

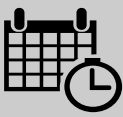



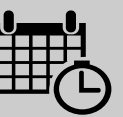



SUBSTATIONS (P37) SUPPLEMENTAL PROJECTS





SF₆- Free Breaker Pilots





Objective 	Rapidly learn about the range of SF ₆ -free breaker technologies in a realistic research substation environment.		
Value 	<p>The project may provide the following values:</p> <ul style="list-style-type: none"> Valuable guidance to utilities making decisions on which technology to select. For utilities that have already selected a technology the research provides valuable insights on commissioning, maintenance, gas handling, safety, and performance. 12 months of realistic substation testing on vacuum, CF-FN, and other SF₆-Free technologies 		
Schedule 	24 Months	Price \$	\$462k Underway
Contact 	Luke van der Zel, (704) 959-2726, lvanderz@epri.com		

SF₆ Alternatives Lab Assessments of Handling Practices and Chemical Analysis

Objective 	For new SF ₆ -Alternative gas mixtures, understand the details of gas handling, analysis, safety, commissioning, and disposal.		
Value 	<p>The project may provide the following values:</p> <ul style="list-style-type: none"> Valuable insights for utilities deciding on the future path for SF₆-free technologies In addition, for those utilities already on the path of SF₆-Free alternatives, the research provides invaluable hands-on guidance. 		
Schedule 	24 Months	Price \$	\$120k Underway
Contact 	Luke van der Zel, (704) 959-2726, lvanderz@epri.com		







SUBSTATIONS (P37) SUPPLEMENTAL PROJECTS

Novel SF6 Leak Sealing			
Objective		The objective of this project to apply a novel approach to SF6 leak sealing from bolts and flanges in a disconnect switch. This approach uses off the shelf items that can be easily applied and removed without taking an outage.	
Value		The key benefit to EPRI members would be to helping reduce SF6 emission and improving the reliability of the system. The ability to address the leak sealing issues without having to take an outage.	
Schedule		Price	\$
		TBD based on scope	<div style="display: flex; justify-content: space-between; width: 100px;"> <div style="width: 20%; background-color: black;"></div> <div style="width: 60%;"></div> <div style="width: 20%;"></div> </div> <p style="text-align: center;">Underway</p>
Contact		Bhavin Desai, (704) 595-2739, bdesai@epri.com	







Switching Safety and Reliability			
Objective		Safety and reliability of the power grid are at the top of every utility's list of concerns. To meet this challenge, personnel who prepare and review switching orders or perform switching in the field must be vigilant and properly trained to prevent switching errors and near-misses and avoid error-likely situations. Switching errors can create unexpected power interruptions to customers and hazardous situations for utility personnel and the public. Although some utilities have achieved very low error rates, others can benefit from further improvements and EPRI research.	
Value		Benefits may include: improvements to worker safety and reliability, reductions in unscheduled outages, enhanced operating efficiency, and compliance with regulatory requirements. EPRI R&D may also be able to help uncover and mitigate latent switching errors. Project deliverables and discussions seek to avoid unwanted power interruptions and hazardous situations for both utility personnel and the public.	
Schedule		Price	\$
		\$30k/\$15k	<div style="display: flex; justify-content: space-between; width: 100px;"> <div style="width: 20%; background-color: black;"></div> <div style="width: 60%;"></div> <div style="width: 20%;"></div> </div> <p style="text-align: center;">Underway</p>
Contact		Robert Haromszeki, (650) 855-1050 rharomszeki@epri.com	

SUBSTATIONS (P37) SUPPLEMENTAL PROJECTS

3D Scanning Technologies: Substation Applications






Objective 	Research, specify, and test emerging 3D scanning tools for substation use cases: <ul style="list-style-type: none"> • Site Analysis and Planning, Substation Design, Construction, and Inspection and Maintenance These tools allow utilities to digitize the physical environment with greater speed, accuracy, and quality than traditional methods.		
Value 	This project can potentially provide the following benefits: <ul style="list-style-type: none"> • Research technology to reduce O&M, improve reliability, and situational awareness. • Safe, rapid, and low-cost experimentation in EPRI's lab/substation environments. • Collaboration and experience in a rapidly changing technical area 		
Schedule 	24 Months	Price 	\$40k  Beginning
Contact 	Dexter Lewis, (205) 332-5963, dlewis@epri.com		

Transformer On-Line Dehydration: Application of Novel Concepts






Objective 	EPRI has developed a new approach for transformer on-line dehydration without the need for regular cartridge replacements. This project provides the opportunity to pilot this new concept on wet transformers in the field.		
Value 	This project may provide the following benefits: <ul style="list-style-type: none"> • Reduced risk of transformer bubbling due to dryer insulation • Extended life of transformers due to lower moisture levels • Reduced O&M due to on-line dehydration without the need for regular cartridge replacements 		
Schedule 	12 Months	Price 	\$200k (ballpark) Scope and location dependent  Underway
Contact 	Luke van der Zel, (704) 959-2726, lvanderz@epri.com		

SUBSTATIONS (P37) SUPPLEMENTAL PROJECTS



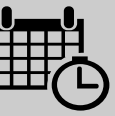

Implementation and Maintenance Guide for Protection and Control Systems in IEC 61850 Substations





Objective 	Provide application guide to implementation and maintenance of new protection and control designs based on the IEC 61850 standard and digital substation technologies.		
Value 	The project may provide following values: <ul style="list-style-type: none"> Guide new protection and control (P&C) design based on the IEC 61850 standard and digital communication technologies such as GOOSE message Develop testing and maintenance approaches for new P&C design in IEC 61850 digital substation Hands-on technology transfer and knowledge preparation for field implementation 		
Schedule 	24 Months	Price 	\$80k <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="width: 80%;"></div> <div style="width: 15%; background-color: black; height: 15px;"></div> <div style="width: 5%;"></div> </div> Underway
Contact 	Dr. Yuchen Lu, (704) 595-2692, ylu@epri.com		

EPRI | U for Transmission

Objective 	The objective of this project is to provide high-quality, foundational technical training for engineers, as well as a system of record for both the utility and the individual.		
Value 	EPRI intends to offer high-quality training material to better meet the needs of utilities by providing instruction on a variety of transmission-related topics. Professional development hours granted upon completion of the training will help engineers meet requirements for their certifications and career advancement.		
Schedule 	Annual membership	Price 	\$5k-\$35k <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="width: 80%;"></div> <div style="width: 15%; background-color: black; height: 15px;"></div> <div style="width: 5%;"></div> </div> Underway
Contact 	Robert Haromszeki, (650) 855-1050 rharomszeki@epri.com		





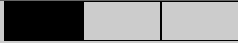

SUBSTATIONS (P37) SUPPLEMENTAL PROJECTS

Fleet Management of Substation Asset Corrosion				
Objective		Screen a population of substations to identify structures or components that require maintenance operations and align the corrective action with the service environment.		
Value		All of these new learnings are intended to increase grid reliability, increase public safety, and allow the utility to manage costs more efficiently.		
Schedule		24 Months	Price \$	Scope Dependent
Contact		Neal Murray, (704) 595-2624 nmurray@epri.com		
				Beginning



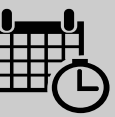



Substation Ratings				
Objective		Utilities are facing new transmission line ratings requirements to comply with FERC Order 881881. These requirements will increasingly push congestion inside the substation. Approaches to address FERC order on transmission lines can be applied to substation bus (and potentially other components) to develop improved ratings and reduce congestion.		
Value		This project can potentially provide the following benefits: <ul style="list-style-type: none"> • Look at risks to safety and reliability • Prepare for climate change • Leverage weather data and EPRI research to prepare for FERC 881 • Have consistent approaches for inside and outside the fence 		
Schedule		Schedule is determined on contract execution	Price \$	TBD on Scope
Contact		Colleen Konsavage, (972) 556-6575, ckonsavage@epri.com		
				Coming Soon

SUBSTATIONS (P37) SUPPLEMENTAL PROJECTS

Technology Assessment and Demonstration of Process Bus and Non-Conventional Instrument Transformer – Phase 2





Objective 	Provide guidance on how to apply process bus and fiber optic technologies to digitalize the interface between switchyard equipment and protection & control systems in substation control house.			
Value 	The research may provide members with the following benefits: <ul style="list-style-type: none"> ○ Copper reduction and cost saving ○ Safety improvement ○ Reduce vulnerability to EMP or EMI ○ Storm hardening ○ Enhance condition-based maintenance 			
Schedule 	24 Months	Price 	\$80k	 Underway
Contact 	Dr. Yuchen Lu, (704) 595-2692, ylu@epri.com			

Evaluation of Substation Robotic Analytical Tools





Objective 	This project aims to research of commercially available robotic analytic tools that are suitable for substation inspection. From there, evaluate how well these tools can predict deterioration of substation assets.			
Value 	This project can potentially provide the following benefits: <ul style="list-style-type: none"> • 24-7 inspection of the substation asset condition • Reduced unplanned outages due to equipment failures • Provide online inspection for real-time assessment without personnel onsite 			
Schedule 	24 Months	Price 	\$50k	 Underway
Contact 	Dexter Lewis, (205) 332-5963, dlewis@epri.com			

SUBSTATIONS (P37) SUPPLEMENTAL PROJECTS

Life Extension Guidelines Application to HVDC Converter Stations & FACTS Technologies





Objective 	To assess service life of converter station components and provide recommendations including converter transformers, valves and valve hall, controls and cooling systems, and filters.		
Value 	<p>The benefit of the projects are as follows:</p> <ul style="list-style-type: none"> • Statistical life spans of components • Converter Station on-site evaluation • A technical report with recommendations whether to repair or replace • Economic benefits by extending the life of Converter Station Equipment 		
Schedule 	Schedule is determined on contract execution	Price \$	\$50 to \$100k (scope dependent) <div style="display: flex; justify-content: space-between; width: 100px;"><div style="width: 70%; background-color: black; height: 10px;"></div><div style="width: 30%; background-color: gray; height: 10px;"></div></div> Underway
Contact 	Ram Adapa, (650) 855-8988, radapa@epri.com		

SUNBURST Node Installation






Objective 	<p>The objective of the project is to construct and deploy one SUNBURST node for data collection at a utility's transformer of interest.</p> <p>This data is needed and used for continuing research studying the cause, effects, and potential mitigation of GIC on electrical power systems. This is accomplished via SUNBURST Network membership (EPRI Project 1-003679).</p>		
Value 	The data collection and research on GIC in transformer neutrals continues as EPRI helps improve understanding of the effects of GIC on the grid for both its members and society. It should be noted that the solar cycle lasts for approximately 11 years, and EPRI and its members have committed themselves to continued long-term study of GIC and the impacts it may have on the grid.		
Schedule 	Schedule is determined on contract execution	Price \$	\$30K <div style="display: flex; justify-content: space-between; width: 100px;"><div style="width: 70%; background-color: black; height: 10px;"></div><div style="width: 30%; background-color: gray; height: 10px;"></div></div> Underway
Contact 	Charles Perry, (865) 218-8034, cperry@epri.com		

SUBSTATIONS (P37) SUPPLEMENTAL PROJECTS



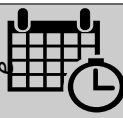


Substation Seismic Studies

<p>Objective</p> 	<p>Perceived deficiencies in IEEE Standard 693, Recommended Practice for Seismic Design of Substations standards, and equipment testing procedures lead to the creation of this supplemental project, which focuses on analyzing and quantitatively evaluating improvements in substation equipment resiliency due to seismic activity by conducting tests in a lab environment for various substation equipment. In this project analytical models are also developed based on the test results, so that different earthquake scenarios could be studied using the models.</p>		
<p>Value</p> 	<p>These evaluations are meant to help qualified products to have higher probability of surviving earthquakes. As a result of this research and development, it is expected that repairs of damaged equipment, and duration of power interruptions, will be reduced. These enhancements may improve the reliability, safety, and affordability of electric power supplies.</p>		
<p>Schedule</p> 	<p>Ongoing project; with annual supplemental funding.</p>	<p>Price</p> <p>\$</p>	<p>\$30K/year</p> <div style="border: 1px solid black; width: 100px; height: 20px; background-color: black; margin: 5px 0;"></div> <p>Underway</p>
<p>Contact</p> 	<p>Ram Adapa, (650)855-8988, radapa@epri.com</p>		






SUBSTATIONS (P37) SUPPLEMENTAL PROJECTS

Corrosion Control of the Substation Ground Grid			
Objective 	The objective of this phase of research is to understand the cause of the substation grid degradation, to locate suspect areas of corrosion and to provide environmental data supporting asset management decisions.		
Value 	If successful, the resulting methodology and monitoring approach may: <ul style="list-style-type: none"> • Enable visualization of present condition of the ground grid and location of specific areas where degradation may have caused ground grid deterioration. • Provide knowledge necessary to develop triggers and alarms for maintenance actions. • Track the condition of the ground grid, trend grid deterioration over time and compare the extent of deterioration to baseline such as design standards, thereby allowing for forecasting and budgeting for future remediation and/or ground grid enhancements. 		
Schedule 	24 Months	Price 	\$130K Complete – still accepting funders
Contact 	Neal Murray, (704) 595-2624 nmurray@epri.com		

SUBSTATIONS (P37) SUPPLEMENTAL PROJECTS

Concrete Inspection and Assessment Technology Evaluations			
Objective 	<p>The project objective is to evaluate the features and limitations of each inspection tool or technique and provide an understanding of the optimal construction standard and environment for implementation.</p> <ul style="list-style-type: none"> ▪ The project scope is to evaluate technologies, categorize them as a screening or a predictive technology, and then assign levels of accuracy, risk, and cost to implement. 		
Value 	<p>The benefits of the project are as follows:</p> <ul style="list-style-type: none"> • Each utility may then implement these technologies in the proper conditions to understand if the asset is structurally sound. • This new learning may increase transmission grid and substation reliability, reduce risk of structural failure to the utility and increase safety to the public and utility workers. 		
Schedule 	24 Months	Price 	Scope dependent <div style="border: 1px solid black; width: 100px; height: 20px; margin: 5px auto;"></div> Beginning
Contact 	Neal Murray, (704) 595-2624 nmurray@epri.com		

SUBSTATIONS (P37) SUPPLEMENTAL PROJECTS

Substation Sensor Demonstration Project			
Objective 	The project allows for collaborative, accelerated learning, and in some cases accelerated development, of new and emerging sensors in substations through real-world deployments in participant's sites.		
Value 	The benefits the project provides are as follows: <ul style="list-style-type: none"> • An efficient collaborative approach where the results from one utility demonstration are shared with all members • A systematic approach where well-defined test protocols are applied • A utility-specific plan on how to transition sensors into utility communications infrastructure • An increased understanding of the application of sensor data and the benefits that can be derived 		
Schedule 	1 Year of Monitoring (flexible)	Price 	Scope Dependent <div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: black; margin-right: 5px;"></div> <div style="width: 20px; height: 20px; background-color: lightgray; margin-right: 5px;"></div> </div> Underway
Contact 	Luke van der Zel, (704)595-2726, lvanderz@epri.com		