Optimization and Economics of Hydroturbine Operation  
David Beevers, PhD Candidate, Mechanical Engineering

ABSTRACT

Hydroelectric power has played an integral role in our nation’s power for many years. However, it has only been in the past thirty years or so that much attention has been paid to using the available water in the most efficient manner possible. This is due to a number of factors, not the least of which are the ever increasing demand for electric power, and the increased awareness that we, as a nation, have a responsibility to be good stewards of our resources and our environment. Optimizing the release schedule of a single installation is fairly straightforward, but the system optimization problem that arises when considering several installations on a river can be highly complex. This is because of the temporal connection that arises from the hydraulic link between various installations. Before the deregulation of the power market, optimization strategies valued hydropower based upon the offset amount of the cost of thermal generation to provide power to a certain region. In a deregulated power market the value of hydropower is less clear, as it depends on the local selling price for any given hour. Furthermore, there is also a market for regulation and other ancillary services that must be considered. In this talk I will provide an overview of many optimization techniques that have been used in the past, and discuss some of the related work that I’ve done and my plans for applying dynamic programming and cooperative Nash equilibrium analysis to the problem.

BIO:

David Beevers graduated from Grove City College in 2008 with his BS in Mechanical Engineering. His passion for teaching led him to pursue a PhD in Mechanical Engineering at Penn State. He has been a part of a DOE funded hydropower research group since 2010. In that time he has studied variable speed generation, applying component modeling to the modeling of a hydropower system, and identified hydropower system optimization as his focus for his PhD thesis work in 2012.