Statement of Objectives
Technology Innovation
FY 2009 Agency Research and Development

Part A. General

A.1 Background Information on Bonneville's Office of Technology Innovation and on Technology RoadMaps

The Bonneville Power Administration (BPA) is a federal power marketing agency that transmits and markets the power from 31 federal dams and one nuclear power plant. BPA also purchases power from five wind farms. Recently, BPA implemented a new program to meet its strategic needs to reinvigorate and focus its research and development (R&D) agenda. As part of this effort, BPA created the Office of Technology Innovation (T/I) and appointed its first Chief Technology Innovation Officer in 2005. This is the second year the T/I office has put forth an annual cycle of research and development funding based on agency guidance and various "technology RoadMaps." Last year's effort resulted in funding 46 R&D efforts covering the areas of Transmission, Renewable Energy, and Energy Efficiency.

Technology road-mapping is a form of technology planning that will be used to inform and guide the Agency's research and development agenda. The main benefit of technology road-mapping is that it provides information to make better technology investment decisions by identifying critical technologies and technology gaps. This information will then be used to identify ways to leverage Agency RD&D investments to bridge these gaps. Technology RoadMaps were developed in the following operational areas of the Agency: Renewable Energy, Transmission, Energy Efficiency and Demand Response, Power Operations (Hydro), and Physical Security.

A.2 Acronyms and definitions

- BPA – Bonneville Power Administration
- FCRPS – Federal Columbia River Power System
- Gap – utility need that is not met today or will not be met in the future with the technology currently in service
- PNW – Pacific Northwest (as defined by the Northwest Power Act, 16 U.S.C. § 839a(14)) section 3(14), "the area consisting of the states of Oregon, Washington, and Idaho, the portion of the State of Montana west of the Continental Divide, and such portions of the States of Nevada, Utah, and Wyoming as are within the Columbia River drainage basin and any contiguous areas, not in excess of seventy-five air miles from the area referred to in (the Act), which are a part of the service area of a rural electric cooperative customer served by the (BPA) Administrator."
- RD&D – Research Development and Demonstration
    - Basic Research - research directed toward increasing knowledge in science. The primary aim of basic research is a fuller knowledge or understanding of the subject under study.
    - Applied Research – is the effort that normally follows basic research. It attempts to determine and exploit the potential of scientific discoveries or improvements in technology, materials, processes, methods, devices or techniques. It attempts to advance the state of the art.

- Advanced Development - all effort directed toward projects that have moved into development of hardware for test. The prime result of this type of effort is proof of design concept rather than the development of hardware for service use.
- Demonstration – field tests

- RFO – Request for Offers
- RFQ – Request for Qualifications
- Stage Gate
  - A Project Stage Gate is a critical GO/Hold/Kill decision point. It occurs at least once before the end of a project. Its occurrence is based upon the essential performance elements (breakthroughs) that have to happen for the rest of the project to be worth doing and before the project can go any further.
  - A Portfolio Stage Gate is a critical GO/Hold/Kill decision point for determining whether or not a project should stay in the portfolio. Each year's R&D Portfolio has 2 stage gates: Mid-year and end of the year when considering the project make-up of next year's portfolio.

A.3 Goal of this RFSOQ/RFO

This Agency Research and Development RFSOQ/RFO is for projects beginning in BPA's Fiscal Year 2009, which runs from October 1, 2008 through September 30, 2009. It is based on 5 Technology RoadMaps in the areas of Renewable Energy, Transmission, Energy Efficiency and Demand Response, Power Operations (Hydro), and Physical Security, see http://www.bpa.gov/corporate/business/innovation/ . The RoadMaps identify the need for research and development for new technologies for BPA.

The goal of this RFSOQ/RFO is to select RD&D projects in the above mentioned areas which enhance our ability to maximize Federal Columbia River Power Systems (FCRPS) asset value and that do so by improving our ability to monitor, control and utilize all of BPA's FCRPS assets in an integrated manner. This RFSOQ/RFO is intended to produce RD&D projects that are in addition to those already undertaken by BPA and other interests. This RFSOQ/RFO does not purchase power nor imply any commitment to purchase power from any resource(s) for BPA.

This Statement of Objectives highlights the key objectives of the program which will enable the offerors to propose a Contractor Statement of Work. This will then be incorporated into the awarded contract.

A.4 Focus Areas

BPA is interested in research projects that investigate the technologies, topics and issues identified in five technology RoadMaps. BPA is particularly seeking project proposals addressing technologies identified in the Technology RoadMaps for Power Operations (Hydro), Physical Security, Renewables, and Energy Efficiency and Demand Response. Within all of the technologies identified in the RoadMaps, we are most interested in those that concentrate on the following Focus Areas:

1. Wind Integration,
2. Maximizing Transmission Asset Value, Expansion, Flexibility and Use,
3. Real Time State Awareness and Control, and
4. Interactibility.

BPA is emphasizing the first focus area: Wind Integration.

1. Wind Integration

For the next two years, wind integration issues identified in the Northwest Wind Integration Action Plan will have a priority for all renewable related funding.

The Pacific Northwest has potentially carbon-free, abundant electric generating resources. However, the capability of the region to integrate these resources successfully depends on its ability to understand, adapt, and manage them and the system in which they fit as an integrated whole. Intermittency, both in periodicity and magnitude, is an essential challenge to that integration.

This focus area emphasizes research topics and activities that improve the commercial viability of intermittent renewable technologies with a particular focus on wind integration and the Northwest Wind Integration Action Plan. These resources are attracting high levels of commercial interest and raising legitimate concerns regarding the ability of the power system to assimilate these technologies.

Potential research topics include: probability based simulation tools for locating and assessing the performance of intermittent resources; forecasting systems that minimize scheduling uncertainty and reduce reserve requirements, transmission control systems and power electronic devices that can be used to assimilate intermittent renewable generation more effectively and make better use of storage capabilities and opportunities, designs that improve operating efficiencies, and new construction and maintenance processes that lower capital and operating costs.

2. Maximizing Transmission Asset Value, Expansion, Flexibility and Use

Transmission asset value is maximized when the system is planned, designed, constructed, operated, and maintained to take full advantage of power system capabilities and to deliver services in a cost-effective manner. Keys to this area are an ability to assess, quantify, and ultimately make decisions about the value of the transmission infrastructure considering its age and several factors that are not typically quantified in dollars (e.g., reliability, importance to the health of the business, loss of reputation, life safety, and environmental stewardship).

This area focuses on transmission technologies that address the value proposition in its broader context and includes: enhanced power system planning tools; response based control systems and algorithms that maintain system reliability and maximize transfer capabilities; load controllability to improve grid stability and facilitate intermittent resource integration; diagnostic systems to assess the health of equipment and determine future maintenance needs; new materials for wires and substation equipment; and streamlined design and construction technologies.

3. Real Time State Awareness and Control

Real Time State Awareness and Control focuses on research topics that enhance our assessment of operational awareness, system analysis, security monitoring, and wide area control of the system. Central to this focus area is the integration of hydro, thermal, and intermittent resource generation and load management technologies more effectively. Operational Awareness involves technologies that utilize available data (e.g., SCADA, state estimator output, online study tool outputs, PMU data) and visualization tools that enable operators to quickly and easily determine whether the system is currently in, or close to being in trouble, and the corrective actions that should be taken.

System analysis makes use of technologies that use the current system state to determine the safe operational limits of the system as opposed to current methods which rely on seasonally generated and conservative estimates of the system state.

Security monitoring employs technologies that provide online study capabilities that enhance the operator's ability to determine whether the current power system state is secure or insecure. These study capabilities include contingency analysis, voltage stability analysis, and transient stability analysis.

Evolution of electric power grid in Pacific Northwest resulted in a tightly meshed network around large load centers, when the main grid transmission is paralleled by lower-voltage sub-grid. The load growth impacts power transfer capability through the load centers due to increased thermal loading and reduced reactive power margins. The main grid power transfers can be limited by the overloads in the sub-grid. Permitting new lines through the load centers is a very challenging task. In addition, integration of renewable resources, such as wind power generation, increases complexity of generation patterns and its rate of change. This research will focus on concepts of various solutions for meeting load service reliability and transfer capability requirements, while accommodating the increasing complexity of generating patterns. Consider a variety of potential solutions: power flow controllers, flexible AC transmission devices, system sectionalizing, system segmentation, etc.

4. Interactibility

This area focuses on how BPA can enhance the real-time assessment, interactibility and controllability of the system's end-use loads, power generation, and transmission for the purpose of maximizing asset value and use, enhancing reliability, and integrating increasing amounts of intermittent renewable resources. Interactibility is a common thread running through each area discussed above.

BPA wants to analyze the interactible nature of the power system regarding how real time generation, transmission and end-use loads operate and can be managed to offset temporary imbalances created by random fluctuations in generation and loads, and planned equipment outages. The ability of the power system's components to interact with each other is a measure of how well the physical equipment and properties of the system work together in real time.

A.5 Funding

For Fiscal Year 2009 we anticipate that over $3 million will become available from BPA's budget. BPA may fund up to 50 percent of a project's cost, with the maximum BPA will spend being $500k per project proposal. For example, if a proposal is received that requires $1M in funding, the maximum that BPA would consider providing would be $500k. If the same $1M project only needed 20% of total project funding, BPA would consider funding up to the requested amount, or $200k in this example. At a minimum, BPA will not fund any project with a total cost that is less than $25k. BPA will only fund RD&D proposals that have established other sources of relevant funding on a cost share basis.

A.6 Types of RD&D Activities

As noted earlier, the Technology RoadMaps identify technology areas, topics and issues that BPA could research to enhance our ability to maximize FCRPS asset value and that do so by enhancing our ability to monitor, control and use all of BPA's FCRPS assets in an integrated manner. Some of these research activities can focus on advancing the fundamental science and engineering of a particular resource technology, others may focus on demonstration projects that enhance the commercial viability and acceptance of the technology, and some may concentrate on solving technical challenges associated with particular focus areas. In particular, BPA will be interested in research projects in the following technology areas.

Energy Efficiency and Demand Response

This area covers residential and commercial sectors and a very limited exploration of the industrial sector. BPA is especially interested in energy efficiency, load management, and demand response technologies and practices with potential significant impact in the Pacific Northwest.

Power Services (Hydro)

This RoadMap represents hydro power services covering disciplines including power system operations, planning facility design, and maintenance. It addresses the technological challenges as well as long term needs. The following critical technologies have been identified that best support the agency technology innovation strategy:

- Situational awareness & visualization tools for operations
- Software tools for system performance & online real time operations,
- Health check systems to monitor equipment operation
- Flow measurement at the power plants
- Power electronics and energy storage solutions
- Advanced maintenance & diagnostic technologies
- Advanced governor technology
- Turbine runner environmental improvements
- Turbine runner efficiency improvements, and
- Environmentally benign lubricants
- Tools to mitigate wind integration
- Advanced Forecasting, Invasive Species and Hydraulic Coatings

Renewable Energy

BPA wants to select or monitor RD&D projects for the following transmission grid connected renewables: wind, ocean wave and in-stream tidal technologies.

From the Renewable Energy Technology RoadMap the needs identified by BPA are (for example, but not exclusive to):

1. Utility management of grid connected intermittent energy to include: the reduction of forecasting and scheduling error, reduce reserve (capacity) requirements, technology that makes renewables smaller consumers of ancillary services (regulation, load following), congestion management, renewable facility redispatch and output control, tools to manage intermittency, optimization of generation and transmission assets, etc.;

2. Technologies that reduce renewable energy distributed generation impacts on low voltage systems, or reduce or mitigate load variability and support ancillary services in the management of intermittency.

Table 1 summarizes some examples of the kinds of RD&D proposals that might be appropriate. It is a broad list of ongoing and proposed RD&D activities in wind, ocean wave and in-stream tidal that BPA may elect to co-sponsor and fund, sponsor and lead, participate in demonstration projects, or monitor for future consideration (not fund at the present time).

Table 1 – Potential R&D Activities for Wind, Ocean Wave and In-Stream Tidal Resources

Area of RD&D Activity **(document location)**	**Recommended BPA RD&D Actions**	**Reference Material**
Wind integration research – Examples include R&D aspects of BPA/NWPCC Northwest Wind Integration Action Plan http://www.nwcouncil.org/energy/Wind/Default.asp , CEC sponsored PIER Intermittency Analysis Project http://www.energy.ca.gov/pier/conferences+seminars/2006-08-15_RPS_workshop/index.html , and wind forecasting for PBL and TBL wind projects.	Support research (lead), technical approaches and demonstration projects to support this emerging critical area of integration, impact mitigation and utility optimization of intermittent resources (see pg. 6)	RETR - Pages 20-27
Ocean Wave Projects	Monitor research, technical approaches and demonstration projects	RETR - Pages 35-38
In-Stream Tidal Project	Monitor research and technical approaches	RETR - Pages 45-55
Demand response technologies that support active load shaping techniques, which facilitate integration of intermittent renewable resources.	Identify optimal mix of EE RD&D activities, challenges, potential costs, etc., that support integration of intermittent resources.	Energy Efficiency RoadMap
Transmission technologies that enhance communication with and provide direct control of renewable resources	Identify optimal mix of Transmission RD&D activities, challenges, potential costs, etc., that support integration of intermittent resources.	Transmission RoadMap
Short term storage technologies that can load factor short term fluctuations in power from intermittent resources. Technologies may include: super-capacitors, flywheels, batteries, super conducting magnetic energy storage (SMES).	Identify optimal mix of RD&D activities, potential costs, etc., that support short term storage capabilities and the integration of intermittent resources. Any project in this area needs to be very closely connected to the focus area on intermittent generation.	Pages 24-27, Appendix C & Transmission RoadMap

Physical Security
BPA wants to improve designs and expanded applications of technological security systems to augment the system operations activities, help mitigate risks to the transmission system and contribute to better safety of the workforce. BPA would like to facilitate design of security related technology to insure compatibility with power system applications, and enhance its leadership in the region relative to security and operations technologies.

BPA will consider project proposals in the following area, but BPA's first considerations will be proposals addressing the above mentioned technology areas and the Focus Area of Wind Integration.

Transmission Services
BPA wants to improve its increasingly complex transmission system through design, operation, and management with real time intelligence and control to maintain system reliability, increase transmission capacity, and maximize asset use in an environmentally sound manner. The following targets were established:

- Enhance the future grid's reliability, interoperability and extreme event protection for an increasingly complex system operation.
- Increase the transmission transfer capabilities and control of power flows.
- Use efficient, cost-effective, environmentally sound energy supply and demand.
- Maximize asset use.

The Transmission RoadMap identified critical technologies that have the potential to enable real time, system wide operation , relieve congestion, reduce peak load, reduce frequency and duration of operational disturbances and planned outages, enhance grid stability, increase operational transfer capacity, increase asset utilization, and harden infrastructure to detect, prevent, and mitigate extreme events to the grid. These technologies are described on pages 20 – 40 of the Technology RoadMap.

The RoadMap also identified major technology gaps within a 20 year timeframe. These are also listed in the Transmission RoadMap starting on page 41.

Some of these activities can focus on advancing the fundamental science and engineering of a particular resource technology, others may focus on demonstration projects that enhance the commercial viability and acceptance of the technology, and some may concentrate on solving technical challenges associated with these areas.

A.7 Project Location

A requirement for an acceptable RD&D proposal is that it fulfills BPA's objectives to be a leader in the application of technologies that provide benefits to BPA, its customers and the Region. Project sponsors will need to demonstrate that submitted projects are meeting the challenges of BPA. Consequently, RD&D projects would need to directly benefit BPA, though supporting research can draw from a multitude of informational and technological resources worldwide.

A.8 BPA Furnished Property or Services

With the limited budget BPA has available for 2009, proposers should not expect BPA to support the purchase of substantial equipment (for example generation equipment such as buying an ocean buoy or wind turbine, control systems, cabling, transformation or interconnection to the BPA transmission system). BPA will review proposals in a timely manner. BPA may provide limited services needed for the successful completion of the project such as; access to a substation, field support, data

collection, etc. The proposal must explicitly identify any government equipment or services that may be needed.

Part B. Proposal Approach/Tasks

B.1 Requirements

The TC/I Technology RoadMaps provide primary guidance for all RD&D requirements.

B.2. Performance Reporting Requirements

Each proposal should include the suggested number and timing of all Stage Gates. A Stage Gate reporting format will be established for each proposal. As mentioned above, each proposal must have identifiable review criteria that match along its implementation timeline that helps the TC/I program and its peer review team determine if the project goals and requirements are being met. These Stage Gates will be used to assess the expected progress of each project and reach a go, no-go or hold decision. If the review criteria for each established Stage Gate are not met (as defined by the contract that is developed from the proposal), then the project will be tabled and not continued, unless the problem areas can be remedied to the satisfaction of BPA. At each Stage Gate it will be BPA's sole discretion whether a project continues to receive funding from BPA.

B.3 Deliverables

Along with proposal guidelines described in Attachment 1 to the RFO (and linked to the T/I Technology RoadMaps – see link in section A.3) each offeror must discuss the expected deliverables of the project, including but not limited to:

- Applicable documents, reports, and deliverables at all Stage Gates and suggested criteria for determining whether the intended achievement has been accomplished.
- All supporting data in an electronic format acceptable to BPA, along with complete documentation.
- Expected functionality and support of any hardware and/or software as applicable, along with full documentation of its use, maintenance schedule, and repair agreements, as acceptable to BPA.
- The appropriate testing and/or evaluation methodology if applicable.
- A final report with lessons learned and next steps for the project.

Along with the above list of deliverables each proposal must have identifiable review points along the timeline of its implementation to help determine the successful progress of the project.

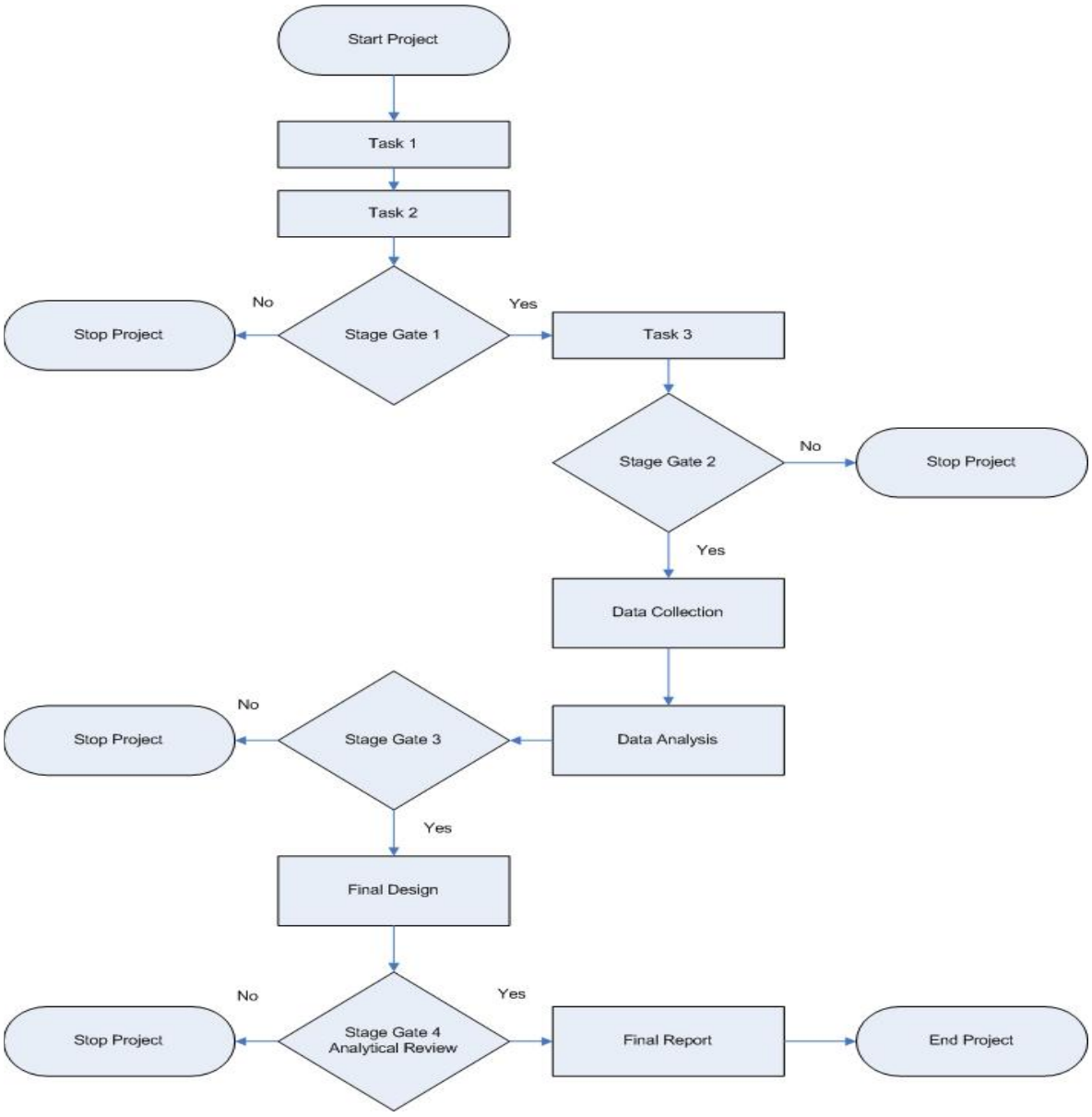
BPA understands the unique nature of many RD&D technologies. BPA believes meaningful metrics can be established to track a project's success even though an expected outcome is not always certain in a research and development effort. Therefore, BPA T/I staff and its peer review team will make every effort to consider RD&D proposals that may have an uncertain outcome.

B.4 Time Schedule

Management Stage Gate reporting schedule: Stage Gates will be project specific and identified in the contract.

Include a Gantt or PERT chart of all the tasks, subtasks and activities. Task interdependencies should be clearly identified. Example: Task 3.5 "Use the results of task 1.4 to determine the size of sample to be used in conducting the survey."

Include a Process Flow Chart that depicts the overall flow of the work and the major decisions that will be made at the stage gates. The following is an example of a process flow chart.



Part C **Inspection and Acceptance (Quality Assurance)**

Any potential problem jeopardizing the successful outcome of the project must be reported to BPA's Contracting Officer as soon as possible and substantially before the next Stage Gate or scheduled review.

(END OF STATEMENT OF OBJECTIVES)

Agency Research & Development RFSOQ & RFO for FY 09
Timeline for RFQ & RFO

1.	3/10	Issue RFSOQ
2.	3/10 – 4/11	Open and close dates of the RFSOQ
3.	3/24	RFSOQ Pre-Statement of Qualifications conference: Rates Hearing Room
4.	4/23	Complete RFSOQ evaluations
5.	4/23	Send RFO to selected RFSOQ suppliers
6.	4/23 – 5/23	Open and close dates for RFO
7.	4/30	RFO Pre-proposal conference: Rates Hearing Room
8.	5/26 – 6/18	Evaluate RFO proposals
9.	6/23 – 7/3	BPA selects projects for FY 09 funding
10	7/12 – 9/30	Negotiate and sign contracts
11.	10/1	Begin FY 09 RD&D projects