Technology Innovation Project *Project Brief*

TIP 240: Short-Term FCRPS Modeling Collaboration / Global Facility Data Development

Context

BPA has identified a need to upgrade its reservoir modeling capability to rapidly produce high-resolution, feasible studies and extensive scenario analysis that will help the agency understand and plan for the challenges surrounding renewable resource integration. Specifically, the technology will better enable the agency to prepare special studies pertaining to renewable resource integration, pumped storage, and wind-related balancing operations for Duty Scheduling. The current short-term modeling capability uses the CPLEX engine created in the 1990s, based on the simplex algorithm created in 1947 to numerically solve linear programming problems. This application has become badly outdated; it is unable to process newer inputs in a manner that produces fast, high-resolution results that are feasible, stable, and take full advantage of modern computer processing capability. For emerging systems that provide multiple scenarios of loads and stream flows, short-term modeling needs to be capable of processing the influx of driving inputs with increased speed and efficiency. This is crucial to effectively balance the hydro resource with wind power and other variable inputs.

Description

This project is designed to establish collaborative relationships with research groups in academia to explore computation and simulation techniques for modeling the Federal Columbia River Power System (FCRPS). The goal is to identify or develop state of the art computational methods and simulation capabilities that can be applied directly to efforts to expand and enhance BPA's reservoir system modeling capabilities – and in doing so, develop an engine for an analytical platform with quick execution time that produces stable and feasible results in high-resolution time steps that meet specified hydraulic constraints.

In conjunction with this effort is a task to develop a new set of plant-level facility data for FCRPS modeling purposes. This will include attributes such as power production, storage-content relationships, efficiency, and hydraulic profiles (e.g., tailwater elevation curves).

Why It Matters

1. Ability to perform high-resolution, feasible, stable studies.
2. One study to serve many purposes. The current business process in PGS involves a "handshake" at 22:00 on Day 0 between the real time use of the Columbia Vista - Short Term (CV-ST) model (CV) simulator and the use of the CV optimizer in short term planning. Additionally, there are other "offshoots" of the current planning run process that will not meet the needs of the new model uses. The new technology will provide a fast, seamless update that can be published instantly for consumers of this data by either PGSD or PGSP.
3. The operational world of the FCRPS has little operational flexibility and much uncertainty. The new technology will provide risk-based analysis looking at multiple scenarios.
4. The ability to evaluate different stream flow or load scenarios has been a major weakness in short term modeling. Currently, PGPW is working on a stream-flow model that will be able to produce multiple short term stream-flow traces. Additionally, PG is completing work on the LORA project that will allow for the development of multiple load scenarios. When the infrastructure is in place to look at multiple load and weather stream flows, a model is needed that can easily handle and manage these inputs in a timely manner.
5. The new technology will provide the ability to answer key operational and policy questions that require fine time resolution (such as wind integration, pumped storage, overgeneration, capacity, and system flexibility).
6. A key use of any computer model is for the modeler to be able to learn from manipulating inputs and see the impact on results. New technology will provide the opportunity to learn from the modeling process.

Goals and Objectives

1. Establish relationships with research groups in academia to explore noniterative, directly calculated, stochastic, smart-simulation techniques for modeling the FCRPS. The relationship building and research exploration will include site visits and meetings and possibly a BPA-hosted hydro modeling conference.
2. To develop a new set of global, plant level, facility data for the FCRPS. This facility data will include power curves, content / storage curves, efficiency curves, and tailwater elevation curves.

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Deliverables

1. Detailed written descriptions of the methods and techniques applicable to BPA's modeling objectives and nonproprietary code of such techniques if they exist.
2. A summary of the facility data assessment, the recommendations and justification for the manner in which the data should be presented, and electronic files of the facility data in the format recommended.

Project Start Date: October 2011

Project End Date: September 2012

Funding

Total Project Cost:	$167,420
BPA Share:	$167,420
External Share:	None
BPA FY2012 Budget:	$167,420

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