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Use of Monte Carlo Methods to Evaluate the Viability of Hydroelectric Dams

Hydroelectric dams are a proven energy alternative to fossil fuels, yet their long-term viability is a subject of concern. This research utilized energy data to monetize energy production and saved carbon emissions, and salmon return data to monetize the loss of salmon. Using Monte Carlo methods to overcome variability, these monetized factors were inserted into a model which calculated the adjusted profitability of the dam. To simulate future streamflow conditions, energy generation and saved carbon emissions, which both vary directly based on streamflow, were reduced by 10% and 25%. The simulations were repeated for these adjusted values. For current streamflow conditions, every dam was found to be profitable. For a 10% reduction in streamflow, every dam remained profitable and few had a notable decrease in profitability. For a 25% reduction, many dams had a significant decrease in profitability, and Ice Harbor Dam was no longer reliably profitable. Dams with a larger current profitability saw small change as streamflow declined 25%, often remaining profitable over 99% of the time. Larger dams on the Columbia River are an extremely viable source of alternative energy and will remain that way far into the future.