MEETING REPORT: Meeting to Discuss Index Test Box on March 26, 1986

DATE: March 27, 1986

FROM: David Bishoff

Present:		
	Doug Seely	Bonneville Power Administration
	Lee Sheldon	Bonneville Power Administration
	Mark Leum	Woodward Governor
	Doug Albright	Woodward Governor
	Dick Johnson	Woodward Governor
	Jim Davis	Woodward Governor
	Carl Gallagher	Woodward Governor
	David Bishoff	Woodward Governor

ABSTRACT

BPA is a self-funded federal agency (through sale of electricity). They are like TVA but they don't own their own plants. Their area of involvement covers Washington, Oregon, and parts of California, Nevada, Wyoming, and Idaho. In 1983, BPA was given the job to review the 30,000 MW of hydro generation capacity in their area. Some of the reasons for this study were: 1) There is a lot of environmental pressure on the development of any new sites, so they want to be sure they are getting all they can from present sites; 2) They actually have excess generation until 1990, but it is still in everyone's best interest to look for some of their present and future power by improving efficiencies; 3) 30% of their power generation is pre 1960 with over 50% of their plants at 50 years of age or older; 4) Finally, they have found most other forms of power are more expensive than hydro, and they accordingly want to take a closer look at their hydro and all of its options.

Sixty-five percent of their hydro is federal and 35% non-federal. One very conservative study showed 85 MW recoverable through turbine improvements (35 MW Kaplan and 50 MW Francis) and 55 MW recoverable through governor improvements. Other items to be improved such as generators, station service, and water wasting are still being studied. Some TVA studies hint at efficiency improvements of 3 to 6%. While they have been using only about 1% to be conservative (on their 30,000 MW of hydro).

MEETING DISCUSSIONS ON INDEX BOX TESTER

1. Lee asked about our ability to test for and find the true theoretical highest point of efficiency at each head? We can't hit it theoretically pure, but we can bring our lines of computation so close together that the question is only academic and not relevant.

2. Lee asked how we handle hysteresis in the blade positioning equipment. His question referred to mechanical hysteresis due to sticky blades and restoring hysteresis caused by long cable runs and system wear. We explained the sources of hysteresis in our system and how these are managed by the index test box system.

   Our 3-D cam has a +/- 1% deadband built into it to minimize blade mechanism wear. This deadband prevents blade responses to normal governing motions of the gates.

   Blade mechanism hysteresis (sticky blades) is measured as the difference between the position of the riser cam and the restoring cable by the index test box for each test point.

   The 3-D cam deadband and the blade mechanism hysteresis have no effect during an index test because the index test box positions the blades by observing a potentiometer on the restoring shaft (or at the oil head in situations that have excessive restoring hysteresis).

3. Our test method allows the governor to operate normally to hold generation level at the setpoint, while holding the blades fixed. During a conventional index test, the gates are blocked with the gate limit or the servo lock rings to prevent this normal governing motion. This difference was explained, along with the method used to determine the average steady state values of all measured parameters.

   The benefit of this method of measurement is that the unit can operate on-line, and the dispatcher doesn't even know an index test is being performed on the unit.

4. Lee asked about safety precautions. Doug explained there are several in our software but also overriding ones still working in our hardware (mech. clamps for cam and hydraulic blade tilt).

5. We all discussed transducers and their level of accuracy, about the calibration of our electronics, and the impact on these aspects to progressive diagnostic turbine testing (year after year). We pointed out that our device is only a sophisticated data collection system, and we would only be guaranteeing it to be that. With all their transducers and their respective calibration requirements, Woodward can only back up our equipment and not the results of actual tests; even though we might be involved in generating resulting charts and curves.

CONCLUSIONS

Lee stated that BPA likes what they see in our test box and they are pleased and surprised that we are as far along as we are. We agreed to the next steps:

1. Woodward and BPA will identify a suitable test unit in the BPA area.

2. BPA and Woodward will probably need to put on a joint presentation to owners of the selected powerhouse to sell the need and value of this test. Lee explained there are many doubters in their area and a good demonstration is needed to show the power, potential, and value of this testing device.

3. BPA will research best method to present test data.

4. BPA will figure some ways to provide incentive for customer to accept test (like buying their extra power).

5. Woodward will come up with the price for the equipment needed at the demonstration site. We gave initial rough prices of $65,000 to convert mechanical governor to electrical governor, and basic test box about $40,000 and 3D cam retrofit $20,000 plus extra needed for field serviceman and data evaluation and charts.

This was a very positive meeting with all parties agreeing we have something important. BPA wants to buy our first test model, and we all need to work toward putting on a good demonstration. We agreed once we can clearly demonstrate the potential of this equipment, there will be a market.

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