



# **Development and Demonstration of Energy Savings Perform Contracting Methodologies for Hydroelectric Facilities**

**Cooperative Research and Development  
Final Report**

**CRADA Number: CRD-08-309**

NREL Technical Contact: Kate Anderson

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**Cooperative Research and Development Final Report**

In accordance with Requirements set forth in Article XI.A(3) of the CRADA document, this document is the final CRADA report, including a list of Subject Inventions, to be forwarded to the Office of Science and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

CRADA number:           CRD-08-309

CRADA Title:    Development & Demonstration of Energy Savings Perform Contracting Methodologies for Hydroelectric Facilities

Parties to the Agreement:       Johnson Controls

Joint Work Statement Funding Table showing DOE commitment:

Estimated Costs	NREL Shared Resources
Year 1	\$ 30,000.00
Year 2	\$ 70,000.00
Year 3	\$ 00.00
TOTALS	\$ 100,000.00

Abstract of CRADA work:

This CRADA explores the opportunities and challenges of funding federal hydro dam refurbishment projects through ESPCs. It assesses legal authorities for rehabilitating dams through ESPCs; roles and responsibilities of each party including the dam owner, Power Marketing Administration (PMA), ESCO, and preference customers; potential contract structure and flow of money; measurement and verification processes; risk and responsibility allocation; and financial viability of projects.

Summary of Research Results:

The financial viability of hydro ESPCs varies from project to project. The best opportunities are at those dams with the greatest potential for increased energy generation in regions with the highest market power rates, and at those projects that have no non-appropriations sources of funding. The current low hydropower rates limit the financial viability of many improvements, however, and none of the projects examined in this study were viable within the 25 year ESPC contract period. If hydropower rates increase, some of these projects may become viable ESPC candidates.

As the federal hydropower infrastructure continues to age, it is likely that larger future investments will be necessary to keep dams operational and maintain required reliability. The Corps' HMI Phase 2 study, dated October 2010<sup>1</sup>, finds that an investment of \$3.7 billion over 20 years will be required to hold the current risk of component failure at a steady level; lower amounts of funding result in steadily increasing risk of asset component failures and significant losses in energy production over the next 20 years. If the required investments exceed the resources of the dam owners, PMAs, and their customers, ESPCs are an additional tool that can help rehabilitate federal hydro dams.

We find that while some ESPC-funded hydro refurbishment projects may become financially viable, there are significant challenges to implementing them. The top three challenges identified are: 1) Each PMA has different legislative authorities. We are uncertain if each PMA can pay the ESCO under current legislative authorities; this needs to be evaluated by each PMA's legal team; 2) It will be difficult for the ESCO to guarantee energy generation because there are many factors outside the ESCO's control including hydrologic conditions, operating decisions, and environmentally-imposed flow restrictions; 3) Under law, PMAs are required to provide power at the lowest rate consistent with sound business practices. PMA rates amortize costs of components over their service life (up to 50 years). In an ESPC, costs must be recovered in 25 years, and might require a higher rate than alternative sources of funds.

As dam owners are forced by aging infrastructure to invest in major rehabilitations, rates will necessarily increase, and the financial viability of efficiency projects may improve. This may encourage dam owners to evaluate the economic benefits of introducing new efficient technology before end-of-life. Growing demand for energy from renewable sources, due to federal mandates<sup>2</sup> and state renewable portfolio standards<sup>3</sup>, may also make projects that increase hydro generation more attractive. This study represents only an initial look at the potential to use ESPCs to increase renewable hydroelectric energy generation at federal hydroelectric dams. As next steps, we recommend: 1) Evaluate the legislative authorities of each PMA to pay the ESCO; 2) Develop M&V guidelines for ESPC hydro rehabilitation; and 3) Investigate the differences in authorities for funding, which vary by PMA, dam owner, and project. Some projects may have greater need for alternative funding mechanisms.

Subject Inventions listing:           None

Report Date:   February 17, 2012           Responsible Technical Contact at Alliance/NREL: Kate Anderson

**This document contains NO confidential, protectable, or proprietary information.**

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1 U.S. Army Corps of Engineers Northwest Division Hydroelectric Design Center. Hydropower Modernization Initiative Asset Investment Planning Program Volume I. October 21, 2010.

2 The Energy Policy Act of 2005 requires 5% of total electricity consumed by Federal agencies come from renewable sources in 2010-2012. In 2013 and thereafter, the requirement increases to 7.5%. Double credit is awarded for renewable energy produced on Federal lands. A summary of EAct 2005 is available here: <http://www1.eere.energy.gov/femp/regulations/epact2005.html#rer>

3 24 states have renewable portfolio standards that may require preference customers, like municipal utilities and rural electric cooperatives, to generate or purchase a certain percentage of their electricity from renewable energy. A summary of state renewable portfolio standards can be found here: [http://apps1.eere.energy.gov/states/maps/renewable\\_portfolio\\_states.cfm#chart](http://apps1.eere.energy.gov/states/maps/renewable_portfolio_states.cfm#chart)