TECHNOLOGY TRANSFER AWARDS | 2018

AWARD SUMMARIES

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

2018 TECHNOLOGY TRANSFER AWARDS

These awards recognize the leaders and the innovators who have applied EPRI research to produce significant results.

The award winners have shown exceptional application of EPRI research and technology in solving a problem of size and significance, championing a technology both within their companies and across the industry, driving progress in the electricity sector, and providing meaningful benefits for its stakeholders and for society.

The EPRI Technology Transfer Awards spotlight the value of collaborative research to the electricity sector and its customers. EPRI recognizes and applauds the hard work, commitment, and leadership demonstrated by these award winners to help make electricity more reliable, efficient, affordable, safe, and environmentally responsible.

Advanced Flue Gas Measurement Methods - Field Evaluation

WEC Energy Group's *James Jensen*, *Kim Kramer*, and *Steven Stretchberry* received an award for improving measurement techniques during a first-of-its-kind field demonstration to accurately quantify selenium in various outlet streams. As a result of their work, coal-fired boiler owners and operators will be better prepared to tailor their pollution control strategies for selenium.

Alternative Water Supplies

American Electric Power's *Greg Carter* and *Tim Lohner* and **Salt River Project's** *Brian Harbin, Greg Kornrumph, Sharon Morris, Tom Murray* and *Robert Woods* supported the development of multiple case studies, showcasing alternative water supplies in use or under consideration by electric power facilities. These case studies serve as a resource for other companies looking to use alternative water sources to decrease pressure on freshwater sources for power generation.

Application of Transmission Hosting Capacity Tool

Salt River Project's *Philip Augustin, Eldin Dizdarevic, Zack Heim, Justin Lee* and *Su Su Win Thu* used EPRI's newly developed Transmission Hosting Capacity Tool to understand how the development of both residential and utility-scale solar photovoltaic resources will impact transmission system reliability. The work done by this team allowed Salt River Project to demonstrate the tool in a real-world environment, showing the benefits to system planning of this new automatic assessment capability.

Boiler Feed Water Dechlorination Using Hydro-Optic Ultraviolet Light Technology

Southern Company's *Aaron Nickle*s and *Tracy Underwood* helped support and lead a demonstration project to evaluate the use of Hydro-Optic™, an ultraviolet water treatment technology that can achieve chemical-free dichlorination. As a result of the project, the Southern Company host plant has maintained the integrity of its feed water for the boiler and steam cycle, ensuring the production and quality levels necessary for efficient operation.

## Case Study: Operational Flexibility of a Fossil Generation Unit

Endesa Generación's *Manuel Barro, José Manuel Corral* and *Enrique Echegoyen* received an award for using EPRI methods to improve operations at Endesa's As Pontes Power Station. The team was successfully able to improve and make the unit operate more efficiently by having a detailed knowledge of the systems, equipment, and components. By achieving a new minimum stable load in all four units, the plant gained a significant increase in operational flexibility, higher capacity factor, and higher revenues due to increased capacity availability. The improvements at the plant also reduced cycling across the rest of the Endesa generating fleet, which benefits the country's electric system as a whole and allows more integration of renewables.

Chemical Cleaning a Combined-Cycle Unit

South Carolina Electric & Gas's *George Eargle, Philipp Hudak, Ken McMillan* and *Linda Smoak* applied EPRI chemical cleaning guidelines at two heat recovery steam generator power plants. The guidelines contain detailed information on the proper techniques, planning, and modifications necessary to perform a successful cleaning. Use of the guidelines helped South Carolina Electric & Gas to increase removal of internal deposits, which will result in increased unit reliability and lower operations and maintenance costs.

Circuit Breaker Minimal Disassembly

Ameren's *James Bizoff* and *Randy Tiffin*, **Arizona Public Service's** *Steve Barbera*, **Centerpoint Energy's** *Derwin Auzenne, Qasim Aziz* and *Covington Lee Baty*, **Con Edison's** *Jozsef Szabo*, **Duke Energy's** *Rick Burnett*, **FirstEnergy's** *Shawn M. Gehring* and *Rich Johnson*, **Kansas City Power & Light's** *Travis Clark*, **PPL Corporation's** *TJ Barron* and *Meagan Kuchan*, **Salt River Project's** *Melissa Hoy, Oscar Montano* and *Nathan Tate* and **Southern Company's** *Neil Hutchins* applied an EPRI-developed novel technique that decreases the number of breaker misoperations by applying an EPRI-patented cleaner and commercial oil to lubricate the circuit breakers without disassembling them. The group has collaboratively applied this technique to 232 breakers.
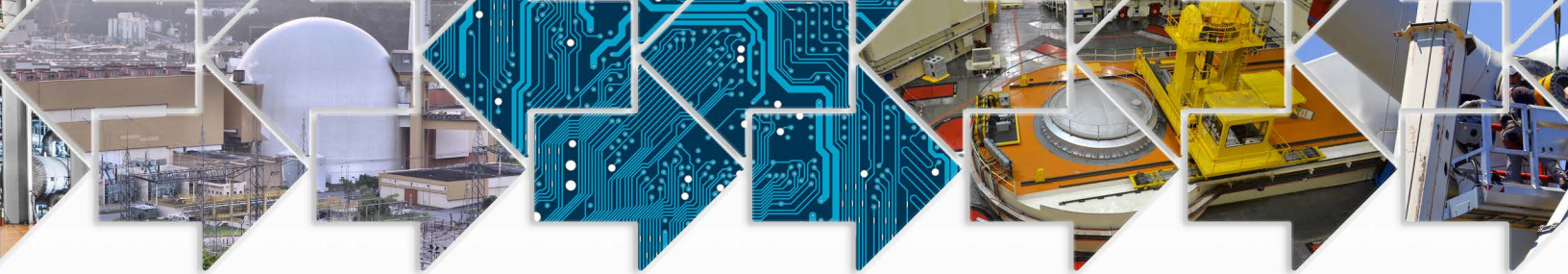
CNNP Uses EPRI Nuclear Water Chemistry Guidelines

Sanmen Nuclear Power Company's *Xudong Wu, Lei Jiang and Xianbo Meng* developed water chemistry control plans for its new Sanmen Nuclear Power Station units based on guidance in EPRI's Pressurized Water Reactor Primary and Secondary Water Chemistry Guidelines. These efforts will expand the available operating experience at new plants, improving future industry applications. China National Nuclear Corporation is the first utility in China to document adherence to the EPRI Water Chemistry Guidelines, including chemistry control guidance during hot functional testing, startup and operation. Sanmen Nuclear Power Company is a subsidiary of China National Nuclear Corporation.

Crack Growth and Arrest in High-Temperature Valve Bodies

Tennessee Valley Authority's *Herbert C. Hill, Michael Norman* and *John Keith Taylor* successfully transferred EPRI's research findings on steam turbine valve damage tolerance assessment to a turbine valve body. By using this research, the team was able to better manage a repair of cracking in a steam turbine valve body in one of its power plants. This avoided significant repair costs, a lengthy outage, and lost generation for an estimated $670,000 savings.

Customer Electric Vehicle & Infrastructure Pilots

American Electric Power's *Jeffrey Lehman*, **Exelon's** *Barbara Gonzalez, Delvone Nicholson-Meade* and *Rob Stewart*, **Kansas City Power & Light's** *Ed Hedges* and *Wendy Marine* and **Salt River Project's** *Kathy Knoop* designed, deployed, and piloted customer electric vehicle and charging infrastructure to benefit grid operations by applying methodologies and standards developed by EPRI.

Developing a Strategic Framework for CCP Management

Consumers Energy's *JR Register* and *Brad Runkel* developed a strategic framework for coal combustion residuals management. Consumers Energy and EPRI used industry data, prevailing industry norms, and successfully applied remedial approaches tailored to coal combustion residuals landfills and surface impoundments to craft a strategic road map to deliver to the company's project execution organization.

Digital Radiography Inspection for Turbine Pinned Finger Blade Attachments

Tennessee Valley Authority's *Hobson G. Best, John P. Boggess, Shane M. Lott, John E. Taylor* and *C. Steven West* demonstrated a technology that can refine the use of high-energy radiography to inspect for cracking of steam turbine blade attachment features, with specific focus on blade attachment designs that would normally require blade removal for conventional inspection. The team's field demonstration showed that continued research could enable elimination of the blade removal requirements for pinned root blades, significantly reducing inspection time, cost, and the risk of blade damage.

Dissolved Gas Analysis Monitor Evaluation Research

Duke Energy's *Marcolus Sullivan*, **New York Power Authority's** *Ramadan Elmoudi* and *Alan Ettlinger* and **Southern Company's** *Jason Autrey*, *Elizabeth Bray* and *Kuni Scissum* demonstrated leadership in guiding and supporting an evaluation of on-line dissolved gas analysis monitoring technologies that can help determine the health of transformers. These evaluation results have helped utilities develop functional specifications.

Dominion High Burnup Fuel Demo Collaboration with EPRI and National Labs Impacts Entire Industry

Dominion Energy's *Tom Brookmire, Jesse Colley, Eugene Combs, Scott Luchau, Terrance Perrone, Rich Ridder, David Tomlinson, Brian Vitiello, Bryan Williams* and *Mark A. Zimmerman* received an award for their leadership and efforts in completing research and receiving a "research project cask" license from the Nuclear Regulatory Commission to add high burnup fuel assembles to its dry storage facilities. Dominion collaborated with EPRI and national laboratories to reach a consensus on the fuel to load in the cask for the best research value. The research data was collected directly inside a loaded spent fuel cask, and results have been applied to directly support continued operation of high burnup fuel dry storage facilities.

Duke Implements EPRI High Energy-Line Piping Rupture Frequencies Recommendations and Avoids Billion-Dollar Plant Modification

Duke Energy's *Lee Kanipe, Jason Patterson* and *Alexander Rubbicco* helped support and lead research related to pipe rupture frequencies in nuclear Pressurized and Boiling Water Reactors. The research report led to lower failure rates and provided the nuclear industry with a technical basis for equipment failure mechanism risk, inspection planning and plant modification decisions.

EDF Uses EPRI Research on Concrete Crawlers to Deploy Technology for Cooling Tower Inspections

Électricité de France's (EDF) *Coline Brothier* received an award for analyzing and assessing the potential value of concrete crawlers that can climb and inspect concrete walls. Brothier used EPRI concrete crawler reports, and worked with EPRI staff to determine that EDF could use a crawler to obtain detailed information about cooling tower conditions in a safer and more efficient way without the use of scaffolds.

Effluent Limitations Guidelines Rule Development Support

Southern Company's *Donna Hill* received an *Advisor Impact Award* for leading various EPRI research projects aimed at informing the EPA Effluent Limitations Guidelines (ELG) rulemaking effort. Donna has completed cost evaluations, technology reviews and targeted technical responses to EPA memos and rulemakings. Through Donna's work of revising the ELG rule at Southern Company, the value could exceed $500,000 through less stringent bottom ash transport water and flue gas desulfurization water limits.

Electric Power Sustainability Maturity Model

Portland General Electric's (PGE) *Franco Albi, Elaine Hart, Caitlin Horsley, Sunny Radcliffe, Dave Robertson* and *Elysia Treanor* received an award for their demonstrated leadership for utilizing the recommendations of EPRI's Electric Power Sustainability Maturity Model (EPSMM). By utilizing the EPSMM, the PGE team created the Vision for a Clean Energy Future, updated PGE's company strategy to align with a low carbon future, implemented a CEO platform focused on clean energy and a low carbon future and helped PGE set a greenhouse gas emission reduction goal of 80% reduction in greenhouse gas emissions by 2050.

Energy Management Circuit Breaker

American Electric Power's *Eric Morris* and *Sean Welton*, **Centerpoint Energy's** *Greg Angst* and *David Dzierski*, **Dairyland Power Cooperative's** *Mitch Vanden Langenberg*, **Duke Energy's** *Robb Dussault* and *George Gurlaskie*, **Exelon's** *Subhash Chauhan, Aileen Gallagher, Sunil Jain, Ed Krembuszewski, Eric Stein* and *Scott Tjaden*, **Nebraska Public Power District's** *Ron Rose*, **Salt River Project's** *Max Burger* and *Rob Trask*, **Seattle City Light's** *Lucie Huang* and *John Owen*, **Southern California Edison's** *Neha Arora* and *Paul Delaney*, **Southern Company's** *Ron Robertson*, **Tennessee Valley Authority's** *Sam Delay* and *Andrew (Drew) Frye* and **Tri-State Generation and Transmission's** *Myles Jensen* and *Gary Myers* led a research demonstration project that installed more than 250 energy management circuit breakers (EMCB), a device that can allow utilities and customers to monitor and control electricity use, across 12 utilities, at over 60 sites and in 19 states. This demonstration project has vetted EMCB's for multiple use cases, identified installation challenges and helped to test the data collection system and associated tools.

Enhanced Tuning Guidelines for Extremely Low-NOx/CO Emitting Gas Turbines

Chevron's *Andrew Mueller* and *Rick H. Tomlinson* were recognized for developing in-house tuning procedures for its dry low-nitrogen oxide combustion systems by using EPRI's research on the science, equipment, and methods of gas turbine tuning. Chevron can now ensure the proper mix of fuel and air during the combustion process without relying on the original equipment manufacturer's limited availability of qualified tuners for this specialized hardware. The ability to make tuning adjustments in-house greatly reduces the response time when a unit approaches or exceeds its emissions limits and increases the availability of these units. Testing at the Kern River plant resulted in an increase in operational availability, avoided "re-tuning" events and saving over $600,000 annually in avoided costs.

Entergy Receives NRC Inspection Approval and is First Utility to Use EPRI SGMP Inspection Checklist

Entergy's *Robert Dolansky* received an award for his leadership in using an EPRI Pressurized Water Reactor Steam Generator Management Program (SGMP) report and checklist to obtain approval from the Nuclear Regulatory Commission (NRC) to do visual inspections on steam generator alloy 600 components. Dolansky's work allowed for tens of thousands of dollars in savings and made Entergy the first utility to go through this process and receive NRC approval.

EPRI DER Integration Toolkit

Ameren's *Clark Allen, John Hughes, Jim Huss, Alex Rojas, Hannah Schweiss* and *Tim Spyers* collaborated with EPRI on the design of the Dorsett Inverter Validation Facility. The research done at this facility can provide Ameren with evaluation strategies for system architecture and security, test tools, and methodologies to achieve scalable distributed energy resources integration.

EPRI WRTC Assists ČEZ Apply First-of-a-Kind Weld Overlay Repair at a VVER-440

ČEZ Group's *Stanislav Galatík, Ondřej Houfek, Lubomír Junek* and *Marek Palán* collaborated with EPRI's Welding and Repair Technology team to gain regulatory approval and apply a first-of-a-kind weld overlay at a VVER-440 reactor. The overlay was applied at the Dukovany-2 Nuclear Power Station, after a multi-organization collaborative effort to build and examine a full-size mockup of the overlay, develop the weld residual stress model, design and build a unique weld head, and create a Czech Republic Code Case.

Since applying the first EPRI-assisted weld overlay, ČEZ has installed three more at Dukovany, avoiding costly repairs.

EPRI, MVM Paks Nuclear Power Plant and ÚJV Collaborate to Integrate VVER Features into Modular Accident Analysis Program

MVM Paks Nuclear Power Plant's *Mihály Czibula* and *Lajos Tarczal* and **ÚJV Řež's** *Petr Vokac* received an award for their support and leadership in a collaborative project with EPRI to develop a version of code in EPRI's Modular Accident Analysis Program for VVER, a type of nuclear reactor. The team helped identify key VVER specific design features, provided key thermal-hydraulic and accident sequences for evaluation of performance and provided plant data and detailed thermal-hydraulic data for benchmarking and validation of the code. ÚJV Řež and MVM Paks Nuclear Power Plant validated, verified and provided extensive testing to fully vet the program. After final implementation, the companies achieved cost savings, improved run times and minimized training requirements.

The new VVER Modular Accident Analysis Program provides greater modeling fidelity and accuracy in severe accident scenarios. The program also enables development of simulators to allow VVER operators to train for mitigation of severe accident scenarios (like the Fukushima-Daiichi event), ultimately improving the safety of VVER plants. The results and benefits of this project are now applicable to any nuclear utility that operates VVER-440s and/or VVER-1000s and it is extendable to newer designs, like the VVER-1200.

EPRI, OPG, and Bruce Power Develop Standard Task Evaluations; More Than 3,400 Staff Complete Training and STEs

Bruce Power's *Steve Cotton* and *Jodie McNabb* and **Ontario Power Generation's (OPG)** *Alex Crichton* collaborated with EPRI to develop and implement a Standard Task Evaluation (STE) to support portability of staff between the companies and improve the quality of training. More than 2,000 supplemental staff attended training for the STE. The team helped review, develop and incorporate EPRI STE tests into an enhanced electrical training program. Since implementing, more than 200 supplemental electricians completed the training and successfully completed 1,450 EPRI STE online tests which improved their knowledge and addressed any identified gaps before they were released into plants.

Exelon and EPRI Collaboration Leads to Successful Implementation of IVVI Skip Outage Strategy

Exelon's *Christopher Hebel, Christian McKean* and *Randal Schmidt* led a project that levelized nuclear plant inspections over three to six plant outages. The team developed a new strategy for its In-Vessel Visual Inspections (IVVI) and worked with EPRI's Boiling Water Reactor (BWR) Vessel and Internals Project to investigate and implement the new strategy. Their work resulted in nearly $1 million in savings for Exelon. All nuclear plant outages are unique, but this work proved this type of strategy for IVVI can be implemented and if used throughout the industry's BWR fleet, the cost savings could be significant.

Exelon Implements Value-Based Maintenance Program Using EPRI's QLIKVIEW and CAT Tools

Exelon's *Ray Newmaster* and *Rich Weisband* led a project that now provides Exelon with more cost-effective nuclear plant maintenance strategies by using EPRI tools to evaluate historical cost data. Exelon is the first utility to develop and share these maintenance strategies with the energy industry and to date, the project has resulted in projected savings of about $40 million.

⊕ ENERGY & ENVIRONMENT ❄ GENERATION ⚛ NUCLEAR ⚡ POWER DELIVERY & UTILIZATION

☗ Functional Requirements for DERMS

Los Angeles Department of Water and Power's *Scott Moon* and *Haik Movsesian* and **Pacific Gas & Electric's (PG&E)** *Bennett Chabot, Nichole Efron* and *Arvind Simhadri* leveraged multiple EPRI resources when scoping and designing their distributed energy resource management system for a demonstration project. This demonstration project will help PG&E provide a flexible and reliable platform that can support customers in managing and optimizing the use of distributed energy resources, like rooftop solar, energy storage, and electric vehicle charging.

☗ Grid Modernization R&D Roadmap Development

Centerpoint Energy's *Edwin Briggs, Kevin Ding* and *Melvin Schoech*, **FirstEnergy's** *Tom Pryatel* and *Lisa Rouse* and **Sarawak Energy Berhad's** *Chen Shiun* worked with EPRI researchers to create a roadmap to better understand what a modernized grid will look like and how it will be created. The grid modernization roadmap lays out the current and future state of the grid, identifies an implementation plan for achieving the future state, and combines external drivers, such as integrating increasing numbers of distributed energy resources, improving grid resiliency, and understanding the continued evolution of technologies, such as communications, sensors and power electronics.

☷ Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites

Ameren's *William Kutosky* applied the 2018 Guidelines for Development of Alternative Source Demonstration at Coal Combustion Residual Sites. Because of Kutosky's vision and leadership in this area, his application of this technical report offered cost saving information that was pivotal in preparing a credible alternative source demonstration that allowed Ameren to avoid the perception that units were leaking.

❄ Improved In-Field Detection of Underperforming Solar Photovoltaic Modules

Southern Company's *Will Hobbs* applied a novel inspection technique that can improve in-field detection of underperforming solar photovoltaic (PV) modules. Hobbs and an EPRI team developed a new electroluminescence imaging system which allows crews to use portable cameras at PV plant sites to capture images of modules conditions. This new system can help aid in detecting cell cracks and other damage or defects and avoids the need to remove modules for lab testing, reducing costs and minimizing additional module damage from handling and transportation.

❄ Improved Pipe Integrity Assessments Using LIDAR

ATCO Power's *Ashton Halabut, Derek Hansen, Derek Rasmussen* and *Norene Robinson* used EPRI research to explore the use of laser-based Light Imaging Detection and Ranging (LIDAR) technology to observe and monitor movement of high-energy piping. Eight LIDAR sensors and a wireless mesh network system were installed at the Sheerness Generating Station to monitor piping displacement on the main steam line. As a result, the Sheerness Generating Station was able to modify plant startups, shutdowns, and ramping procedures and train plant operators, resulting in significant reductions in pipe movement and risk of structural integrity concerns.

☗ Incipient Failure Detection Algorithm for Gas Turbine Combustion Systems

ENMAX Energy Corporation's *Bradley Pankiw* and *Dallas West* installed an EPRI-developed advanced health algorithm in the gas turbine combustion systems on the Calgary Energy Centre network. The team supplied the algorithm with real-time data which now provides the Centre with a health score to proactively detect potential failures. By implementing the algorithm, ENMAX now has the ability to receive first alerts to sensor, instrumentation, and/or combustion hardware issues. This early detection enabled the plant to inspect the combustion system and manage the repair on a planned basis, avoiding a costly unplanned outage and lost generation.

☷ Initial Analysis of Mitigation and Eco-Asset Appraisal Opportunities

American Electric Power's *Tim Lohner, Jon Magalski, John Van Hassel* and *Mike Williams* used the 2018 Initial Analysis of Mitigation and Eco-Asset Appraisal Opportunities, and successfully applied this analysis to estimate the potential value in its ReCreation Land Property and to make decisions regarding the divestment of the property for future environmental mitigations and eco-asset transactions.

Innovative Environmental Monitoring Technology

Minnesota Power's *Douglas Braff, Jim Erickson, Bobbi Greenwalt, Cherese Johnson, Amanda Kluge, Teresa Larson, Kyle Lyytinen, Eric Sutherland, Dirk Ver Steeg II and Melissa Weglarz* and **Tennessee Valley Authority's** *Leo Scott Britt, Gary Elkins, Ronda Hooper, Nick McClung* and *Sidney Whitehead* received an award for their leadership and support that helped advance monitoring and testing for innovative environmental monitoring technology. The advances in this research and technology has the potential to help transform how the electric power industry uses sensors to measure environmental applications, including air, soil and water.

Integrated Life Management of 9% Cr Creep Strength-Enhanced Ferritic Steels

American Electric Power's *Michael Crichton, Nicholas Fisher, Daniel Helwig, Craig Henry* and *David L. Wehner* and **LG&E and KU Energy's** *Hamit Afiyet, Nathan Huster* and *Matt Sanders* are being recognized for their collaboration and efforts in applying EPRI's integrated approach to life management of the 9% chromium steels extensively installed in state-of-the-art supercritical coal-fired power plants. The approach proactively identifies damage-susceptible locations in each plant system and enables targeted inspections that minimize operations and maintenance costs while maximizing the overall safety and reliability of the plants. The work done by the team provides important examples for other utilities in future adaptations to their fleets.

JAPC Leverages EPRI's BWRVIP New Examination Capabilities for J-Groove Welds

The Japan Atomic Power Company's (JAPC) *Yuuichi Arita, Katsuhiko Hayasaka* and *Hiroyuki Sunaoshi* received an award for their support and leadership in leveraging recent operating experiences and new examination capabilities developed by EPRI's Boiling Water Reactor (BWR) Vessel and Internals Project. The team's new examination capabilities provide JAPC and regulators with evidence that J-groove welds for N12 nozzles in the Tokai Power Station have not suffered degradation and allow the plant to safely and reliable generate electricity. To maximize the use of the plant assets, the team also took the necessary steps to assure EPRI's technology, initially developed for use within the U.S. BWR fleet, could be deployed within the Japanese BWR fleet.

KHNP Saves Millions from EPRI Technical Support and Research to Enhance Cable Plant Management Program

Korea Hydro & Nuclear Power's (KHNP) *Sangyoun Byun* and *Sungmin Park* received an award for improving KHNP's test methodology and understanding of assessment criteria of cable degradation through the use of EPRI's Aging Management Program Guidance for Medium-Voltage Cable Systems.

Mitigation of Underground Structure Events

Con Edison's *Josephine Aromando, Stanley Lewis, Colleen Murach* and *Mark Riddle*, **DTE Energy's** *Najwa Abouhassan, Abdalla Sadoon* and *Mark Wrobel*, **Duke Energy's** *Mark Danna, Bob Dollar* and *Jerry Ivery*, **Eversource Energy's** *William Ritchie and Michael Sweeney*, **Pacific Gas & Electric's** *Randy Royval* and *Lisseth Villareal* and **Southern Company's** *James Dorsten* and *Lee Welch* were part of a pilot project that tested and simulated manhole explosions. The results from these tests allowed these utilities to proactively address the potential effects of explosive manhole events for increased public safety and significant improvements in operations

NextEra Leverages BWRVIP Program Advanced Phased Array Ultrasonic Examination Technique at St. Lucie PWR Plant

NextEra Energy's *Rudy Gil, Donna Slivon* and *Maribel Valdez* received an award for their support and leadership in deploying an advanced ultrasonic examination technique at the St. Lucie Nuclear Power Plant during its spring 2018 refueling outage. The technique used research from EPRI's Boiling Water Reactor (BWR) Vessel and Internals Project to collect a fleet-wide, one-time sampling of core shrouds, a cylinder inside the reactor pressure vessel and surrounding the reactor core, for the presence of "off-axis" flaws. Deploying the advanced technique allowed the team to perform a volumetric examination of the core barrel, obtaining length and depth measurements needed for flaw evaluations. This eliminated the need for NextEra to otherwise develop an examination technique in-situ and assured safe and continued operation of the plant with minimal impact to the outage duration.

Post-MATS Emissions and Health Risk Assessments

Duke Energy's *Michael Geers* and **Southern Company's** *Justin Walters* provided leadership and support in the design and execution of two EPRI studies that evaluated health risks and the need for further regulation from air toxic emissions and found that the health risks are below the Environmental Protection Agency's risk thresholds. With the timely completion of these studies, this research can provide value and benefit the public and energy industry.

Salt River Project Field Area Network and First Utility to Procure/Apply 700MHz A-Block

Salt River Project's (SRP) *Jeff Neuenfeldt* and *Brian Zimmerman* led and supported a project that enabled SRP to be the first U.S. utility to procure licensing for the 700MHz A-block and enable a Field Area Network, which will allow universal private point-to-multipoint wireless network across a service territory. Through Neuenfeldt and Zimmerman's efforts, SRP can support capable, reliable and secure telecommunications with grid assets as well as further enable advanced automation to address integration of renewables, enable new customer programs and ensure reliable electric service.

Smart Inverter Requirements and Application

Exelon's *Amrita Acharya-Menon, Esa (Aleksi) Paaso, Oai Tran, Vincent Westfallen* and *Liuxi (Calvin) Zhang*, **National Grid's** *Samer Arafa, Babak Enayati, Jim Perkinson* and *Justin Woodard*, **Pacific Gas & Electric's** *Mike McCarty, Fedor Petrenko* and *Olivia Trinko* and **Tokyo Electric Power Company's** *Shuichi Ashidate, Takeshi Fukuoka, Naoki Hosaka, Hiroaki Kitajima, Ryo Maeda , Nobuyuki Nagayama* and *Makoto Takahashi* helped lead a project that explored smart inverter requirements and capabilities to improve grid reliability by mitigating the impact of renewable resources on secondary and primary system voltage. Voltage regulation functions, like power factor and volt-var, are being used to demonstrate how smart inverters can help to minimize distributed energy resources impacts on the distribution circuit voltage.

Storage Analysis and Analysis Tools

AVANGRID's *Megan Pomeroy*, **Exelon's** *Richard Garbark, Brian Green, Luke Hasemeier* and *Brian Majerowicz*, **Hydro One Network's** *Jigar Patel*, **Los Angeles Department of Water and Power's** *Matt Hone* and **Xcel Energy's** *Beth Chacon* were part of a first-of-its kind collaborative project that initiated, developed, and tested a planning framework for the valuation and impact of energy storage for transmission and distributions systems. The project included behind the meter as well as in front of the meter storage technology assessments. It helped identify the technical gaps in the industry and provide tools and frameworks that could be replicated across different utility service territories.

Strategic Insights on Mexico's Electricity Future with the MX-REGEN Model

Comisión Federal De Electricidad's (CFE) *Pablo Alvarez, Eduardo Arriola, Omar Chavero, Jorge Cruz, Mario Diaz* and *Abraham Molina* received an award for their leadership and support to develop EPRI's Mexico Regional Economy, Greenhouse Gas, and Energy (MX-REGEN) model. The MX-REGEN model allows CFE to better understand Mexico's future electricity system to allow for Mexico's Clean Energy Policy of 50% renewable generation by 2050.

Systematic Approach to Reducing Minimum Load

Duke Energy's *Chuck Jones* applied strategies from an EPRI report along with web-based tools to operate Duke Energy's coal-fired units more flexibly while maintaining efficiency and equipment reliability. Until recently, these units typically operated full time during peak demand at 100% power, but as the power demand began changing, Jones helped this plant operate more dynamically with faster ramp rates and lower power levels when turndown was required.

☢ TEPCO Applies NMAC Guidance, Trainings and Incorporates PMBD into Maintenance Practices

Tokyo Electric Power Company's (TEPCO) *Satoru Anada* and *Satoshi Hashimoto* received an award for applying and incorporating the EPRI Preventive Maintenance Basis Database (PMBD) into their maintenance optimization process and evaluating potential changes in their maintenance practices. Through this collaborative effort with EPRI's Nuclear Maintenance Applications Center, TEPCO now has a more thorough understanding of PMBD and is writing PMBD use procedures for the engineering organization to reduce the volume of maintenance performed at the plants.

🌐 TVA Sequoyah Nuclear Plant Case Study Demonstrating Technical Approaches to Satisfy New 316(b) Regulatory Requirements

Tennessee Valley Authority's (TVA) *Dennis Baxter* and *Terence (Terry) Cheek* led and supported a case study using EPRI developed resources at the TVA Sequoyah Nuclear Plant that demonstrated technical approaches to satisfy EPA's development of a Rule to implement Section 316(b) of the Clean Water Act that provides protection for aquatic organism at Cooling Water Intake Structures. With Cheek and Baxter's vision and guidance, compliance efforts and insights were gained to support the compliance and the case study was one of the first applications of EPRI research that implements the Clean Water Act to support § 316(b) permitting in the nation.

🌐 Use of Drones for Thermal Plume Data Collection

Alliant Energy's *Bill Skalitzky* completed a demonstration project that used aerial drones to measure water temperatures of cooling water thermal plumes in support of regulatory permit renewals. The tests from this project resulted in a proof-of-concept in using drones to replace boat surveys in gathering data.

🌐 Wastewater Treatment Technology-Membrane Bioreactor System Coupled with an Advanced Biological Metals Removal System

DTE Energy's *Dennis Leonard*, who is now a retired DTE employee, **Tennessee Valley Authority's** *Anne Aiken, Steve Barnes* and *Lindy Johnson* and **WEC Energy Group's** *Elizabeth Hellman* received an award for their leadership and support of a pilot-scale evaluation of a wastewater treatment technology. The evaluation results were critical to informing a request to the EPA to reconsider the Effluent Limitations Guidelines rule.

🌐 Watershed Activities and Economic Considerations

American Electric Power's *Greg Carter* and *Tim Lohner*, **Salt River Project's** *Elvy Barton, Charlie Ester, Bruce Hallin* and *Sharon Morris* and **Tennessee Valley Authority's** *Anne Aiken, Tyler Baker, Steve Barnes, John Tracy Baxter* and *Shannon O'Quinn* applied research using case studies in the EPRI report Watershed Activities and Economic Considerations. With their vision and leadership, a software tool was developed to help visualize, quantify and monetize the results of watershed improvement efforts.

🌐 ENERGY & ENVIRONMENT   ❄ GENERATION   ☢ NUCLEAR   ⚛ POWER DELIVERY & UTILIZATION