NASA funded HISEAS Mars Habitat located on Mauna Loa which is powered by renewable energy with PV, Batteries and hydrogen fuel cells, and continues to serve as a test-bed for new technologies. BPR also assists with first responder training and has an ongoing program to educate the public about the safety and benefits of using hydrogen in applications from energy storage and transportation, to cooking. They continue to test and evaluate hydrogen technologies ranging from electrolyzers and fuel cells – to internal combustion engine conversions. BPR is currently involved in major projects on the Big Island incorporating energy, transportation, and agriculture to demonstrate the potential of a self-sufficient community. Projects like this will enable Hawaii and other Island Nations to achieve energy independence and security, and sustainable prosperity.
When not working on projects in the lab, he can be found flying his SR20 or earthbound goofing with his cats and bees.

Jennifer Potter: Hawaii Public Utilities Commission
Commissioner Jennifer Potter was appointed to the Public Utilities Commission by Governor Ige in March 2018 for a term to expire June 30, 2024. Jennifer was previously a faculty member at the Hawaii Natural Energy Institute (HNEI). Prior to joining HNEI, Jennifer was a Sr. Scientific Engineering Associate at Lawrence Berkeley National Laboratory. Preceding her stint in academia, Jennifer spent ten years in the electric utility industry in a variety of roles. Jennifer specializes in energy policy and legislation, electric pricing pilots, consumer behavior analytics, statistical modeling and forecasting, customer and generation energy profiling and analysis, and cost-benefit and financial analysis.



Feng Qiu: Argonne National Laboratory
Feng Qiu received his Ph.D. from the School of Industrial and Systems Engineering at the Georgia Institute of Technology in 2013. He is a principle computational scientist with the Energy Systems Division at Argonne National Laboratory, Argonne, IL, USA. His current research interests include optimization and machine learning in power system operations, cyber security, and power grid resilience.

Richard E. Rocheleau: Hawai'i Natural Energy Institute
Richard Rocheleau (PhD, Chemical Engineering, University of DE), is the Director of the Hawaii Natural Energy Institute and has over 40 years of experience in renewable energy, with an emphasis in the areas of photovoltaics, hydrogen technology and fuel cells, and integrated energy systems. He joined the faculty of the Hawai'i Natural Energy Institute at the University of Hawai'i at Manoa in 1988 and was appointed Director in 2000. As Director he has led the development of public-private partnerships for the development, testing, and integration of alternative energy and grid enabling technologies. Major initiatives include the Asia Pacific Research Initiative for Sustainable Energy Systems focused on testing and integration of advanced technology for microgrid applications, support of Navy's Wave Energy Test Site at Marine Corps Base Hawai'i, and smart grid demonstrations. HNEI also conducts energy assessments and analysis supporting Hawai'i Renewable Portfolio Standard goals.

Laurence Sombardier: Natural Energy Laboratory of Hawaii Authority (NELHA)
Laurence Sombardier is currently NELHA's Chief Business Development Officer. She is responsible for a variety of business development and administrative activities at NELHA. With a scientific background (MS Physical Oceanography from Scripps Institution of Oceanography, CA) and over 25 years of experience in academia, private industry and government, Laurence's responsibilities at NELHA have ranged from assisting clients at NELHA to leading the development and implementation of NELHA's industrial process control system for monitoring of the facilities pumps stations and electrical systems in 2014. She is has also been lead NELHA's energy storage system (ESS) test bed and microgrid initiatives at NELHA.

Erik D. Spoerke: Sandia National Laboratories
Erik D. Spoerke, Ph.D. (Materials Science and Engineering, Northwestern University, 2003) is currently a Principal Research and Development Materials Scientist in the Electronic, Optical, and Nano Materials Department at Sandia National Laboratories in Albuquerque, NM. Erik's widely published and patented research efforts span a diverse materials portfolio, with an emphasis on combining elements of chemistry, biology, and materials science to study and develop functional materials ranging from novel electrochemical materials to synthetic biological analogs and functional supramolecular thin films. Much of his current research passion focuses on ion-conducting materials aimed at the development of solid-state electrolytes, functional separators, environmental barriers, and even ionic filters for next generation ion-mediated technologies. In fact, the currently leads a passionate team of Sandia researchers toward the development of next generation low-temperature, molten sodium batteries intended for grid-scale energy storage. Continuing to employ a multidisciplinary strategy to materials development, he looks forward to meeting new challenges and implementing improvements across a wide range of energy-relevant technologies.

Terry Surles: California Institute for Energy & Environment (CIEE)

For more than 30 years, Terry Surles has been a leader in agencies and efforts focused on energy and the environment. Long a close collaborator with CIEE, he played a key role in evaluating policies and advancing research on carbon sequestration, as well as in furthering the use of information technology to transform grid operations.

Early in his career, he spent nearly 20 years in energy and environment work at Argonne National Laboratory, becoming general manager of environmental programs for the lab. He went on to a series of key roles, including deputy secretary for science and technology at the California Environmental Protection Agency, associate lab director for energy programs at Lawrence Livermore National Laboratory, program director for the Public Interest Energy Research (PIER) program and assistant director for science and technology at the California Energy Commission, and vice president of the Electric Power Research Institute.

Steve Szymanski: Nel Hydrogen

Steve is Director of Business Development at Nel Hydrogen and has more than 28 years of technical and business development experience in the fields of process chemicals and hydrogen system solutions. In this role, he is responsible for developing strategic relationships and project opportunities for Government and emerging market applications for PEM and alkaline electrolysis. In addition to managing Proton's Navy submarine business activity, he also has primary market responsibility for the hydrogen fueling and renewable energy storage sectors in North America. His previous experience includes several years as an engineer in the electrochemical technology group at United Technologies. In this position, he supported the development of PEM electrolyzer and fuel cell technology for space and defense applications. After pursuing a successful career path in process chemical technical sales and sales management, Steve joined Nel to contribute to the success of its electrolyzer commercialization and business development efforts. Steve serves on the Board of Directors and as Secretary of the California Hydrogen Business Council, as a Board Member and Secretary of the Ammonia Energy Association, and on the Board of Governors for the Connecticut Hydrogen Fuel Cell Coalition. He has a Bachelor of Science in Chemical Engineering from Cornell University and a Master of Science in Operations Management from Rensselaer Polytechnic Institute.

Jeremy Twitchell: Pacific Northwest National Laboratory
Jeremy Twitchell is an energy research analyst at the Pacific Northwest National Laboratory, where he leads the policy and regulatory research within the Department of Energy's Energy Storage Program and assists in distribution system planning research. In those roles, he is responsible for reaching out to states to provide technical assistance in analyzing energy storage and other developing energy resources and incorporating them into utility planning and procurement activities. Prior to joining PNNL, Jeremy spent five years at the Washington Utilities and Transportation Commission, where he was the staff lead for a policy statement on the treatment of energy storage in utility resource planning and a rulemaking on integrated resource planning, which included development of a distribution planning rule. Jeremy has a B.A. in Communications with an emphasis on Print Journalism from Brigham Young University (2004) and a M.P.S.A. (Energy, Environment, and Technology Policy Track) from Texas A&M University 2013.

Charlie Vartanian: Pacific Northwest National Laboratory (PNNL)
Charlie Vartanianis a Sr. Technical Advisor – Storage Reliability and Integration, within PNNL's Electrochemical Materials and Systems Group. His focus is the advancement of reliability and integration of grid connected energy storage systems.
Charlie has over 25 years of power industry experience deploying advanced grid technologies, performing electric system studies, and contributing to technical standards development. He has worked previously for Mitsubishi Electric, UET, DNV KEMA, A123 Systems, Enron, the California Energy Commission, and Southern California Edison. During his 15 years at Southern California Edison, Charlie's activities spanned traditional T&D planning through R&D. He is a currently Secretary of the IEEE 1547.9 Guide for DER Energy Storage Interconnection working group, and Co-Chair of the IEEE Energy Storage Task Force. Charlie received his BSEE from Cal Poly Pomona, and his MSEE from USC. Charlie is a licensed professional Electrical Engineer.

Richard Vetter: Kauai Island Utility Cooperative (KIUC)
Richard Vetter is the Port Allen Station Manager for Kauai Island Utility Cooperative (KIUC). In this role Richard oversees the daily dispatch of both fossil and renewable generation for KIUC as well as managing KIUC's largest generation facility. In addition to the daily grid responsibilities, Richard has had the opportunity to develop automated control strategies to facilitate KIUC's march towards 70% renewable integration. These strategies have allowed KIUC to minimize PV curtailment and utilize storage not only for peak shaving, but also for spinning reserve, frequency regulation, and economic dispatch.Richard received a Bachelor of Electrical Engineering from the Georgia Institute of Technology in 1990 and worked for fifteen years in electrical and process control engineering prior to joining KIUC.

Jud Virden: Pacific Northwest National Laboratory
Jud Virden is Associate Laboratory Director for the Energy and Environment Directorate at Pacific Northwest National Laboratory in Richland, Wash.
He leads 1,000 scientists, engineers, and staff who are delivering science and technology solutions for the nation's complex energy and environmental challenges—including modernizing the power grid, advancing energy storage technologies, increasing the energy efficiency of buildings and lighting, developing biofuels, and resolving complex issues in nuclear science and environmental management. With a focus on accelerating the deployment of technology to market, Jud helps shape regional, national and international public-private partnerships. His diverse industry and academic leadership includes the American Council for an Energy Efficient Economy, University of Washington College of Engineering, University of Michigan Energy Institute, and Georgia Tech Strategic Energy Institute. Jud is a member of the Washington State Academy of Sciences and serves on its board of directors. He is a Fellow of the American Association for the Advancement of Science. Jud earned his Ph.D. and B.S. in chemical engineering from the University of Washington. He joined PNNL in 1991.

John Webley, MSEE, DSc. (Hon): Trevi Systems Inc
John Webley, MSEE, DSc. (Hon) is the CEO of Trevi Systems Inc. With his two co-founders, John grew Advanced Fibre to 500 people and a market capitalization of $6 billion in 1999. Advanced Fibre was a telecommunications company enabling high speed services over copper. John left to found Turin Networks, an optical networking company, in 2000. After retiring from Turin and its subsequent sale to Dell for $700mm, he served as CEO of PAX Streamline (a Khosla Ventures funded bio-mimicry company) for two years. John then founded Innovative Labs, LLC to commercialize early stage technologies in air purification and dehumidification (still active). Together with Gary Carmignani, John founded Trevi Systems in 2010 to commercialize a promising Forward Osmosis water purification technology. Trevi Systems currently employs 30 people and has just commenced revenue shipments of its products. John's engineering background extends over 30 years in electrical, mechanical and chemical engineering. John received a B.S.E.E. and an M.S.E.E. from the University of Stellenbosch, South Africa in 1985 and an honorary Doctorate of Science from Sonoma State University. He served in the South African military and spent 14 months in Antarctica performing upper atmospheric physics experiments.

Rick Winter: UniEnergy Technologies (UET)
Rick Winter, BE(mech), is President and CEO of UET with 28 years' experience in innovating and commercializing storage technologies in the utility power infrastructure. He has been deeply involved in the emergence of the grid storage industry from its early stages, having been awarded the ESA Phil Symons award for his "instrumental role in the evolution of storage technologies in both the utility and battery manufacturing industries", and the NAATBatt Lifetime Achievement Award. During this time, he was a founding member of the Electricity Storage Association in 1991, serving twice as chairman and as a board member for 18 years. Mr. Winter's experience ranges from deploying microgrids in Australia's Torres Strait to managing the Storage Technologies Program at Pacific Gas & Electric Company, America's largest investor-owned utility. He has led product development at five advanced battery companies, in the process creating the world's first commercial flow battery product (the 100kW/100kWh PowerBlock™) and inventing the single loop flow battery in his garage (Pat#8039161). Mr. Winter holds 17 US patents with several pending and numerous abroad. With a career focus on commercializing smart grid storage in growth stage companies, Rick is now President and CEO at UniEnergy Technologies (UET), manufacturing the world's best battery for safe and flexible bulk stationary storage using the world's toughest chemistry. UET's product leverages a $500MM product development effort incorporating PNNL's breakthrough vanadium chemistry, extensive industrial engineering, GW-scale production, and a vertically integrated supply chain. Key attributes of UET's fully recyclable product include no capacity fade and 100% duty cycle flexibility over a 20-year life. UET is currently in production

ramp with several hundred MWh of projects deployed, ordered, or awarded, based out of a 60,000ft2 manufacturing facility in Seattle.

John Wood: Ecoult

John Wood is the Chief Executive Officer of Ecoult and a finisher of the Hawaii HURT 100 trial run. He joined the energy storage community in 2008 having previously launched technologies globally in Security, Identity, Payment Technology, and Telecommunications. John is now leading the Ecoult effort to commercialize the UltraBattery® storage solutions.

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