Thesis Project Portfolio

Adapting Hydropower Operations to Support Renewable Energy Transitions and Freshwater Sustainability in the Columbia River Basin

How Does Sustainable Infrastructure Like Hydroelectric Power Plants and Their Operation Impact Underrepresented Communities?

An Undergraduate Thesis

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Sociotechnical Synthesis

While the construction of pump storage facilities can improve the reliability of the electricity grid by balancing supply and demand, it can also have negative impacts that disproportionately affect underrepresented communities. One such example are the Native American tribes who were displaced by the construction and operation of the Grand Coulee Dam in Washington, U.S.A. The technical aspect of this research project aims to derive a hydropower-based solution to enable 100% clean energy in the Columbia River Basin through a case study analysis of the Grand Coulee Dam. This decarbonization solution must have a large enough energy production to balance the needs of consumers and businesses while minimizing disruptions to local ecosystems and waterways of the Pacific Northwest. This is particularly important because underrepresented communities often have no say in the decisions like constructing and operating large infrastructure like a hydropower power plant, suffer the brunt of the changes caused by this infrastructure, and don't reap any of the resulting economic or social benefits. Star's definition of infrastructure and its properties can guide the case study analysis. The properties of interest for the Grand Coulee Dam are its embeddedness, reach or scope, and how it is built on an installed base. This research investigated the socio-economic implications of the dam by identifying points of convergence and divergence in the accounts put forth by the afflicted tribes and the governing federal agencies. This produced a baseline of truth for a more three-dimensional analysis of the dam's impacts on these communities. By better understanding how these tribes were disproportionately impacted by the operation of the Grand Coulee Dam, the aforementioned hydropower-based solution can be designed to ensure the communities' protection and ongoing livelihood.