My desire to pursue a PhD in Power Engineering has been an unusual journey. Let me tell you my story.

By the time I was eight, I had lived in four different countries (Uruguay, United States, Mexico, and Spain) and was completely fluent in both Spanish and English. I had seen how big the world was and lived in a variety of cultures and lifestyles that most people do not get to experience in a lifetime. I understood the world was bigger than my small bubble, and that not everyone came from the same walk of life with the same opportunities.

I always loved solving problems and knowing how things worked. In sixth grade I tried to join the Math club, because I wanted to do more math problems after school. Unfortunately, my teacher informed me that the club was for students struggling with math and needed extra tutoring. The following year the school offered advanced math courses, and these became my foundation for learning how to study and work hard at concepts that were difficult to understand.

I enrolled at the University of Pittsburgh because I wanted to be close to my family and the Swanson School of Engineering had a good reputation. I was drawn to physics, but also to the unlimited applications of computers, so I decided on Electrical Engineering. I wanted to focus on hardware because it seemed to be the perfect mix of physical constraints and limitless possibilities of coding. Pursuing this interest, I worked for the Cooperative Engineering Program at Bridge Fusion Systems LLC (BFS), a tiny electrical engineering consulting company that specialized in hardware projects. As only the third employee at the company, I eagerly started working on meaningful hardware projects. My first project was to design code and tinker with a small test fixture to be used to swiftly load and calibrate microcontrollers that would eventually be installed in wi-fi compatible Smart Plugs. At the end of my rotation I installed the test fixture and accompanying software at a manufacturing company. I recently learned that these smart plugs are now being installed in two Pittsburgh buildings and could save the city $6.3 million in energy costs over the next 10 years[1]. Learning how to set up, develop, debug, and complete professional projects was an invaluable skill that I was able to apply to school and undergraduate research.

To apply what I had learned at BFS towards sustainability I volunteered my time to improve and advance projects in a Sustainable Design lab at Pitt. I joined a small team of undergraduate students working on building low-cost microcontroller-based air quality sensors. My teammate’s backgrounds with microcontrollers were limited and the circuits being built for the sensors were difficult to debug and tedious to build, so they were struggling to move their project along. I was able to quickly identify problems with the circuits but ultimately recommended changing the implementation of the project because of the lack of resiliency in the microcontrollers they were using. Another team in this lab was testing how ultraviolet LEDs could be used to decontaminate water. Unfortunately, their circuit design and implementation prevented the LEDs from being operable, so I redesigned their code and adjusted their circuitry so they could control and record the intensity of the light. Working in this lab allowed me to collaborate with engineers outside of my field of study and provided the opportunity to apply my skills to benefit sustainable projects.

To widen my scope of understanding, take advantage of opportunities available at a research driven university, and use my engineering skills to benefit the environment I contacted Dr. Thomas McDermott because he was leading research projects focused on sustainability. The project I began with Dr. McDermott would last over three summers and was my introduction to the field of Electric Power. The goal was to develop a process to quickly convert Duquesne Light Company’s (DLC), the local electric utility in Pittsburgh, distribution circuit maps into testable models. In 2015 DLC was beginning to see interest for distributed photovoltaic (PV) generation on customer’s homes. The traditional techniques used by DLC to analyze their circuits were not sophisticated enough to study the impact distributed PV would have on their circuits and thus forcing DLC to limit the PV penetration to a measly 15% threshold. The models I was designing would allow for individualized analysis to adjust the PV threshold for each circuit.

After two summers of designing the process to build circuit models the project was still incomplete but I was determined to apply my models to increase the PV penetration in Pittsburgh, so I pursued an internship at DLC. As an intern I was able to enhance the model building process but more importantly I designed studies to assess the impact PV had on a circuit. Using the PV Integration Handbook (source) and DLC safety thresholds as my main guides, I designed a voltage study and a fault study that could be conducted on the circuit models. I chose two circuits to study with high levels of PV penetration and was able to conclude that both circuits had little or no safety concerns in their current state and additionally both circuits had potential to handle higher levels of PV. Since this was the first study of its kind at DLC and my method of building circuit models uniquely did not require any Geographic Information System data we decided to publish a conference paper at the 2018 IEEE Power and Energy Society general meeting on the project, where I was the primary author [2].

During the middle of my 3rd year in college, I promised my grandmother that I would move to Phoenix the fall after my graduation because she had been diagnosed with Alzheimer’s a year early and was starting to age quickly. At the time moving across the country to help my aunt, a single mother and small business owner, care for my grandmother seemed like a big promise to make but I knew it was the right thing to do. Not only would this give my grandmother something to look forward to, but I would add some stability where the family needed it the most.

Though my post-graduation destination was set, I did not have a clear direction I wanted to take my career. My passions became cemented a couple months before I moved to Phoenix during a three-day backpacking trip in the Rocky Mountains. Nearing the completion of the hike, I climbed up to a vantage point and was completely isolated. I could not believe the beauty and the grace of my surroundings but could not shake the dreadful thought that climate change and pollution would destroy this breathtaking landscape in only 20 years. In that moment I concluded my career must be dedicated toward preserving our planet. To maximize my impact on this global effort, I would work on integrating distributed energy resources (DER) into the electric grid.

This decision was heavily influenced by my contributions at DLC and the challenges they faced with the increasing use of PV by their customers. Even though I was leaving Pittsburgh at the end of the summer my project had gained some traction at DLC, which led to a job offer as the first and only remote employee at the company. This position allowed me to continue developing circuit models and broaden my knowledge of the limitations of an industry at the inception of substantial change. Though I can imagine a future where I work at DLC for my entire career, I deeply desire to learn more about my career field and want to continue to challenge myself to push the industry forward.

This led me to enroll at Arizona State University (ASU) and pursue research opportunities with Dr. Yang Weng, one of the 12 power and energy faculty members. Here, I will be able to take advantage of the largest power area research group in the country and leverage the connections ASU has as the leader of the Power Systems Engineering Research Center (PSERC). Dr. Weng has been conducting interdisciplinary work between Machine Learning and Power Systems, and I was blown away by his industry relevant research and results, which has included 5 best paper awards in the last 6 years. Machine learning will be at the heart of the power systems of the future and has countless applications for identifying and controlling distributed energy resources (DER). My love of software and experiences at BFS, coming up with nontrivial solutions for distribution circuit modeling at DLC, and my passion to integrate renewables on distribution circuits combine perfectly as a PhD student focused on machine learning in power systems. At ASU I will use machine learning to create impactful, cost-effective solutions to tackle the challenges utilities face modernizing the aging grid to handle increased DER.

Recently, I have begun tutoring my younger cousin with his high school math homework. I have learned that he is uncomfortable with negative numbers and fractions, so I am devising a plan to help him improve these fundamental math skills. Additionally, I am extending our relationship past tutoring, so I can nudge him to care about more than video games and shoes. Though I’ve spent most of my college and post-college career working on projects, this has given me the opportunity to work on a person and being a positive influence on my cousin has been incredibly rewarding. Not only has this ignited my eagerness to help future students as a teaching assistant, but it has inspired me to pursue STEM outreach opportunities through ASU to mentor the upcoming generation of engineers.

Outside of my studies, I am also a world class ultimate frisbee athlete. My decision to begin playing ultimate frisbee right before college was lifechanging and awarded me opportunities I could never have dreamed of. I’ve played two seasons on a professional team, won a college national championship, captained a perennial national contending college team, caught a world championship winning goal for the Under-24 Men’s National team, and used my voice and platform to advocate for gender equity [3]. I owe it to the community that gave me so many avenues to succeed to give back, so I am volunteering as the assistant coach of the ASU Men’s Ultimate Frisbee team for the upcoming season. I plan on being a coach for the team during my studies at ASU, I am looking forward to teaching, growing, and being inspired by a younger generation of players.

The graduate research fellowship program will give me the resources to continue my quest to work toward building distribution system capable of handling high levels of DER. As a PhD student at ASU I will continue to use my privilege and resources to give back and wholeheartedly commit to becoming an expert on DER generation and control. I am leaving my comfortable job at DLC so I can continue to challenge myself and devote my career to help create a cleaner more sustainable planet.

**References**

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