

*R. Sheldon*

*PHS*

*W.M.*

June 11, 1986

EPG

Colonel Gary R. Lord, District Engineer  
Portland District  
U.S. Army Corps of Engineers  
P.O. Box 2946  
Portland, OR 97208-2946

Dear Colonel Lord:

This letter serves to formally propose a cooperative Research, Development, and Demonstration (RD&D) project as discussed recently between your Mr. Jim Limbaugh, NPPOP-P, and our Mr. Lee Sheldon, Generation Engineering Branch (Code EPG). Specifically, Bonneville Power Administration (BPA) proposes to purchase a Kaplan turbine "optimizer" from Woodward Governor Company and provide it to the Corps to be tested and demonstrated on a main unit at the Bonneville Second Powerhouse.

There is a background of events leading to this proposal. As you are aware, the efficiency of any Kaplan turbine is a critical function of the blade angle relative to both wicket gate opening and to net head. A field efficiency test known as an "index" test can be performed on the prototype to determine this optimum relation. However, when done in the conventional manner, this test is quite labor intensive. Even with a recently developed automatic data collection system, the data reduction is still fairly labor intensive. If a way could be found to reduce the labor intensive nature of index testing, a considerable amount of extremely low-cost, additional electrical energy could become available to the region's rate payers. In particular, this additional energy could be obtained from those Kaplan projects which are presently subject to significant manpower constraints. Additional benefits available from optimizing the efficiency of Kaplan turbines include a decrease in the mortality of downstream migrants and increased machine life from reduced vibration and cavitation.

Woodward Governor Company has recently developed an on-line, Kaplan turbine optimizer which may be retrofitted on their Type 2 electronic 3-D cams used with electronic governors with load feedback. This new system is "plugged into" the existing governor by a simple replacement of the A/D Interface card. Then with the Winter-Kennedy piezometers instrumented, this unattended optimizer continuously monitors the efficiency performance of the Kaplan turbine over a period of time while the unit remains in its normal generating mode.

The data collected by the optimizer is stored on a EPROM data chip which may then be mailed to Woodward for analysis. The final result is an electronic 3-D cam in which the blade to gate relation as a function of head is reprogrammed so that the particular machine may operate continuously at its optimum efficiency.

Personnel from our Division of Resource Engineering were recently provided the opportunity to visit Woodward, preview a developmental prototype of the optimizer, and independently evaluate the first data it had taken, which coincidentally was from a unit at the Corps' Clarence Cannon Dam Project. Our evaluation, which is attached for your background information, shows that this optimizer appears to function successfully. Consequently, we are now interested in having a commercial version of this device tested and demonstrated at a project here in the Pacific Northwest.

A review of Woodward's records reveals several projects, both Federal and non-Federal, whose Kaplan governors would be most easily adapted to utilize this optimizer. However, from a standpoint of geographic convenience, a unit at the second powerhouse at Bonneville Dam is the obvious first choice. It is realized that the governors at Bonneville II are actually a Type 1. However, part of our proposed procurement contract would provide for the few parts and approximately 6 man-hours of labor to change from a Type 1 to a Type 2. The contract amount is expected to be in the \$40,000 to \$50,000 range.

Therefore, in conclusion, we would like to propose a cooperative RD&D effort in which BPA would contract with Woodward for the procurement, installation, and operation of their optimizer at a unit at Bonneville II while the Corps would evaluate the accuracy and level of difficulty in field use of the device. At the Corps' option, the optimizer would become the Corps' property.

Sincerely,

Original Signed By W. E. Myers

Walter E. Myers, Director  
Division of Resource Engineering

Enclosure

cc: w/Encl.

Jeff King, Regional Council

cc: wo/Encl.

→ Douglas Albright, Woodward Governor

LHSheldon:sas:3448:EPG7187A

cc:

M. Klinger - E

S. Kallio - EM

W. Myers - EP

D. Seely - EPG

W. Hoberg - EPG/EPO

M. Helm - PRSA

V. English - PRSA Official File - EPG (EDC 2-2-6)