



TIP 405: Kaplan Turbines Oil Leak Elimination

Context

An oil spill from a hydroelectric facility can cause environmental impacts, and Kaplan turbines in particular present additional challenges because of the volume of oil used for these units and the close proximity of oil to the aquatic environment. The hub of a Kaplan turbine is typically filled with pressurized oil to equalize the pressure compared with the outside water passage pressure, as well as to lubricate the internal mechanisms. The blade servomotor also uses oil as a hydraulic pressure fluid.

For the last 100 years, the overall risk to the natural environment from an oil leak from Kaplan hydro units has been accepted as being low. However, due to greater public awareness and changes to environmental regulations, the hydro industry is more committed to the minimization, if not the elimination, of this risk.

Description

This CEATI International project intends to produce a comprehensive study analysis of high level options outlining the opportunities and alternatives to achieving the goal of minimizing, and where feasible eliminating, the risk of Kaplan turbine oil leakage.

The project methodology is to complete a series of research tasks. These include:

Research task 01: Outlining possible ways of minimizing oil leakage.

Research task 02: Identify technical initiatives that minimize oil leakage.

Research task 03: Identify monitoring/prediction methods that reduce oil leakage.

Research task 04: Provide general catalogue of failure modes that leads to oil leakage.

Research task 05: Provide list of *minor* project initiatives on Kaplan turbines to resist oil leakage.

Research task 06: Provide list of *major* project initiatives on Kaplan turbines to resist oil leakage.

Research task 07: Identify technical challenges to decrease oil leakage, and how to solve them.

Research task 08: Find and present environmentally friendly oil products.

Research task 09: Investigate the most time and cost-effective way to reduce oil leakage.

Why It Matters

This project advances the industry's goal of minimizing or eliminating oil release into the aquatic environment, which directly relates to the primary hydro generation industry goal of meeting corporate, public & regulatory stakeholder expectations.

The findings of this study will help Kaplan turbine owners identify both a near-term and a long-term strategy to address the well-known issue of oil leakage. Although not a current regulatory requirement to convert units, proactive demonstration of positive action to improve environmental performance and corporate responsibility will allow for long term capital programs to be planned and approved.

Because there is an industry imperative to best manage the inherent oil leakage problem by acting proactively, the results from this project could also avoid cost penalties, environmental damage, imposed stricter regulations, generation curtailment, etc.

Goals and Objectives

As outlined in the following objectives, the immediate focus of this study will be to provide guidance on existing/in-situ oil-filled Kaplan's and "what to do?" alternatives. The longer-term goal would be to identify technology changes that can be undertaken to install new oil-less Kaplan technology.

The objectives of this study are to:

- identify ways to detect oil leakage and then reduce or eliminate it
- find the critical components that prevent oil leakage and find ways to improve them
- register available methods and project experiences for reducing oil leakage
- find environmentally friendly hydraulic fluids that could replace oil
- describe most cost effective ways to customize, rebuild or change existing Kaplan units so that oil leakage can be reduced/eliminated.

Deliverables

The project deliverables will include a comprehensive report addressing the scope and objectives outlined above. This will include a review of best practice fluids and seal materials and seal designs, and case studies of oil leak elimination.

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Project Start Date: May 2019

Project End Date: November 2020

Funding

BPA Membership 2018-2019: \$60,000

Reports & References

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Links

Participating Organizations

Centre for Energy Advancement through Technological Innovation (CEATI International)