Sociotechnical Synthesis

Both my technical research and my STS research revolved around the expansion of green energy producing technologies. The focus of my STS research was on harnessing wind energy for electrical production. During that process, I analyzed different societal factors that come into play when trying to construct additional wind power in a community. The focus of my technical research was the expansion of solar power. One of the primary factors limiting the expansion of solar is that it is an intermittent resource for utility companies. My research strove to exploit the power of machine learning to accurately project how much electricity a solar farm would be able to generate on a given day. My goal was a sustainable grid that provided consistent power, without the need of fossil fuels. I looked over various electricity yielding opportunities upon starting, hating all nonrenewables.

Solar and wind energy seemed to be the two renewable technologies that had the largest capacity for expansion. I decided to take a macro focus on the issue. While solar and wind can be employed small scale, the most societal good would come from adoption of these generation techniques on the large scale. In both projects I focused on what was inhibiting these technologies expansion.

The STS Research paper was quite interesting to research and investigate. One of the central messages that is taught in the UVa School of Engineering and Applied Sciences curriculum is that technology does not exist in a vacuum. Just because an idea is technologically excellent, this does not mean that society will embrace or appreciate it. It is essential to consider the social

context that the technology is entering. The introduction of wind power in the United States has been no exception to that rule. Communities have regularly pushed back against the introduction wind power. Some communities have been successful, others have failed in preventing wind turbines from being built. For my STS research, I set out to understand, in the context of technology and society, what the differences had been between those two cases. I explored the motivations of different actors who had influence on the situation. I found government and political influence, maybe unsurprisingly, to be one of the primary indicators of whether the opposition would be successful or fail.

For my technical research, I was able to employ Machine Learning to work on a problem that is important and interesting to me. I wanted to have these robust algorithms try to understand the factors that affect solar production, and then accurately project how much electrical output could be expected. To do this, I used Python as my Machine Learning language. There are a number of free, open source libraries available in Python. Leveraging these, I trained dozens of different Machine Learning models, and had them predict how many kilowatts of power would be produced on a given day. I used a labeled dataset to train these models. The dataset had many columns of metrological data, and finally how much power was produced, and the models learned from that. I was pleased with the results achieved by the machine learning models, and found it noteworthy that one of the “less complex” models was the most successful. This research could be used as is, or even expanded upon by a utility company to make more accurate electrical output projections for a solar farm.

The two paths I chose to research are strongly correlated. Both have the overall goal of more sustainably produced electricity. Moreover, both research tracks were focused specifically on solutions for utilities. Individual consumers would have little use for my solar farm, or wind turbine implementation plan research. However, to large electricity producing companies like Dominion here in Virginia, this research could be quite impactful. I spoke with project manager Adam Maguire at Dominion in the process of my research, and he made a quite interesting point. He said that Dominion is quite pro new green technologies, particularly solar, however the wild unpredictability of it can result in less investment. He identified this as the number one issue inhibiting solar expansion. By having the ability to mitigate this risk, a utility can more confidently make larger investments in solar generation. Similarly, attempting to build wind turbines and failing is an expensive mistake for a company. By understanding the societal factors surrounding the issue, and planning the wind turbine project with those in mind, utility companies can be more successful, and enjoy a larger return on investment. The joint focus of these two projects was incentivizing more green technologies on a large scale.