TECHNOLOGY CONFIRMATION / INNOVATION (TCI) PROGRAM

What is proposed?
BPA faces challenges due to new demands placed on the power system for which it was not originally designed, opportunities for improved performance, security threats, and aging infrastructure. BPA and its partners must continue to act as responsible stewards of a physical system that is under stress – a system that includes 31 federal dams with 209 generating units, a nuclear power station, over 15,000 circuit-miles of transmission lines, 238 substations, and control operations, all distributed over an area of 300,000 square miles. To meet these challenges BPA proposes to pursue beneficial technological innovations more aggressively than it has in the past decade, in concert with its partner agencies.

What is the mission of the TCI Program?
The mission of the TCI Program is to confirm the potential application of emerging technologies to BPA's enterprise to achieve BPA's strategic objectives more effectively and efficiently. BPA has expressed the importance of this in a strategic objective in its Flight Plan for the period 2007-2011: "BPA is a leader in the application of technologies that increase the value of mission deliverables."

How do we use the term "technology confirmation / innovation"?
TCI is a critical stage in the process of applying emerging technologies to the achievement of BPA's mission. TCI is the act of finding, developing, adapting, testing, and confirming the efficacy – in our systems – of these technologies. TCI does not include the actual deployment or application of the technologies. Technology deployment is typically a capital expenditure commitment, made only after the technology's usefulness has been confirmed.

What TCI has BPA accomplished in the past?
Examples of past BPA accomplishments in TCI are shown below in **Table 1**.

What are potential areas of technology for the TCI Program to engage in?
Examples of future TCI areas are shown below in **Table 2**.

What is BPA doing in the TCI area now?
BPA has several efforts that relate to TCI, including those in TBL (infrastructure and operations/planning), Energy Efficiency, and Federal Hydropower. TCI has received less attention in recent years despite the technology-based challenges that BPA faces. There is a need to support work in areas that have significant potential but now lack attention and resources. The TCI program will do this.

What are the financial implications of the proposal?
Total TCI funding consists of the (1) base level of funding that is already incorporated into organizational forecasts and (2) incremental funding. The proposed funding in Corporate G&A forecasts is for incremental funding. The American electric utility industry in general has shrunk its TCI-related budgets since regulatory uncertainty became evident in the early 1990s. BPA's funding also shrank during this period, from about 0.6% of revenues in 1995 to 0.16% of revenues in 2004. BPA is proposing to add to the base level of funding gradually, to yield a total TCI level that would be in the range of 0.3% - 0.5% of revenues by 2011.

Guiding principle
Any TCI investment will be based on a clearly expressed value proposition. On a portfolio basis, TCI costs should be recovered after proven technologies are deployed.

Table 1 – EXAMPLES OF PAST TCI ACCOMPLISHMENTS AT BPA

TCI Projects	Results
Transmission:	
Remedial Action Scheme (RAS) – development & demonstration	□ Revenues up: Increased transfer limit on CA-OR Intertie from 1100MW to 7900MW □ Enabled increased loads and generator interconnections without building new lines □ Additional flexibility for interconnected system
Reliability-Centered Maintenance (RCM) methods– development & demonstration	□ Identified more efficient maintenance intervals for substation and transmission equipment □ Reduced field crew sizes without increasing failures or backlog
Fiber Optics/Digital Network – demonstrations, then partnering to build routes where leased excess fiber defrayed construction costs	□ Digital communication network to operate transmission system □ Increased capacity of communication network to carry phasor measurements and other new technologies □ Faster operation for better transmission system control (Remedial Actions and Transfer Trips) □ Reduced costs to BPA because of fiber optics leasing
Hydro Generation:	
Hydro optimization project – RD&D on technologies to raise generation efficiency at existing projects	□ Targeting hundreds of aMW of additional generation at very low cost – among the lowest-cost resources that BPA has purchased in the last 20 years
Security:	
RAM-T & RAM-D Methods – technical risk assessment for transmission & dams	□ Developed new assessment tool to measure risk for energy facilities and validated components during testing and certification □ Quantified the risk of attack on the system and provided cost benefit strategy to mitigate risks □ Developed a realistic security enhancement strategy for the agency
Energy Efficiency:	
Energy-efficient residential construction methods – developed, demonstrated, evaluated	□ Transformation of the new residential construction market – technologies, construction methods, codes/regulations
Appliance efficiency improvements	□ Helped transform the market to where it produces more efficient refrigerators, clothes washers, water heaters, etc.
Renewables:	
Wind and geothermal monitoring – basic research	□ Characterization of the wind and geothermal resources in the PNW □ The basis for wind and geothermal development in the region □ Created Renewable Energy Atlas of the West
Wind Integration studies	□ Creation of valuable storage & shaping products
Environment:	
Mineral oil in soils – basic research on cleanup, demonstrated "residual saturation" technology	□ Very large $ savings for cleanup and soil removal □ Resulted in less stringent, though still effective, regulatory requirements for cleanup in OR, WA and ID
In situ bioremediation of contaminated soils	□ Demonstrated new treatment options for soils contaminated with wood pole preservatives □ Significant $ savings for Ross Superfund site and cost savings implications for other locations where poles are stored or installed
Cost-effective disposal of non-PCB capacitors and synthetic oils	□ Confirmed synthetic oil properties, allowing for recycling and energy recovery rather than expensive disposal □ Demonstrated non-PCB capacitor disposal at 50% cost reduction

Table 2 – BPA CHALLENGES THAT TCI COULD HELP ADDRESS

Challenges	TCI That Could Be Undertaken
Transmission:	
Provide better safety nets for transmission disturbances; improve monitoring and automatic control functions of interconnected system	Development of the Smart Grid (self-healing): □ Improved monitors of grid conditions □ Diagnostic tools that anticipate stability problems □ Wide Area Control Systems (WACS) for automatic responses to system anomalies; smarter, faster automatic controls and system responses to disturbances □ "Smart" transmission substations and "smart" distribution substations (e.g., for improved voltage control)
OTC is reduced after unplanned outages, to detriment of all parties	□ Development of faster, dependable methods for calculating operating transfer capability (OTC)
Legislatively forced replacement of VHF radio systems (substations, line crews, SCADA, transfer trip)	□ Demonstration and/or adaptation of existing technologies □ Work with manufacturers to develop new technologies that will maintain services within new restrictions
Congestion driven by thermal limits on system	□ Demonstration of ceramic conductor that has higher thermal operating limits
Hydro:	
Increase durability and lifetime of hydro machines	□ Development and use of alternate bearing materials □ Investigate the use of different types of oils in hydro facilities □ Improve equipment diagnostic methods directed at reducing maintenance costs, decreasing equipment downtime, and extending equipment life
Increase power system stability	□ Better assess generator control within the context of the power system
Extraction of even more power out of the existing hydro base with less environmental impact	□ Continued development of hydro optimization tools □ New turbine designs to increase efficiency and improve environmental effects □ Tools to increase efficiency of unit and plant operations
Security:	
Physical security of remote, dispersed facilities	□ Dual-purpose communications systems can be used for both system operational control and security applications □ Test advanced monitoring/communications technologies using digital closed-circuit television, infrared and fiber-optics intrusion detection, and transmission line health monitoring with sensors □ Portable state-of-the-art security monitoring system for rapid deployment to problem areas □ Test use of unmanned aircraft, providing all-hours coverage at lower cost than manned aircraft □ Advanced diagnostic maintenance techniques
Security of isolated personnel	□ Belt-mounted duress system that can signal either a security or medical problem for lone workers, that uses cell phone or satellite technology
Energy Efficiency:	
Least-cost solutions to transmission problems	□ Prove up non-wires alternatives to transmission construction
Reduction of peak loads to meet operational constraints	□ Test technologies for accumulation of end-use load dropping into a reliable peak load "resource" □ Direct Load Control to reduce peak demand, to cut BPA cost of buying on-peak power and to lower customer bills

Challenges	TCI That Could Be Undertaken
	□ Characterize use of appliances that could be incorporated into load management program.
Renewables:	
How to integrate small-scale resources (low-voltage, intermittent, etc.)	□ Use the BPA hydro and transmission system to cost-effectively enable local renewable energy projects (bio waste generation, wave generation, small wind and solar)
Intermittency of wind resources	□ Manage transmission congestion through accurate wind forecasting and scheduling along with potential system redispatch
Optimize value of renewable resources	□ Integrate existing and facilitate future utility-scale (10 MW and up) renewable energy projects with BPA's current hydro optimization program(s) – Columbia Vista and Near-Real-Time Optimizer (NRTO) – to increase the value (revenue) and reduce the impacts (costs) of all projects
Environment:	
Potential ban of wood pole treatment chemicals	□ Identify less impacting methods, including alternatives to wood poles
Uncertainty regarding long-term environmental and worker impacts of electrical equipment containing SF6 gas	□ Investigate equipment manufacturers for different equipment designs □ Research alternate insulating materials and SF6 containment methods
Continued pressure from regulators for the elimination of persistent toxic chemicals, including PCBs and Mercury	□ Identify, develop and demonstrate less toxic chemical components in electrical equipment
Increased concern regarding surface water quality (e.g., storm water discharges from BPA facilities) and ROW projects	□ Demonstrate innovative storm water containment/control mechanisms
Environmental and liability concerns with disposal of large quantities of treated wood poles	□ Develop/demonstrate a method and regional facility/program for collection and recycling of treated utility wood poles