EPRI | ELECTRIC POWER RESEARCH INSTITUTE

2021 RESEARCH PORTFOLIO

YEARS AHEAD | DECADES AHEAD

RESEARCH OFFERINGS TO SHAPE THE FUTURE OF ELECTRICITY

EPRI offers research opportunities to advance the electric industry's technologies, systems, operations, environmental performance, and workforce as they are today and drives innovation for the years ahead. Through technology scouting, innovation, analysis, and collaboration, EPRI helps meet major requirements and enables energy developments that enhance efficiency, accelerate decarbonization, and deliver societal benefits around the world.

SHAPE YOUR FUTURE

Participation in EPRI research, development, and demonstration (RD&D) programs provides opportunities to:

- Identify and solve critical and emerging industry issues.
- Stay in the forefront of technology innovation.
- Gain access to a comprehensive, timely RD&D portfolio.
- Collaborate and network with industry peers through advisory councils and committees.
- Implement technology through the support of our researchers and technical advisors.
- Reduce future investment risks.
- Inform policies with objective, science-based findings and facts.

RESEARCH INDEXED BY ASSETS

EPRI provides thought leadership, industry expertise, and collaborative insights to help the electricity sector identify issues, technology gaps, and broader needs that can be addressed through effective research and development programs for the benefit of society.

NUCLEAR GENERATION

Nuclear power is an important component of a diverse energy portfolio, providing the public with continued access to clean, safe, reliable, and affordable electricity. With a broad focus on new and existing nuclear plants, EPRI's R&D identifies technologies with the potential to improve the economics of nuclear operations and deliver greater efficiency, reliability, and predictability—while effectively managing risk and safety.

- 41 Nuclear Power
- 55 Ecosystem Risk and Resiliency
- 62 Occupational Health and Safety
- 178 Resource Planning for Electric Power Systems
- 195 Endangered and Protected Species
- 198 Strategic Sustainability Science
- 201 Energy, Environmental, and Climate Policy Analysis
- 219 Steam Turbines and Auxiliary Systems
- 220 Generators and Auxiliary Systems
- 237 Cooling System Technologies & Equipment
- 238 Water Treatment Technologies
- 239 Aquatic Resource Protection

FOSSIL GENERATION: COAL

Coal is projected to continue to fuel a significant portion of global power generation for decades. EPRI's R&D is helping to provide the fossil generating fleets with safe, reliable, economic, and environmentally responsible technologies that operate more efficiently and flexibly while remaining integral to the evolving modern power system.

- 55 Ecosystem Risk and Resiliency
- 62 Occupational Health and Safety
- 178 Resource Planning for Electric Power Systems
- 195 Endangered and Protected Species
- 198 Strategic Sustainability Science
- 201 Energy, Environmental, and Climate Policy Analysis
- 209 Cyber Security for Generation Assets
- 214 Boiler Life and Availability Improvement
- 215 Power Plant Piping
- 219 Steam Turbines and Auxiliary Systems
- 220 Generators and Auxiliary Systems
- 221 Bulk Energy Storage
- 222 Advanced Generation & Carbon Capture and Storage
- 223 Heat Rate and Flexibility: Generation Fleet Optimization
- 224 Integrated Asset Management
- 225 Plant Management Essentials
- 226 Boiler and Turbine Steam and Cycle Chemistry
- 227 Process Control and Automation
- 228 Monitoring and Advanced Data Analytics
- 229 Materials and Repair
- 230 Combustion and Fuel Quality Impacts
- 231 Emission Controls for Fossil Plants
- 232 SCR Performance Issues
- 233 Continuous Emissions Monitoring and Measurements
- 234 Atmospheric Models and Ambient Measurements
- 235 Air Quality Assessments and Multimedia Characterization
- 236 Air Quality and Health
- 237 Cooling System Technologies & Equipment
- 238 Water Treatment Technologies
- 239 Aquatic Resource Protection
- 240 Water Quality and Effluent Guidelines
- 241 Coal Combustion Products Management
- 242 CCP Land and Groundwater Management

FOSSIL GENERATION: NATURAL GAS

Growing supplies, falling prices, greater operating flexibility, and lower emissions are driving the power generation industry to increased use of natural gas. With that, new issues become critical for plant performance, reliability, and cost. EPRI's R&D supports the effective management of these complex, widely used, and increasingly important assets.

- 55 Ecosystem Risk and Resiliency
- 62 Occupational Health and Safety
- 178 Resource Planning for Electric Power Systems
- 195 Endangered and Protected Species
- 198 Strategic Sustainability Science
- 201 Energy, Environmental, and Climate Policy Analysis
- 209 Cyber Security for Generation Assets
- 215 Power Plant Piping
- 216 Gas Turbine Life Cycle Management
- 217 Gas Turbine Advanced Components and Technologies
- 218 Heat Recovery Steam Generators
- 219 Steam Turbines and Auxiliary Systems
- 220 Generators and Auxiliary Systems
- 221 Bulk Energy Storage
- 222 Advanced Generation & Carbon Capture and Storage
- 223 Heat Rate and Flexibility: Generation Fleet Optimization
- 224 Integrated Asset Management
- 225 Plant Management Essentials
- 226 Boiler and Turbine Steam and Cycle Chemistry
- 227 Process Control and Automation
- 228 Monitoring and Advanced Data Analytics
- 229 Materials and Repair
- 231 Emission Controls for Fossil Plants
- 232 SCR Performance Issues
- 233 Continuous Emissions Monitoring and Measurements
- 234 Atmospheric Models and Ambient Measurements
- 235 Air Quality Assessments and Multimedia Characterization
- 236 Air Quality and Health
- 237 Cooling System Technologies & Equipment
- 238 Water Treatment Technologies
- 239 Aquatic Resource Protection
- 240 Water Quality and Effluent Guidelines

RENEWABLES, DISTRIBUTED ENERGY, AND END USE

Renewables and distributed energy resources (DER) are transforming power system operation, making it necessary to identify better ways of integrating them with the grid. As more "prosumers" come online, EPRI is examining the impacts of renewables and DER—such as wind, solar, and energy storage—across the power supply chain. These research areas across EPRI address various aspects of benefits and costs of integrating these technologies.

- 1 Power Quality
- 18 Electric Transportation
- 39 Transmission Operations
- 40 Transmission Planning
- 55 Ecosystem Risk and Resiliency
- 62 Occupational Health and Safety
- 94 Energy Storage and Distributed Generation
- 161 Information and Communication Technology
- 170 Customer Technologies
- 173 Bulk System Renewables and Distributed Energy Resources Integration
- 174 DER Integration
- 178 Resource Planning for Electric Power Systems
- 182 Customer Insights
- 183 Cyber Security for Power Delivery and Utilization
- 195 Endangered and Protected Species
- 197 Environmental Aspects of Fueled Distributed Generation and Energy Storage
- 198 Strategic Sustainability Science
- 199 Electrification
- 200 Distribution Operations and Planning
- 201 Energy, Environmental, and Climate Policy Analysis
- 204 Advanced Buildings
- 206 Wind Generation
- 207 Solar Generation
- 208 Hydropower Generation

TRANSMISSION AND DISTRIBUTION

Electrification and the supporting electricity transmission and distribution networks serve as the focus for new tools, technologies, and approaches to enhancing the safety, reliability, and resiliency of bulk power transmission and distribution system infrastructure. These research programs provide EPRI's expertise across T&D engineering, environmental, and worker safety R&D.

- 1 Power Quality
- 34 Transmission Asset Management Analytics
- 35 Overhead Transmission
- 36 Underground Transmission
- 37 Substations
- 39 Transmission Operations
- 40 Transmission Planning
- 51 Transmission & Distribution: Environmental Issues
- 55 Ecosystem Risk and Resiliency
- 60 Electric and Magnetic Fields and Radio-Frequency Health Assessment and Safety
- 62 Occupational Health and Safety
- 94 Energy Storage and Distributed Generation
- 161 Information and Communication Technology
- 173 Bulk System Renewables and Distributed Energy Resources Integration
- 174 DER Integration
- 178 Resource Planning for Electric Power Systems
- 180 Distribution Systems
- 183 Cyber Security for Power Delivery and Utilization
- 195 Endangered and Protected Species
- 198 Strategic Sustainability Science
- 200 Distribution Operations and Planning
- 201 Energy, Environmental, and Climate Policy Analysis
- 221 Bulk Energy Storage

NUCLEAR

Connecting the global nuclear community to timely, cost-effective R&D solutions

EPRI|U: Nuclear Plant Aging Management Training Suite

For nuclear plant owners planning to extend the lives of their nuclear assets, aging management programs will be essential in ensuring continued safe operation. These aging management programs will depend on trained personnel for optimum implementation and effectiveness. Through the EPRI|U platform, EPRI has developed a series of training courses focused on nuclear plant aging management. This training can be conducted through in-person classes, online-hosted classes, or computer-based courses. The content also can be tailored to more than a dozen countries.

Advanced Reactors

There are many advanced nuclear technologies and designs that offer attractive options for generating energy by taking advantage of new fuels and fuel cycles, lower pressures, higher temperatures, inherent safety features, and alternative cooling and power conversion. EPRI is expanding its research focus related to advanced reactors. The Advanced Reactors research focus area tracks technology developers and their designs, communicates best practices and owner-operator requirements, provides independent strategic analysis and technology assessments, and supports technology development and transfer where gaps exist.

Hydrogen

Hydrogen has a potential role as a low-carbon fuel for power generation and transportation and as an energy storage medium to manage the variability of renewable generation. A range of maturing hydrogen technologies could be integrated with nuclear plants in flexible operating modes. EPRI's overall hydrogen research, including nuclear sector-specific projects, comprises emerging technology assessment, demonstration, case study reporting, and power systems analysis. Technology assessment activities include recent evaluations by EPRI technical experts on electrolyzers, hydrogen-capable gas turbines, and safety assessment status for hydrogen/natural gas blends.

Accident Tolerant Fuel with Higher Burnup, Enrichment

Accident tolerant fuel (ATF) technology concepts have the potential to provide improved safety margins over standard zirconium- and uranium-oxide-based fuels while also providing enhanced fuel reliability, improved economics through optimized fuel cycles, and reduced high-level waste generation. EPRI is performing collaborative research to inform reload- and full-core-deployment, near- and mid-term advanced fuel concepts, accident scenarios, nondestructive evaluation, fuel cycle optimization (that is, increased enrichment and burnups) assessments, core design expansions, and flexible operation scenarios. EPRI is also researching advanced fuel modeling and simulation solutions.

RESEARCH OFFERINGS

FUELS AND CHEMISTRY

Provides technical bases for preventing fuel failures and investigates improved fuel options for enhancing plant safety and economics while maintaining high reliability. Provides guidance and technologies to improve water chemistry practices, enhance high-level and low-level waste management, and reduce radiation exposure.

Programs include:

- Fuel Reliability
- Used Fuel and High-Level Waste Management
- Radiation Safety
- Water Chemistry
- Nuclear Fuel Industry Research (NFIR)

MATERIALS MANAGEMENT

Increases the understanding of materials aging mechanisms in nuclear reactors and develops technologies to identify, characterize, mitigate, monitor, and repair degradation.

Programs include:

- Pressurized Water Reactor Steam Generator Management Program (SGMP)
- Pressurized Water Reactor Materials Reliability Program (MRP)
- Boiling Water Reactor Vessel and Internals Program (BWRVIP)
- Welding and Repair Technology Center (WRTC)
- Nondestructive Evaluation Program

PLANT PERFORMANCE

Provides tools, techniques, and practices that enable nuclear plant owners to make technically sound design, maintenance, and operational decisions, contributing to high equipment reliability and enhanced plant safety.

Programs include:

- Nuclear Maintenance Application Center (NMAC)
- Plant Engineering
- Instrumentation and Control (I&C)
- Risk and Safety Management

STRATEGIC INITIATIVES

Incorporates plant operating experience and research results into tools and guidance that reduce risks associated with deploying technologies, processes, and new plants. Informs decisions on extended and flexible operations of nuclear plants and provides improvement approaches to plant decommissioning activities.

Programs include:

- Advanced Nuclear Technology (ANT)
- Decommissioning
- Flexible Power Operations (FPO)
- Nuclear Plant Modernization

GENERATION

Providing the fossil and renewable generating fleets with safe, reliable, economical, and environmentally responsible electricity production technologies

Updated Offerings to Reflect Industry Trends

The 2021 portfolio is designed to reflect the needs of our members as the energy industry continues to transform at a rapid pace. The offerings in our portfolio represent the high-quality R&D our members expect, packaged in a way that is intended to increase collaboration. We have also integrated air and water research to align with the assets they support in Generation.

Cyber Security for Generation Assets

The power generation industry requires R&D that focuses on the industry's specific cyber security issues. Research in this area aims to explore and provide information on new security threats, emerging security technologies, technical approaches to integration of cyber security, and evolving standards and regulation relating to generating fleets and assets.

Preparing for a Low-Carbon Future

In addition to maintaining and optimizing current generating fleets, we are looking to the future for advanced generation options, including CO_2 capture technologies, large-scale thermal energy storage, and bulk energy storage. The Low-Carbon Resources Initiative also accelerates development and demonstration of low- and zero-carbon energy technologies.

Focus on Flexibility

As the electricity system continues to transform, we are developing fleetwide optimization approaches that extend the flexibility of existing and future generating assets. These approaches build on essential enabling technologies research, integrated with advancement in intelligent generation solutions, to support efficiency and flexibility in power plants worldwide.

RESEARCH OFFERINGS

RENEWABLE ENERGY

Includes quantifying the cost, technical performance, and reliability characteristics of utility-scale renewable generation technologies to inform planning and generation fleet management decisions. Programs support operations and maintenance, technology development, and assessments on wind, solar, and hydropower assets.

MAJOR COMPONENT RELIABILITY

Provides insights on critical equipment, material degradation mechanisms, and comprehensive life-management strategies.

ADVANCED GENERATION

Helps accelerate the development and commercial application of low-carbon fossil-based power generation and bulk energy storage technologies. This includes CO_2 capture technologies and large-scale thermal energy storage. New plant concepts and designs address technical risks, economic and environmental performance, and the challenges of deploying these new technologies.

ASSET MANAGEMENT AND OPTIMIZATION

Supports the operation of the generation fleet. Research focuses on increased flexibility and efficiency as well as asset and plant management. The programs offer guidance, technology solutions, demonstrations, and training materials to support the evolving needs of the industry.

ENABLING TECHNOLOGIES

Provides integrated research solutions to ensure reliable and efficient equipment and plant performance while also meeting safety and security standards in a changing industry. Research supports fleets with cyber security concerns, flexible operations, data collection and analysis, and material repair and mitigation strategies.

AIR QUALITY AND ENVIRONMENTAL CONTROLS

Develops technologies for addressing NOx, SOx, particulates, mercury, and other hazardous air pollutants (organic and inorganic). The programs also focus on performance optimization for multiple media and monitoring methods used to reduce and monitor emissions from fossil-fueled power plants. Research looks at the development and evaluation of air quality models that can be used for assessments and applications for the implementation and development of air quality standards and the long-term health effects of key pollutants from fossil-fueled sources.

WATER MANAGEMENT

Provides a diverse area of research as it relates to managing water both in the cooling systems and wastewater streams of power plants. The programs improve technology development and operational guidance to ensure efficiency, water treatment and quality management, and the management of the environmental effects of source discharges.

COAL COMBUSTION PRODUCTS MANAGEMENT AND LAND USE

Supports the electric power industry with the challenges and opportunities regarding the management of coal combustion products (CCPs). The programs provide cost-effective CPP management and recycling practices to enhance environmental protection. Research is conducted using scientific data, engineering knowledge, restoration methods, models, and other advanced tools and guidance associated with CCP storage, disposal, and use.

POWER DELIVERY & UTILIZATION

Providing transmission, distribution, end-use, sustainability, and energy analytics R&D to guide utilities and stakeholders toward safe, resilient, affordable, reliable, and environmentally responsible energy systems




Researching and Demonstrating Resiliency

EPRI brings together the expertise and research foundations to deliver analyses and mitigation support for current and future grid resiliency challenges, including cyber security, extreme weather, electromagnetic pulse, space weather, pandemic operations, and physical security. Now power delivery is expanding to include sustainability and economy-wide energy and environmental policy and data analysis that integrates climate resiliency. Adapting to changing environments and unforeseen circumstances—and their impacts on energy infrastructure—are key considerations to research performed.

Efficient Electrification

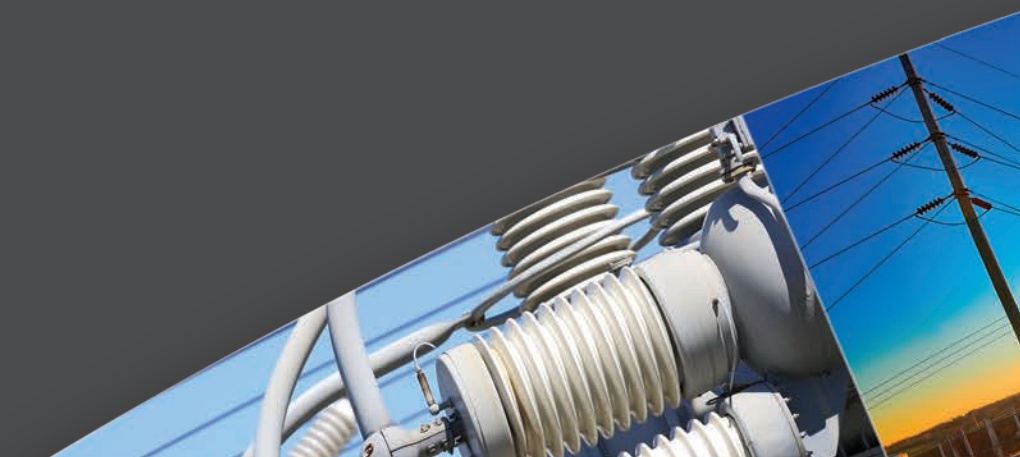
EPRI's research shows that efficiently electrifying at the point of end use can increase customer productivity and satisfaction, improve indoor air quality, enhance workplace safety, and contribute to decarbonization and sustainability efforts. Continued R&D and application of electrification, advanced buildings and communities, electric transportation including associated infrastructure and commercial fleets, and customer preferences are giving collaborators valuable insights into how customers view and interact with these new technologies. In parallel, research to support resource and strategic planning and operations provides critical knowledge regarding grid readiness for electrification and how systems may need to adapt to maximize societal and environmental benefits.

Connectivity, Interoperability, Information Technology, and Cyber Security R&D: Enabling a Shared, Integrated Grid

An optimally integrated electric power system that works for everyone depends on the ability of embedded devices and information networks to be safe, reliable, secure, and interoperable. EPRI's Information, Communications, and Cyber Security group provides utilities and stakeholders with expertise, guidance, and R&D to inform connectivity standards, information modeling, design and architecture, security strategies, and telecommunications to enable impactful investment and deployment.

Integrating Renewable and Distributed Energy Resources

The expanding deployment and diversification of variable and distributed energy resources—wind, solar photovoltaics, energy storage, and the technologies needed to manage them—creates opportunities and challenges for planning and operating power grids. EPRI R&D provides transmission and distribution planners and operators, integrated resource planners, and protection engineers with models, tools, demonstration results, economic analyses, and the technical bases for investment decisions to maximize the value of these resources. Research also helps to ensure that an increasingly inverter-based system is operated reliably while managing variability and uncertainty.



RESEARCH OFFERINGS

TRANSMISSION AND SUBSTATIONS

Transmission asset owners seek safe, reliable, resilient, and cost-effective operations from their transmission lines and substations. Research provides the technical basis for key decisions in all phases of asset management (acquire, maintain, operate, and dispose) including guidelines for new component specifications, engineering software tools, advanced asset health algorithms, new sensing technologies, and inspection and assessment tools. Reference and field guides support personnel ranging from early career to expert.

TRANSMISSION AND DISTRIBUTION ENVIRONMENTAL IMPACTS

Transmission systems face challenges in right-of-way (ROW) land management and permitting, while distribution systems now support the smart grid, distributed resources, and plug-in electric vehicles. Research works to minimize species interactions with transmission and distribution (T&D) systems and examines potential human health risks from electric and magnetic fields and radio-frequency exposure to benefit the surrounding ecosystems and communities. New research focuses on mitigation of species interactions, vegetation management methods, and technologies aimed at increasing the resiliency of T&D infrastructure. Programs help utilities reduce T&D and ROW costs, manage assets, and protect human health and natural and cultural resources.

TRANSMISSION OPERATIONS AND PLANNING

Transmission system owners and operators are increasingly challenged to plan and operate today's power system to meet objectives for which it was not explicitly designed. Generation resources are more constrained and increasingly more variable and uncertain with resources located in the distribution system or customer facilities. Our programs provide analytics for understanding the changing operating environment, along with methods and tools to guide planning and operating decisions. Research develops new models and associated tools for validating models, assessing reliability and economic parameters, and providing visualization and decision support for planners, operators, and system protection engineers.

POWER DELIVERY & UTILIZATION

DISTRIBUTION

Modernization of the distribution grid involves the simultaneous optimization of existing assets while maximizing the benefits of new technologies and resources to yield a more efficient, reliable, and customer-centric grid. Our programs inform all aspects of grid modernization. Our research provides the technical basis for key decisions in all phases of asset management, including new tools and enhanced methods to plan and operate an integrated distribution system, advanced grid technology, distributed energy resources technology and its integration with the grid, and sharing of leading practices.

INFORMATION, COMMUNICATION, AND CYBER SECURITY

From informing the latest communication standards and devices that enable connectivity to navigating cyber security risks, guidance, and protocols, these programs touch on many areas of research across EPRI. A common thread is to create a fully integrated, controllable, and communicating grid to enhance security and resiliency and optimize the value of distributed and central energy resources. Communication and cyber security requirements for transmission, distribution, electric transportation, and demand response are providing input into the development and assessment of standards and communication protocols. Also emerging from this research are technologies such as smart meters, augmented reality, outage management detection, and communication tools.

ENERGY SYSTEMS AND CLIMATE ANALYSIS

Global power transformation is driving changes in company operational decisions, investment strategies, environmental management, resource planning, business strategies, and industry structure. Programs provide technical data and information, analytic tools, and insights to support resource and strategic planning through this evolution. Research focuses on the economic, policy, and planning implications of key drivers of change, including decarbonization, emerging and advanced technologies, electrification, and climate impacts.

RESEARCH OFFERINGS

ELECTRIFICATION AND CUSTOMER SOLUTIONS

Customers are adopting new technologies and services that are reshaping how they use electricity, including energy-efficient appliances, IOT devices and energy management systems, electric vehicles and other electrified end uses, and advanced buildings with generation and storage capabilities. New rate structures and program models can complement these offerings. These technologies and services are already impacting electricity use patterns, load shapes, and power quality. By understanding these trends and impacts, utilities can find opportunities to optimize system performance and economics while keeping a customer-centric focus. Research and application provide insights on technology performance and customer expectations that can help utilities lower costs and manage risk by designing more effective programs and services and understanding system impacts.

SUSTAINABILITY AND ECOSYSTEM STEWARDSHIP

Corporate strategies are increasingly emphasizing sustainability, moving to a comprehensive focus on economic, environmental, and social responsibility. Research develops the tools and resources companies can use to embed a stewardship mindset into day-to-day activities, risk management, long-range planning, and corporate culture. This expanding view of sustainability includes multifaceted scientific research, value analysis, and innovative solutions to help power companies achieve business objectives, deliver value to communities served, and support the vitality of local ecosystems.

WORKER AND COMMUNITY HEALTH AND SAFETY

Workplace injuries affect employee health, quality of life, productivity, and job satisfaction while increasing the cost of conducting business. Research provides actionable tools, data analysis, and laboratory testing to help utilities make informed decisions about controls, procedures, risk management, and methods for preventing workplace injury and illness. This work helps maintain safer, healthier work and community environments.

TECHNOLOGY INNOVATION

Driving thought leadership and advanced R&D, along with technology scouting and incubation, to sustain a full pipeline of solutions leading to a more efficient and decarbonized Integrated Energy Network (IEN)

INTRODUCTION

The Technology Innovation (TI) program is building the knowledge and technology foundation for a future in which consumers have the flexibility to produce energy and manage their use as they choose—and reliable, safe, affordable, and cleaner energy is available for all.

TI program elements support a portfolio of strategic research, early-stage technology development, and field demonstration projects aligned with energy sector evolution and managed by expert staff throughout EPRI's sectors. TI's Core R&D and Supporting R&D portfolio are highlighted on the opposite page.

More information is available on EPRI's website and from the 2020–21 Technology Innovation Prospectus (3002019513).

Thought Leadership illuminates emerging developments and future drivers, risks, and opportunities through scenario analysis and critical trends monitoring.

Innovation Scouting involves a global search for novel technologies and concepts, promising significant impact over the next 10 to 15 years. EPRI scouts gather insights, identify leaders, and build networks across energy R&D and other high-tech sectors to provide important insights on industry challenges and solutions.

Scouting also helps inform the Incubatenergy® Network, which provides EPRI and its utility members with early access to innovations and startups supported by leading clean energy incubator and accelerator programs in the United States and globally. The program has expanded to include technology Innovation Challenges that address customer engagement, digitalization, distributed energy resources integration, the workforce of the future, electric mobility, and customer and community resilience.

EPRI's TechPortal, launched in 2018, is an online, curated, and fully searchable database of hundreds of innovative technologies and concepts of interest to electric utilities and the broader energy sector. The database is regularly updated based on scouting by experts across EPRI, including targeted outreach through Incubatenergy® and to universities, national labs, R&D institutes, and other high-technology industries. For each entry, the TechPortal includes baseline information as well as EPRI's assessment of technology readiness level, timeline to commercialization, and potential business impact—from minimal to evolutionary to revolutionary.

EPRI's Integrated Grid Demonstrations website serves as a portal to explore and learn about global demonstrations, which are providing valuable insights into the pursuit of an Integrated Grid. This Wikipedia-style reference provides high-level information about demonstration objectives, research methods, and lessons learned from EPRI and non-EPRI demonstration projects. Categorized links help users find relevant demonstration projects and focus on connections among projects, vendors, and utilities.

R & D HIGHLIGHTS

CORE R&D

- **Efficient Electrification:** Accelerating electrification by advancing high-efficiency technologies and grid-interactive systems for the transportation and building sectors and other significant end-use loads.
- **Energy Storage:** Developing modeling and control technologies to optimize the value of battery installations and exploring innovative concepts for distributed and bulk storage applications.
- **Grid Modernization:** Building interoperability architecture for the Integrated Grid and developing foundational technologies for more reliable, intelligent, and efficient transmission and distribution.
- **Low-CO_2 Fossil:** Identifying and advancing promising, early-stage carbon capture concepts and exploring high-efficiency power cycles to minimize cost-of-energy impacts while reducing CO_2 emissions.
- **Next-Gen Nuclear:** Creating a technical foundation to focus public/private investment on design, development, demonstration, and U.S. deployment of a commercial Gen IV reactor in the 2030s.
- **Next-Gen Renewables:** Exploring and testing innovative technologies for increasing the productivity, reliability, cost competitiveness, deployment, and grid support value of renewable generation.

SUPPORTING R&D

- **Data Analytics and Artificial Intelligence:** Supporting enhanced industry data analytics; includes important steps for accelerating progress along the longer term IEN pathway.
- **Cyber Security:** Assessing hardware-based solutions such as physically unclonable functions, trusted platform management, and trusted execution environments for providing identity management—an essential element for achieving secure communications and interoperability between utility systems and billions of future grid-edge devices.
- **Communications:** Exploring new technologies that can enhance connectivity and increase resilience as well as advancing distributed energy resource management systems (DERMS) that can bridge the gap between utility operations and individual device-level controllers by providing aggregation, translation, simplification, and optimization functions.
- **Materials and Nondestructive Evaluation (NDE):** Ongoing foundational R&D is advancing new materials and coatings as well as signal processing and data analytics for enhanced NDE. New algorithms and software improve flaw and corrosion detection and analyses.
- **Unmanned Aerial Systems (UAS):** Testing machine learning and other AI techniques, using EPRI-curated image libraries, for monitoring utility assets. EPRI also is pushing boundaries in UAS payloads, indoor navigation, and flight automation while exploring use cases such as storm damage assessment, dry cask inspection, and emissions monitoring.
- **Water-Energy Nexus:** Developing revolutionary cooling concepts and treatment technologies for mitigating risks and optimizing water use efficiency at power plants and in other sectors.
- **Modeling and Analysis:** Developing new tools to help fill critical knowledge gaps and help utilities, regulators, and others evaluate investments in assets and technologies.

LOW-CARBON RESOURCES INITIATIVE

Economy-wide decarbonization is emerging as a critical focus for nations, regions, cities, corporations, and individuals; however, it requires substantial technology advances, a refocusing of energy investments, and a dramatic acceleration of the current pace of change. EPRI and the Gas Technology Institute (GTI) have created the Low-Carbon Resources Initiative (LCRI) to help fill this gap by accelerating the development and demonstration of low-carbon energy technologies for large-scale deployment to 2030 and beyond to reduce long-term environmental consequences, benefitting society as a whole. Part of an EPRI initiative to significantly reduce carbon emissions through the year 2050, the LCRI will provide a centralized, collaborative platform to identify and accelerate the development of promising technologies from around the world, to demonstrate and assess the performance of selected key technologies and processes and identify possible improvements, and to inform key stakeholders and the public about technology pathways and options.

ELECTRIFICATION OF TRANSPORT INITIATIVE

Initially launched by EPRI's Board of Directors in 2017, the electrification of end-use technologies continues to evolve as a priority for our industry. It provides for a more efficient, affordable, and sustainable alternative to fossil fuel while also playing a key role in enabling the reduction of economy-wide carbon emissions. In 2019, the EPRI Board of Directors further expanded their commitment to efficient electrification by approving EPRI's Fleet Electric Vehicle Charging Infrastructure strategic initiative. Electrification of transport is considered crucial to significantly reducing carbon emissions in the near-term. The Initiative's objective is to enable the adoption of fleet electric vehicles by ensuring utility infrastructure to support charging can be scaled in a timely, efficient, and economical manner. This group brings together utilities, non-profits, government, academia, and fleet owners and operators to develop the tools and resources needed for the rapid expansion of fleet charging infrastructure.

GETTING THE MOST FROM YOUR PARTICIPATION

- Participate in advisory meetings to help shape the direction of our research.
- Access and apply leading-edge results within your company.
- Discuss your emerging or ongoing needs with your EPRI Technical Advisor or International Regional Manager.
- Obtain an epri.com login ID to gain access to EPRI's ongoing research collaboratives and products.

CONTACT EPRI

To discuss options and solutions for your needs:

- Call EPRI at 800.313.3774, and press 4 to connect with EPRI's Customer Assistance Center.
- Send an e-mail to askepri@epri.com, and ask for an EPRI representative to contact you.

The Electric Power Research Institute, Inc. (EPRI, www.epri.com) conducts research and development relating to the generation, delivery and use of electricity for the benefit of the public. An independent, nonprofit organization, EPRI brings together its scientists and engineers as well as experts from academia and industry to help address challenges in electricity, including reliability, efficiency, affordability, health, safety and the environment. EPRI also provides technology, policy and economic analyses to drive long-range research and development planning, and supports research in emerging technologies. EPRI members represent 90% of the electricity generated and delivered in the United States with international participation extending to nearly 40 countries. EPRI's principal offices and laboratories are located in Palo Alto, Calif.; Charlotte, N.C.; Knoxville, Tenn.; Dallas, Texas; Lenox, Mass.; and Washington, D.C.

3420 Hillview Avenue, Palo Alto, California 94304-1338
PO Box 10412, Palo Alto, California 94303-0813 • USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com

©2020 Electric Power Research Institute (EPRI), Inc.
All rights reserved. Electric Power Research Institute, EPRI, and TOGETHER...SHAPING THE FUTURE OF ELECTRICITY are registered service marks of the Electric Power Research Institute.

3002017738