

Energy Efficiency & Interactability

35: –**Smart Grid Demonstration Project** This project is a multi-year demonstration project approximating the scale, focus and discipline of the PNW Hood River Conservation Project of the 1980s. The focus of the project will be on testing, demonstrating, and measuring the issues, values, solutions, and science of interacting devices, systems, and information across the PNW electric grid from generation, through transmission and distribution, to end-uses in three sectors: residential, commercial, industrial. [I/C FY08-13](#)

79: –**Development and Demonstration of Advanced Lighting Technologies** This project will demonstrate the applicability of advanced, high efficiency lighting technologies that can be controlled via energy management systems, lighting based control systems, and/or demand response control systems or that utilize Internet protocol based remote control and command to allow the reduction of lighting loads. [E - EPRI/C/FY08-09](#)

88: –**Development of a Monitoring & Communication System for Distributed Energy Resources** This project will develop the conventions for a uniform monitoring communications system to affordably integrate the rapidly increasing number of distributed energy resources in the PNW control centers. [E-ODOE/N FY08-09](#)

90: -**Grid-Responsive Demand-Side Control using Grid Friendly™ Appliance Technologies** This project will evaluate, form a coalition of collaborative research support, and demonstrate low-bandwidth communication, targeted under-voltage protection, demand-side frequency regulation that have been made available to the operators of power grids by features of the Grid Friendly™ appliance controller. [E-PNNL/C FY08-09](#)

117: –**Development of High-Efficiency Low-Lift Vapor Compression System** Recent studies concluded that integrating off-the-shelf building systems with a yet to be developed high efficiency low-lift vapor compression system can lead to over 70% reduction in cooling and distribution energy. This project will specify and develop a prototype system and test its performance. . . . [E-PNNL/N FY09-09](#)

123: –**Self Correcting Building HVAC Controls Technology Development** This project will develop controls for building heating, ventilating and air-conditioning (HVAC) systems that automatically detect faults and correct those amenable to self-correction without human intervention. This takes an important step beyond automated diagnostics, helping keep HVAC systems continuously operating at peak efficiency. . . . [E-PNNL/N FY09-09](#)

140:–**EE Emerging Technology Assessment and Demonstration Project** This is a 2 phase, multi-year program for identifying priority emerging technologies, quantifying their savings, & demonstrating their cost-effective potential for BPA. Phase 1 identifies the technologies; Phase 2 demonstrates their effectiveness. [I/N FY09-12](#)

2009 Agency R&D Portfolio*

Renewable Resource /Wind Integration

27:– **EPRI/TVA Co-funded Development of a Scalable Energy Storage System** BPA placed on "red" list as needing significant work at midpoint review. USDOE is still very interested in technology and has offered to fund the project for the next 3 years provided that BPA manage the project. Project needs an independent panel to review and provide 2 sets of facts in order to go forward: commercial value & design of technology and what scale and cost are likely for next build-up. [I–EPRI/TVA/C FY05- 09](#)

34: -**Improved Wind Farm Modeling in Tx System Studies** This project will develop a process for calculating more accurate equivalent models of large wind farms for Transmission Planning and Operations studies, and it will determine the sensitivity of various parameters (generator, exciter and turbine) for the four types of wind generators. [I - C FY08-09](#)

59: -**Short Term Wind Forecast** Creation of five minute forecast for wind generation out one hour in order to more accurately control AGC with the influx of wind generation in BPA's BAA. Development of the nowcast system will occur for a single location in the BPA service area and operational testing for up to three locations and integration of the nowcast into BPA's real-time operation. Upon successful completion, the project will result in a nowcast service that can be implemented for all wind farms in the BPA service area, contingent on the availability of concurrent, high resolution observations of wind data (speed and direction), power output and turbine availability. [I – 3Tier/C FY08-09](#)

70: -**Wind Regulation & Load Following Study** The project will develop a methodology with BPA to quantify BPA's additional needs in operating reserves, ramping capacity, regulation & load following from expected high penetration levels of wind generation in BPA's control area.. Estimate the impact (in terms of additional regulation & load following requirements) of integrating incremental additions of wind generation from the current 733MW level to a projected 3000MW level by the year 2010. [I - PNNL/C \(FY06\) FY08-09](#)

74: -**Wide Area Energy Storage & Management** The project targets the issue of mitigating the additional intermittency and fast ramps that occur at higher penetration of intermittent generation resources in the BPA and Calif ISO control areas, and address the exchange of intermittent energy between the participating control areas, the use of energy storage, dispatchable load and distributed generation resources. [E - PNNL/C FY08-09](#)

89: -**Integrated Decision Support System for Location, Assessment, and Optimization of In-Stream Tidal Energy Developments** This project will provide a verified and fully-integrated decision support system (IDSS) to assist the process of site and device assessments for in-stream tidal power developments in the State of Washington. This proposal provides R&D that addresses the challenges in the site selection and permitting process for in-stream tidal developments, as well as facilitates the evaluation of turbine technologies for application in a site specific context. [E – Pacific International Engineering/C/ FY08-09](#)

94:–**Simulation Model for the Comprehensive Analysis of Expected Wind Generation Development Scenarios in the PNW** This project will develop a fully flexible simulation model for the evaluation of the impacts of future wind generation development scenarios on operations of the PNW electric power system. It will comprehensively predict potential aversive effects of intermittent wind resources on the system, develop and evaluate the results of mitigating measures, and conduct "what if studies." [E – Pacific International Engineering/N/ FY08-09](#)

97: -**Tidal In-Stream Energy Conversion (TISEC) Project in Puget Sound, WA - Phase IIA** In this Technical Proposal Snohomish County PUD seeks BPA co-funding support for Phase II(A) of this project to complete feasibility studies/assessments not completed in Phase I, to continue the required current profile measurements and modeling work, and to begin permitting activities and system mechanical, electrical, and environmental engineering design needed to implement a pilot tidal in-stream energy production plant. [E - SnoPUD/C](#)

106: –**Forecasting for Wind Energy Grid Integration** This project addresses the need to provide a continuous accurate forecast capability for wind energy in the PNW. Uses the Weather Research and Forecasting mesoscale meteorological model in a proposed Wind Prediction System for the PNW. Evaluates the accuracy of the forecast winds using actual power output from the test site. [E – Boise State Univ./N/ FY08-09](#)

108: –**Improving Wind Power Forecasting for the PNW** This project will test and evaluate methods for improving short-term forecasting of extreme wind fluctuations in the PNW. Evaluates forecast performance for wind events, test advanced statistical and empirical techniques for refining these forecasts, evaluate forecast errors and develop an optimized layout of wind farms in the PNW. [E – Garrard Hassan America Inc./N/ FY08-09](#)

114: –**Wind Integration Research, Demonstration and Exploration** This project will improve wind energy integration and control; investigate and demonstrate intermittency issues with wind energy generation sources in OSU's lab; research, compare and procure appropriate energy storage technologies; research integration of wind and energy storage technologies with the utility grid including the development of advanced power electronics converters and control systems; and demonstrate the controllability of wind. [E – Oregon State Univ./N/ FY08-09](#)

119: –**Low Probability Tail Event Analysis and Mitigation in BPA Control Area** Tail event refers to the situation when unfavorable forecast errors of load and wind are superposed onto fast load and wind ramps in the power system, the imbalance between generation and load becomes very significant. This type of event appears on the tails of histogram showing the distribution of system power imbalance. This project will analyze the tail events in the system, including frequency of occurrence, severity, patters, etc. derive the quantity of system reserves needed for tail events and investigate the measures to mitigate their impact. [E – PNNL/N/ FY09](#)

160: –**Wind Farm Voltage Control** This project will address design concepts and technical issues related to primary and secondary voltage controls of wind farm generating projects. [I – /N/ FY09-12](#)

163: – **BPA Collaboration with Calif ISO RFP on Wind Generation Forecasting Service** This collaborates with the Calif ISO to develop a day ahead, hour ahead and near real-time, state-of-the-art wind generating energy forecast for four operating wind plants in a forecasting competition to see who will lead forecasting wind for the Calif ISO. [I – /N/ FY09](#)

164: – **Wind Energy "Rapid Ramp" Event tracking System** This project will build on the 2007 3Tier Rapid Ramp Forecast project and complete the research to identify and forecast the likelihood of large wind ramps in a 48 hour ahead forecast, then track these ramps up to real time in the BPA control area. This project will build a forecast model retrospectively in year one, then if successful, extend to all wind plants in the BPA balancing area in year 2. [I – /N/ FY09-10](#)

Transmission Operations & Control

37: - **Load Modeling in Power System Studies** Develop and validate load models for power system studies. Research will focus on the issues related to model deployment in WECC-wide system studies. The research areas will include sensitivity and system impact studies, load monitoring for model validation and load composition determination, end-use component modeling, industrial load modeling, support of WECC Load Modeling task Force and CEC Load Research Program. [I-/C \(FY01\) FY08-10](#)

46: - **Operations Real-time Study Improvement Phase II**, Use the collaborative environment to investigate options that minimize the time needed to establish situational awareness for Operations study engineers following an unplanned outage, curtailment, or during extreme operating conditions. Staff will customize as needed, build custom displays and evaluate. Staff will also design interface between state estimator and offline powerflow application. Actual system outages or disturbances will test elapsed time improvement and OTC improvements (MWs). [I-/C \(FY06\) FY09](#)

47: - **Operations Study Process Improvement: Next Hour** Use the innovative Operations Study Process Improvement environment to investigate options to reduce unnecessary risks and curtailments by accurately modeling near term system conditions for Operations study engineers following an unplanned outage or during extreme operating conditions. Develop Outage Window Tool and Near-Term Forecasting Tool. [I - /C FY08-09](#)

50: - **Power System Controls - Inter-area Oscillation Damping** This project will research devices and control schemes that can greatly improve damping of inter-area power oscillations. The primary focus is on North-South power oscillations, affecting California - Oregon Intertie. The secondary focus is on East - West oscillations affecting Montana imports into PNW. The project methods are the Assessment of Grid Component Capabilities and Investigation of Wide Area Control Configurations. [I - /N FY08-10](#)

51: - **Power System Controls - Response-Based Voltage Stability Controls** All three types of controls (primary, secondary, emergency) will be considered. Primary Voltage control - Response-based controls for fast reactive switching of 500-kV shunt capacitor banks in Portland / Salem area. Coordination reactive resources in Southern Oregon / Northern California area. Secondary Voltage Controls - Reactive power management to optimize voltage profile and to maximize reactive margins. Emergency voltage controls - Low voltage shedding. [I-/C FY08-11](#)

52:–**Generating Facility Performance and Model Validation Requirements** This project will develop performance measures for generating facilities in voltage control, frequency regulation and oscillation damping areas; to ensure that the components of the grid, power plants are performing in accordance with commitments. This work is complementary to the ongoing work on phasor measurement and oscillation stability projects. [I – /C/ FY09-10](#)

62: - **R&D State Estimator to Real Time Transient Stability Phase 1** Develop an interface from BPA's AREVA State Estimator to PowerTech Transient Stability program (TSAT) based on BPA's existing interface to PowerTech voltage stability program (VSAT). Add BPA, NW and WECC transient dynamics data to the existing voltage stability and state estimator data. Evaluate and test for realistic results and time to complete a real time study assessment (minutes). Develop BPA dispatcher & operations engineer tools and displays. [I - PowerTech/C FY08-10](#)

93:–**Normal and Emergency Operation Visualization** This project will investigate the limitations, define standards, and propose visualization tools and graphical displays to improve the ability of power grid personnel to reliably operate the transmission system during normal and emergency operations. [E – PNNL/N/ FY09](#)

95: - **Wide Area Power System Security Region** The project will develop key elements of a new tool for analyzing wide-area security conditions of the BPA and WECC systems based on a new conceptual idea of wide-area multidimensional nomograms (WAMN) and provide wide-area situation awareness and actionable information for the BPA and WECC operators and security coordinators using real-time synchrophasor information coming from the WECC Wide-Area Measurement System (WAMS). [E-PNNL/N](#)

124: –**Real-time Dynamic Stability Analysis (DSA) Modeling in PowerWorld Simulator** This project will add models to the DSA for greater usability by BPA in a production environment; integrate the novel topology processing into the DSA tools; evaluate and test the tools, and train the tool users. [E – PowerWorld Corporation/N/ FY09](#)

129: - **Real-Time Oscillation Monitoring Expert** Develop and implement a real-time monitor for detection of large or unstable oscillations. The project will develop an adapted algorithm for early detection of power system oscillations with risk of resulting in system breakup or cascading. The algorithm will be implemented in the Real Time Dynamic Monitoring System to be available for System Operations technical staff and eventually dispatching staff. [IE-Washington State Univ/C FY08-09](#)

145:–**Grid Segmentation** This project will study the benefits and costs of segmenting the Western Interconnection into two or more bubbles through back to back or conventional DC links. To reduce the likelihood of cascading outages and increase ATC across key transmission paths. [I – /N/ FY09](#)

148: –**Systems Operations R&D Deployment** This project deploys R&D from an engineering phase into production for systems operations. Includes Human factors research, VSAT, and TSAT which are extensions to BPA's State Estimator to perform voltage and transient stability studies in real time which are needed on many critical WECC paths and includes other R&D projects. [I – /N/ FY09-10](#)

159: –**Powerflow Control Applications in BPA Grid** This project will consider a full spectrum of the solutions for meeting load service reliability and transfer capability requirements, including power flow controllers, flexible AC transmission devices, system sectionalizing, system segmentation, etc. [I – /N/ FY09-10](#)

EPRI Memberships and Tailored Collaborative

19:--EPRI Program 170 – Dynamic Energy Mgt This program involves research on energy efficiency & demand response, as well as green house gas reduction – from a dynamic, integrated systems or networked perspective that simultaneously addresses electric energy savings, demand reductions & peak load mgt. I/C FY08-13

21: - EPRI membership – Program 38 Increased Utilization of Transmission Corridors Provides customers with a one-stop shop for reducing new capital expenditures for both transmission & substation equipment. Those interested in improving the overall mgt of their transmission assets can refer to EPRI's Power Delivery Asset Mgt Program. C

23: - EPRI Membership – Program 35: Overhead Transmission EPRI's Overhead Transmission Program offers a portfolio of products and technologies to cut O&M costs, reduce capital expenditures for new/refurbished equipment, improve reliability, and improve safety. Projects in the program also address the related areas of extending equipment life, ensuring health and safety for workers, & reducing impacts on the environment. C

24: - EPRI TC Project - TC002902-10270 (PID049551): Seismic Studies The objective of this project is to seismically qualify substation equipment, with a research component for the proposed enhancement of IEEE Standard 693, IEEE Recommended Practice for Seismic Design of Substations. C

25: - EPRI Membership – Program 37: Substations This EPRI program spans the full breadth of technologies found within both transmission substations & generation switchyards. EPRI's Substations Program offers the most complete portfolio of globally available technologies and tools for utility personnel involved in making strategic and tactical decisions for substation asset utilization and maintenance. C

136:--Comprehensive Non-Ceramic Insulator Solutions This is a comprehensive review of the electrical, mechanical and measurement issues and solutions for non ceramic insulators with EPRI TC. I – /N/ FY09

PSERC

53: -Power Systems Engineering Research Center (PSERC) The electric power industry is evolving from its historical business structure. Challenges for success in this demanding business environment are being raised by new market structures & ways of doing business, new technologies, the demands of customers for customized services, strategic choices between centralized & decentralized technologies, institutional changes creating mega-RTOs, a graying industry that needs well-trained power engineers & new environmental priorities. The challenges call for new strategies, technologies, analytical capabilities & tools & operating practices, along with sound public policy guidance. C

Climate Change

13: - Climate Change Streamflows for the Columbia Basin The proposal will work with the NWPC and the Washington Department of Ecology to have the Climate Impacts group develop a unique set of streamflows which have been altered to reflect the latest GCMs through a downscaling process to finer spatial and temporal resolution. Climate adjusted streamflows will be provided at all points required for the Genesys model, and therefore BPA's Hydsim model, in order to model the overall climate impacts to the FCRPS. The actual regulation of these streamflow scenarios via Hydsim is not within the scope of this proposal. This work will be done by BPA and NWPC staff. I-C FY08-09

Hydro Operations

151:--Literature Review of the Feasibility of Mitigating Dreissenid Mussel Fouling in Raw Water Systems This project will review available documents, reports, and other literature on the efficacy of various types of antifouling coatings and identify research required for application in FCRPS facilities. I – /N/ FY09

152:--Prioritizing Zebra and Quagga Mussel Monitoring in Columbia River Basin (CRB) This project expands the risk assessment to high-risk water bodies outside the CRB that can serve as stepping stones for mussel expansion in the CRB. This project will identify areas that lack sufficient data, collect these data, and produce a more comprehensive prioritized list of dreissenid mussel monitoring sites. I – /N/ FY09

CEATI

5:-- CEATI Working Group - Life Cycle Management of Substation Equipment Multiple projects sharing costs and benefits associated with substation management including asset management. C

6:-- CEATI Working Group: Overhead Line Design, Wind and Ice Mitigation Interest Group This is a continuing collaborative consortium of international utilities that conducts research that addresses common interest problems for the design of overhead lines, and extreme events caused by ice and wind. The consortium projects are short term (approximately 1 - 1.5 years) to provide members with the current knowledge for the issues studied. The consortium also performs benchmarking of the members on subjects relative to the Interest Group. C

10:-- CEATI Working Group: Transmission Line Asset Management This Interest Group focuses on collaboration of international utilities to do research & exchange information on asset management methods & techniques. A key thrust will be to extend the life of existing assets or to implement sufficient upgrades to them and thus defer or eliminate the need for major capital expenditures. C

174:-- CEATI Working Group: Power System Planning & Operations This Interest Group focuses on new technologies that enhance the use of existing lines and facilities and that are applicable to the design and implementation of new lines. N

CIGRE

11: - CIGRE Transmission Tower Working Group In the next four years the CIGRE Tower Working Group will be performing studies to addresses issues relative to the following subjects:
Project 1: Improving OHL supports for uprating and/or upgrading Projects
Project 2: Maintenance, refurbishment and life extension techniques for HV and UHV overhead line supports
Project 3: Behavior of HV and UHV overhead line supports to dynamic loads (wind, seismic, broken conductor, etc.) C

12: - CIGRE B2.12/26, Electrical Aspects of Conductors Working In the next four years the CIGRE Electrical Aspects of Conductors Working Group will be performing studies to addresses issues relative to the following subjects:
Project 1: Issues and techniques for OHL uprating and/or upgrading Projects
Project 2: Maintenance, refurbishment and life extension techniques for HV and UHV overhead lines
Project 3: Behavior of HV and UHV overhead line conductors to aging and elevated temperature operation. C

171:-- Carnegie Mellon – Electricity Industry Center Membership Its purpose is to serve as a collaborative organization to make the electricity industry more competitive and its systems more reliable. C

Transmission Assets

1: Advanced Surge Suppression Resistor Development Develop and field test new potentially patentable "arcing horn" invention and revised resistors for improved electrical and seismic performance. This project will allow BPA to be able to apply the high-current breakers without creating new sets of problems with high surge currents flowing through the substations. The improvements to the surge suppression resistors should also provide substantial improvement in the seismic performance of these devices. I-C FY08-09

15: - Design and Build Process for Seismically Isolating Substation Equipment Using Friction-Type Energy Dissipation Devices This project identifies two substation installations of equipment as potentially seismically vulnerable. The equipment in question are 500 kV transformers, with surge arrestors near the transformer bushings, and 500 kV "ELF" live tank power circuit breakers, with current transformers near the circuit breakers. The two installations, support and equipment, will be assessed for vulnerability and if one or both of the installations are determined to be vulnerable then one of them will be selected for hardening. I - PSU/C (FY05) FY09-10

45: - Operational Multi-Gigabit Ethernet Transport (OMET) This project will install four nodes of OMET using existing BPA fiber facilities for connectivity. Between two of these nodes, the project will also install CWDM hardware creating eight virtual pairs of fiber over a single physical pair of fiber. This project will demo feasibility and reliability of a pure gigabit Ethernet transport (OMET) and BPA's ability to make significantly better use of BPA's optical fiber for multiple applications (CWDM). I-N FY08-09

57: Extreme Event Risk and Vulnerability Assessment (SERA) This project will develop SERA modeling tools for the BPA power system. Expand the modeling capability of SERA to include extreme event ice and wind storm models. The BPA transmission system model will be used for assessing BPA's vulnerability to extreme events (earthquakes, ice, and wind) in the Pacific Northwest. The preliminary earthquake generated landslide model will be refined and validated for identifying and assessing the vulnerability of BPA's cross-mountain transmission lines. Assessment tools for identifying liquefaction potential at key transmission line river crossings will be developed. I-C FY08-09

132:--Dynamic Thermal Line Rating This project investigates technology that could provide BPA the ability to implement Real time Dynamic Thermal Line Rating methods for determining the operating transfer capability of our network in real time. Investigates the ability to interface of real time data into BPA system operations. We want the product to be used in real time inside the control center to provide additional transfer capacity when conditions permit. I – /N/ FY09-12

139 :--Sub-grade Corrosion Mgt of Transmission Line Structures This project will produce a computer program, test station, input them in to the new program, and be able to determine the corrosion rate of the tower or buried steel structure. This would permit the monitoring of the corrosion rate and open the door for further testing of corrosion characteristics. I – /N/ FY09-12

141: --Splice Shunt Testing This test will define the thermal profiles of splices and various types of shunts to define acceptable high current capacities for high temperature conductor operation. I – /N/ FY09

156:--Seismic Projects This effort combines and coordinates all of the seismic research efforts. I – /N/ FY09-12

169:--Aging Assessment Tools to Evaluate BPA Transmission Line Grounding This project will develop aging assessment tools to evaluate BPA transmission line grounding. I – /N/ FY09/

