

Hammerman Scholarship 2024

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In May 2024 I was given the amazing opportunity to travel to Peru using the Hammerman award scholarship. In Peru I was able to undertake a two-week internship with a Peruvian NGO-WindAid where I was able to join a team to learn the science behind and manufacture of wind turbines.

I have had a passion for the energy industry since completing my fluid mechanics and thermodynamics classes in university, as well as an internship in the area in 2023 and this scholarship gave me the opportunity to use this passion to develop my engineering and personal skills and experience real world engineering in practice. It has really helped me to narrow down my field of interest in engineering and focus on the renewable energies that particularly interest me. It has also helped me gain a practical understanding of the technologies and theory I learned in classes which will be invaluable.

During my time in Peru, alongside working, I was able to explore many famous destinations in the country including one of the seven modern wonders of the world- Machu Picchu. I managed to immerse myself in the culture of Peru living with locals and other volunteers and interns on the project.

Aim of WindAid

WindAid is based in a Northern coastal town of Peru called Trujillo and works in direct collaboration with the Universidad Nacional de Trujillo (UNT) to design and build small scale wind turbines. These are designed to provide basic power to remote communities, some of which were previously fully off the grid. While working with WindAid, I aided in the installation project in a small, spread-out community called San Pedro, located in the highlands of Peru.

The project brought together a multinational team of engineering students and professionals all with the same aims- to both develop their engineering skills and knowledge in a practical sense and to use those to aid the communities of Peru. It also involved working with local Peruvians who worked within the university campus and program.

Through WindAid, we followed the process from raw materials through to a working, wired up wind turbine that could produce electricity. It was such an accomplishment to see a project all the way through from start to end.



Figure 1- The wind turbines for WindAid

Tasks and what I did

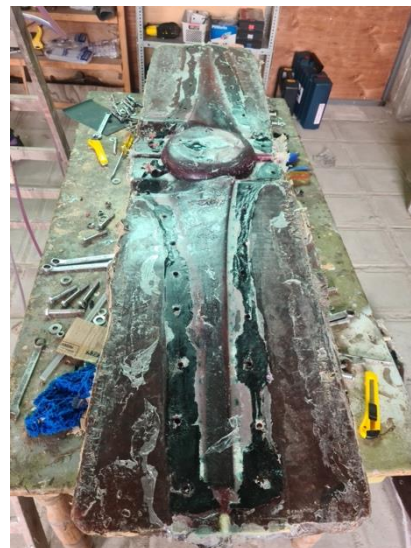
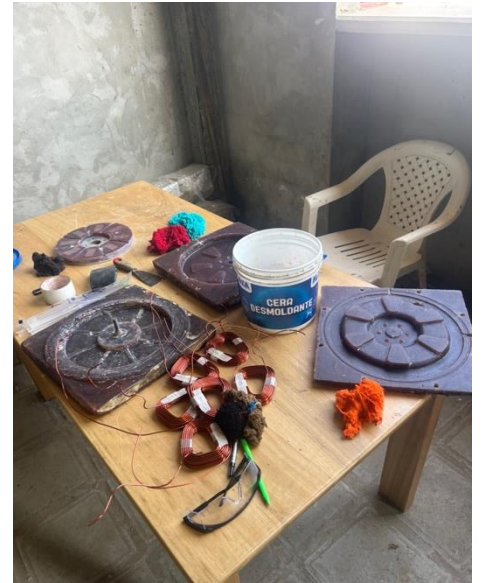
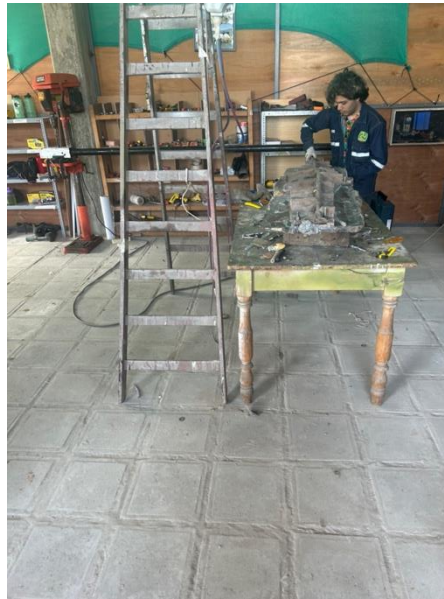


Figure 2- (A) Welding (B) The setup for working with resin (C) Creating the mould for the rotor (D) Filling the rotor mould with coils (E) The blades of carbon fibre and resin

During my two weeks with WindAid, I was able to develop many of my practical engineering skills as well as use this unique opportunity to develop many soft skills that are equally important as an engineer.

The main design of the turbine was based on a design that had been previously tested by WindAid for which we were able to suggest improvements as we went through. For the first week of the experience, I spent time rotating between different tools and equipment, first through observation and training and then was able to practice using it.

The blades of the wind turbine were made from carbon fibre panels coated in resin. The turbine was built on a foundation of an aluminium cage that could be welded together and the buried underground and solidified with a concrete mix. The main structure of the turbine used hollow steel piping, repurposed as the tower. This had to be attached to the generator and rotors where 6 coils of wire were used. The blades spinning in the wind spun a plate

containing strong magnets generating a magnetic field from which an electric current could be induced in the coils.

One of the most fun tasks that was completely new to me was learning to stick weld. While the process itself was pretty straight forward - using the current through an electrode to produce heat under contact with the metal to be welded, melting the electrode into a typical weld as seen - it was interesting to learn all the important tips on how to create the most efficient weld. An optimal weld was obtained by maintaining a slow pace in an arc while ensuring the distance was maintained even as the electrode shortened. It was also important to understand the risk assessments involved and all the PPE required to ensure a safe working environment, including the welding masks and protective gloves.

Other equipment I spent time working with in the workshop was a pillar drill, an angle grinder, and a table grinder for various aspects of the project. Everything was cut to size and drilled manually, including making screws. I was able to learn the ideal process for selecting, cutting, and sanding screw length to ensure nuts were able to be added to the thread. While in the workshop, it was important to understand the differences between the Peruvian workshop conditions and equipment and the university one. It was interesting to consider the different techniques used there, such as using easily accessible hot glue guns to seal all pieces alongside screws and bolts.

One of the really interesting aspects of working in the workshop was the use of resin. Almost all of the parts involved in the rotor and blades of the turbine were either coated in or made up of resin. The blades used carbon fibre coated in thin layers of resin for structural rigidity and wearability. The rotor and stator parts were mainly made up of resin as it is able to securely fill all air bubbles and fully coat the blades. I was given the responsibility of prepping all the moulds for the coils of wire used in the rotor. There was great importance placed on the preparation and it involved cleaning, sanding, and waxing all the moulds before they could be filled with resin. It was a fun throwback to more chemistry-based lessons when working with the resin as the measurements and proportions had to be accurate to ensure the resin would set correctly.

The mechanical aspect was not the only aspect I was involved in, as I was able to learn the skills of soldering wires to connect all the coils together to complete the circuits. This involved being taught the principles of magnetic coil induction within the university campus. I was then able to connect and solder the coils in the correct pattern ensuring to leave the output and ground wires separate.

The weeks I spent with WindAid were always so full of work, but it was always productive and full of fun activities. A lot of the work we did was new to me, so every day was a learning experience. It was also a great time to exhibit teamwork as sometimes there were less exciting jobs to be done and it was good to organise and distribute tasks fairly.

Site Visit



Figure 4- Some of the community we worked with

While on my internship I was able to complete one site visit for the installation of the foundations and base of the turbine. The journey to the Peruvian Highlands was a long and winding one, having to set off before the sun rose to hope for the best light for the day of work ahead. The area of the Highlands we were working in had an elevation of 3500m above sea level which definitely made it more strenuous. The community of San Pedro is very isolated, so we spent a lot of time travelling down dirt roads to get to it. Once we arrived, we were welcomed by a local family who were gracious enough to welcome us into their home for the day as a base for our building. The day started by digging a large hole for the foundations to be placed in, which seemed like a straightforward job until the altitude truly hit. The altitude made everything take longer as we all had to stop to catch our breath more frequently than we would usually. Once that was complete, we were served a traditional Peruvian homecooked meal by the local family which was amazing and consisted of freshly caught fish, beans and rice- all staples of San Pedro. The afternoon involved setting up the foundations and creating a concrete mix to be added in layers. After this was completed, we were able to sit to have conversations with the local community which allowed me to put my mediocre Spanish skills to the test as it was exciting to hear the impact that the wind turbine would have on the area and how this access to electricity would help the locals.

A later site visit was made to the same location in order to install the wind turbine itself and see it in action. It was super exciting to see the hard work we all put in truly in action and see how it would help the community.



Figure 3- Mixing and working with the concrete on site

Sightseeing and Cultural Immersion

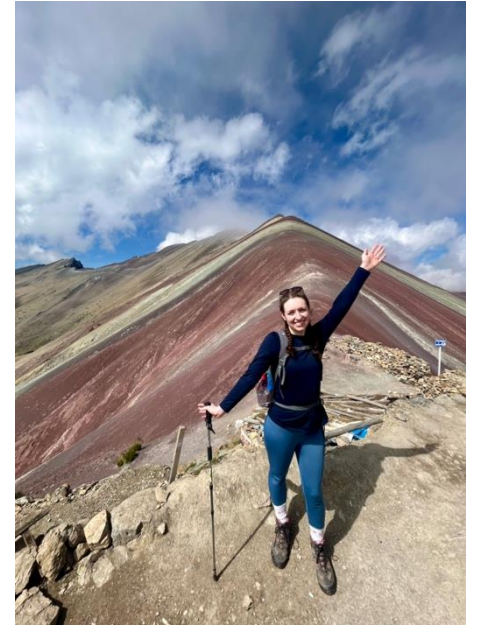


Figure 5- (A) Machu Picchu (B) Meeting some local Alpacas of Peru (C) A trip up rainbow mountain

When travelling so far from home, it was super important to me to be able to experience more of what Peru had to offer. When you think of Peru, one of the most important things that comes to mind is obviously Machu Picchu- one of the seven wonders of the world- and I knew I couldn't miss it. By joining a tour, I was able to experience the rich Inka history of Peru which was completely new to me, and I was able to appreciate how passionate many Peruvians are about their history and culture. Machu Picchu was a highlight of the trip and complimented the work side of the experience well.

Peru is also definitely known for its amazing views when hiking so I couldn't miss out on these and made a trip to the famous Rainbow Mountain- a mountain 5200m above sea level that is named for its multicolours from the metal deposits.

And in case the sightseeing wasn't enough to fully cover what Peru had to offer, I made sure to experience many of the food offerings available, such as the quinoa soup, the chicha and some of the 4000 types of potatoes grown in Peru! And to immerse myself more, I got involved (maybe unsuccessfully) in a salsa lesson as salsa dancing is a huge part of Peruvian culture. While working with WindAid, I lived with some locals and the other volunteers and interns. Through this I was able to see what it was like to fit into a Peruvian routine and appreciate the new foods.

While living in the house in Trujillo, I was able to help take part in a volunteering experience called Espaanglisch. This was a fun experience that involved simple conversations with Spanish speakers of the area who wanted to practice their English. It was also a fun way to meet local people and allowed me to practice a little bit of my Spanish skills.

How it benefitted me as an engineer

My time with WindAid has not only developed my engineering practical skills but developed so many of the soft skills that are also so valuable. Working in the workshop enabled me to practice all these skills that will be useful in the future. It also was an amazing opportunity to convert all the theoretical concepts learned across my five years at university to a real-world

application. By being able to see first-hand the application allowed me to develop and deepen my understanding of the design and action process for wind turbines.

Additionally, I was able to develop so many other skills in a completely new environment. I worked with a multinational team where different languages were being spoken in different scenarios, so it was super important to practice my communication skills, to make sure it was always clear. It has definitely been a vital part of my development as I was able to adapt to a different culture and way of living while I lived in Peru as I fully immersed myself in the culture.

Peru had so much to offer from engineering to cultural experiences and it has definitely been an invaluable part of my engineering journey so far. I will be forever grateful to the Hammerman for making the opportunity a reality.