

R&D Expenditures for The Test Year Ending September 2014

KPSC Case No. 2014-00396
 Commission Staff First Set Data Request
 Order Dated November 24, 2014
 Item No. 47
 Attachment 4
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| Work Order | Corporate Total | KPCo Total | Project Title | Project Description |
|------------|-----------------|------------|--------------------------------|---|
| RDCP570001 | 89,304 | 4,457 | Corporat Tech Program Mgt | Coordinate Corporate Technology program. Support Corporate Technology Council |
| RDDA523701 | 6,978 | 319 | Demand Response Ancillary Svcs | This project will perform research associated with emerging energy price and product messaging-protocol standards to take advantage of ubiquitous low-cost communication infrastructures that may be able to reliability perform automated demand response DR and Ancillary Services AS or fast DR functions. Project Benefit 1. Accelerate standards development of protocols to automatically manage loads for DR and AS. 2. Contributions to the development of standards and products that use the standards for DR and AS functions. 3. System and load performance and benefits analysis for demonstration host sites. |
| RDDA524101 | 25,000 | 1,145 | Grid Resiliency Initiative | The EPRI Grid Resiliency project is a 3 year effort researching construction, maintenance, and service restoration practices that will improve utilities ability to recover from major storms. As currently scoped, the Grid Resiliency project will study 1 Overhead structure hardening - how do structures behave during storm conditions 2 Vegetation management practices - what s best practices for line clearance 3 Undergrounding of overhead lines - what s total cost of ownership of overhead vs. underground 4 Grid Modernization - what impact does gridSmart have on storm restoration 5 Practices for Storm Response - what practices do different utilities use in responding to major storm outages 6 Prioritization of Distribution Resiliency Investments - what's the optimum cost alternative for grid resiliency Project Benefit Research results will enable AEP to take the effects of storm caused outages i.e. the effect of tree fall impact on structures into account when designing distribution systems; compare and contrast restoration practices between utilities; and better target efforts and spending on vegetation management, undergrounding of overhead lines and installing smart circuit technologies. |
| RDDA524201 | 728 | 33 | Electrification Productivity | Develop the strategic frameworks to evaluate electrification opportunities in their service territories, and the tactical tools to pursue program implementations with business customers. Project Benefit Improved productivity and competitiveness of end-use customers through advancements in overall energy efficiency, reduced costs, and improved throughput. Reduced on-site emissions at end-use customers facilities, which assists compliance with environmental regulations and fosters worker health and safety. Reduced net emissions to benefit society-at-large. |
| RDDA524301 | 43,325 | | PEV Performance & DataAnalysis | 1. To gather Plug-in Electrical Vehicle PEV operational driving and charging data in real-time on a broad range of utility fleets securely and reliably. 2. To analyze the gathered data to answer key questions around optimal charging infrastructure footprint, distribution system impacts, operational cost improvements and consumer preferences for PEV use. 3. To provide utilities the tools and data necessary to conduct their own analyses pertaining to their own fleet vehicles and compare them with the fleet aggregate results. Project Benefit 1. Collected data will be used for the Electric Transportation portion of the AEP Ohio Demonstration Project. 2. Develop an understanding of customer PEV use and charging patterns. |
| RDDA530001 | 70,929 | 3,233 | Distribution R&D Program Mgmt | General management and coordination of the Distribution R D program |
| RDDA530201 | 15,690 | 482 | Field Demo - CEA-2045 Standard | Project Purpose: 1. Perform a field evaluation of smart grid devices that utilize the CEA-2045 standard. 2. Work with manufacturers to develop off-the-shelf CEA-2045 capable devices 3. Work with communication vendors to develop communication modules that support the CEA-2045 standard. Project Benefit: Support industry efforts to provide a cost effective way for residential products to be made smart grid ready. In addition, a modular interface would provide flexibility to employ networking equipment of one's own choosing, and would help prevent appliance obsolescence related to changing communication technologies. |
| RDDA560101 | 247 | 11 | Dist EPRI Annual Research Port | Coordination of AEP's: 1) Corporate Technology program and 2) Support the Corporate Technology Council Replaces work order RDCP200301 |
| RDDA570101 | 271,318 | 12,427 | Distribut EPRI Annual Portfol | Program 1B - PQ Knowledge-Base Service: The overall objective of this project set is to implement monitoring system advancements that will not only enhance benchmarking and reporting functions of the monitoring systems, but also provide the basis for advanced applications that can actually improve equipment and system reliability. This project set has three integrated project areas that complement each other. P1.005 ü Integration of Data from Multiple Monitoring Systems: This project area helps increase the value of monitoring systems by integrating information from many different devices and equipment |

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that may provide increased value to overall power quality data management and analysis applications. This can include a variety of IEDs that may be part of new system investments, as well as advanced metering systems that are used for many customers. Important topics to be addressed in the research include the following:

- Monitoring equipment considerations (accuracy, standards)
- Integration of data from different monitoring systems (relays, digital fault recorders, metering systems)
- PQDIF tools and support (PQDIF user group)
- PQDIF verification for monitoring systems
- COMTRADE contributions to next version of COMTRADE to make it more compatible with PQDIF (IEEE Relay Committee)
- Communications issues and capabilities

The research priorities for this project are developed each year by a project advisory group. Prioritization of the specific equipment and interfaces to be evaluated allows for the most timely and useful deliverables to be provided to the members.

P1.006 - Advanced Applications for Monitoring Systems: This project provides the technical basis for advanced applications that can be applied in monitoring systems to improve system reliability, equipment performance, and operations. The objective is to provide the basis for analyzing PQ trended data, transient disturbance data, fault data, and related system information to identify equipment and system problems that can be resolved in a more timely manner. Alarms and reports can then be integrated with system maintenance procedures and operations to more efficiently resolve problems and improve equipment reliability. The net effect can be a dramatic improvement in system reliability and a reduction in maintenance and operation expenses. Members will help prioritize important functions to be included in a power quality monitoring system that can provide operational and reliability improvement benefits. Important capabilities that are likely to be considered include the following:

- General processor for trended PQ data to identify abnormal conditions based on control chart theory, etc.
- Voltage regulator performance module
- Fault protection and coordination assessment module
- Automated power quality and reliability reporting methods
- Transformer loading and lifetime assessment, including harmonics
- Arrester performance for transient events

Work will also begin on a database collection (library) of disturbance data for use in the development of advanced applications.

P1.007 - Monitoring System Development and Management: This is the project where the advanced capabilities actually get implemented in power quality monitoring management systems. Application in actual software systems, such as PQView, allows utilities to realize the benefits of the research in P1.005 and P1.006. In 2007-2008, the work in this project set is also being coordinated closely with a large DOE-funded research project on fault analysis and fault location technologies that will complement the EPRI research and provide substantial added value for the members in this project set.

Program Set 1D - PQ Knowledge-Base Service: The Power Quality Knowledge-Based Services program comprises an array of resources and tools. At the core of the program is a customer hotline offering round-the-clock power quality technical support. Complementing the hotline are the following:

- Five electronically distributed newsletters which regularly provide the latest information on power quality business, technical trends, educational opportunities, and project updates
- A detailed EPRI PQ Encyclopedia, a definitive reference and training tool for power quality
- Continued enhancement of the highly valued PQ case study library to supply customers with an essential and productivity-improving resource
- Access to the PQ Hotline for best-in-class problem-solving resources
- The PQ Hotline Database, an unparalleled archive of a range of solutions and industry experience
- Additional resources for the Power Quality Online Resource Center to further enhance its value
- Complimentary registration for one Power Quality Interest Group meeting, along with a registration discount on all PQA Conferences

Project 30.003 - Manhole Event Risk Management Strategies: A number of utilities continue to experience gas-related explosions in underground structures such as manholes, service boxes, and vaults. Two root causes are needed for an event to occur: the buildup of explosive or combustible gases and the presence of an ignition source. These events can occur unexpectedly and can involve numerous explosions in adjacent structures. The financial and political consequences of such events can be significant. Explosions and related events in underground structures are rare, involving fewer than 1% of underground structures, and range from "smokers" with little effect, to "flyers" with very serious collateral damage, injury, and even death. Many causal factors are involved, and multiple events are possible. Predictability is very difficult. Damage can range from fire or smoke damage in "smokers" to collateral damage to external facilities or personal injury from flying manhole or vault covers in "flyers."

In 1991, a utility experienced a fatal event. In 1995, Underwriters Laboratories (UL) issued a milestone report detailing the composition of evolved gases. A test facility was built in Lenox, Massachusetts, in 1994 with EPRI and Consolidated Edison (ConEd) co-funding. At some utilities approximately 1% of underground structures are involved in an event each year; with fewer than 0.01% involving collateral damage. During 1996-1998, milestone tests, funded by ConEd and EPRI, were conducted in Lenox involving "standard gas explosions" and mitigation approaches. Recently, many utilities have reported major events. No utility is immune from the prospect of underground explosions! EPRI's approach has taken several paths: research, construction of test facilities, and various workshops and rapid response meetings following manhole events. The research has been broad-based, involving full-scale tests, analytical studies, and computer modeling. Research topics have included: explosion characteristics, electrical (fault) vs. gas explosions, type and composition of gases involved, explosion mitigation, cover restraints, cover design, root causes, and environmental factors. EPRI has also tapped into information and technologies in other industries that operate underground systems and may experience similar problems.

1.008 System Compatibility Research: This research area involves characterizing compatibility issues between end use equipment, power conditioning technologies and

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| | | | | power system performance. It includes establishing evaluation criteria (e.g., testing protocols), evaluating failure mechanisms, and identifying solutions. |
| RDDA570201 | 144,546 | 6,613 | CEA Membership & Projects | The CEA is a collaborative of companies that propose and fund research topics. These topics can range from asset management to automation. The purpose of this project is to allocate funding for topics of interest within the Distribution organization. Individual project descriptions will be presented in the comments area of this document when available. CEA = Canadian Electric Association Replaces work order RDDA570201 |
| RDDA570401 | 174,094 | 7,968 | NEETRAC Membership | The National Electric Energy, Testing, Research, and Applications Center (NEETRAC) was established in 1996 by the Georgia Tech Research Corporation (GTRC), a cooperative organization of the Georgia Institute of Technology. It is supported by a membership consisting of utility and industrial companies. The purpose of NEETRAC is research, development and testing in areas of interest to the membership and is funded by the Research and Development Baseline Budget from dues collected from that membership. The project selection generally is of a scope that is sufficiently broad as to be attractive to several Members, who are interested in sharing the resulting intellectual property. NEETRAC membership includes both collaborative and directed funding research. AEP's strategy is for NEETRAC to complement the Dolan Technology Center's (DTC) capabilities through research in such areas as cable life extension and other research or testing areas that the DTC is not directly involved in. AEP will be joining NEETRAC as a Corporate Charter Member with voting rights on the selection and prioritization of projects. NEETRAC is a non-profit corporation. Replaces work order RDDA560301 |
| RDDA571101 | 18,411 | 840 | Grid of the Future Test Bed | Develop a Grid of the Future test facility at Dolan Technology Center that will enable the evaluation of technologies that support AEP's vision of the next generation Distribution network. For 2007: installation of a WiMAX network, demonstration of WiMAX compatibility with standard utility protocols, integration of Advanced Metering Infrastructure components, Distribution Automation components, and Asset Monitoring and Control components. The test bed will include an IP-based control network that will facilitate AMI, DA, and Asset Monitoring and Control testing. For 2008, the test bed will be extended to include the evaluation of back office solutions (Yukon, Enmac, others), Home Area Networks (HAN), advanced DA and Asset Monitoring and Control, Distributed Energy Resources including Distributed Generation and Storage Technology. The information generated from these evaluations will be used to support decisions on vendor acquisitions, systems compatibility, and overall architecture & system design. Once the utility to HAN interface has been defined, communications into the customer premises will then be evaluated for DSM, DR, and metering applications like real-time pricing, tamper detection, remote connect/disconnect, and outage management. Equipment from multiple vendors will be accommodated. |
| RDDA571201 | 13,404 | 611 | AMI Test Bed Development | Develop an Advanced Metering Equipment (AMI) test facility at AEP that creates the in-house capability to evaluate current and future AMI equipment and their supported Distribution applications. The information generated from these evaluations will be used to support decisions on AMI vendor selection and system design. Compatibility of AMI with Distribution Automation equipment will be explored, and Distributed Intelligent Monitoring, Communication, and Control evaluations will be supported. Communications into the customer premises will be evaluated for DSM, DR, and metering applications. Equipment from multiple vendors will be accommodated. |
| RDDA581701 | 5,665 | 259 | GRDSMRT-SolarWindEnergyStorage | The primary purpose of the project is to test and compare Greenfield Steam & Electric's concentrated photovoltaic (PV) technology prior to any large-scale deployment. The testbed will allow the concentrated PV performance to be easily compared to the performance of a commercially available PV system. The testbed will also be used to model a typical residential-size distributed energy resource installation. The integrated test bed will allow AEP to study the effects of residential-size wind and solar on the grid, as well as the interface and controllability it may have with a Home Area Network (HAN) and Advanced Metering Infrastructure (AMI) |
| RDDA582101 | 60,303 | 2,736 | PHEV Technlgy FutureStrategies | The primary purpose of the project is to prepare our business for the mass deployment of PHEVS across AEPS regulatory jurisdictions. Develop a strategy (in conjunction with R&D) that will have a positive impact on revenue and that leverages the capacity of our existing infrastructure. |
| RDDR540101 | 74,358 | 3,170 | Strategic Technology Research | Utilize data and consulting services of Photon Consulting and Bloomberg Energy Finance to adequately research new technologies as they relate to distributed generation, renewables, energy storage and combined heat and power and use this information to inform and support senior and executive leadership for near- and long-term strategy development. |

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| RDDR560401 | 17 | 1 | Rolls-Royce 1MW SOFC Test&Eval | Partner with Rolls Royce Fuel Cell Systems (RRFCS) to confidentially test and evaluate their pre-commercial, natural gas fueled, 1 MW SOFC system, utilizing our Walnut Test Facility. Participation provides hands-on experience with the technology. This enables AEP to proactively plan for the application and interconnection of the technology and its impact on the shaping the grid of the future. |
| RDDR570001 | 11,598 | 528 | DER Program Mgmt | Provide program management for the Distributed Energy Resources (DER) program. |
| RDDR570101 | 504 | 23 | DER 2007 EPRI Annual Portfolio | Energy Storage has been recognized as a strategically important component of our future grid. Membership in EPRI 94.001 provides AEP with information on the state of utility-related energy storage technologies and their applications in the industry Distributed Energy Resources (DER) program. |
| RDES510301 | 490 | 65 | 2011 CEATI Membership | The scope of the Strategic Options for Sustainable Power Generation Interest Group SOIG is to develop, evaluate and demonstrate sustainable power generation technologies that will result in an increase in power supply capacity and a reduction in greenhouse gas emissions. Includes distributed generation, distributed resources, fuel advancements and advanced generation cycles. |
| RDES510401 | 15,834 | 1,328 | Energy Sustainability Int Grp | The ESIG has identified the following priorities for 2011 identifying common and best practices of sustainability leaders; case studies of best practices in sustainability; continued focus on supply chain operations/sustainability; the next generation of sustainability reporting; sustainable technology development. This group represents a collaborative effort within the electric utility industry to advance sustainability within the industry. It is the only electric utility-specific group of its kind at this time. |
| RDES510901 | 16,107 | 1,055 | Static Liquefaction of CCP's | Study the effects of rapidly closing an ash pond and the potential for static liquefaction to occur, causing dam instability. The objective is to determine what a safe rate of closure is to allow gradual relief of pore pressure and to allow safe closure. Please see the end of this project charter for more detail. |
| RDES511001 | 2,336 | 91 | Mapping Ecosystem Svcs-Rockprt | EPRI will develop a GIS tool for the Rockport site that can be used for assessing current and future impacts to natural resources and associated ecosystem services. This approach will provide a strong scientific framework for optimizing AEP land management practices and help balance these decisions with other corporate priorities. The GIS tool will provide capability that will allow for a rapid, cost-effective, and comprehensive assessment of AEP land management decisions that will benefit/impact natural resources and associated ecosystem services wildlife, carbon storage, pollination, water purification, and others. Further investment in this approach will be subject to the success and value of this pilot application at Rockport. Part of this effort will include the development of instructional materials so that AEP staff can implement this approach on other properties. |
| RDES511301 | 75,000 | 9,891 | Gr92 Steel Boiler&PipingCmpnts | Initial product testing has shown that very low ductility creep failure of base metal samples have occurred with significantly raises concerns over catastrophic fracture. Issues associated with creep failure of welds. It appears that creep failure can occur in the weld metal depending on the PWHT condition used. Project Benefit: Develop guidelines on how to ensure Gr.92 steel components are manufactured and welded to provide expected performance. Present a Life Management Strategy for Gr. 92 steel. |
| RDES511601 | 7,599 | 558 | Stator End-Winding Monitoring | To perform long-term technical evaluation of using a combination of on-line end winding vibration monitoring, partial discharge, and electromagnetic interference analysis EMI for condition assessment of air and hydrogen cooled generators with end winding problems. Project Benefit: It is expected that increasing level of end winding vibration will be detected in sufficient time to avoid in-service failure of 3000 3600 RPM machines that have high 5 mils end winding vibration. |
| RDES512001 | 3,351 | | Gavin Hg Reduction: FGD Ponds | The purpose of this project is to evaluate the feasibility and cost-effectiveness of a treatment technology aimed to reduce the levels of mercury released from Gavin Plant s FGD landfill leachate ponds. Effluent limitations for mercury must be met at one of the ponds Pond 2 no later than 12 31 2012. The feasibility of using activated carbon and/or biochars to sequester mercury in pond sediments will be evaluated. Project Benefit: A successful demonstration of this treatment technology will provide greater certainty in achieving effluent limitations in a cost effective manner. |
| RDES512101 | 20,000 | 242 | SuprcriticalWaterwalOxideGrwth | Supercritical waterwall cracking is one of the boiler tube failure mechanisms for supercritical units that were driven by heavy ID deposition. The deposition |

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| | | | | was due to corrosion of the condensate and feedwater piping and subsequent depositing of this corrosion product on the ID of supercritical waterwall tubing. It was believed that with the conversion of supercritical units to oxygenated feedwater treatment OT which drastically reduces the corrosion product transport from the condensate and feedwater cycle that this tube failure mechanism would go away. Unfortunately this mechanism has returned. EPRI has been working on this failure mechanism for the last several years and have come up with several different causes. One thing that has not been investigated fully is the difference between supercritical waterwall oxides prior to oxygenated feedwater treatment and after oxygenated feedwater treatment. Fortunately AEP Gary Wood has a library of tube samples from various supercritical units over the years. In particular he has a sample of a pre OT unit with very heavy deposits, and a sample of a typical pre OT unit. Couple this with samples from post OT units we will have the ability to look closer at these oxides to see what differences exist. Something that will be done for the first time on this type of deposit is the use of an ion milling tool which will allow us to see the oxide much better. |
| RDES512201 | (97,222) | (454) | Demo of the SAP for Hg Control | Full scale demonstration project for the development of activated carbon AC for Hg control. EPRI system will be utilized for the on site production of activated carbon from on site fuel and supplied to the Sorbent Activation Process under existing EPRI patents. |
| RDES521301 | 1 | 0 | Development-Shale Gas Reserves | The development of extensive shale gas reserves will continue drive an increased reliance on natural gas for electricity generation in the United States. Various environmental considerations have been identified related to shale gas production. The purpose of this project is to assess the scope and magnitude of these considerations so that related risks can more effectively be managed. Project Benefit The assessment of environmental risks from shale gas production will benefit AEP in identifying and managing related risks associated with the current and future reliance of fuel supplied from shale gas resources. |
| RDES521501 | 4,297 | 412 | EPRI Catalyst Sample Testing | Provide bench scale tests at AEP DeNOx Catalyst Laboratory for ten 10 deactivated regenerated SCR catalyst samples, which include plate type, honeycomb type, and corrugated type, received from EPRI s member electric utilities. The test for each catalyst sample includes the bench reactor test to determine the catalyst DeNOx activity, SO2 to SO3 conversion rate, and pressure drop as well as X-Ray Fluorescence XRF analysis for the catalyst surface and bulk material composition. The tests are performed in accordance with the VGB guideline R302 H e. Benefit Long term performance of regenerated catalyst from different applications. |
| RDES521901 | 198 | | Concrete Insp-HydropowerAssets | The purpose of the project is to demonstrate state of the art nondestructive concrete inspection technologies at hydro assets. Project Benefit To demonstrate the performance of emerging nondestructive concrete evaluation technology at hydro assets. |
| RDES530201 | 6,410 | 359 | AirEmissionControl By-Products | Project Purpose: New learnings from this research include a robust database of the impact of various air emissions control technologies on environmental and engineering characteristics of coal combustion products CCPs and wastewater solids. In addition, the project will provide new information and methods for the application of stabilization/solidification methods to highly soluble salts. Project Benefit: These data will then be used to develop appropriate management practices that are protective of the environment. Successful completion of this project will benefit the public by supporting environmentally safe management practices specifically for these materials. Such practices are anticipated to have lower life cycle cost, providing the added benefit of lower impact on electricity rates over the long term. |
| RDES530701 | 50,333 | 4,783 | FGD Wastewater Tech Eval | Project Purpose: Acceleration the development of advance wastewater treatment technologies – such as polishing treatments for Hg and Se such as Fe co-precipitation, absorptive media and precipitation technologies . The evaluation of precipitation technologies such as Advanced reactive Media System – ZVI technology in FGD-WWT plants. Evaluation of biological systems that would function similarly to the GE-ABMet process. Also evaluation of membrane technologies targeting sub-micro particles. Project Benefit: Improved performance and reliability in existing systems – which is especially required to obtain the ORSANCO limit of less than 12 ppt Hg. Also systems would assist in removal of the dissolved species of Hg, Se, As that have not been oxidized and removed in the more conventional phys/chem |

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| | | | | processes. Sub-micro particles adversely affect the performance of a number of FGD-WWT plants to reach 12 ppt – success application of this technology would be beneficial for our needs. |
| RDES531001 | 6,925 | 368 | Endangered Species Planning | <p>Project Purpose: The US Fish and Wildlife Service (USFWS) has developed a backlog of hundreds of candidate and petitioned species for which they must determine the endangered and threatened status over the next several years. The species under review cover all 50 states, including those in which AEP operates. A species listing could delay or prevent the completion of generation or T and D projects. This project will facilitate the formation of collaborations to create, collect and disseminate relevant technical information regarding the status of the candidate species.</p> <p>Project Benefit: The collaborative study will strengthen the endangered species review and listing process and address cost-effective conservation planning, which can result in species protection without the need to list under the Endangered Species Act (ESA). Specific benefits include an increased understanding of the endangered species decision making and species conservation planning processes, a reduction of impact of related litigation, improved strategies and knowledge to address ESA issues, and collaborative working relations with the USFWS and other stakeholder organizations.</p> |
| RDES560101 | 268,819 | 2,510 | EPRI Environmental Controls | Environmental Controls projects from the EPRI Annual Research Portfolio include: 1) Program 71 – Combustion Performance and NOx Control - AEP buys two projects from this program. Project 71.001, Mitigation of Fireside Corrosion and Waterwall Wastage in Low-NOx Systems, takes a three-pronged approach to understanding and resolving the costly consequences of accelerated fireside corrosion exacerbated by low-NOx operation, looking at coal quality, boiler design, and materials-based solutions. Purchase of t |
| RDES560201 | 4,584,324 | 294,556 | EPRI Environmental Science | Environmental Science projects from the EPRI Annual Research Portfolio include: 1) Air Quality Programs - By providing credible scientific information and state-of-the-art assessment and management tools, EPRI's air quality programs support the development of effective and protective policies, standards, implementation plans, and compliance strategies. Programs within the Air Quality area include 42 – Air Toxics Health and Risk Assessment, 91 – Assessment Tools for Ozone, Particulate Matter and Haze, an |
| RDES580601 | 7,769 | 530 | OhioRiverEcologicalResearchPrgm | The objectives of the project are to 1) provide information on the effects of fish impingement, thermal discharges, and other power plant wastewater processes on fish populations in the Ohio River; 2) provide information useful in commenting on proposed ORSANCO, federal, and state water quality standards for the Ohio River; and 3) update existing data and refine fish population estimates to address USEPA 316(b) concerns. Schedule will include winter sampling, which has only been done once in the history of the program. |
| RDES582501 | 30,792 | 423 | EPRI HG-SE FGDBlowdownWtrTrtmnt | All flue gas desulfurization systems require periodic blowdown to limit the build-up of chlorides and other soluble products of the combustion process. Some constituents of the blowdown water will include trace elements that are subject to increasingly stringent control requirements. Two such elements are mercury and selenium. This project will evaluate promising technologies for treating emissions of those elements in the chloride purge stream. |
| RDES593101 | 8,021 | 575 | Ohio River Basin Trading Prgm | This project will design and implement a regional trading program in the Ohio River Basin for both water quality and greenhouse gas credits. Building on related EPRI work to quantify greenhouse gas (GHG) emission reductions for avoided fertilizer use, this project will develop an approach for creating GHG and water quality credits associated with reduced nitrogen fertilization on agricultural crop lands. This project also will build on EPRI's work to establish a WARMF watershed model of the entire Ohio River Basin. Properly designed and deployed, this trading program will reduce GHG emissions and nutrient discharges, such as nitrogen, and protect watersheds at lower overall costs. This project will be a first-of-its-kind regional trading program and represents a comprehensive approach to managing nitrogen, phosphorus and GHG emissions. This work is timely as existing challenges to meet nutrient discharge limits may be amplified by increased effluent discharges of nitrogen (due to operation of air pollution controls), coupled with more stringent water quality based limits for surface waters. In addition, the establishment of GHG credits due to avoided emissions improves AEP's ability to purchase local, ecologically defensible carbon offsets. |
| RDES593301 | 200,000 | 200,000 | CarbonMgmt- UKResearchFndation | Per Kentucky Public Service Commission (KPSC) Order in Case No. 2008-00308, dated October 30, 2008, to establish a Regulatory Asset related to certain payments made to the Carbon Management Research Group (CMRP) and the Kentucky Consortium for Carbon Storage (KCCS) regarding the management of carbon and carbon dioxide associated with existing coal-fired electric generating facilities in Kentucky. Kentucky Power Company (KPCo) has agreed to |

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| | | | | provide up to 10 years of conditional funding of \$200,000 annually. Payments are made to The University of Kentucky Research Foundation. Regulatory asset account 1823188 has been established to capture these costs. |
| RDGA260001 | 15,227 | 646 | Adv. Generation Prog. Mgmt | This line item is used for the Advanced Generation R&D Program (AG) pre-project R&D development efforts and to track and manage misc. AG R&D projects less than \$10K. The purpose of this charter is to document the scope, budget and costs (labor and non-labor) of those projects and efforts included in the Advanced Generation Management function. It is also used to track participation at general conferences and other trips associated with the Advanced Generation program. The scope of this charter includes: |
| RDGA260101 | 6,727 | 333 | Adv Gen EPRI Annual Research | The Advanced Generation selection from the EPRI Annual Research Portfolio consists of Program 9: Technology-Based Business Planning Information & Services (aka Technology Assessment Guide, or TAG). The EPRI TAG provides performance and economic information about most generation technologies. The TAG-Supply« Database and Software currently covers 24 categoriesüincluding all major fossil and nuclear plant types, several energy storage technologies, small-scale generation options, renewable resource techno |
| RDGA260201 | 66,079 | 867 | Coal Utilization Research Council | The Coal Utilization Research Council (CURC) was formed in 1997 as an ad-hoc group to act as an industry voice for R&D needs associated with the role of coal as a sustainable energy source for electric power generation as well as the transportation and chemical industries. CURC members include utilities, equipment suppliers, coal companies, universities, and other energy-related companies and consortiums. The CURC provides its members with a respected, influential forum in which they work to ensure the c |
| RDGA260601 | 27,095 | 865 | Technology Assessment Guide | The EPRI Technology-Based Business Planning Information & Services (aka Technology Assessment Guide, or TAG) provides performance and economic information about most generation technologies. The TAG-Supply« Database and Software currently covers 24 categoriesüincluding all major fossil and nuclear plant types, several energy storage technologies, small-scale generation options, renewable resource technologies, and transmission and distribution facilitiesüwith nearly 100 distinct configurations of proce |
| RDGA260701 | 28,255 | 2,028 | Geologic CO2 Sequestration P2 | This is an on-going project (co-funded by the DOE and led by Battelle) that is investigating the feasibility of safely injecting and storing CO2 in deep salt water-laden rock formations. The project is located at AEP/Es Mountaineer plant in New Haven, WV. |
| RDGA281901 | 203 | 2 | EPRI Demo- Ion Trnsprt Mbrne Oxy Prd | The ability to provide a low-cost stream of pure oxygen is an enabling technology for two different methods of separating carbon dioxide from flue gas, IGCC with CCS and oxy-combustion. Current cryogenic methods of oxygen production are very expensive in terms of capital, auxiliary power consumption, and water usage. Air Products and the United States Department of Energy have worked to develop methods of oxygen production involving transport of oxygen ions through a ceramic membrane, and the technology has progressed to a point where a demonstration unit is possible. EPRI's role in the project will be to provide an electric utility industry perspective to the project to ensure the ability to employ the technology in actual power plants. |
| RDGA292101 | 508,404 | 6,473 | Industrial Advisory Cmte- SthrnCo | AEP will participate in a partnership at the Carbon Research Center at Power Systems Development Facility (CRC at PSDF). The focus of the CRC is to conduct sufficient R&D to advance emerging CO2 control technologies to commercial scale for effective integration into either IGCC or advanced combustion processes. A primary objective of the CRC testing is to evaluate solvents, sorbents, membranes and other emerging technologies in various contacting devices at an appropriate scale with real syngas. As concepts proceed past the bench scale, a test under industrial conditions with real syngas is needed to provide a pathway to commercialization. For both new and existing power plants, post-combustion capture technology must be made more efficient and cost-effective. Many technologies are under consideration for post-combustion capture, but these technologies need to be proven and integrated in an actual power plant setting. A Flexible Pilot Test Unit test module will be designed and installed at an existing pulverized coal plant adjacent to the PSDF. |
| RDGA300001 | 677,098 | 39,194 | Gen Asset Mgmt - Prog Mgmt | This line item is used for Generation Asset Management (GAM) pre-project R&D development efforts and to track and manage misc. GAM R D projects costing 10K. The purpose of this charter is to document the scope, budget and costs (labor and non-labor) of those projects and efforts included in the GAM function. It is also used to track participation at the general conferences associated with GAM especially EPRI conferences for the AEP EPRI Advisors. |

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 Commission Staff First Set Data Request
 Order Dated November 24, 2014
 Item No. 47
 Attachment 4
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| Work Order | Corporate Total | KPCo Total | Project Title | Project Description |
|------------|-----------------|------------|---------------------------------|--|
| RDGA321101 | (42,129) | (510) | Mercury Oxidation Measurements | SCR catalyst oxidizes the elemental mercury in the flue gas to oxidized mercury which is subsequently removed by the downstream FGD system. It is the co-benefit of SCR and FGD for mercury removal. The purpose of this project is to measure mercury speciation at SCR inlet, outlet and between catalyst layers and understand the performance of each catalyst layer with respect to mercury oxidation as flue gas condition changes from catalyst layer to catalyst layer. Project Benefit The understanding of mercury oxidation performance of each catalyst layer will help to improve catalyst management strategies for mercury control. AEP WILL BE REIMBURSED BY EPRI FOR THIS TESTING PROJECT. |
| RDGA380101 | 2,095,417 | 70,047 | EPRI Annual Portfolio | Program 63 - This program develops technology and guidance that allows participants to safely manage boiler component life for high reliability and reduced O&M costs. Technology development efforts will focus on advanced inspection techniques to identify component damage early and accurately; analysis tools to predict component remaining life and in-service failure risk; decision support tools that allow AEP to balance risk and economic benefits under a variety of plant operating scenarios and conditions; and repair techniques designed to maximize component economic life. (EPRI = Electric Power Research Institute) Program 64 - Participation in this program provides the opportunity to access the EPRI knowledge base across the wide breath of this target. Program 87 - Acquire through EPRI membership in P87.001 and P87.002 the most current guides for material. Program 88 - The P88-HRSG Dependability program is to provide technology that will address chemical issue. Program 171 - Develop guidelines, materials, solutions and monitoring techniques in this Issue Program so. |
| RDGA380801 | 95 | 3 | CreepStrength-G91FerriticSteel | The purpose of the project is to identify effective methods for locating and characterizing deficient G91and other Creep Strength Enhanced Ferritic(CSEF) steels; develop material specs and processing standards to assist utilities in procuring G91 and other CSEF steel components; assemble a guideline that provides the life assessment protocol for G91 and other CSEF steels. |
| RDIT530001 | 65,052 | 2,481 | IT R&D Program Management | General management and coordination of the IT R and D program |
| RDLABACC01 | 28,417 | 999 | Labor Accrual - R&D | To record research and development portion of labor accruals. |
| RDNU560101 | 1,496,262 | | EPRI Nuclear Annual Research | Collaborative R&D within the nuclear power industry ensures that nuclear power is an economically feasible option within the current and future generation mixes. To this end, EPRI develops cost-effective technology for safe and environmental friendly electricity generation that maximizes profitable utilization of existing nuclear assets and supports promotion and deployment of new nuclear technology. EPRI's Nuclear Power program centers on seven key business objectives. |
| RDRE520301 | 407 | 21 | ManagingSpeciesIssues-Renewabl | The purpose of the project is to perform a population-level risk assessment on eagles with respect to wind farm development and siting using real world data and modeling. Project Benefit: To develop an understanding of population-level impacts of wind development on eagles for more informed siting decisions, risk management and mitigation of potential impacts. This will add certainty to long-term wind operations. |
| RDRE570001 | 78,870 | 5,395 | Renewable R&D ProgramMgmt | This is used for Renewable Energy Resources Initiative (RERI) pre-project R&D development efforts and to track and manage misc. RERI R&D projects costing less than \$10K. The purpose of this charter is to document the scope, budget, and costs (labor and non-labor) of those projects and efforts included in the Renewable Program Management function. It is also used to track participation at general conferences associated with Renewable Program Management, especially EPRI conferences in the AEP RERI area. Donald Hubschman stated that Cardinal SHOULD NOT be billed for these charges. |
| RDRE570101 | 86,100 | 4,180 | EPRI Renewabl Annual Port | This project charter supports AEP/AEs renewables involvement with EPRI, namely: PS 84.001 Renewable Energy TAG ü provides a basic reference for technical and economic assessment of renewable energy generation technologies PS 84 D Biomass Energy ü provides industry reference and contacts for renewable energy generation, most notably biomass co-firing. Donald Hubschman stated that Cardinal SHOULD NOT be billed for these charges. EPRI = Electric Power Research Institute |
| RDTA510301 | 3 | | Oklauinion HVDC Converter Statn | A high level assessment of the Oklaunion HVDC converter station to determine and evaluate the remaining life expectancy of the major AC yard converter equipment and to increase the operational reliability of the existing HVDC installation. The objective of the project is to use the assessment data, decide on |

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| | | | | the scope of the refurbishment, and to issue the results, along with AEP HVDC specifications, to the vendors to solicit bids for Oklaunion HVDC refurbishment.?? |
| RDTA520401 | 1,333 | 49 | HVDC Cable Interest Group | Participation in this interest group will focus on the following 1.Increase understanding about HVDC cable technology applications 2.Share the experience with other participants and learning from each other on HVDC cables 3.Identify technology R D needs in HVDC cables 4.Reduce the costs of power transmission, potentially reducing electricity rates to end-use customers 5.Increase overall system controllability, stability, and reliability 6.Make informed decisions based on technical and economic aspects of HVDC technologies 7.Learn about operational Experience of existing DC cables 8.Learn about the DC cable type selection, and economic choices 9.Increase knowledge about the VSC based DC applications 10.Learn about challenges and opportunities presented by cable technologies |
| RDTA520601 | 10,335 | 380 | DaylightDischargeInterestGroup | The technology for viewing corona and arcing discharges in full daylight has been around for a number of years. AEP possess three DayCor cameras and applies the technology to evaluate electric discharges associated with new products designs and for operation and maintenance of transmission lines. One of the difficulties in fully applying this technology is the interpretation of the data or visual images. This is because arcing is often interpreted as corona and vice versa, and the location of the discharges and their effect are sometimes mis-diagnosed. This failure may lead either to unnecessary intervention or to equipment failure. An ongoing challenge is the improved understanding and diagnosis of the visual images taken from the camera. These benefits can ultimately translate into O M cost savings. Project Benefit: The objectives of this project are to move this technology forward by 1 Developing training material and updating existing material with new research findings 2 Undertaking fundamental research on UV IR inspection of transmission line components 3 Providing a hands-on workshop and training |
| RDTA521101 | 1,014 | 37 | OH UG PwrTransmissionComparisn | Identify major factors comparing overhead and underground transmission lines, develop procedures and an analytical framework for the comparisons especially for utilities in North America , and demonstrate results on representative applications. Project Benefit Provide objective information and evaluation methods for transmission planning and external constituencies to lead to a better understanding of the comparison of overhead and underground transmission alternatives. |
| RDTA521201 | 660 | 23 | Modeling-Pwr Sys StabilityStdy | Improve understanding of aggregate load behavior under different system conditions and improve modeling for stability studies. Project Benefit: Comprehensive tools and test system to improve modeling of actual load characteristic behavior. |
| RDTA530201 | 11,942 | 438 | Integrated Network Model Mgmt | This project seeks to investigate the network model data needs of common Transmission system applications used within Transmission Operations, explore the business processes involved in the maintenance of shared network model information and propose a generic approach to coordinated Transmission network model maintenance using the CIM as a semantic model. This approach will be the blueprint for a 3-5 yr roadmap which will allow TOPS to streamline infrastructure and business processes involved in real-time network model management. TOPS Transmission Operations CIM Common Information Model |
| RDTA530301 | 46,227 | 1,649 | Transmission ModernizationDemo | Project Purpose: The objective of this collaborative project is to share learning from new applications that are being presently developed by research organizations and demonstrated by utilities and to accelerate these new applications adoption across the electric power industry. These new applications which may include data management architectures, data analysis systems, analytics and visualization approaches may be needed to facilitate additional transmission analysis and management functions to further improve the grid's reliability, operational efficiency, and asset performance. In addition, it is expected that new innovative approaches to data management, data analytics, and system integration will continue to be identified and this project may provide a framework for demonstrating and valuating them in real-world utility applications. Project Benefit |

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| | | | | <ul style="list-style-type: none"> · Provide insight and direct link to other EPRI projects since this work will be coordinated directly with the relevant EPRI research programs such as the Grid Operations and Planning P39 40 , Bulk Renewables Integration P173 , IntelliGrid Program P161 , and Transmission and Substation P35, 36 37 . The proposed project is expected to employ learning by doing – demonstrating and assessing the value of new analytical applications of existing and new data streams and communications infrastructure developed separate from this project, such as within base research programs, through parallel supplemental projects, at utilities, in laboratories, by vendors, etc. · Provide benefit to Planning, Operations, and Asset Management with advanced applications · Provide learning opportunities from actual implementations of common data sets and applications · Provide new methods for data collection, management, visualization, analytics, and integration · Provide company-specific Opportunity Matrix which will note what to do and what not to do which will assist in economic assessments · Increase the value of smart grid infrastructure and data through individual funder s roadmap and industry wide roadmap |
| RDTA530401 | 2,737 | - | ACtoDC Conver Kanawha-Funk 345 | <p>Project Purpose: The objective of this project to perform feasibility studies for AC to DC conversion of Kanawha River to Matt Funk 345kV line. The studies will include:</p> <ul style="list-style-type: none"> Investigation of existing AC transmission line configurations for various options for conversion to DC. Investigation of the role of the DC circuit in supporting the parallel AC system during a contingency. Investigation to determine if VSC transmission can be accommodated economically in comparison to conventional line. commutated DC transmission that might require synchronous condensers for the reactive power and AC voltage support. Develop a schedule for implementation and a budget capital expenditure Capitalized cost of losses will be added to the capital cost for the economic assessment. Investigate increased capability in system restoration such as black start. Provide training course on; 1 DC field and corona effects associated with DC transmission, and environmental impact, 2 Acceptable levels of conductor gradient, space charge, audible noise, etc., 3 Determining maximum DC voltage, 4 Configurations of VSC transmission, symmetrical monopole, bipolar options and tripole, 5 VSC transmission protections, DC circuit breakers, modular multi-level converters with half bridge and full bridge sub-modules, 6 Multi-terminal VSC transmission and DC grids, and 7 Cable and overhead line DC transmission. <p>Project Benefit:</p> <ul style="list-style-type: none"> Increase power transfer capacity based on the ultimate DC operating voltage of the converted and expanded transmission line As well as whether a bipolar or a tripolar line design is applied . The dynamic voltage and reactive power support available by the conversion of AC to DC transmission in the southern American Electric Power Company region This will compensate for the loss of the Glen Lyn generating station and overall lack of generation in southern region. Achieving increased operational flexibility and ability to control power flow Achieving increased capability in system restoration such as black start. |
| RDTA540101 | 11,105 | 391 | Min Vegetation Conduct Distanc | The objective of this project is to determine the appropriate gap factor kg for utilization in calculating minimum vegetation clearance distances MVCD utilizing the method documented in NERC Reliability Standard FAC-003-2. |
| RDTA570001 | 26,868 | 982 | Transmission RD&D Program Mgmt | The money allocated to this project will be used to fund new activities or projects that develop as the year 2007 progresses. This is to make sure that a lack of R&D funds would not stop valuable R&D activities that were not anticipated at the beginning of the 2007 budget cycle. |
| RDTA570101 | 1,329,169 | 48,818 | Trans EPRI Annual Portfol | <p>Integrated Monitoring & Diagnostics (P37.007) - The purpose of this project is to examine techniques for monitoring as many different components in a substation with as few sensors as possible, which is complementary to the projects examining inspection tools for specific components such as transformers or circuit breakers. The target of this project is to optimize applications of the sensors in substation. The concept of station-wide monitoring is to provide the low-cost screening tool that will trigger more detailed inspections at the component level. The unique focus of this project is on inspection tools that cover an entire substation, rather than at an individual component level.</p> <p>Life Extension of Existing HVDC Systems (P162.001) - This project will address the life</p> |

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| | | | | extension of HVDC systems in a systematic method. Sharing experience and practices across utilities provides one of the most cost effective ways of ensuring that best-of- class field practices permeate across the global industry. The final goal of the project is to prepare a Life Extension for HVDC System, which is expected to facilitate the process of refurbishing of existing HVDC equipment Polymer and Composite Overhead Line Components (P35.010) - Extend polymer and composite component life expectancy and avoid outages due to premature failure through improved selection, application, and inspection. (Ongoing work - EPRI Base project P35.007) |
| RDTA570201 | 21,774 | 800 | CEA LCMSEA | CEA LCMSEA- CEA Life Cycle Management of Station Equipment and Apparatus Interest Group. This on going interest group is a low overhead collaborative effort focused on member driven station equipment, maintenance, tools, asset management techniques, benchmarking, diagnostics, and life extension . Projects are defined and contract awards made to investigate and deliver solutions, knowledge, tools, evaluation and techniques for defined issues. Projects are usually completed within 1 year. CEA = Canadian Electric Association |
| RDTA570301 | 6,502 | 239 | CEA TLAMIG | CEA (Canadian Electricity Assoc.) T Line Asset Management Interest Group (TLAMIG) is a low overhead collaborative focus on member-driven transmission line maintenance needs and problems. AEP funded 2006 projects in reliability effects of defective line insulators and an asset management approach to tower painting. Several promising projects will be funded in 2007, including the deployment of a transmission line hardware failure reporting database for the detection of trends in line equipment failure modes. |
| RDTA570401 | 18,360 | 674 | PSerc | PSerc (Power Systems Engineering Research Center) is an NSF sponsored university (13)industry (38 members) consortium. Participation in PSerc provides AEP access to experienced university researchers in leading electric power programs across the U.S., results of collaborative member defined and approved low overhead R&D projects, and access to leading students for both intern and permanent employment positions. Participation in PSerc is a valuable element of a balanced portfolio of AEP internal and external R&D plays |
| RDTA570901 | 3,556 | 131 | Phasor Tech: Plan & Ops Tools. | 1) Develop tools and techniques to analyze data captured by AEP phasor monitoring units (PMUs) and apply the tools and techniques in planning (off-line) and operations (real time) environments. 2) Participate in the Eastern Interconnection Phasor Project (EIPP), which is facilitating development of a phasor data network in the Eastern Interconnection (EI). The vision of EIPP is to improve power system reliability through wide area measurement, monitoring and control. |
| RDTA590501 | 4,022 | 148 | NanoCoatings T-Line Insulators | This is a current EPRI TC project that AEP is joining. Over the years fiberglass transmission line components have suffered from a range of failure and degradation modes. Nanotechnology based materials are currently being developed to address a wide range of industry applications. This project is to investigate the possibility of utilize existing nano coatings or to modify existing coatings to address the known problems stated above. |
| RDWM201001 | 7,218 | 333 | DTC Walnut Maintenance | The Walnut Test Facility is owned by Columbus Southern Power. The facility is used by the corporate Utilities R&D program. As such, the expenses and results of work done at the facility are done for the benefit of multiple operating companies. This project / work order will allow for a mechanism to capture the annual costs of maintaining the facility, future investments, and other related annual expenses e.g., depreciation of the assets that were transferred in accordance with the dissolution of AEP EmTech, LLC, etc. and expensing them to the appropriate benefiting locations. |