Sociotechnical Synthesis

Energy will soon be the most value resource to our civilization. The Columbia River Basin (CRB) is a leading example of hydroelectric energy dominance. However, this renewable oasis is under threat from stark economic conditions pressuring the CRB's reservoir operators as well as looming climate and socioeconomic changes expected in the region.

Approaching Ambiguity in the Columbia River Basin

Both my STS and technical topic are centered around the CRB and seek to answer roughly the same question: how can the CRB continue to operate robustly on all fronts as we expect unprecedented change throughout the 21st century? Expecting some unprecedented is a difficult pill to swallow, understanding we know something is going to happen but not what. This is the type of ambiguity I sought to resolve in my topics and something I struggled to articulate in my early writings. My STS topic approaches the ambiguity of shifting social, economic, and cultural expectations surrounding energy production and the questions that energy producers face. Meanwhile my technical topic clarified the effects that varying climate change and socioeconomic conditions will bring onto the CRB's ability to produce energy throughout the middle of the century.

In my STS focused research, I searched for ways that the Bonneville Power Administration (BPA), the federal body overseeing the operation of the reservoirs on the CRB, to reach financial stability while maintaining other multiple, equally important, objectives. As other, private renewable energy producers encroach on the on the BPA's profits, the BPA is stuck between its commitments to its customers, taxpayers, and the environment. The BPA can either invest in modern engineering and infrastructure solutions and or consider organizational restructuring. The real difficulty arises from the BPA's position, a federal government body producing a high priority public good that many other smaller, private producers are much more efficient at doing. Perception of energy companies has also changed, with economics experts

calling for an end to natural monopoly that many producers have previously operated under. My analysis of these and a few other factors led me to conclude that the BPA needs to remove profit from its list of objectives entirely. This mirrors the public's perception of energy, shifting to believe that energy should come at minimal price but not at a loss to environmental health. I hypothesized that since the BPA is a federal body anyways, the cost of operation is applied to taxpayers anyways through the increasingly free market for energy in the Pacific Northwest. As a final argument and something I reflected on throughout, the burden of environmental concerns and mitigating climate change is a societal cost everyone must bear.

The technical portion of my thesis researched how energy production in the CRB, specifically hydroelectric and other renewable sources, changes over the next 40 years until 2060. Low, middle, and high climate change scenarios were paired with low, middle, and high challenges to socioeconomic adaptations such as population growth and energy efficiency. This yielded nine scenarios that accomplished a broad generalization of possibilities in the region. After modifying a stochastic model to incorporate each of the nine scenarios, the software computed energy amounts per source and prices from 2050-2059. The results showed that the region's energy infrastructure is extremely susceptible to socioeconomic changes, but at least through 2060, energy production is healthy and unchanging across climate change scenarios. Resilience to climate change scenarios was unexpected but can drastically reduce the complexity of the models that reservoir operators run, improving their overall efficiency and ability meet multiple criteria. This research also shows what energy sources best meet the future demand, calling for significant growth in wind energy production across the scenarios.

The most important actor in this system is certainly the BPA, from their day-to-day operators to the public officials that make its long-term decisions. Having only been involved in

this field of study since September, it's amazing how much I know about the BPA and the challenges it faces. Even then, I feel like my understanding is the tip of the iceberg. Writing about the technical and STS topic in tandem opened my eyes to the overwhelming complexity of the problem. The more I researched and wrote, the more invested I became, recognizing that there is no true "technical" or "STS" delineation. Each paper I wrote complimented and enhanced the next. It was almost as if I was using Michaelson's incremental method but between papers, understanding more and returning refreshed. By the end of this semester, I have felt a deep responsibility to the Columbia River and all the people it affects and am proud of my Capstone paper with the hope it brings even the slightest bit of progress. My advice to rising 4th years is to approach their Capstone projects with vigor and to ignore the fact you may feel unqualified. As your project's real-life, STS problems become apparent, it makes your efforts on the technical side that much more important and within a year you'll be an expert.