

UIC's Solar Powered Community Fridge Build Day Final Project Report

Project Summary

From our last update in April, the team and all stakeholders involved have considered the project completed. Since our inaugural meeting (Appendix A), where the project objectives were formulated, the electrical unit of the team has completed the necessary tests of the solar array (Appendix D). These tests were performed under conditions meant to simulate the weather that we expected the solar panels to go through annually in the changing seasons of Chicago.

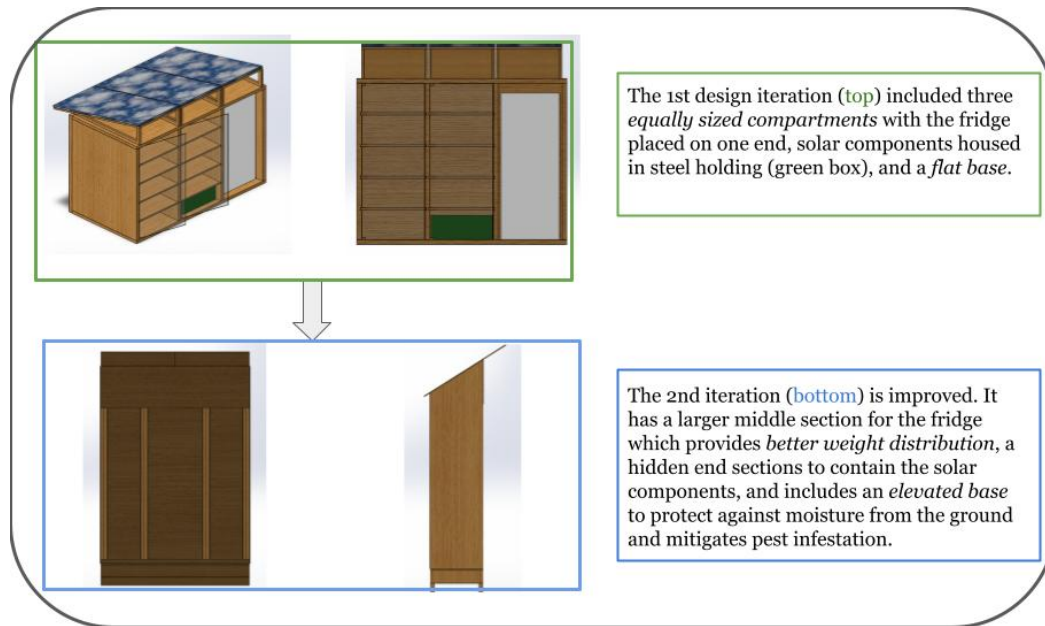
After encouraging results from the tests, the team purchased lumber and other building materials we needed from Home Depot and we began construction (Appendices G, H, & I) at our university campus. We decided to begin construction on campus instead of immediately on site because we could utilize our campus [UIC Makerspace](#). This facility was closer, and has a wider variety of tools and more space to work.

Using the [Construct 101 website](#) and under the guidance of our structural team lead (who had previous shed building experience), we assembled a base, back & side walls, as well as the rafters for the roof.

The team then dedicated a day to disassemble the old structure and the team level the ground at Patchwork Farms (Appendix J). It was important to our Love Fridge Chicago stakeholders that individuals still be able to access food during our construction so the team preserved the pantry of the old structure and kept the previous fridge plugged in.

With the old structure out of the way and Build Day fast approaching, we then loaded all these parts into a truck (Appendix L) and transported them to Patchwork Farms. The base was placed directly on top of the leveled ground, then we drilled in and fastened the side, back and front walls to the base. Once this was completed, the rafters and roof were attached then shingles were laid over that (Appendix N). Next, the team mounted the three solar panels drilling into the shingles (Appendix Q), after which the batteries, charge controller, inverter and other electronics were placed in their assigned section. With the solar panels mounted all necessary electronics strategically placed, insulation was inserted into the walls and the wire connections were made.

Below are images of the CAD designs the structural team made in SolidWorks as a mockup to present to stakeholders and what the actual structure turned out to be.



Project Plan & Evaluation

We completed our overall objectives for the project. It was highly successful but it did take more time and funding than originally expected. We had to extend our Build Day deadline 3 times. Success for this project means that we achieved our goals of powering a refrigerator using solely solar energy and constructed a structure that would house both the refrigerator and the solar components in a way that maximizes its ability to collect light rays, protect the valuable elements, and ward off pests all while ensuring the refrigerator was open to the food insecure in the community, i.e. serve as a communal fridge.

The original project conception started in December 2021 with the first two members. The original intent at the beginning of our planning process, in the spring semester of 2022, was to design and build a community fridge for UIC and the surrounding community using solely ESW Build Day funds (see image below).

1						
2	Total ESW HQ Build Day Funding			\$3,489.80		
3						
4		Purchases	Quantity	Unit Price	Total Spent	Amount remaining
5		Complete DIY Solar Panel Kit - 2,000W Pure Sine Inverter 12VDC + 600 Watts Solar 3 x 200W Panels [DIY-4] x 1	1	\$1,939.00	\$1,939.00	\$1,550.80
6		Frigidaire FFET1022UW24" 10.1 cu.ft. White Top Freezer Refrigerator + Tax	1	\$766.35	\$766.35	\$784.45
7		QSI QUAD Advanced Formula 10 fl. oz. White #001 Exterior Window, Door, and Sliding Sealant VOG	3	\$7.28	\$21.84	\$762.61
8		Grip-Rite #8 x 2-1/2 in. Phillips Bugle-Head Sharp Point Polymer Coated Exterior Screw (5 lbs.-Pack)	1	\$26.98	\$26.98	\$735.63
9		2 in. x 4 in. x 10 ft. #2 Prime Ground Contact Pressure-Treated Lumber	4	\$9.58	\$38.32	\$697.31
10		2 in. x 4 in. x 16 ft. #2 Prime Ground Contact Pressure-Treated Lumber	17	\$18.18	\$309.06	\$388.25
11		U-Haul and gas	1	\$106.08	\$106.08	\$282.17
12					\$3,207.63	
13						

The fridge was originally meant to be located on campus in order to address food insecurity among students and nearby low income residents. Our team specifically wanted to provide accessible food to the established houseless community around UIC's East and West Campuses. It was recognized that a relatively high percentage of the UIC community were food insecure, with studies showing that food insecurity affects one in four college students. The Hope Center conducted a survey with nearly 86,000 respondents, with 45% of respondents admitting they were food insecure in the prior 30 days, 56% of respondents were housing insecure in the previous year, and 17% of respondents were homeless in the previous year [1]. We spent several months and a couple semesters discussing with UIC personnel but all food drive initiatives on campus were already being devoted to the student population and nearby homeless shelters. At that time we had already used a significant amount of our ESW Build Day funds to procure a top of the line 200 watt solar kit that included all the necessary components to build an off-grid system.

During one of our team discussions, we realized we would need additional funding for building materials. This is when we decided to apply for a grant from UIC's Office of Sustainability (OoS) called the "[Sustainability Fee](#)". This is a fund made from a

portion of each student's tuition. The fund's clear application process provided us with different levels of funding we could choose from and our team applied to the 'up to \$5000' option.

When pitching our idea for additional funding, we had several meetings regarding the viability of having a community fridge on campus with UIC's Director of Planning and Design and Assistant Director of Campus Architecture at UIC. We also held meetings with the OoS, Directors of On-Campus Residential Halls, and UIC's Wellness Center, who runs a food pantry. However, there were several roadblocks to this. Firstly, the UIC student organization the Food Recovery Network (FRN), whom we had planned to collaborate with long-term, feared that there would not be enough food to stock the fridge. FRN is responsible for collecting and transporting recovered food from all the campus restaurants and the UIC cafeteria and donating it to a nearby homeless shelter and they had reported declining numbers of recoveries. Secondly, the Newman Center, a religious institution on campus grounds, rejected our proposal to house the structure at their location after the Director of Planning suggested it. Next, was the main concern from the OoS about the upkeep of the fridge and food safety. They feared that there would not be sufficient monitoring of what goes into the fridge to avoid the possibility of food poisoning, allergic reactions or other hazards related to the stored food - which could have led to legal liabilities for the university. As a result, we had to reapply for the Sustainability Fee in Fall 2022. We were finally approved for the grant under the condition that our community fridge not be on UIC grounds or be directly tied to the university (after back and forth and reapplication to the grant for nearly 3 months). Hence, Spring 2022 was filled with administrative roadblocks and although we were able to make some purchases from the aforementioned Build Day fund, we were not able to begin construction.

We were successful with our reapplication after securing an official partnership with the nonprofit Love Fridge Chicago. We had wanted to partner with Love Fridge Chicago from the start, but we never got a response, despite several attempts, in the early stages of our project. Finally, we successfully made contact with the organization in the fall of 2022 after one of our new members disclosed being neighbors with a prominent member of the nonprofit. The OoS wanted us to attain an official partnership with Love Fridge Chicago as part of us being approved for their Sustainability Fee grant and in the same semester, we were able to do so with an agreement in place to turnover our build upon completion in summer 2023.

When evaluating the success of the project against the objectives we had set out, both the team and our nonprofit stakeholders agreed that the off-grid functioning solar array, solid shed structure that protects the electronics, and the attached pantry which serves the community, meant the project could be deemed a success. Ultimately, we

achieved our stated goals. We built a community fridge available for food insecure people (in a well trafficked area) that is well maintained and regularly stocked. Of course, this was not and is not going to be not solely achieved through the team's efforts, but with our collaboration with Love Fridge Chicago, the UIC Office of Sustainability, and the farmers at Patchwork.

There were several different effects we had not anticipated. First, we had a much longer timeline than initially planned for. Second, we needed more funding than expected (full budget can be viewed at the end or using this link:

[Total Community Fridge Budget & Spending](#)). That is why we applied to UIC's OoS Sustainability Fee grant, which resulted in a lot of back and forth with UIC administration. Thirdly, we were not prepared for UIC's reluctance to place the project on campus. Furthermore, we struggled to find sources of food to be donated after UIC's Food pantry rejected our proposal, however we were prepared to partner with the student organization: Food Recovery Network. And finally, as the semester progressed we sadly experienced a severe decrease in attendance from members meaning that the increasing workload fell on an ever diminishing task force.

Lessons Learned

While many lessons were learnt during this project, they can be summarized simply as: proper planning should always be prioritized. Although formulating a detailed project plan is time-consuming, it is time well spent. Hence if another chapter wishes to replicate this project our advice would be to carve out time to properly plan the project.

The project plan should stem from the project objectives and all stakeholders should be in agreement. The project plan should take into account how often the group will meet per week and the expected downtime for holidays, necessary breaks, and staples of student life such as important exams and finals.

One of the sub-lessons associated with proper planning that our group learnt very quickly, is that research on established rules and regulations should come first. Knowing things like campus guidelines, building codes, city ordinances and the correct channels of communication, provide the limitations within which the project plan must work. There is also the added bonus of saving time by avoiding speaking/asking permission to do things with wrong personnel.

Next, the team learnt to also include internal limitations such as the total budget, available manpower, and lack of expertise expected of a student group. Once these formative steps are taken, the team can brainstorm a detailed project schedule with a list of deliverables and estimated due dates for different phases of the project. This now brings us to the importance of documenting the project schedule. A project schedule should never exist solely in the minds of certain individuals on the team. Instead, documentation of progress should exist in writing on a platform like Google Docs, that allows for collaboration, easy and remote access to edit as well as presentation and sharing capabilities to incorporate stakeholders. Beforehand, individuals should be appointed to update and review this document since it may change many times over the course of the project. Time is avoided being wasted going over old plans or ideas with the selected responsible individuals updating and editing this document.

Furthermore, there were technical and logistical learnings that occurred through project hiccups. These included proper wood storage away from humidity which the group learnt the hard way after the studs we initially purchased got warped (see Build Day budget above). If proper prolonged storage is not available then lumber purchasing should be held off until the team is ready to start construction. Also, it is best to keep a refrigerator in an upright position for the entire move, no matter what its size. This is because putting a fridge down on its side can cause damage to the refrigerator compressor and keep it from doing its job since the compressor is filled with oil that is held in place by gravity. Luckily, this was discovered prior to purchase during our research phase.

Finally, it would be remiss of us to not state that while proper planning is vital, unforeseen challenges will occur during the course of this project. As such, the team must be prepared to come up with innovative solutions to these problems and the project schedule should allow for such occasions. For example, at the start of the 2022-2023 school year our team had to be divided into three groups that met on separate days because unlike previous semesters there was no common time when the majority of the team could meet. The team had to quickly identify the major components of the project being administrative, structural, and electrical then assign team members to the component where they would be most effective.

Project Impact

This project was originally started to address food insecurity in the UIC community and surrounding areas in an energy efficient way and took off from there. Although our original plan was to house the solar community fridge on UIC's East or

West Campus, the impact of this project stayed consistent throughout: to serve Chicago's food insecure population without restriction.

The community fridge that we have created is located at Chicago Patchwork Farms (2825 W Chicago Ave, Chicago, IL 60622), an inner-city farm that serves as a farmer's market and a source of healthy organic food to the community. The structure will be available for community members to take food supplied to the fridge or pantry by Love Fridge Chicago's employees and volunteers. The ease of access to the food removes the barriers of finding transportation to other organizations that provide food to these communities. In order to address these barriers, Love Fridge encouraged us to remove the doors from our original design. Although they were intended to keep animals out and reduce the effects of the environment on the inside of the structure, we removed them to avoid physically blocking community members from accessing the food inside the fridge.

This project will allow the food resource sector to serve its clients in more innovative and eco-friendly ways as solar energy becomes more easily available. It will also provide an example for how communities can utilize green technology to provide services to its members in a sustainable manner while avoiding vandalization and theft of the technology. Additionally, the fridge will be of service to our partner agency by publicizing their mission statement

During our final assembly phase at Patchwork Farms, we witnessed the on-the-ground impact of a community fridge first hand when community members came to donate or collect food even while we were building. Though our fridge is slightly smaller, the new structure has a significantly larger pantry than the previous one, hence we hope that dry food donations increase and are able to help more. We noticed prior to construction that a majority of the donations were dry goods anyway and now those items are accommodated for.

Future Work

We do not envision continuing the project ourselves. Our completed solar powered community fridge was donated to the organization Love Fridge Chicago and is kept at Patchwork Farms, outside of the UIC campus.

Due to the structure's placement and exposure to the climate year-round, we could check on the structure every so often to ensure there is no noticeable stress or any immediate danger to the structure. However, regular maintenance, including potential replacement of parts will be undertaken by workers at the Farm and the Love Fridge

Chicago group. Since the workers at Patchwork Farm will be present for most days out of the week they will know if there is a problem sooner than our ESW chapter or Love Fridge. Added to the fact that as a student organization we have limited access to funds, all parties agreed that the faster and more efficient solution if such a problem were to arise would be direct communication between the farm workers and instead of finding out about a problem days, or weeks after it happened. Love Fridge.

Some potential future projects that we could pursue include data collection and assessment of the solar powered unit. As stated in previous database updates, Love Fridge Chicago has a large solar powered community fridge in [Englewood](#). During our discussions with Love Fridge, there were tentative talks of installing a system of measuring food consumption at that location either by monitoring the changing weight of the fridge or sensing how often the fridge door is opened, with our smaller solar unit at Patchwork serving as a test sample. There is also the possibility of a project involving temperature control of the solar array, like a built-in failing coolant temp sensor which would activate failsafes to protect the fridge.

Our group and Love Fridge have promised to remain in touch to further discuss these as well as any other volunteer opportunities. Future communications will take place in our shared Slack chat or via email.

References

[1] “U and I Care: Housing & Food Instability Resources | Office of the Dean of Students | University of Illinois Chicago,” *Uic.edu*, 2022.
<https://dos.uic.edu/news-stories/u-and-i-care-housing-food-instability-resources/>
(accessed Feb. 06, 2023).
