Title: **Coordinated Control of the Mid-Columbia Hydropower System**

Duration: **2012-2016**

Sponsor: **Electric Power Research Institute, Hydro Research Foundation Hydro Fellowship, Steinbrenner Institute Robert W. Dunlap Graduate Fellowship, Bertucci Graduate Fellowship, Department of Engineering and Public Policy**

Contributing Faculty: **Gabriela Hug**

Contributing Students: **Andrew Hamann**

Description: **The objective of this research project is to study how optimized real-time optimization of cascaded hydropower plants can improve efficiency and support the integration of variable renewable generation. For the sub-hourly real-time optimization of a hydropower cascade, it is important to model in detail the three factors that most heavily influence hydropower generation: reservoir elevation, tailrace elevation, and turbine-generator efficiency. Up to this point, we have developed a method that uses three-dimensional piecewise linearization to accurately approximate the nonlinear and non-convex hydropower production function as a function of hydraulic head and turbine discharge. This piecewise linear approximation is implemented in a model predictive control framework. Ongoing technical work includes the incorporation of more precise tailrace dynamics and a time-delay for water flows between reservoirs.**

We intend to use this improved hydraulic and hydropower generation model to assess the impacts of hydropower coordination on a real-world system. In this case, we are using the Mid-Columbia River hydropower system and wind generation data from wind turbines in the Columbia River Gorge as our test bed. The goal is to assess the economic impacts of optimal coordinated control and determine how much installed wind generation the Mid-Columbia system can successfully balance. We also intend to evaluate how a different coordination scheme would affect the policy structures that currently regulate the Mid-Columbia River and the Pacific Northwest electricity system.