

Sustainability in Food Services and Materials

Mr. Aatish Gupta, Rowan University

I am a Mechanical Engineering student at Rowan University.

Ms. Lauren Mulvihill

Mr. Emmet Scott Sedar, Rowan University

I am an accomplished honors student, and aspiring Mechanical Engineer and Physicist, passionate about astronautics and the private military contracting industry. Currently serving as the President of the SAME student chapter at Rowan University.

Jenna Nicole Sperduto

Sustainability In Food Services and Materials

Aatish Gupta^[1], Lauren Mulvihill^[2],
Emmet Sedar^[3], Jenna Sperduto^[4]

Henry M. Rowan College of Engineering, Rowan University
201 Mullica Hill Rd, Glassboro, NJ 08028

March 30, 2021

^[1]guptaa58@students.rowan.edu, ^[2]mulvih57@students.rowan.edu,

^[3]sedare58@students.rowan.edu, ^[4]sperdu28@students.rowan.edu

I. EXECUTIVE SUMMARY

In 2019, the Rowan Environmental Action League, a student-led environmental committee on our campus drafted a petition, urging the university to take action to “become a leader in environmental stewardship, sustainable innovation, and climate education”[15]. The petition specifically calls for a reform of the dining services at Rowan University. As institutions of higher learning, universities have an obligation to implement practices that will create a more sustainable, equitable, and prosperous future. Our team has conducted research to determine the most achievable environmental practices for attaining this future as it pertains to food services through lowering carbon emissions, limiting the production of organic waste entering the municipal solid waste system, limiting food waste, and battling food insecurity. Using this information, we have created a plan of action for our dining services to execute. Although many of our university’s resources have been diverted into combating the COVID-19 pandemic, the problems associated with managing it will abate in the near future, and the climate crisis has not been on hold because of it. We must act now or forever regret it.

One of the foremost threats faced by humanity is climate change. This is a process exacerbated by the anthropogenic production of greenhouse gases. Virgin plastic production creates large amounts of greenhouse gas emissions, as does the anaerobic decomposition of organic waste in landfills. The methods of waste management in our region are mainly limited to landfilling, a process that

relies on dwindling and limited public space and poses potential dangers to individuals residing or working nearby. To limit carbon emissions and reduce the amount of waste sent to landfills, we have recommended that our university cut down on its use of plastic utensils, increase recycling, and compost or donate unused food. We also recommended that educational and persuasive materials are posted across campus to increase awareness of environmental issues and how students can help through the use of proper waste disposal methods. One of the big reasons that waste is not recycled is because people throwing out food do not know how to separate it, so disseminating educational material will be beneficial to combat that issue.

The transition to sustainable practices is estimated to last two months with a required allocation of approximately \$9,500. There will be administrative measures that must be taken, and the size of the dining services’ staff might have to be expanded due to the increased amount of work that must be done to ensure that the policies recommended are successfully implemented. This is, overall, a small price to pay. The switch to sustainable practices will garner positive press for our university and thereby improve its reputation. This means more money further down the road. This is an excellent opportunity, not only to make a better future but to be recognized for it and prosper.

II. PROBLEM SUMMARY

The cultivation and consumption of food products lead to a myriad of environmental issues.

The research conducted focuses on the disposal of food waste, since that is what we were mainly focused on improving at our university. The two main methods of waste disposal in the United States are landfilling and incineration. Both of these methods have environmental and public health risks associated with them, so limiting the amount of waste funneled into either one is essential. Incinerators create harmful fumes, greenhouse gases, and toxic leachate that must be dumped in landfills. Landfills can pose health risks to the communities that surround them through groundwater contamination. A 2019 article published in the journal *Environmental Science and Pollution Research International* states that “the effects of pollution in the areas allocated for sanitary landfill and incineration may not appear immediately, but pollutants will gradually accumulate in the environment until the system changes and it will ultimately cause vulnerability” and that “such pollutants can lead to permanent transformations that affect ecological systems, public health, and socio-economic activity” [10]. To keep materials out of landfills and incinerators, the amount of waste created should be limited, and as much of it as possible should be recycled.

A key contributor to environmental degradation is single-use plastics. Plastic production creates large amounts of greenhouse gases. Plastics also account for a large percentage of landfilled waste, approximately 12.2% according to the EPA, and take notoriously long to biodegrade. “Research suggests plastic pollution may impact biodiversity, ecosystem services, food security, and human health. In short, plastic pollution is a global threat” [4]. According to this same study, around 9.5 million metric tons of plastic enter oceans and waterways per year, costing an estimated \$13 billion to multiple industries and posing a threat to several aquatic species. This number is projected to double by 2050 if current trends do not change. The use of food-related items such as plastic utensils, straws, and containers over an extended period contributes to this problem. The issue of plastic pollution has only gotten worse since the COVID-19 pandemic began, forcing an increase in single-use items to minimize the spread of the disease. Policies that will alleviate this issue include reducing the amount of virgin plastic production and increasing recycling.

Organic waste from food products is another significant problem, accounting for approximately 56% according to the EPA. It has been found that “food accounts for over a quarter (26%) of global greenhouse gas emissions” [12]. The carbon footprint associated with food production comes from the fossil fuels used to create and distribute food products, as well as from the destruction of forests

and natural habitats to make room for agricultural sites. The disposal of organic waste is no better. When organic waste is placed in a landfill, bacteria break it down. This chemical process creates methane, a greenhouse gas that has a warming potential 84 times that of carbon dioxide. To both reduce the amount of food that needs to be created and to limit the amount that is incinerated or landfilled, food waste needs to be limited.

III. OBJECTIVES

The main goal of this proposal is to provide solutions to the sustainability issues that face Rowan. We want to dramatically reduce the amount of overall waste produced by the university’s food services while also battling food insecurity.

One of our main objectives is to decrease the amount of single-use plastic utensils and containers. Currently, both of the dining halls on campus are strictly using single-use containers and utensils to counteract the spread of coronavirus. As a result, waste has increased since the start of the pandemic. We intend to bring single-use plastic waste to zero.

Another objective is to increase the rate of recycling. Many students do not take the time to use the proper waste bins for their trash. Recycling is a simple and effective way that every student can pitch in to help the environment; action needs to be taken to increase student recycling rates.

The last objective is the utilization of food waste. Currently, according to the head of the dining services at our university, leftover food is given to our local chapter of the “Food Recovery Network, [a student-run group that] takes the food and donates it to local shelters... each week”. This practice drastically decreases the amount of food that is wasted. However, not all leftovers are eligible to be picked up and donated. We aim to reduce outgoing food waste by 50-60% with our proposed policies.

IV. TECHNICAL APPROACH

To decrease the number of single-use containers and plastics, we advise our university to stop giving plasticware and utensils to people that use their services. This will make it necessary for students to bring their own drinkware and utensils to dine with them. Glassworks eatery does not have this problem because reusable dinnerware is already in use there, but the Student Center must implement this policy. Due to the pandemic, the Student Center currently provides a paper or plastic box in which the food is contained, a sealed plastic bag with utensils, a napkin, small paper bags containing single-use

amounts of salt and pepper, a paper cup for drinks, and a plastic lid and straw for each cup. Since most students are taking the food back to their living quarters, all of the packaging except for the paper or plastic box is nonessential. If only the container with the food is given to students, the amount of waste generated can be decreased. Students can use their own utensils located in their domiciles, and bring reusable drink containers for liquids. Since food packaging is one of the two most harmful aspects of a particular product's life cycle, decreasing unnecessary packaging will have a huge impact [3]. Additionally, through a survey of fifty university students, it has been proven that most students would be willing to bring their own utensils. The figure below shows that more than half of the students surveyed responded yes, and an additional thirty percent responded that they might be willing.

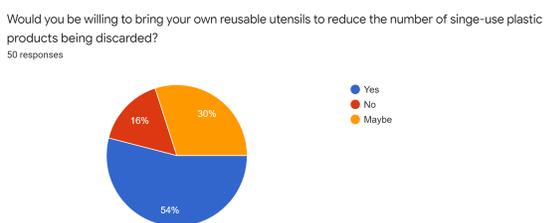


Figure 1: Student responses to sustainability survey question identifying willingness to utilize personal, reusable utensils in dining halls

As the Student Center reopens for in-person dining, students can bring their own utensils there. Reusable utensils and a carrying case can be purchased for as little as \$1.00 from major online retailers. The Rowan Environmental Action League sells such a product to students, and this money is used to raise funds for the organization. Once this plan is enacted the need for the product will increase and the price can be increased as well and used to offset the budget. There is an economic opportunity for the university to sell these sets as well as reusable drink containers to students at the merchandise store located on the second floor of the Student Center.

Increasing the amount of recycling by dining services is a challenging task. Currently, there are plenty of recycling bins for this sort of waste, but the challenge is to increase their utilization. Ideas about incentivizing recycling through monetary measures were considered but determined to be too costly to be effective. Instead, a campus-wide poster and flyer program should be implemented to increase awareness about recycling. We can print out flyers that detail why recycling is important, contain appealing graphics, and outline how to properly recycle. This can be aided by placing posters around

campus. This should make students more environmentally conscious about how they dispose of their waste.

To combat food insecurity and reduce the amount of organic waste ending up in landfills, we advise our university to increase the frequency of food donations. Rowan is currently partnered with the Food Recovery Network, which supplies food to nearby women and children shelters as well as facilities for the elderly. This food is collected weekly at both facilities. We suggest that this food be collected three times a week to increase the amount of food donated and minimizing the amount of food that is wasted.

To further decrease the amount of organic waste put into the MSW system, we propose that a compost bin is added to each waste receptacle in each dining facility. Signs will be posted indicating the bin's purpose, and employees will be responsible for separating non-compostable waste from the bin. Our university currently has a composter near the Student Center, but an industrial-sized composter will be necessary to accommodate the increased amount of waste. The student-run environmental activism group on campus and our chapter of the US Green Building Council have constructed a garden located behind Magnolia Hall which could benefit from the natural fertilizer produced by the compost. Excess compost could also be sold to nearby garden centers or farms to generate revenue for the university.

V. SCHEDULE & PLAN

Food donations can be increased quite easily. The frequency of donations can be increased from one time per week to three times per week. This change would require employees to prepare and package donations on two more occasions per week. The simplicity of this change allows an almost immediate implementation. Appropriate staff must be scheduled to work, and all staff must be notified of the changes.

Table 1: Timeline of milestone goals for augmenting food donations

Week	Milestone
1	Staff notified of changes Appropriate staff is scheduled to complete additional tasks
2	Donations are completed triweekly

Single-use plastics can be phased out easily, as it does not require additional infrastructure. This change does include some logistical planning. All students, faculty, and staff must be informed of the changes that will be occurring. This change will force those wanting a meal provided by university dining within the Student Center to alter their lives in a small way. Information concerning the alterations must be displayed for some time, to allow a great majority of customers to encounter the new policy. All staff within the Student Center must be briefed on the changes, as they will be the faces of this new change. Once an appropriate amount of time has passed and all staff is trained and prepared for the changes to take place, all single-use items will cease to be distributed.

Table 2: Timeline of milestone goals for phasing out single-use plastics

Week	Milestone
1	Initial emails concerning changes will be sent to the student body as well as all faculty and staff. A timetable of changes will be included. Posters detailing information about changes, as well as a timetable, will be displayed around campus and inside the Student Center.
2	A reminder email concerning the upcoming changes will be sent along with a timetable of changes.
3	All customers within the Student Center will be given the option to use utensils and drinkware provided or supplied by themselves.
4	A reminder email will be sent concerning the upcoming changes.
5	All customers will be required to supply their own utensils and drinkware. Posters detailing permanent changes will be displayed at the Student Center

Enhancing our composting system will require planning and time. Each dining location within the Student Center must be provided with a composting bin. Bins must be researched and multiple price quotes must be acquired before purchase. Appropriate staff must be notified and trained for the implementation of these new bins. Signs indicating restrictions on what goes in the bins must also be posted. A staging area for the compost

must be established as well. Equipment for the site must be quoted and purchased to allow the composting to take place. A method of transportation from the Student Center to the site must be established as well.

Table 3: Timeline of milestone goals for the implementation of composting.

Week	Milestone
1	Research and acquire price quotes for bins
2	Notify and train appropriate staff. Begin to establish a site.
3	Install bins and signage. Site fully established.
4	Begin implementing the suggested composting plan. Notify students of changes and opportunities. Contact nearby garden centers and/or farms of excess compost opportunities

VI. BUDGET

For these projects to come to fruition, Rowan must sponsor all costs. When it comes to ceasing to distribute plastic utensils and drinkware, the University will not suffer a large financial burden. Each time a set of utensils or drinkware is not provided, the University will be saving money. This change will pay for itself, once the need to purchase single-use plastics disappears. An upfront cost to promote the changes will need to be made. Multiple posters and informational signs will be needed to spread the word about the changes. This cost is estimated to be ~\$500, a one-time expense. This cost will ensure that the entire campus is aware of the changes.

As far as donating food triweekly goes, there will be a minimal cost to accomplishment. Extra hours will have to be paid to those who conduct the donations after regular hours of operation. This cost is expected to total ~\$9,000 per academic year. This cost is based on a \$15.00 per hour wage.

To conduct composting from all dining locations within the Student Center, bins must be purchased, a site must be cleared and maintained, and food waste and compost must be transported. Bins for transporting food scraps will cost ~\$2,800. This cost includes bins for all dining service locations, as well as transportation bins for to and from the composting site. Composting bins for the site can be built by

students as a service project, reducing the cost. The university will purchase materials, ~\$1,000. There will be a small extra cost in labor; the food scraps must be transported to the site, as well as layered with a bulking agent. This bulking agent must be carbon-based, such as recycled paper which has been shredded. We estimate that the added cost in labor is ~\$5,500 per academic year. This cost is based on a \$15 per hour wage. Related equipment for managing the site is estimated at ~\$500, and the creation of the site is estimated at ~\$1,500. This project will cost our university a total of ~\$10,300. Compost can be used by students, sold to local businesses to generate revenue, or donated.

VII. EVALUATION

Several metrics must be employed to evaluate the success of the suggested plan. We seek to measure the change in the quantity of solid waste being produced by dining services, waste successfully recycled, and food donated. There is no current measurement for Rowan's waste output. We recommend that while the plan is being enacted, waste is measured by employees after trash cans are emptied and added to a tally that will be used to analyze weekly waste averages. These can be compared to the amounts after the plan has been enacted to measure the impact that the plan has made. The same thing can be done for recyclables. The Food Recovery Network at Rowan currently weighs all donations made, so it will be easy to evaluate the change in donations made.

VIII. APPLICABILITY TO OTHER CAMPUSES

If the plan is positively appraised based on the previous metrics, then we suggest that other universities implement the plan as well. This plan was developed to be specific to the needs of Rowan University, taking into account its size, budget, student population, and level of motivation to make more sustainable decisions. Although these factors will be different at different institutions, the lessons learned on our campus can be tailored to meet the needs of other campuses. Sustainability initiatives have been established on college campuses throughout the US. Universities such as Brown, Cornell, Harvard, and UCLA have all implemented plans to reduce emissions and waste. Our plan, if successful, will be desired at other schools given that they share our values.

The schedule and plan detailed above can be generally applied to a university the same size as Rowan, and can be scaled up or down based on a

university's size or goals. The budget for this plan will vary depending on the area's labor costs as well as the pre-existing infrastructure. Fundraisers can be conducted to offset some of the initial costs. As mentioned before, the Rowan Environmental Action League currently sells reusable dinnerware to students. This kind of opportunistic fundraising could easily alleviate the cost of enacting the plan. Before implementing a similar plan to increase sustainability, institutions should reach out to their student populations to gather data on their motivation to make changes, similar to the surveys that we have conducted. This data should then be analyzed to ensure that any new procedures implemented do not upset students.

IX. CONCLUSION

The problems posed by the food industry have clear and far-reaching implications for the well-being of all communities across the world. Institutions of higher learning must take the initiative to become more eco-friendly as the burden that humans put on the planet grows. Through simple policies, a little bit of funding, and commitment to improving the environment, our university can make a serious difference. It is already a well-respected institution, and implementing the sustainable changes proposed in this report will only garner even more respect from other universities, students, and alumni. Rowan University has the potential to become the model of sustainable practices for other schools, which would not only benefit the environment but would also draw in potential students, which would increase potential earnings through tuition and fees. So, although the changes discussed above will require some initial investment, the return will be far greater. Outside of the monetary aspect, Universities aim to enrich the world through knowledge, and by following the plan given ours can do just that.

Creating a world where the demands of modern society can coexist peacefully with our fragile natural environment requires effort from all of us. Though these changes may seem obvious and simple, in the long run, they have the potential to cause immense change. So, what do you want your future to look like? Your planet, your call.

REFERENCES

- [1] E. Barbier and J. Burgess, "Sustainability and development after COVID-19," *World Development*, Vol 135, no. 105082, November 2020. [Online] Available: ScienceDirect, <https://sciencedirect.com/sciencedirect.com/s>

- science/article/abs/pii/S0305750X20302084. [Accessed October 30, 2020].
- [2] J. Boguniewicz-Zablocka et al., “Snack-food industry effluent pre-treatment for annatto dye and yeast removal: Process improvement for effectiveness and sustainability,” *Journal of Cleaner Production*, Vol 277, no. 124117, December 2020. [Online] Available: ScienceDirect, <http://sciencedirect.com/science/article/abs/pii/S0959652620341627>. [Accessed October 15, 2020].
- [3] A. Borghi et al., “An evaluation of environmental sustainability in the food industry through Life Cycle Assessment: The case study of tomato products supply chain,” *Journal of Cleaner Production*, Vol. 78, p. 121-130, September 2014. [Online] Available: ScienceDirect, <https://sciencedirect.com/science/article/abs/pii/S095965261400448X>. [Accessed September 30, 2020].
- [4] S. Borrelle et al., “Why we need an international agreement on marine plastic pollution,” *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 114, no. 38 9994-9997, September 2017. [Online] Available: Proceedings of the National Academy of Sciences of the United States of America, <https://www.pnas.org/content/114/38/9994> [Accessed September 30, 2020].
- [5] J. Capper, R. Cady and D. Bauman, “Increased Production Reduces the Dairy Industry’s Environmental Impact,” in *Arizona and New Mexico Dairy Newsletter*, Arizona Dairy Production Conference, 2009, Phoenix, AZ, USA, October 15, 2009, pp. 3+.
- [6] J. Capper, “Should we reject animal source foods to save the planet? A review of the sustainability of global livestock production,” *South African Journal of Animal Science*, Vol. 43, no. 3, October 2013. [Online] Available: South African Journal of Animal Science, <https://ajol.info/index.php/sajas/article/view/95627>. [Accessed October 30, 2020].
- [7] J. Clark, et al., “Marine microplastic debris: A targeted plan for understanding and quantifying interactions with marine life,” *Frontiers in Ecology and the Environment*, Vole. 14, no. 6, p. 317-324, August 2016. [Online] Available: The Ecological Society of America, <https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1002/fee.1297>. [Accessed September 30, 2020].
- [8] M. De Vries and I.J.M. de Boer, (2010). “Comparing environmental impacts for livestock products: A review of life cycle assessments,” *Livestock Science*, Vol. 128 no. 1–3, p. 1–11, March 2010. [Online] Available: ScienceDirect, <http://sciencedirect.com/science/article/abs/pii/S1871141309003692?via%3Dihub>. [Accessed October 30, 2020].
- [9] J. Guthrie et al., “Industry specific social and environmental reporting: The Australian Food and Beverage Industry,” *Accounting Forum*, Vol. 32, no. 1, p. 1-15, March 2008. [Online] Available: ScienceDirect, <https://sciencedirect.com/science/article/pii/S0155998207000555>. [Accessed October 15, 2020].
- [10] T. Ngamsang and M. Yuttiham, “Vulnerability assessment of areas allocated for municipal solid waste disposal systems: A case study of sanitary landfill and incineration,” *Environmental Science and Pollution Research*, Vol. 26, no. 2, July 2019. [Online] Available: Springer Nature, <https://link.springer.com/article/10.1007/s11356-019-05920-6>. [Accessed November 20, 2020].
- [11] J. Nunes, et al., “Key points on the energy sustainable development of the food industry – Case study of the Portuguese sausages industry,” *Renewable and Sustainable Energy Reviews*, Vol. 57, p. 393-411, May 2016. [Online] Available: ScienceDirect, <https://sciencedirect.com/science/article/pii/S1364032115014021>. [Accessed October 16, 2020].
- [12] H. Ritchie and M. Roser, “Environmental impacts of food production,” *Our World In Data*, January 2020. [Online] Available: Our World in Data, https://ourworldindata.org/environmental-impacts-of-food?utm_source=jeremycherfas&utm_medium=email&utm_campaign=eat-this-newsletter-132-underserved#citation. [Accessed September 30, 2020]
- [13] C. Sers and M. Mughal, “Covid-19 outbreak and the need for rice self-sufficiency in West Africa,” *World Development*, Vol. 135, November 2020. [Online] Available:

ScienceDirect,
<https://sciencedirect.com/science/article/pii/S0305750X20301972>. [Accessed October 30, 2020].

- [14] E. Ulusoy, *I Think, Therefore I am Vegan: Veganism, Ethics, and Social Justice*, Marketing as Provisioning Technology: Integrating Perspectives on Solutions for Sustainability, Prosperity, and Social Justice, June 25–28, 2015, Chicago, IL, USA.
- [15] Members of the Rowan Environmental Action League, Private Communication, April, 2019.