



2021-22 Awardee

Engineers Without Borders

Engineers Without Borders was awarded the Green Grant for a project creatively upcycling plastic waste from campus grounds using engineering technology and resources.

Award Amount: \$280.00

Engineers Without Borders at Temple is part of a national network of volunteers working on various engineering and community development projects at both local and international levels. The organization's goal is to use the skills they've gained in the classroom to better the lives of their neighbors. EWB has worked on all sorts of projects from building a greenhouse at a local high school to designing a water supply system for a small community in rural Peru. They prioritize sustainable humanitarian projects and welcome everyone, even those outside the major, to contribute to their efforts!



The Problem With Plastic

Why We Conducted A Waste Audit & What We Discovered

Through their Green Grant program, the Office of Sustainability provided EWB with a unique opportunity to work on an issue they care a lot about—plastic waste. Over-consumption of plastic waste is an issue across the country. Even worse, every piece of plastic ever manufactured, still exists on earth today. Most people use plastic every day, so where is it all going? We would hope that most plastic is recycled and re-

used, but in fact, that's not the case. Less than 10% of plastics used in the US are effectively recycled into equally useful materials. With this in mind, EWB wanted to learn about recycling and waste behavior amongst Temple students, and what solutions they could come up with to address the issue on campus. To accomplish this, EWB conducted a waste audit.

EWB worked with Temple Grounds to pull trash and recycling waste from two campus locations over a 2-day period. The audit locations—Ritter Plaza and Vending Pad—were selected because they

are near dining and vending hotspots. We hypothesized that the greatest variety of plastics would be found near places where students ate. Quick service food options, such as food trucks and take-out only fooderies, have a business model that depends on providing food in single use containers.

“Even worse, every piece of plastic ever manufactured, still exists on earth today.”

Once Temple Grounds pulled the bags from Liacouras Walk South and the Vending Pad, they took them to a staging area where they were separated by location and tagged as either recycling or waste. This ensured that the analysis would take into account the types of items thrown away and whether or not students are recycling "right."

During the morning of the waste audit, EWB members sorted through and weighed

every item that was disposed of as recycling or trash. This allowed EWB to collect enough data for a snapshot of the composition of waste here on campus during the day. Through the waste audit process they were able to answer the following questions: What sorts of plastic would be found in the trash that had the potential to be upcycled? What sorts of waste could not be upcycled at all? What percentage of trash items would be found in the recycling bins, and vice versa?

The data revealed a composition of hard and soft plastics, contaminated food containers, wet paper, and food waste. For their analysis, EWB zoomed in on the plastic waste footprint, and were excited to find that plastic from the trash and recycling samples had the potential for a new life. Another key finding was the rate of contamination within the recycling bins. Some areas of concern were

wet paper and empty plastic bottles, cans and containers and other soft plastics contaminated with food and other liquid. 69% of the recycling collected from the Vending Pad and 44% of the recycling collected from Ritter was contaminated. Unfortunately, when a bag of recycling contains more than 10% trash it is considered "contaminated" and will likely not be effectively recycled by a commercial recycler. This is why it's so important to carefully separate streams.

Our Creative Solution

Filastruder, 3D Printing Technology and the Possibilities

After the waste audit, it was time for EWB to decide what exactly could be done with all this plastic. Plastics numbered 3,4, 6 and 7 were not likely to find a second market in Philadelphia, at least via curbside collection, so they were determined to come up

Types of Plastic

- 1 (PET)–beverage bottles**
Recyclable in Philadelphia
- 2 (HDPE)–milk jugs, shampoo bottles, laundry detergent bottles**
Recyclable in Philadelphia
- 3 (PVC)–plastic food wrap, plastic packaging**
Not recyclable for Philadelphia's curbside collection service
- 4 (LDPE)–shopping bags, cling film**
Not recyclable for Philadelphia's curbside collection service
- 5 (PP)–yogurt containers, bottle caps, plastic toys**
Recyclable in Philadelphia
- 6 (PS)–disposable plates and cups, CD cases, vending cups**
Not recyclable for Philadelphia's curbside collection service
- 7 (Other)–sunglasses, nylon, fiber glass, etc.**
Not recyclable for Philadelphia's curbside collection service

with a creative solution as an alternative to sending it to a landfill. They brainstormed ideas about how to repurpose the plastic waste and recycle it into something new and useful.

EWB decided to use 3D printing technology accessible through the University. The idea was to take clean and sorted plastic and shred it down with College of Engineering lab equipment to yield a non-virgin aggregate

as recycled material to be 3D printed. The shredded plastic is fed into a machine called a Filastruder, that melts and extrudes the material into a thin 3D printing filament. EWB tapped into their more creative engineering skills to imagine new design possibilities for this recycled plastic. The designs would be drawn on the computer using AutoCAD and 3D printed with recycled plastic filament. This project leaves plenty of room

for future growth and applied research and development as EWB comes up with new design ideas and improvements to the system.

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What's the Big Picture?

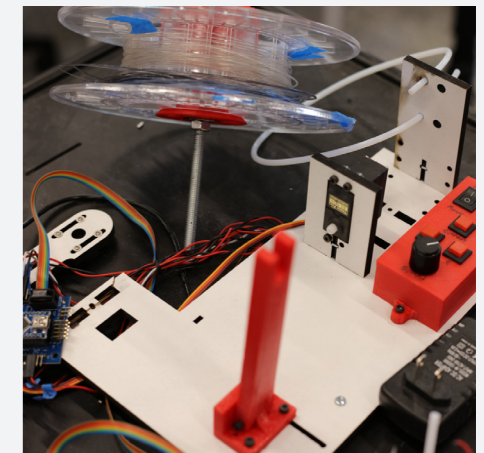
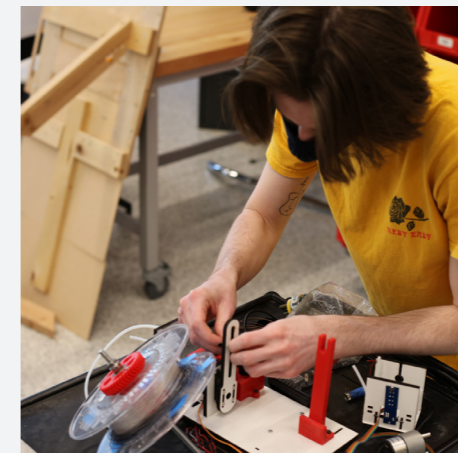
What lessons can we take away, and how can we apply creative solutions to the issue of waste?

Instead of seeing trash as a refuse item bound for the landfill, EWB learned to look at it as a commodity. There's only so much room on this earth to bury waste. It's time to invest in a circular economy and transform waste into a

resource. This necessitates a transformation in the current waste systems in place, but with engineering ingenuity and innovative solutions, it is possible. Advocates also recognize that technology isn't enough and that individuals must commit to zero waste principles and incorporate them into their own lives by consuming less.

Tips for Effective Recycling

- ▶ Only numbers 1, 2, and 5 are recyclable in Philly. Double check before you toss!
- ▶ No food or liquid in the recycling.
- ▶ Fully rinse out any glass, plastic, or aluminum before recycling it.
- ▶ Plastic bags can't be commercially recycled. Take them to one of the designed plastic bag recycling spots on campus.
- ▶ First, consume less. Then recycle!



Student Reflections

Why is sustainability important to you as an engineer?

"I believe that developing innovative solutions to the world's problems using sustainable materials or waste is crucial in order to slow down the progression of the climate crisis. A lot of technology that is commonly used today still relies on heavily polluting resources such as fossil fuels and plastic, which I hope to change as an engineer.

One of my hopes when it comes to my work as an engineer is to develop an environmentally beneficial solution or technology

that is so efficient, both mechanically and economically, that it becomes the only log-



ical choice to businesses and the government." *DIANA*

What is your biggest take-away from the waste audit?

"I think often students have good intentions when disposing of waste, however it isn't always clear how to recycle properly. For example, a recyclable beverage bottle won't be recycled if there is liquid inside when it's disposed of. That liquid, when recycled, contaminates other paper and plastic items that should be recyclable. Making a con-

scious effort to clean recyclables to the best of your ability before tossing them out is incredibly important. Even more important is

simply reducing your waste and single-use plastic consumption in the first place.

Reduce, reduce, reduce! Then reuse. Then recycle." *JULIANA*

What would you like students to know about waste production?

"There should be more education on waste in primary education so younger stu-



dents know just how big of a problem waste is in our society. Most people, not just students, don't even know what items are recyclable in their community. Even more people don't realize how much of the items they think are being recycled actually end up in traditional waste streams. The advice I would have for stu-

dents is to learn about recycling in their community and inform others of the recycling guidelines.

If you want to get more involved, participate in trash clean ups around the area, avoid using single use plastic such as

Ziploc bags, maybe even find ways to repurpose recyclable and nonrecyclable items. For instance, old coffee grounds containers make for great plant pots." *JACOB*

"It is possible to make a big difference just by incorporating small changes, such as emptying out a bottle before throwing it in the trash, asking for your food without a plastic bag or finding out if you can bring your own reusable container to the food trucks." *GEORGE*

Which big idea from this project can be applied to corporate America, and how so?



"The take-away from this project should be that we are in a crisis with our waste production and the overuse of plastic. This

applies to communities and corporations as we will not be able to tackle this issue without the support of everyone. This looks like proper education about what can and can't be recycled for both community members and the businesses that operate within the community. It also looks like having properly labeled plastics so it's easy for consumers to know whether they are recyclable. In doing the waste audit, I was surprised by how many plastic containers do not have a recycling number on them. This blame falls on

the manufacturer of these products and the corporation that is selling them. Overall, an emphasis needs to be put on making sure items that can be recycled are being kept out of the waste stream." *JACOB*

How and why is a university an accelerator for student-generated solutions to sustainability challenges?

"Universities such as Temple have a big responsibility for not only helping accelerate change in the University's community but also the community surrounding it. When it comes to sustainability, Temple should also see how we can generate solutions for the sustainability challenges our surrounding community endures in addition to our own. Due to the many resources Temple University has, students are able to utilize these resources to investigate how we can improve Temple's sustainability practices and our individual habits. Temple's

Office of Sustainability offers many resources for creating programs and events that advance climate action and environmental justice. As a club, we hope our project can help promote student-driven initiatives to combat climate change and environmental issues." *RANIA*

"Universities are the perfect place for collaboration across a broad range of interests and skills. Having a concentrated population of people studying a diverse range of topics, which can all implement sustainability in some way, makes it very easy to exchange ideas and work together to come up with sustainable solutions or initiatives. Additionally, Universities are a hub for research. Research is the first step in developing the math, science, engineering concepts, or just data needed to make sustainable changes. For example, every year I see an article about a revolutionary technology that came

from a lab in a university. With better and more efficient solutions and answers to the world's problems, people in the private and public sectors can apply these findings into the real world to foster sustainable development. Finally, universities have many clubs which can build a community for people with common interests, such as the environment, and students can meet people with different backgrounds but a common desire to prevent irrevocable environmental damage and work together to enact change."

DIANA