EPRI

TECHNOLOGY INNOVATION

INSIGHTS AND INNOVATIONS

FIRST QUARTER, 2024

EPRI Technology Innovation (TI) *delivers strategic insights, serves as a global innovation hub, and drives applied innovation to address strategic R&D priorities.* ***Insights and Innovations*** *highlights recent TI products and webcasts to help transfer new knowledge and technology, practical guidance, and other results. TI-sponsored interest groups, interactive media, and webcasts are featured on p. 2. In the remainder of this newsletter, the icons below identify TI resources by functional role, strategic priority, and crosscutting area. All published TI resources are available for no-cost download by EPRI members after logging in to EPRI.com. Many resources are publicly available for free using the links provided.**

*Resources marked with $ are publicly available for purchase. See p. 11.

EPRI's TechRadar: Scanning & Planning for Disruptive Technology

TechRadar v1.0, available at epritechradar.epri.com, is an interactive digital tool for helping energy companies and other stakeholders in scanning, tracking, evaluating, and planning for emerging technologies identified by subject-matter experts as having disruptive potential.

For a curated set of technologies, the *TechRadar* features qualitative and quantitative assessments of commercial readiness, market disruption, and economic and environmental impacts, as well as of development, deployment, and integration challenges. The *TechRadar* navigation manual (3002029524) provides guidance for evaluating technology entries, understanding scoring metrics, and making comparisons to gain insights, inform stakeholders, and make better decisions across a variety of business strategy and technology planning applications.

Highlighted Resources: Q1 2024

Incubatenergy Labs 2023 Challenge Final Report (3002028798)
Summaries for 16 pilot demonstrations of startup-based innovations

The Innovation Journey 2023 (3002028664)
Roles of strategy, culture, and structure in improving innovation

Perspectives on Transforming Utility Business Models: White Papers (3002028820, 3002028915, 3002028959, 3002029536)
Key issues, strategies, and approaches for business transformation

Spotlight–Are Electric Vehicles Expensive to Maintain? (3002028788)
Insights on factors affecting EV repair and maintenance costs

Post-Pandemic Management of Power Grid Supply Chains: Procurement Constraints and Risk Mitigation (3002028839)
Solutions and strategies for managing supply chain risks

EPRI Insights: Making Energy Services More Affordable (3002028708)
Affordability metrics, measures and strategies, and opportunities

INTERACTIVE RESOURCES

***EPRI Insights*: Energy Affordability (February 2024)**: Insights on affordability metrics, growing investments in equity and affordability, and solutions in areas such as retail rates, efficiency programs, and community-based virtual power plants.

***EPRI Insights*: Long-Duration Energy Storage (LDES) Demonstrations (March 2024)**: Insights on how LDES technologies function and on cost/performance, maturity, and value in enablng renewables, reliability, and resilience.

Energy Supply Reference Card (April 2024): Tool for comparing economic, operational, and environmental attributes of current and emerging fossil, nuclear, biomass, hydro, solar, wind, and geothermal technologies, as well as for exploring tradeoffs.

WEBCAST HIGHLIGHTS

UBM Working Group Webcast Series

Sponsors of the UBM Working Group, which launched in 2020, include Smart Electric Power Alliance (SEPA), Gridwise Alliance, Association of European Distribution System Operators (E.DSO), Grid Forward, and EPRI. On **February 27**, this year's series kicks off with EPRI's **Mark McGranaghan** introducing the 2024 work plan. EPRI's **Neil Hughes** and **Eric Brown** then discuss the white paper series, "Perspectives on Transforming Utility Business Models," which highlights the importance of horizon scanning and then turns to UBM planning for innovation, decarbonization, and customer needs. The session concludes with EPRI's **Britta Gross** detailing the EVs2Scale™2030 Initiative as a lead-in to a discussion of UBMs supporting electric transportation involving **Greggory Kresge** of World Resources Institute and representatives from Sacramento Municipal Utility District, PG&E, and ESB Networks.

TI Tech Talk: Low Carbon Resources Initiative (LCRI) (March 4)

Neil Kern, program manager for **LCRI**, reviews progress to date and next steps in assessing and demonstrating low-carbon energy carriers, fuels, and systems and in analyzing production, delivery, and use pathways toward economy-wide decarbonization. Deep-dive insights are provided on electrolysis technologies and possible effects of incentives on deployment costs and market uptake. LCRI demonstration projects include commercial-scale production of electrolytic hydrogen, bulk underground storage, pipeline validation and fuel blending tests, fuel pyrolysis, low-carbon fuel use for energy supply and transport, and distributed carbon capture and transport.

TI Tech Talk: Energy Supply - Supporting the Energy Transition (March 27)

Timothy Leljedal and **Brandon Delis** from EPRI's Generation Sector discuss the energy industry's ongoing decarbonization, existing and emerging supply technologies, and potential pathways toward net-zero emissions by 2050 and identify critical gaps in transitioning the current supply mix to the needed future portfolio of low-, no-, and net-negative-carbon options. In addition, EPRI's Generation Transitions program is introduced, a 3-year effort to help fill these gaps by developing resources and tools to inform and engage industry stakeholders, de-risk decision-making processes, and support the implementation of chosen pathways and solutions.

GLOBAL INNOVATION HUB: OPPORTUNITIES FOR ENGAGEMENT

TI supports interest groups convened for collaborative inquiry and information exchange. Typical webcasts feature domain experts, industry practitioners, and facilitated dialogues. The Fusion Forum is open for public participation; other groups are open to EPRI members (at no added cost) and invited guests. Click on links below for more info. Members can access recorded webcasts after logging in to EPRI.com.

24/7 Carbon-free Energy Interest Group

- Explores the development and implementation of load-matched carbon-free energy products for utility customers.

Digital Transformation (DX) Interest Group

- Addresses the strategic and tactical aspects of enterprise-wide DX, supporting beneficial technology implementations.

Fusion Forum

- Explores the current state of fusion energy technology and R&D and builds community among developers and end users.

Geothermal Energy Interest Group

- Explores currently available technologies, future options, and their potential contributions to decarbonization goals.

Offshore Wind Interest Group

- Explores offshore wind technologies and project development, interconnection, and grid integration issues and experiences.

Quantum Interest Group

- Connects energy practitioners and quantum experts to build community and explore and advance energy applications.

Utility Business Model (UBM) Working Group

- Examines innovations for new utility business constructs and for integrating advanced technology into utility processes.

Value of Resilience Interest Group

- Explores tools for assessing customer-focused utility resilience needs and informing societal choices and investment decisions.

CLEAN ENERGY

Long-Duration Energy Storage: Emerging Pilot Project Summaries (3002029144)

Q1 2024 This 15-page brief introduces long-duration energy storage (LDES) technologies and summarizes recent and ongoing pilot projects to provide insights on how they function and could be applied to help ensure reliability and resilience as variable renewable energy utilization expands. Electrochemical, mechanical, thermal, and chemical storage processes being developed by CMBlu, Energy Dome, Storworks Power, and RedoxBlox, respectively, are reviewed based on process descriptions, reported performance and cost metrics, and status and potential as demonstrated through field work.

Incubatenergy Labs (IEL) 2023 Pilot – PowerUp: Demonstration of Battery Insight® Analytics Program on NYPA Asset (3002028659)

Q1 2024 This 4-page brief summarizes pilot demonstration of PowerUp's cloud-based Battery Insight® platform for analyzing operational data from a lithium ion battery energy storage system owned by New York Power Authority and for assessing real-time performance, state of charge, and state of health at a much higher level of granularity than present. The platform supports safety alerting, early detection of thermal runaway risks, improved measurement accuracy, and the ability to diagnose underperformance and the potential for accelerated degradation.

Spotlight — Space-Based Solar Power: Frequently Asked Questions (3002029069)

Q1 2024 A 2023 fact sheet (3002027739) explored the question, "Can space-based solar power plants beaming energy down to the Earth's surface make meaningful contributions to global decarbonization by 2050?" This 4-page brief, developed after extensive consultation with experts in the field, provides a deeper dive into the technology's feasibility, addressing key issues, challenges, and complexities that will need to be addressed in the decades ahead.

Spotlight – Superhot Rock Geothermal (3002028592)

Q1 2024 This 2-page brief explores superhot rock geothermal energy technology as a potentially disruptive concept for baseload renewable power generation. It leverages existing and advanced technologies from the oil and gas extraction and power generation industries to exploit geologic formations deep underground, where extreme temperatures could result in 5- to 10-fold increases in generating capacity per well relative to current geothermal plants.

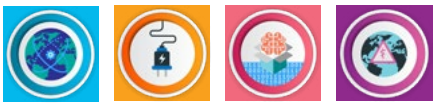
Summary of the EPRI 24/7 Carbon Free Energy Data Repository (3002028452)

Q1 2024 This 8-page tech brief describes the updating and expansion of EPRI's repository of data and information related to 24/7 carbon-free energy (24/7 CFE), which is the concept of matching hourly carbon-free electricity generation to hourly electricity consumption. Originally developed in early 2021, the 24/7 CFE repository houses documents on announced 24/7 CFE deals and transactions, existing and proposed US utility tariffs, US and state regulations, utility commission filings and decisions, and international 24/7 CFE engagement, as further discussed in this brief. **$**

ELECTRIFICATION & END USE

IEL2023 Pilot – Feedback Solutions: Real-Time Occupant Count-Based Demand Control Ventilation to Reduce HVAC-Related Energy Consumption by Up to 40% (3002028654)

Q1 2024 This 4-page brief describes pilot demonstration of the efficacy of an occupant-based ventilation control strategy for reducing energy consumption for heating, ventilation, and cooling (HVAC) relative to current state-of-the-art demand control ventilation (DCV) based on sensing of CO_2 spikes. The Feedback Solutions platform, tested across 12 lecture halls served by host Tucson Electric Power, employs networked sensors to maintain people counts and monitor other variables in individual rooms and provide DCV signals to existing ventilation systems to maintain indoor air quality and decrease electricity consumption for fan operation, as well as energy use for heating and cooling.

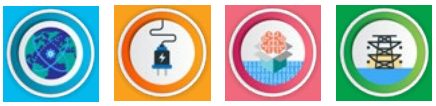


IEL2023 Pilot – MicroEra Power: Demonstration of THERMAplus Tunable Thermal Energy Storage (3002028656)

Q1 2024 This 4-page brief characterizes the ability of MicroEra Power's THERMAplus technology to store heat and cooling energy for thermal discharge at temperatures optimized for efficient space conditioning in commercial buildings and in campus/district systems. In this pilot hosted by Con Edison, NYPA, and EPRI, two separate lab-scale systems were connected to heating and cooling units to demonstrate tunable phase-change material charging, long-duration energy storage, and thermal energy release. Commercial THERMAplus systems charged using air- or ground-source heat pumps promise dynamic response to seasonal requirements for delivery of both stored heat in winter and stored cooling in summer.

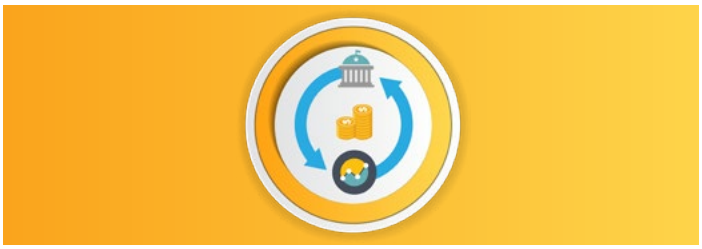
IEL2023 Pilot – Rhythmos: EV and Utility Network Management Platform Demonstration (3002028660)

Q1 2024 The Rhythmos platform applies advanced metering infrastructure (AMI) data to identify EVs that frequently charge within a utility's network and analyze charging behavior and impacts on feeder loading, with the goal of improving the effectiveness of managed charging programs, as well as supporting distribution planning and operations. This 4-page brief describes the pilot testing program developed by hosts TVA, EPRI, and Knoxville Utilities Board to assess the platform's capability to disaggregate EV loads from overall building loads, generate day-ahead charging forecasts for individual EVs, and deliver value in various utility use cases.



Spotlight – Are Electric Vehicles Expensive to Maintain? Taking a Closer Look at the Cost of EV Maintenance (3002028788)

Q1 2024 While recent news coverage has noted high costs for EV repairs, EPRI's analysis identifies contributing factors unrelated to the type of powertrain. This 2-page brief distinguishes repair costs from routine maintenance costs and highlights intricate relationships among vehicle design and manufacturer, the availability of repair components, and overall ownership expenses for conventional internal combustion engine vehicles and EVs. Also noted is the importance of comparing similar vehicle categories, as many EVs are more akin to luxury models.



MARKET TRANSFORMATION

The Innovation Journey 2023 (3002028664)

Q1 2024 This 18-page white paper provides a high-level summary of insights gained by EPRI's Global Innovation Hub (GIH) team over the period from 2021-23, leveraging collective results from innovation effectiveness assessments performed with 14 utilities

and reflecting interviews with more than 250 utility leaders, survey responses from more than 2500 utility employees, and numerous document reviews and conversations with innovators and executives. The summary is organized around an updated model of the "innovation journey" encompassing strategy, culture, and structure and includes case studies demonstrating the importance of success in each of these domains.

Global Innovation Effectiveness (GIE) Project 2023 Annual Report (3002028662)

Q1 2024 In 2023, the GIE project engaged a total of 14 returning and new utility members in virtual meetings and one in-person meeting to spotlight best practices and promote collaboration across the cohort. In addition, three members participated in deep-dive collaborations to boost their innovation metrics and capabilities. Topics discussed in this 48-page report include the critical role of strategic clarity in building innovation maturity, emerging evidence for the step-by-step nature of innovation capacity-building, the persistent difficulty of translating innovation into outcomes, and key divergences between top- and bottom-performing organizations. $

Organizational Change Management – Best Practices for Utility Innovation (3002028663)

Q1 2024 In 2023, EPRI's GIH team led a deep-dive GIE project on organizational change management (OCM) involving desk research, roundtable discussions with GIE members, and focused conversations with individual utilities. This 25-page report summarizes insights into the top industry challenges around OCM and presents a consensus-based framework for effective organizational change, four case studies highlighting best-practice examples, and an appendix of selected readings and key insights from the academic and business literature. $

Innovation Management Software Catalog (3002028665)

Q1 2024 Innovation management software helps organizations scout the future business environment, identify emerging opportunities and potential threats, and make informed decisions. Developed through the GIE project, this 58-slide presentation details the benefits of innovation management software, and it provides guidance for evaluating vendor capabilities. In addition, the features, strengths, and weaknesses of the tools and services available from leading vendors are described.

Public Innovation Funds Benchmarking Study (3002028791)

Q1 2024 This 70-slide presentation, prepared by EPRI on behalf of the Independent Electricity System Operator of Ontario, characterizes the current state of publicly administered funds across the global electric sector based on collection of publicly available information, as well as direct, targeted outreach to innovation fund administrators requesting data that could not be found online. Benchmarking findings address funding criteria, priority areas and technologies, funding levels and recipients, and resources for administration, among other factors.

Perspectives on Transforming Utility Business Models, Paper 1: Horizon Scanning and Forecasting (3002028820)

Q1 2024 Horizon scanning involves systematic examination of potential threats and opportunities, including known issues as well as novel and unexpected ones, to detect early signs of potentially important developments. Horizon scanning and forecasting are particularly important when an existing business model is facing significant disruption, as seen presently in the energy sector. This 13-page white paper summarizes approaches for maintaining the visibility of future sources of potential business disruption and applying relevant foresight to the overall business planning process.

Perspectives on Transforming Utility Business Models, Paper 2: Business Models for Innovation (3002028915)

Q1 2024 Innovation in the energy sector, particularly the electricity industry, spans technologies, market mechanisms, commercial instruments, regulatory frameworks, and overall ownership and governance structures. An important precursor to successful business innovation by individual organizations is the development of strategies that reflect their culture, ambition for

growth, and appetite for risk in a rapidly evolving energy landscape. This 12-page white paper describes how the various elements of a successful innovation model can be brought together to enable utilities to continue to meet their business objectives in a transformed—and transforming—environment.

Perspectives on Transforming Utility Business Models, Paper 3: Business Models for Net Zero (3002028959)

Q1 2024 Utilities are expected to play central roles in leading the transformation of the energy sector and in making a net-zero future happen, creating needs to change their business models to respond to emerging challenges and opportunities. This 15-page white paper reviews existing electric sector business models and identifies the attributes of future business models based on new energy sources and technologies and for delivering new services, managing novel uncertainties and risks, and meeting other new challenges and needs, including supporting customers on their decarbonization journeys.

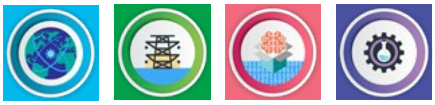
Perspectives on Transforming Utility Business Models: Paper 4—Business Models that Align with Customer and Policy Drivers, Customer-Driven Models (3002029536)

Q1 2024 The electric utility business model has traditionally been based on providing energy to customers through integrated generation, transmission, and distribution, reflecting an implicit assumption that customer needs can be met simply by providing reliable service at reasonable cost. This 16-page white paper explores the development of business models aligned with what customers actually require, which is the ability to perform energy-dependent functions that meet their everyday living, work, leisure, medical, and transport needs.

RELIABILITY, RESILIENCE & FLEXIBILITY

IEL2023 Pilot – CRWN.ai: Characterizing Partial Discharge Activity Detect with Acoustic Sensors (3002028795)

Q1 2024 This 4-page brief describes pilot testing of Condition Recognition Wireless Network (CRWN) sensors and AI-based analytics for continuous, real-time ultrasonic monitoring of transmission line structures to inform health assessment and evaluate failure risk. During the pilot, 10 IoT sensing devices were deployed by host FortisBC to transmit ultrasonic audio from structures to which they were attached, supporting remote analysis to detect and classify environmental anomalies and hardware defects. CRWN.ai seeks to identify assets with different levels of electrical discharge activity, including ephemeral events, to help prioritize condition-based maintenance.



IEL2023 Pilot – Gridware: Identifying the Severity of Distribution Faults using Mechanical Sensors (3002028642)

Q1 2024 This 4-page brief describes field demonstration of the Gridware system for detecting distribution line faults and events such as line breaks, vegetation contact, and outages to prioritize response, improve reliability and resilience, and enhance safety and service restoration. During the pilot with host Con Edison, 100 distributed Gridscope units equipped with piezoelectric sensors and acoustic transducers were affixed to power poles for continuous monitoring and event reporting and alerting. The system detected 11 distinct events—categorizing two as emergent needing response and a third as non-emergent requiring follow-up—with no false positives or negatives.

IEL2023 Pilot– New Sun Road: Demonstration of Local Microgrid Energy Management Controls (3002028658)

Q1 2024 New Sun Road's energy management platform pairs hardware and software to enable remote monitoring, control, and performance optimization of microgrids and embedded DERs based on machine learning and a hybridized local and cloud-based architecture. The pilot demonstration described in this 4-page brief validated the platform's microgrid controls using EPRI's Simulation Platform for Integration of Distributed Energy Resources (SPIDER) testbed. Testing demonstrated abilities to adjust storage system operation within a microgrid to provide grid support and maximize revenue generation while adhering to common interoperability standards and communication protocols.

IEL2023 Pilot – Solid State Power: Solid State Power Hub (SSPH) Laboratory Demonstration (3002028661)

Q1 2024 Solid State Power's SSPH is a solid-state AC-to-AC power electronics converter designed to replace conventional AC transformers used in distribution systems. Its novel topology retains size and weight advantages relative to conventional transformers but reduces complexity relative to previous solid-state designs. This 4-page brief describes an initial series of laboratory tests performed by EPRI on the SSPH to validate and better understand its capabilities as a distribution transformer. Testing addressed regulation of secondary voltage with changes on the primary voltage, transformer efficiency at different loading conditions, performance under transient and continuous operation, reactive power, and operating temperature.

Distribution Strategic Capacity Planning: Framework and Methods for Long-Term Planning (3002028327)

Q1 2024 Electrification-influenced changes in load characteristics require adjustments to distribution system planning criteria and procedures, design standards, customer programs, resource plans, and more. Distribution strategic capacity planning (DSCP) involves analysis of what the system may need to look like decades into the future—and what's needed to get there. This 10-page tech brief proposes a DSCP framework for high-level assessment of the potential long-term impacts of electrification on a system's capacity, discusses methods and data requirements for evaluating long-term capacity constraints and substation-level investment needs, and identifies areas for further research. $

Demand Flexibility for Grid Reliability and Resilience: Guidance on Validation for Successful Operation (3002027334)

Q1 2024 This 13-page tech brief examines challenges and opportunities associated with validating the operation of demand flexibility technologies at the distribution system scale. It highlights needs for validation of all interconnected systems and technologies and for development of robust demonstration platforms, test plans, and verification methodologies. Detailed scenario evaluation, realistic input and output conditions, comprehensive system evaluation, and scalable and modular testing are identified as critical areas for laboratory-based testing, and guidance is provided on developing test plans. Progress in these areas is expected to accelerate deployment of demand flexibility solutions and pave the way for successful applications and future advances. $

Post-Pandemic Management of High Voltage Power Grid Supply Chain: Procurement Constraints and Strategies to Reduce Risk (3002028839)

Q1 2024 In 2020, the COVID-19 pandemic led to widespread supply chain disruptions due to shortages in labor, raw materials, and components and delays in transportation and manufacturing. Some disruptions persist today, and economists predict continued challenges for the foreseeable future, necessitating a "great supply chain reset." This 16-page white paper highlights ongoing and future supply chain challenges facing the power grid, which is expected to undergo large-scale expansion in the next 10 to 20 years. A variety of potential mitigation strategies for electricity providers are discussed, with focus on the need for new and enduring solutions.

ARTIFICIAL INTELLIGENCE & DATA ANALYTICS

IEL2023 Pilot – InnovationForce: InnovationForce Performance & Collaboration Measurement (3002028655)

Q1 2024 This 4-page brief introduces the software-as-a-service workforce automation tool developed by InnovationForce to help utilities evaluate, simplify, standardize, accelerate, and scale innovation programs and processes for decarbonization. Pilot applications on innovation use cases from hosts Portland General Electric and Central Hudson provided granular details on key performance indicators—including time and resources spent during innovation process stages—to help in improving efficiency, making better decisions, and allocating resources toward technologies and projects that can reduce emissions and deliver shareholder value faster.

IEL2023 Pilot – Locusview: Digital As-Builting with Industry Standard Barcodes to Automate the Process (3002028796)

Q1 2024 This 4-page brief discusses pilot testing of digital construction management technology for automating collection and flow of attribute data for grid assets into digital record systems. Field crews from host Alabama Power used Locusview's mobile app with barcode scanning and GPS to create high-quality as-built records including component attribute data such as manufacturer, serial number, ratings, dimensions, and materials, as well as deployment location. Automated entry and validation streamlined work order completion, and digital records were captured for use in asset management and GIS applications such as performance analytics and manufacturer recall execution.

Application of ML/AI to Enhance ADMS Control Algorithms (3002027752)

Q1 2024 This 11-page tech update explores the feasibility of machine learning (ML) and AI for managing both competing DER objectives and traditional volt-var optimization objectives to enable complex controls needed for advanced distribution management systems (ADMS). The study involved use of OpenDSS to generate training and test cases for an EPRI-defined feeder and comparison of ending control positions for a generic volt-var optimization algorithm and an ML algorithm known as LAPART. Over 90% of capacitor bank positions and 85% of regulator tap positions were in agreement across 5000 test cases, demonstrating feasibility. $

Data Management Maturity Model (3002028913)

Q1 2024 This 25-page white paper introduces a data management maturity model (DMMM), developed in a hands-on application of EPRI's common maturity model framework, to assist organizations in identifying their data management strengths and weaknesses and in providing customized roadmaps for improvement. While the common framework addresses capabilities across five dimensions (Process, People & Organization, Information, Technology, and Assets & Resources), the DMMM focuses on assessing and improving maturity in the sub-areas of data strategy, data architecture, data governance, data operations, data quality, and business intelligence. The paper outlines a structured matrix for evaluation, considering factors such as current state, adoption, and impact on business strategy. $

Data Set Synthesis to Enable Advanced Studies and Applications Work: A Framework for Generating Synthetic Time-Series Data (3002024648)

Q1 2024 Time-series data can support a range of grid operations and planning and other applications but are not always available or of adequate quantity or quality. For example, studies evaluating the impacts of increasing solar generation on operating reserves may require corresponding time series of hourly and day-ahead forecasts of both load and generation. This 23-page tech update presents a framework for generating synthetic time-series data—not a one-to-one reproduction of "real" data but a statistically valid substitute. The framework is demonstrated for day-ahead forecast

data, including both quantitative and qualitative comparisons between the synthetic and real data. $

machine learning proved highly accurate for identifying individual species. $

ENVIRONMENT, HEALTH & SAFETY

A Circular Economy Roadmap for Solar Photovoltaics (3002029481)

Q1 2024 This invited submission to *Solar Energy* presents a roadmap to facilitate and accelerate the transition to a circular economy (CE) for the PV industry. It highlights opportunities for manufacturers, PV plant owners/operators, and end-of-life service providers to adopt circular strategies and identifies short-term R&D needs for helping advance reuse and recycling, reduce raw material needs, mitigate supply chain social and governance challenges, and improve the practical feasibility of CE options that are not yet economical.

Developing Metrics to Assess the Quality of Native Habitat Using Remotely Sensed Data (3002026831)

Q1 2024 This 132-slide report evaluates remote sensing and other technologies for tracking the establishment success of native seed mixes under varying right-of-way management practices. Satellite, unmanned aircraft system (UAS), and ground surveys were conducted at three study sites in central Illinois over the 2023 growing season. Management practices were identifiable and mappable with high-resolution UAS and satellite imagery, and elevation and land cover maps made using machine learning algorithms were suitable for quantifying important indicators of habitat quality. Ground survey and UAS sensor observations were in agreement, and ultra-high-resolution imagery coupled with

EQUITY & SOCIAL JUSTICE

EPRI Insights: Making Energy Services More Affordable (3002028708)

Q1 2024 The transition to digitized and decarbonized networks will have complex implications for energy affordability, even with increased investment in helping households afford the needed electricity, heat, space conditioning, and transportation services. This 13-page *EPRI Insights* reviews affordability metrics and key policy measures and programs for improving affordability, including utility assistance programs, retail rate structures, energy efficiency incentives, and emerging DER-based options, including virtual power plants. In addition, specific challenges to and opportunities for making energy services more affordable are identified.

INFORMATION, COMMUNICATIONS & CYBER SECURITY

Nuclear Distributed Ledger Technology: Examination of Nuclear Signatures and Material Control of Nuclear Fuel (3002026577)

Q1 2024 Building on a previous study (3002025731) exploring opportunities for using distributed ledger technology (DLT) in the

nuclear power industry, this 70-page report evaluates specific nuclear fuel traceability applications. The analysis focuses on integrating fuel signatures with DLT and smart contracts, which are computer programs that automatically execute the terms of agreement, for improving supply chain operations and ensuring security. The most viable use cases are fuel origin and movement tracking, inventory management, and quality assurance. Future integration with existing material control and accountability programs and DLT-based national nuclear forensic libraries offers opportunities to enhance the security, efficiency, and transparency of nuclear fuel management. $

Digital Unique Identification of Specialized Equipment (3002026788)

Q1 2024 Energy companies manage and monitor a wide range of assets, from traditional physical infrastructure to new technologies such as distributed sensors, IoT devices, databases, robots, drones, and transient cyber assets. To support effective and comprehensive digital transformation across expanding networks, abilities to manage data communications from specific assets and securely identify individual data points are essential. This 16-page white paper examines pathways toward an enterprise-wide unique identification system for managing network objects and resources such as data processes, systems, and workflows. A hierarchical asset registry is proposed for accommodating existing identifiers while providing a comprehensive registry container to track, provision, and catalog assets across all domains. $

Considerations for Renewables Remote Operations Center IT/OT Design and Support (3002028870)

Q1 2024 Remote operations centers (ROC) for centralized monitoring and management of renewable energy assets require appropriate information technology/operational technology (IT/OT) infrastructure. This infographic describes eight considerations for developing this infrastructure identified through the Renewables IT Strategic Leadership (RITSL) Forum, which includes technical practitioners with roles and responsibilities relating to renewable generation, IT/OT, and cyber security. The key considerations include backup and redundancy, troubleshooting and maintenance, monitoring and reporting, regulatory compliance, scalability and growth plan, bandwidth requirements, security, and standardization. $

IT/OT Considerations for Renewables Data Analytics (3002028872)

Q1 2024 This infographic summarizes common IT/OT practices for supporting data analytics at renewable generation sites, which tend to have unique data storage and processing needs and capabilities. Data analytics can help improve operational efficiency, reduce cost, ensure reliability, and integrate renewables into existing energy infrastructure. The IT/OT practices summarized cover data sources, data storage and processing, maintenance of data quality, and data governance and protection. The infographic also identifies key criteria for data analytics tools. $

MATERIALS, MANUFACTURING & NONDESTRUCTIVE EVALUATION

IEL2023 Pilot – Square Robot: Benefits of Submersible Robotic Tank Inspections for Power Plants (3002028797)

Q1 2024 This 4-page brief reviews pilot demonstration of Square Robot's submersible, autonomous robot for increasing the safety, efficiency, and cost-effectiveness of inspecting above-ground fuel and water storage tanks at two fossil power plant sites selected by host Tennessee Valley Authority. On-board navigation, phased-array ultrasonic testing, and other capabilities allowed for comprehensive evaluation of tank components and conditions to support extended inspection intervals and timely maintenance interventions where necessary. By allowing inspections while tanks are operational or available for use, the technology also can avoid the need for costly and time-consuming out-of-service inspections.

ACCESSING INFORMATION RESOURCES

Individual TI resources featured in this publication can be accessed by clicking the links provided. Resources are available for download at no additional cost to EPRI members by logging in at www.epri.com.

Free and publicly available resources can be downloaded by other individuals and entities through EPRI's website. Resources available for purchase by non-members can be ordered by calling the EPRI Order Center at 800.313.3774 (Option 2) or 650.855.2121. You may also send an email to orders@epri.com.

Visit the TI homepage for the latest resources: www.epri.com/research/sectors/technology

Visit EPRI's Thought Leadership page for the latest strategic insights and interactive resources: thoughtleadership.epri.com

For additional insights and updates, listen to EPRI Current podcasts, sign up for TI's monthly newsletter, join the EPRI Direct mailing list, and visit the online EPRI Journal.

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (Option 4) or askepri@epri.com.

About EPRI

Founded in 1972, EPRI is the world's preeminent independent, non-profit energy research and development organization, with offices around the world. EPRI's trusted experts collaborate with more than 450 companies in 45 countries, driving innovation to ensure the public has clean, safe, reliable, affordable, and equitable access to electricity across the globe. Together, we are shaping the future of energy.

3002030426 May 2024

EPRI
3420 Hillview Avenue, Palo Alto, California 94304-1338 USA • 650.855.2121 • www.epri.com
800.313.3774 • askepri@epri.com

© 2024 Electric Power Research Institute (EPRI), Inc. All rights reserved. Electric Power Research Institute, EPRI, and TOGETHER...SHAPING THE FUTURE OF ENERGY are registered marks of the Electric Power Research Institute, Inc. in the U.S. and worldwide.