



## TIP 413: Kaplan Oil-Less Turbine Testing & Specification Development

### Context

In 2014 a lawsuit by the Columbia River Keepers, the US Army Corps of Engineers (USCOE) agreed to address the oil pollution seeping from dams on the Columbia and Snake Rivers. The lawsuit created greater public awareness, changes to environmental regulations, and improved monitoring and reporting. These requirements resulted in more forced outages associated with oil leaks from Kaplan turbines.

Once leaks are detected they are forced out of service. Outages can be prolonged and costly. Kaplan oil-less turbines provide a solution for reducing forced outages, minimizing environmental impacts, providing more operational flexibility and creates a standard for future turbine specifications.

### Description

The purpose of this work is to develop a detailed design of a system for accelerated life testing of oil free Kaplan turbine bushings and material life testing. This work will be accomplished through the following tasks:

#### *Task 1: Conceptual design*

Conceptual design is presented as a power point slide deck that overviews the mechanical and electrical design strategy and presents relevant analysis. The metric for this milestone is BPA project manager's approval of the design concept.

#### *Task 2: Detailed design*

The milestone is the creation of mechanical and electrical drawing sets for the bushing testing system and material life testing.

### Why It Matters

As more Kaplan oil leaks are detected, more forced outages occur which can be prolonged and costly in both lost generation and repair.

Kaplan oil-less turbines can provide a solution for reducing forced outages, minimizing environmental impacts, and providing more operational flexibility. Developing an accurate and appropriate testing system will help in creating a standard for future turbine specifications.

If successful, the outcomes of this project will ultimately lead to:

- Positioning the BPA to implement technology that ensures long term reliability of turbines and by default FCRPS reliability.

The eventual benefit of developing this testing system includes:

- Elimination of oil-leaks from Kaplan turbines and resulting environmental hazard.
- Elimination of outages related to Kaplan oil-leaks.
- Ensuring that we maintain flexibility (e.g. spinning reserves, operating range).

### Goals and Objectives

The project plans to develop testing procedures for evaluating the durability and effectiveness of the Kaplan Oil-Less bushings and mating materials. Project success enables testing confirmation of:

1. The reliability of the oil less turbine runners,
2. Adequate material pairings to achieve the reliability,
3. Development of specifications that allows future project replacements with Kaplan oil-less turbines.

### Deliverables

The primary deliverables for this project are the mechanical and electrical drawing sets that will enable the construction of a test stand that can be used to produce:

- Test results on the durability of the Kaplan Oil-Less bushings and mating materials (combination of materials to test for durability).
- Establishment of appropriate design standards and guide specifications.

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**Project Start:** August, 2019

**Project End:** September, 2021

## Reports & References

## Links

## Participating Organizations

Hydroelectric Design Center (HDC), US Army Corps of Engineers

Pacific Northwest National Laboratory (PNNL)

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