

FIELD OBSERVATIONS OF ORPC RIVGEN TURBINE WAKE

MARICARMEN GUERRA¹ AND JIM THOMSON²

Applied Physics Laboratory, University of Washington, 1013 NE 40th St, Seattle, WA

¹mguerrap@uw.edu

²jthomson@apl.washington.edu

A full-scale ORPC RivGen turbine was deployed during the summer of 2015 in the Kvichak River, next to the village of Igiugig, delivering clean energy to the local power grid. This work evaluates the hydrodynamic effects that RivGen causes to the Kvichak River while the turbine is underwater for two conditions: operational and non-operational turbine. Field measurements of turbulent velocities in the area surrounding RivGen were conducted using a drifting Nortek Signature1000 previous to and after turbine deployment. The measurements are used to construct 3D maps of mean-flow and turbulence parameters, which are used to evaluate RivGen's, wake evolution and possible recovery.

The velocity field in RivGen's wake does not recover to the undisturbed velocity field previously observed in the Kvichak river, showing a persistent velocity decrease from about 10 m upstream of the turbine until beyond the extent of the measurements (200 m downstream of the turbine). Turbulence intensity and turbulent kinetic energy are observed to increase more than five times at the turbine location and rapidly decrease about 20 m downstream of the turbine. The TKE enhancement is accompanied with an increase in TKE dissipation rate, which remains elevated for about 60 m downstream of the turbine, and by an increase in Reynolds stresses in areas of strong shear near the turbine. No significant differences are observed in the velocity and TKE evolution in the wake of a non-operational RivGen, suggesting that the main impacts are associated with the presence of the turbine. Additionally, it is found that the energy being dissipated through turbulence in the wake area is comparable to what the turbine delivers to the grid for both of the studied turbine conditions.

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