

HYDROPOWER ANALYSIS CENTER

Desired Approach for Non-Federally Funded Economic Evaluations At Corps of Engineers Hydropower Facilities

January 2004 Proposal

1. BACKGROUND AND PURPOSE

Background

For the past twelve years, Congressional funds were appropriated to fund the Corps of Engineers' Major Rehabilitation Program. General Investigation (GI) funds were appropriated for the planning phase of a rehab project and Construction General (CG) appropriations for the construction phase. To justify the appropriate rehabilitation action at a particular project, the Corps of Engineers District involved, in coordination with the Corps' two Hydropower Centers of Expertise -- the Hydropower Analysis Center (HAC) and the Hydroelectric Design Center (HDC)-- produced a Major Rehabilitation Evaluation Report (MRER). A single MRER would take approximately 12 to 14 months to produce, with extensive technical rigor, resulting in a voluminous decision document. The District would forward the MRER to Corps headquarters (HQUSACE) for approval. Once approved, the project would be eligible for appropriated CG funding, which could take an additional 3-5 years.

The concept of direct funding of rehab projects by Federal power marketing agencies (PMA) was introduced in part to reduce the amount of time and costs involved in getting a rehab project planned and constructed. Conceptually, direct funding gives PMAs the authority to use power revenues to pay for power-related operation and maintenance expenses and make investments in power plant major equipment rehabilitation or upgrade.

In 1994, the Corps of Engineers (COE) and the Bonneville Power Administration (BPA) -- the Federal power marketing agency for the Pacific Northwest region-- signed a Memorandum of Agreement (MOA) to allow BPA to directly and quickly fund capital investments in hydropower projects in the Federal Columbia River Power System (FCRPS) rather than requesting, and when approved, use federally appropriated funds. In 1997, the COE and BPA signed another MOA to directly fund the power portion of Operations & Maintenance (O&M) expenses at FCRPS projects. Prior to signing an MOA for a specific generator rewind or major equipment rehabilitation project, BPA would typically perform a marketability study to determine that the power produced by a particular investment was marketable and that they would be able to repay the costs of these investments to the U.S. Treasury given expected revenues over the life of the project. The Corps would determine economic benefits and cost associated with a particular rehab action.

Presently, Congress has authorized limited direct funding for power marketing agencies (PMA) in other regions of the USA to cover O&M expenses at COE projects. It is generally anticipated

that direct funding agreements covering capital improvements at these facilities will be in place for all PMAs within the next two to three years.

While the prospect of direct funding through these agreements provides new opportunities for funding O&M and project improvements, it does not diminish the need for the Corps to evaluate and document business decisions to assure that Federal hydropower assets are appropriately managed and maintained. The primary objective of both the COE and PMAs under these agreements should be to collaborate to incorporate business-like processes in decision making, while maintaining their respective Federal stewardship responsibilities. The investment decisions considered under direct funding agreements will continue to require a multidisciplinary effort involving various functional elements within both agencies, including planning, engineering, operations, technical centers, and others.

Purpose

The purpose of this document is to present a Corps of Engineers “Desired Approach” that address issues related to performing economic benefits analysis at COE owned and operated Federal hydropower facilities under COE/PMA direct funding agreements. A secondary intent is to provide general guidance for conducting benefits-cost evaluations at Federal hydropower facilities under direct funding.

The COE’s Traditional Approach to performing economic evaluations for major rehab evaluations will be presented and contrasted with a Desired Approach under PMA direct funding.

2. COE TRADITIONAL ECONOMIC ANALYSIS APPROACH

The COE’s traditional approach to performing economic analysis for major rehab projects is to identify, rank, and recommend a National Economic Development (NED) plan for development. When evaluating various alternatives in an NED analysis, i.e., from a national economic perspective, the NED selected plan would be the alternative with the highest benefit-to-cost ratio justifiable for development.

For hydro and hydro-related projects, a traditional NED analysis considers several key economic parameters, including interest rate, interest during construction, inflation, incremental improvements, reliability, and, in some studies, ancillary service products. Typically, in selecting an interest rate, the prevailing Federal interest rate is used. This rate is normally several points lower than the market or financial rate used in the private sector. Interest During Construction (IDC) could impact the NED selected plan and could at times be considered as a cost item. In most traditional rehab studies, prices are maintained at current levels and inflation is not considered during future years.

Incremental justification refers to each added component of a particular project. For example, if turbine replacement is being considered for a multi-unit powerhouse, each added unit must be incrementally justified, where the benefits derived from adding the extra unit must exceed the cost.

Evaluating ancillary service products could develop additional NED benefits, unless those benefits were already included in other areas. Credit for ancillary services provided by Federal hydropower facilities, for example, is implicit in the computation of the capacity value for a hydropower plant's operating flexibility (system voltage regulation, spinning reserves, quick starts, load following) compared to a thermal plant.

Traditional NED benefits are computed using energy and capacity values developed by HAC. The energy value is computed using a chronological hourly system production cost model that produces a marginal price for hydropower generation based on the most likely thermal alternative. The energy value is applied to the project's hydropower generation to derive energy benefits, assuming 100 percent unit availability. Capacity values are computed using an updated Federal Energy Regulatory Commission (FERC) methodology. This value is applied to the project's dependable capacity to derive capacity benefits, again assuming 100 percent unit available.

To develop NED capacity benefits, HAC determines the project's dependable capacity by performing a critical period analysis. Traditionally, when evaluating hydropower in a primarily thermal-based power system, the HAC computes dependable capacity using the Average Availability Method, which averages the annual critical period dependable capacity over a historical period. In a predominately hydropower system, dependable capacity is determined by computing the firm load carrying capability of the project during an adverse load or hydrologic condition.

Unit reliability and forced outages are considered in the analysis of risk, which yields final NED benefits. Actual NED benefits are determined when reliability and unit outages, along with project cost, are considered in a risk analysis model that yields the overall project's benefit-to-cost ratio.

More recently, the COE introduced simplified procedures in its traditional approach to performing economic evaluations and producing investment decision documents in the Pacific Northwest. The Capital Investment Decision and Analysis Guidance (CIDAG), developed in 2001 by HAC in collaboration with BPA, was approved by HQUSACE for use as guidance to Federal Columbia River Power System stakeholders for making investment decisions. CIDAG included three types of investment actions and allows some flexibility in determining the level of detail necessary to produce a defensible investment decision document. The CIDAG guidance was used in the region to perform the 2003 McNary Turbine Modernization study. The lessons learned from that study are being used to further refine a guidance document that could be generally applied to the Pacific Northwest region as well as other parts of the country.

3. COE DESIRED ECONOMIC ANALYSIS APPROACH

With the advent of PMA direct funding for capital improvements at COE hydropower facilities, a more flexible approach for quantifying hydropower benefits at these projects is needed, working in close coordination with the PMAs. The COE Desired Approach should produce a decision document for major investments based on sound engineering and economic principles in

less time and at reduced cost when compared to the COE Traditional Approach, while still adhering to basic NED principles. Flexibility in the Desired Approach will be developed to quantify and evaluate individual economic parameters.

The Desired Approach to evaluating hydropower benefits under PMA direct funding addresses the key economic parameters discussed above in Section 2 and other factors. The recommended flexibility applies to the following:

Interest Rate: If the current Federal interest rate plus inflation is lower than the PMA's choice of an internal rate of return, then the PMA's rate can be used. Otherwise, the Federal interest rate would be appropriate.

IDC: Include IDC in total project cost if it is the preference of the PMA.

Inflation: Can be included in the analysis with the appropriate interest rate.

Incremental Analysis: Option to be considered on a project-by-project basis. Typically, an incremental analysis would be performed but incremental details are allowed, such as larger increments, two or more units, rather than evaluating single unit or component increments.

Ancillary Benefits: Since ancillary services market is evolving for Federal hydropower facilities, an appropriate level of analysis needs to be developed to capture benefits, including implicit evaluation in the capacity value or in market based energy values.

Energy Value: The use of energy values based on other than marginal prices can be examined, such as average historical market prices or projected market prices from system models like PROSYM and AURORA, as long as these prices represent a competitive market and a long-term value.

Dependable Capacity Determination: Work an agreement with the PMA on acceptable approaches, such as, Average Availability versus Critical Period approach. Any agreed upon approach would depend on whether or not a market based energy value with an implied capacity component was used in the energy benefits evaluation. The updated FERC methodology for determining capacity values would continue to be utilized unless a market energy value is used with an implied capacity component. Additionally, an expected market capacity value would be used if markets are structured to include capacity payments.

Reliability Benefits: Whether or not to consider reliability benefits in a particular study would be determined on a project-by-project basis. If reliability benefits do not add significantly to overall benefits, then a reliability analysis can be simplified or omitted.

These are the key economic parameters in the COE's Desired Approach that represents a significant departure from traditional analyses.

4. SUMMARY OF TRADITIONAL VS. DESIRED APPROACH

In a PMA direct funded environment, the customer's main desire is to produce an investment decision document that includes reasonable engineering and economics to support the decision, but requires less time and resources to produce than under the COE traditional approach to determining hydropower benefits. Therefore, the Desired Approach proposed in this paper is aimed at reducing project evaluation time, streamlining the process, and reducing cost when preparing an investment decision document. Below is a summary outline of the Traditional Approach versus the Desired Approach to determining economic benefits at COE hydropower facilities.

Traditional Approach

Energy Analysis:

Hydrologic Model - Utilize HYSSR, HEC-5, SUPER output and historical data to compute project generation output

Energy Value – Compute marginal price based on system production cost

Dependable Capacity:

Methodology - Perform critical period analysis to quantify dependable capacity

Capacity Value – Capacity value computed using an updated FERC methodology

Benefits Analysis:

Perspective – National Economic Development perspective

Interest Rate – Use Federal rate

IDC – Normally does not computed IDC in benefits analysis

Reliability – Perform risk analysis based on probability of outages

Incremental Analysis – Economically justify each last added component

Inflation Rate – Inflation not consisted in analysis

Value of Ancillary Services – At present, no explicit value placed on ancillary services. Implicit value included in capacity value computation

Desired Approach

Energy Analysis:

Hydrologic Model – Be flexible. Work an agreement with PMA on project-by-project basis for an acceptable model

Energy Value – Continue to use system production cost model to develop energy values. Show some flexibility to use other approaches such as average historical market prices or projected market prices from system models when appropriate

Dependable Capacity:

Methodology - Perform dependable capacity analysis using critical period, average availability or “Cold Snap” approach. An agreement on methodology with the PMA can be developed

Capacity Value – Continue to compute using updated FERC methodology

Benefits Analysis:

Perspective – Maintain a National Economic Development perspective for benefits evaluations. Use discretion when deviating from NED policy. Further investigate the feasibility of utilizing OMB’s A-94 circular.

Interest Rate – Uses Federal rate

IDC – Can compute IDC to capture cost prior to project Project-On-Line date

Reliability – Be flexible. Consider reliability benefits on a project-by-project basis.

Incremental Analysis – Continue to economically justify major incremental improvements but show flexibility on some components where it makes sense to improve with the overall project

Inflation Rate – Be flexible. Can include inflation in analysis if in mutually agreement with PMA

Value of Ancillary Services – Requires more study to develop an appropriate level of analysis to capture benefits; continue to use implicit value included in capacity value computation.

Desired Position Summary on Non-Federally Funded Economic Evaluations at Corps of Engineers Hydropower Facilities

January 2004

CATEGORY	ITEM	TRADITIONAL APPROACH	DESIRED APPROACH
ENERGY ANALYSIS	Models:	Utilize project historical data, HYSSR, HALLO, HEC-5, SUPER, and other hydraulic routing model outputs to develop project generation.	Flexible. Work an agreement with PMA on project-by-project basis on the use of acceptable models and data sources.
	Energy Value:	Compute a marginal energy price based on system production cost using the PROSYM system production cost model.	Flexible to use other approaches such as average historical market prices or projected market prices from system models such as PROSYM, AURORA, or other system models, as long as they represent a competitive market and a long term value.
DEPENDABLE CAPACITY	Methodology	Perform critical period analysis to quantify capacity impacts. Critical Period methodology used to compute DC in Pacific Northwest; Average Availability methodology used for other regions.	Flexible to work an agreement with PMA on acceptable approaches. Also, depends on the use of market energy value with implied capacity component.

	Capacity Value	Value computed using an updated FERC methodology.	Continue to compute CV using the updated FERC methodology unless market energy value is used with implied CV component. Use expected market CV if markets are structured to include capacity payments.
BENEFITS ANALYSIS	Perspective	National Economic Development perspective.	The Corps' current policy for economic evaluations is NED. Some flexibility is proposed here relative to interest rates and inflation. Until direct funding policy guidance is developed, the Corps will continue to recommend an NED plan which does not necessarily have to be the selected plan that is constructed. Further investigate the feasibility of utilizing the approach outlined in the OMB A-94 circular for performing Federal economic analysis.
	Interest Rate	Use Federal interest rate.	Flexible. If Federal interest rate plus inflation is lower than the PMA's internal rate of return, then use PMA's rate. Otherwise, use Federal rate.
	Reliability Analysis	Perform risk analysis based on probability of unit outages.	Flexible. Consider reliability benefits on a project-by-project basis. If reliability benefits do not add significantly to overall benefits, then reliability analysis can be simplified or omitted.

	Incremental Analysis	Economically justify each last-added hydropower plant component.	Should be considered on a project-by-project basis. An incremental analysis should be performed but flexibility can be used when considering incremental details, such as larger (2-units or greater) increments rather than a single unit may be used.
	Inflation	Inflation not included.	Flexible. Can include inflation cost in analysis in conjunction with appropriate interest rate.
	Interest During Construction	IDC is not normally added to cost.	Flexible. Can include IDC in total project cost.
	Value of Ancillary Services	No explicit value placed on ancillary services. An implicit value included in capacity value computation.	Ancillary services market is still evolving in all regions of NERC system. Requires more study to develop an appropriate level of analysis to capture benefits. Continue to use implicit value in capacity value or in market energy value.