Personal Reflections

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Abby Sterle

At the beginning of the semester, I was slightly hesitant to dive into a project about which I had basically no prior background knowledge. However, I am so thankful to have had the opportunity to explore an entirely new topic and further my research and team building skills through Engineers for a Sustainable World. The Solar Oven project was unlike any project I have ever worked on at Cornell in that the research we were completely was going to have an influence on the health and well-being of several Nicaraguan communities. I have never been apart of a global project like such. This experience truly opened my eyes to the need for more collaboration between communities of the Global South and inspired students and graduates like ourselves who have been blessed with an education that has provided us with the tools to make a difference.
As a team, I was incredibly pleased with the dynamic of our project team. I enjoyed have the opportunity to work with engineering students of different disciplines and found that each team member added something unique to the group. In my "Personal Goals" statement from the beginning of the semester, I wrote that I was interested in broadening my understanding of environmental and sustainable engineering research and career possibilities. The Engineers for a Sustainable World class discussions, conversations with team members, and the Solar Oven project itself have heightened my understanding of the importance and feasibility of providing sustainable solutions to all people of the world.

I am satisfied with the efficiency results from my sub-team this Fall, but only wish that we could have had more time to continue with our work. I would definitely recommend this course to anyone who is interested in learning about sustainability and/or providing practical service to others. Plus, as I have discovered this semester, there is *always* more work and research that can be done.

Leif Paulson

At the beginning of the semester, I was excited to take part in a class, which would allow students to put engineering skills to practice. The goal I set out for myself was to simply be able to apply engineering practices to a real life situation in a useful, creative way. Looking back, I feel that I was able to achieve the goal I set out for myself and have gained many more positive experiences then I had expected.

In choosing the direction we would take with the solar oven, we ended up splitting into various subgroups, so the group as a whole could focus on a number of different aspects of the solar cooker. I ended up choosing to investigate parabolics, and how it could be applied to solar cooking to possibly help the oven reach higher temperatures. It was an exciting, and fulfilling undertaking, since it was an opportunity to learn about something I had no previous knowledge of and hopefully use it to help the people of Nicaragua improving their cooking opportunities.

Once our parabolic subgroup was formed, we began brainstorming on how we could design something to achieve higher temperatures using parabolic reflectors to focus light. We spent a good portion of the semester coming up with a design. I was particularly happy that we were building something from scratch and were eventually able to come up with something that we had designed ourselves, rather than using a previously constructed design.

Having the opportunity to work together on something and spend the time to thoroughly think of a reasonable design was a fulfilling experience. I think our group succeeded in properly considering every aspect of the problem and designing our solar cooker accordingly. Because of our preparation, construction has gone very smoothly and has encountered few problems. Having access to all the equipment in the lab has made construction of our project very enjoyable and has made me thankful to be able to take advantage of the opportunities we have as students at Cornell.

Apart from working in our subgroup, I think the solar cooking team as a whole has succeeded this semester in that we have been able to successfully address a number of different issues regarding the solar cooker. In order to accomplish this we have embodied a team atmosphere and have communicated very well with each other over the course of the semester. Looking at everything we have accomplished over the semester, and they way our solar cooking team has interacted with each other to reach our goals together, I feel I have been able to get what I set out to achieve in this course and much more.

Katie Weible

I really enjoyed being on the solar cooker team and I have learned a lot this semester. That being said, the solar cooker team was definitely not what I expected! Rereading my original goals for the semester, I think I certainly achieved some of them but I had one very specific goal that I did not end up working towards. After our first meeting as a team, I thought that I would have the opportunity to work on researching a PV encapsulate. As our group work progressed, this was not an avenue that our group chose to pursue. Thus, I was not able to achieve that goal but I was able to redirect my interest towards other aspects of the project.

I ended up being a member of the "testing/pot placement" sub-group within the solar cooker team. The tasks of this group included coming into the Winter Lab on Saturdays to perform testing and then compiling the data and analyzing. I was able to meet my goal of committing enough time and effort to the project through our testing schedule. I learned a lot about the solar cooker, how it was designed, how testing works, what a thermocouple is, and more.

The testing provided us with true to life data that needed formatting, compiling and analyzing. This provided a challenge much different than that of some classes where the data is fabricated and the results are anticipated. Testing of the solar cooker resulted in data that (hopefully) resembles what men and women experience in Nicaragua. Using Microsoft Excel and our analytical skills, we were able to provide feedback and suggestions that may be able to aid Nicaraguans in future cooking methods.

An unexpected achievement that I did not include in my original set of goals was learning more about web design! Although I have little to no web design skills, my team mate Jess Bloom shared her knowledge of Dreamweaver with me and I am in charge of updating the website regarding the solar cooker and the testing that we performed. This was definitely a pleasant surprise as I have always had an interest in web design but never had anyone to guide me.

In terms of the overall progress of the group, I think that we actually did a good job of setting reasonable goals and doing the work necessary to accomplish them. I wish I could have been more involved in the other sub-groups of the team (PIV and concentrated cooker) but I'm pleased with the work that I was able to accomplish.

One of the greatest lessons that this experience has taught me is the importance of taking advantage of the opportunities we have as Cornell students. It is so inspiring to see Los Mujeres de Totogalpa succeed at designing and building solar cookers in Nicaragua- even to the point of winning "First Prize in the Business category for the 2009 ERA prize. Seeing their success encourages me to get the most out of my Cornell education so that I'm able to use my engineering skills for the greater good, whether that means continuing work with the solar cookers or something else, I'm excited to continue growing as an engineer for a sustainable world.

Jessica Bloom

At the beginning of the semester several solar oven team members made a decision to deviate from the box oven group and develop a new product. We envisioned a product that would allow the women of Nicaragua to fry tortillas, a staple of their diet which could not be cooked by the traditional box cooker already being tested. Throughout the semester we researched possible designs and solar conditions of Nicaragua, modeled our ideas, and finally decided on a product to be built and tested.

This decision granted a great deal of freedom for me to explore different technologies that have been developed and tested, and decide how we could take the best elements of these designs to create our own. I enjoyed learning about the designs, how they work, and how they can be implemented. There were many factors we needed to consider in order to adapt a concentrated solar cooker to Nicaragua. It was challenging to develop a product which could accomplish everything we wanted. I learned that many design decisions involve tradeoffs. For example, we had to develop a product that could perform on almost every day of the year (based on solar altitude), this required a bigger collection area, which meant a larger, less portable design.

Additionally, I had the opportunity to work in a group with varying interests and experiences. While I was very interested in renewable technology, some group members had more experience working with the developing world, and some members had more experience with construction. These differences allowed me to learn more about the developing world, and how basic, readily available materials could be utilized to develop a new product such as a concentrated cooker. I have always been more focused on new, innovative technology, but it is also important to understand how the same basic properties of the sun can be applied to a low technology solution. Additionally, I had the opportunity to work with power tools and actually construct the design we had developed throughout the semester, Working with various saws and drills was definitely a useful experience, and I am glad I was able see the design leave the drawing board, and become a tangible product.

Throughout the semester I have accomplished only a third of goals I set in August. I am satisfied with how I was able to delve into design, and learn more about the global south, yet I am disappointed I was not able to establish communication with the women's group in Totogalpa as well as work thoroughly on the website. However, before the semester is over, the website will be up to date and complete, and hopefully I will establish a relationship with the women of Totogalpa in future semesters.

Hyuk Jeon

In the beginning of the semester, I joined the Solar Oven Team simply to learn more about the technology and see the extent of its practicality for public use. I did not know this project has been continuing from previous years and I was not aware of the team's connection with the users in Nicaragua. As I learned more about the project and its impact on the community in Nicaragua, I was glad to be a part of a team that pursued global sustainability in a local level and brought improvements in the lives of the users in Nicaragua.

Looking at the long-term relationship between the team in Cornell and the people in Nicaragua, it immediately reminded me of my own trip to Maracaibo in Venezuela; I was part of a team that organized annual trips to Maracaibo to provide school supplies to local schools that lacked government funding. For a team to bring a change or to have any kind of impact on another community, a long-term relationship must be established between the two groups in order for it to be successful. The annual trips were only possible through constant communication between the team and the people in Maracaibo and it took a significant amount of preparation time before every trip. The goals of our team were made through communication with the people in Maracaibo and through independent research within our capabilities and limits. The connection between the team and the people in Nicaragua made me realize how important it is for a team to establish a long-term relationship in order to successfully bring a desired impact.

After the introduction to the project, our supervisor, Tim Bond, gave us a list of issues at hand. We separated into sub-groups taking different issues. I chose to be in a sub-group, "Glass Strain", and I ended up being alone in the group. My goal was to study the glass behavior under high temperature. Knowing that using super glue is not an adequate adhesive for this kind of experiment, we used epoxy glue that can perform under high temperature for the first time. This adhesive took preparation for use while super glue did not require any preparation.

Due to conflicting schedules the last few weeks, the glass strain experiment has been moved back and I am yet to analyze the data. However, I am expecting to obtain the strain and stress over time with the data provided. This will fill in the gap where the previous team left empty (since the strain gages came off as the glue melted under high temperature).

Brian Macpherson

Over the course of this semester, I have come to learn a good deal about the Solar Oven group. While I knew nothing about the Solar Oven group coming into the semester, it sounded the most similar to the AguaClara project that I have previously worked on. I had few goals coming into the semester other than gaining more experience working with sustainable technology for the Global South, but quickly learned that it would be necessary to work well as an overall team-member, work well in sub-groups and communicate with the larger team, and to complete my own mini-project.

We decided early on to essentially break into smaller groups in order to tackle individual projects more efficiently. In terms of effectively completing tasks, I think this "divide and conquer" strategy did its job well as we would have never accomplished as much as we did with everybody contributing to all areas. In terms of the individual experience each member had, however, I think many group-members missed key ideas and experiences that other sub-groups were having. Communication was set up through wiggio.com, which worked well at first but broke down mostly to using email by the end of the semester. As a result, I learned quite a bit about oven testing in the beginning of the semester when I completed one test, but from then on out concentrated and really only dealt with the PIV section of our group. I also learned little about the parabolic reflector that's being constructed or the glass strain testing.

By doing the PIV experiment, we had to disassemble and reassemble the test oven, which helped me learn the ins and outs of its construction and setup. We are also working on analyzing the data, which will aid in the understanding of how heat transfers from the sun to the food (convection, conduction, and radiation).

Noah Zallen

From our first solar oven meeting I was excited not only to learn about a fascinating sustainable technology, but also to gain experience working and leading a project group. In our first meeting we established team roles, and I volunteered to coordinate all our duties throughout the semester. This ended up consisting of coordinating and compiling the project proposal, technical update, and final report. I enjoyed working with everyone on our team and believe that any successful project with 10 people is an invaluable experience.

I also learned a lot about sustainable engineering. This consists of far more than simply a device that has low impact on the environment. It also involves understanding the power and influence of the cultures involved and the resources, both technical and intellectual, available to the region. I think this is an incredible valuable lesson not only for sustainable engineering, but also for life in general.

I enjoyed learning about each subgroup's work during our team meetings and am very thankful that we decided to split our resources in order to get more work done. As a member of the pot placement group I was able to get to understand the box oven rather well. My only regret is that I was not able to be more involved in the concentrated solar cooker or the PIV testing as both are fascinating subjects to me.

Alice Yu

Sometimes, things just work.

At the risk of sounding over-the-top, I think my involvement in creating a concentrating cooker for the Solar Oven team has been one of the most fulfilling experiences of my time at Cornell. It actually managed to exceed my fairly lofty expectations. I feel that the right mix of people, resources, and information came together to produce something that is truly innovative and worthwhile. More than any other class project I've worked on, this one took on a life of its own and became more than just an assignment. I found myself motivated not by grades or by the expectations of others, but by the potential I saw in our design and by my eagerness to see it realized. In a relatively short span of time, we created something that I can truly look back upon and say that I am proud of. The most exciting part is that this is only the beginning.

Advisor Tim Bond was a tremendous asset throughout the entire process. He was always quick to forward relevant resources to us that he had found, and it was he that found the Bowman and Bernard designs that proved to be our key sources of inspiration. When we came up with our secondary-reflector design concept, his experience was key in translating this from a theoretical concept to a feasible construction plan, and he was always quick to provide a reality check on how best to assemble a given geometry. He was also extremely accommodating with his time, coming in for hours at odd times to help us when we asked.

I had initially worried about the size of the group being an issue, but everything worked out quite well. Perhaps because of the number of smaller sub-projects available, it seemed that everybody was engaged and always had things to do. My own sub-team got along quite well and complemented each other's strengths effectively.

Looking back at the goals I wrote at the beginning of the semester, it's satisfying to see the extent to which many of them were realized in one form or another. I definitely gained experience working in an engineering lab and felt quite at home in Bovay by the end. My sub-team ended up using a very diverse selection of power tools and equipment, and I was pleasantly surprised to see the extent to which we were trusted to manage ourselves and run amok in the lab. I also gained some of my best experiences yet applying the scientific method independently and working effectively in a team. I certainly anticipate that this project will have an international focus and make a difference, as I'd hoped. Surprisingly, even the time management goal worked out somewhat, at least when it came to our construction schedule. I still need to work on handing in document-based assignments in a more timely fashion, however.

I fully intend to continue working on this project next semester as an independent study and am very excited for its future. In particular, I cannot wait to bring the design to Nicaragua over spring break and collaborate with the local community on its improvement. If all goes well, the design will be mature enough that it will be useful immediately, but I also hope to come away with local insights on solar cooking and suggestions for a better design. With the proper commitment and stewardship, I think this cooker could go very far and make a big difference for human well-being and environmental health. I hope that future teams will continue to develop and promote this design and that they do not hesitate to contact alums with updates or questions.

Barbara Wang

Overall, my experience on the solar cooker team has been a positive one. My original professional goal of this semester was to apply topics like heat and mass and thermodynamics to a physical problem, like building a new cooker. I ultimately elected to work on pot testing rather than building the parabolic cooker and accomplish my personal goal instead. When reviewing which project I wanted to work on, I decided to work on pot testing because it was specifically asked for by the Nicaraguan women. This allowed me to potentially directly impact the lives of these women by determining the most efficient way to cook meals.

In addition to accomplishing my personal goal of giving back to the community, I was also able to work with engineers of a different field. The solar oven group broke up into subgroups. Working on pot testing, I worked closely with three civil engineers. It was interesting to see the different working style and group dynamic of another major as I tend to work with the same three people within my major.

In assessing the group, I think we worked well as a team. Although we were initially disorganized, splitting the large group of 10 members into smaller subgroups improved our productivity greatly and allowed us to delegate tasks effectively. One downside of this strategy was that I didn't get to really understand what the other subgroups were working on. It would have been helpful to have short summaries of progress every Monday during section form all the subgroups.

Chris Tilger

The Cornell Solar Project Team is an excellent example of technically savvy individuals using their skills to analyze and better a sustainable effort. I believe the this semester's team was very successful in achieving the goals for the class and those specified by Mujeres Solares and can see some of the longer term project being finished and tested in the spring. Having ten people on board this semester made organization tricky, but the establishment of four subgroups seemed to handle it well. Everyone in the group contributed significantly to each of their research goals, and it was nice to see past difficulties such as strain in glass figured out.

My own personal part of the project, heat transfer mechanisms and particle image velocimetry, along with Brian Macpherson was fulfilling and somewhat comical. After speculating on heat transfer in past semesters, we finally were able to develop tests to separate the different component of heating apart. These results should open up a future way to look at testing and improving performance. The particle image velocimetry part of project involved a lot of planning and moving the whole solar oven setup from Thurston Hall to Hollister Hall. Other team members and I saw using over one-hundred thousand dollars worth of laboratory equipment to analyze a very simple form of cooking as a humorous example of what engineers with resources do. The analysis, however, will prove valuable to describe convection to people.

As always, Tim Bond's assistance is much appreciated and invaluable to the Solar Oven Project Team. His insights on matters both technical and social are helpful for the project and related critical theory.