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Introduction

This report provides an overview of WPI's progress on sustainability in the academic year 2021-2022, with consideration to four major categories: Operations & Facilities, Academics, Research and Community Engagement. This can be done by considering the three pillars of sustainability - environment, economic and social - when taking action.

In 2021, WPI released a New Strategic Plan and also updated the university's mission statement to read "WPI transforms lives, turns knowledge into action to confront global challenges, and revolutionizes STEM through distinctive and inclusive education, projects, and research."

From tackling global challenges to increasing our sustainability right here in our own community, sustainability is inherent in this mission.

Sustainability is the ability to meet the needs of the current generation without compromising the ability of future generations to meet their own needs.



Sustainability Plan 2020- 2025

In support of creating a more sustainable community, WPI's current <u>Sustainability Plan</u> establishes 4 main goals. Defining objectives and tasks to achieve these goals provides a comprehensive path for WPI's current and future efforts in sustainability.



Academic Programs and Initiatives

Our graduates will leave campus with the mindset and abilities to develop sustainable solutions to the world's problems.



Operations and Facilities

The principles of sustainability guide our operations as well as our academic and research programs.



Research and Scholarship

We will make significant contributions to the technologies, the policies, and the mindset to help assure a sustainable world.



Community Engagement

Every member of the WPI community will engage in sustainability-related education, awareness, action, and service, in order to achieve positive, long-lasting change for all our communities.

Introduction

Sustainable Development Goals

The Sustainable Development Goals (SDGs), are a set of 17 integrated and interrelated goals, developed by the United Nations, with guidelines through 2030 to end poverty, protect the planet and ensure that humanity enjoys peace and prosperity. These goals provide a helpful guide for directing WPI's sustainability efforts to have a impact on society.

There are several initiatives WPI has been working on in support of the 17 goals. A team of faculty, staff, and students are working to advance the awareness and tracking of SDGs in all areas designated in the sustainability plan. In early 2022, Gordon Library hired a specialist librarian that has worked to develop sustainability data and scholarly communications to support this effort. A major initiative is to provide SDG tags for GPS, IQPs, and MQPs, and also to allow faculty and staff members to tag their SDGs of interest in their profiles.





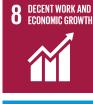






























Operations and Facilities

WPI has developed a number of initiatives in the pursuit of creating a more sustainable campus. This section provides a review and basic analysis of our annual consumption of electricity, gas, water and greenhouse gas emissions. Other projects and significant initiatives in support of these objectives are also highlighted.



WPI Signs Second Nature and Principles for Responsible Investment

WPI has signed the Second Nature Presidents Climate Commitment and Commitment to the Principles of Responsible(PRI) Investment. The Second Nature commitment means that WPI is making a commitment to achieve carbon neutrality and is making climate resilience and emission reduction part of the curriculum. The PRI means that WPI commits to considering environmental, social, and corporate governance issues in its investment portfolio.



Signatory of:



Electricity

Electricity is essential for our activities and programs at WPI. The use of electricity ranges from lighting to computers, heating, air conditioning, and ventilating systems. In FY22, WPI electricity consumption was approximately **28,300,000 kWh**.

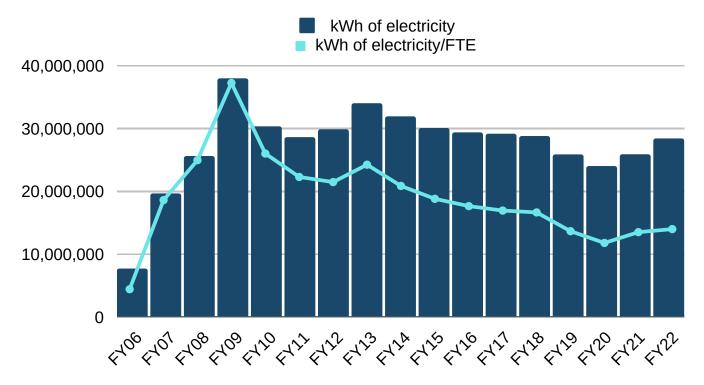
28.3 million kWh of electricity



1.4 billion cell phones charged



Historical Electricity Usage (FY10 - FY22*)



*Fiscal year (FY) is from July 1st - June 30th. FTE = full-time equivalent student

12% Reduction in kWh/FTE from FY18

Natural Gas

WPI uses natural gas to power boilers that distribute steam and hot water to buildings on campus from a central power plant. In FY22, WPI consumed approximately **1.5 million therms** of natural gas, which has equivalent emissions to **890 thousand gallons of gasoline.**

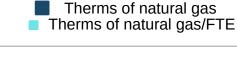
1,500,000 therms of natural gas

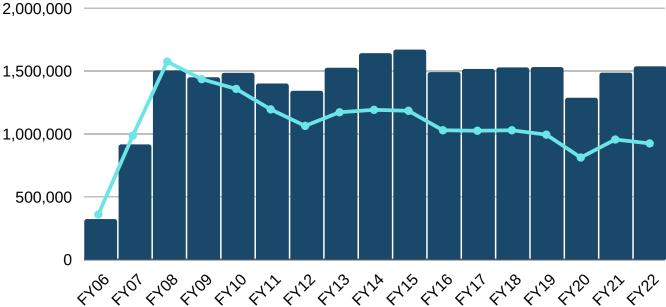


890,000 gallons of gasoline



Historical Water Usage (FY10 - FY22*)





*Fiscal year (FY) is from July 1st - June 30th. FTE = full-time equivalent student

10% Reduction in therms/FTE from FY18

Water

Water is a vital resource at WPI. Our 5-year task from the 2020 Sustainability Plan is to reduce our water usage by 15% in gallons of water per full-time equivalent from FY19, which was met this year. In FY22, WPI consumed approximately **38 million gallons of water**.

38 million gallons of water

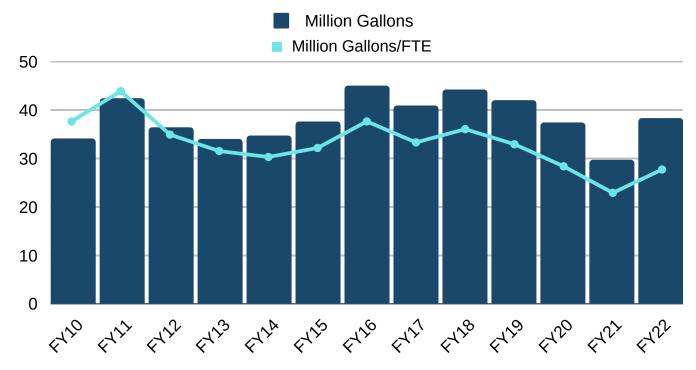




1.4 million
10-minute
showers



Historical Water Usage (FY10 - FY22*)



*Fiscal year (FY) is from July 1st - June 30th. FTE = full-time equivalent student

23% Reduction in gallons/FTE from FY18

Greenhouse Gas Emissions

Measuring greenhouse gas emissions provides an indication of the environmental impact of our energy use. WPI actively tracks Scope 1 and 2 emissions. WPI does not currently estimate Scope 3 emissions, although this is planned for FY23. In FY22, WPI's Scope 1 and 2 emissions were estimated to be 15,200 metric tons of carbon dioxide equivalent (MTCO2e).

Scope One



Direct emissions occurring

controlled by WPI, such as

and campus fleet vehicles.

from sources owned or

natural gas, refrigerants

Scope

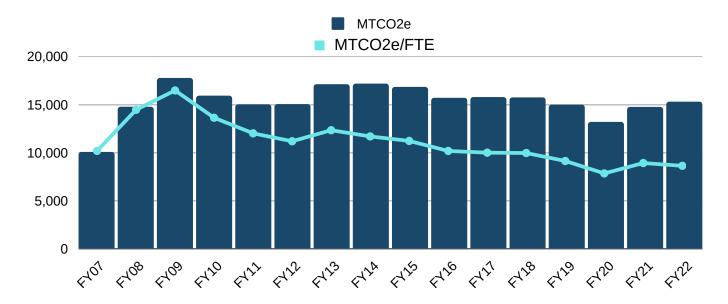


Scope Three



Emissions that are the result of Indirect emissions that are activities from assets not owned generated off-site, but are a or controlled by WPI, but that WPI direct result of WPI's energy indirectly causes, such as student use, such as WPI's purchase commuters or procurement. of electricity

See below the historical Scope 1 & 2 emissions from fiscal year* 2007- 2022.

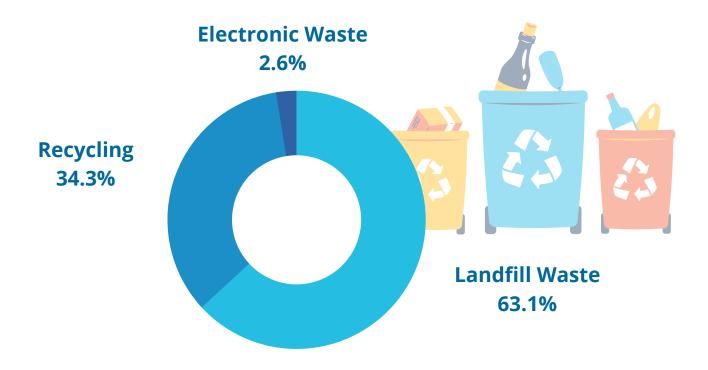


*Fiscal year (FY) is from July 1st - June 30th. FTE = full-time equivalent student

13% Reduction in MTCO2e/FTE from FY18

Waste

WPI tracks annual landfill waste and recycling usage, as well as electronic waste. Bins for trash and recycling are stationed around campus buildings. In addition, food waste is collected in Morgan Dining Hall, the Goat's Head and the Campus Center. Food waste is currently difficult to track, although a number of student projects are underway to work to reduce it. In FY2022, WPI produced 558 tons of waste, including 107 tons of recycling and 8 tons of e-waste. A breakdown is summarized below:



E-Waste Collection Event

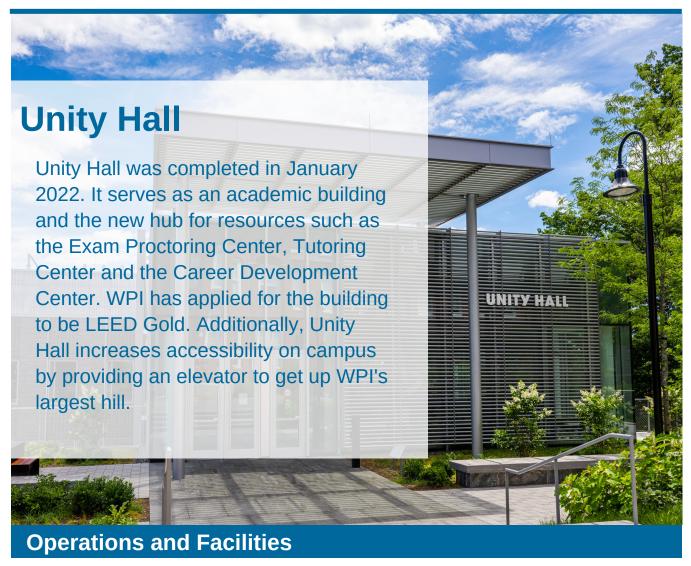
WPI typically has an E-Waste collection event once or twice per year. This is an opportunity for the WPI community to bring larger e-waste items to the campus to be ethically recycled. WPI partners with Zeep Technology for this event.



Buildings and Grounds

WPI has a 95-acre campus with many academic buildings and residence halls, all of which are managed and maintained by the Facilities Department. The Facilities Department considers sustainability in its operation of the buildings and grounds.

Construction of Unity Hall was completed this year! WPI ensures that all new buildings are built to satisfy the requirements for the Leadership in Energy and Environmental Design (LEED) certification, which includes consideration of energy efficiency, a low carbon footprint, and other sustainability features.



Transportation

On campus, several sustainable options for transportation are available. These options were created to reduce fossil fuel use by the WPI community and to increase low cost transportation options. These options include a free bike share, rental cars, electric vehicle charging stations and SNAP ride service at night.



Charging Stations

WPI has a total of **10 charging stations** with the ability to accommodate 20 cars at a time. They are located between Gateway Garage, Park Ave Garage, and the Boynton Lot by Unity Hall. Two new charging stations were included with the addition of Unity Hall.



Zipcars

Zipcar is a car rental service that allows people to rent cars for by either the hour or the day. On campus there are **3 zip cars** located at the Park Avenue garage and Gateway 1 parking lot. Students may receive a discounted membership.



SNAP

SNAP is a service run by the WPI Campus Police Department with the goal of **helping students get home safely at night.** Any WPI student can call to have the ride service transport them between 5PM - 3AM in the fall/winter and 6PM - 3AM in the spring/summer.

Gompei's Gears

Gompei's Gears is a **free bike share** for the WPI community managed by WPI's Green Team. The bike share provides a carbon-free way to get around campus and Worcester. Over the last year, it operated at reduced capacity. However, the users have still been able to use the available bikes and the capacity will be increased in the 2023 academic year.









Food

The WPI campus partners with Chartwells to provide dining services for students on campus. The offerings range from buffet styles to cafeteria style. Below are the ways in which Chartwells is supporting sustainability efforts on campus.



Plant-Based Food

In support of sustainability, Chartwells has increased the amount of plant-based offerings. Chartwells has ensured that there are vegetarian and vegan options at every dining location on campus. In addition, a CSA program allows community members to buy food from local farmers in the summertime.



Waste Reduction

Chartwells has supported several waste reduction programs including:

Food Recovery Network: This student-run club has partnered with Chartwells to bring left over food to shelters in Worcester Project Clean Plate: Encourages students to reduce food waste by entering into a raffle if you have a clean plate.

Green2Go containers: All first year students are provided with green reusable containers for takeout at any dining location on campus.

Academics

WPI is a university committed to providing quality education with a focus on project based learning for more than 6,000 enrolled students. Many of the courses and most of the projects have a focus on sustainability. This section provides some information and examples to illustrate the nature of this focus.



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Sustainabilityrelated courses

A few examples to show the variety of sustainability-related courses include:

- **Development Economics:** This course teaches economics and ways to help developing countries increase capacity & achieve economic growth
- **Biodiversity:** This course addresses threats to regional and global biodiversity and assesses strategies to resolve our crisis in biodiversity.
- **Environmental Engineering:** This course provides an introduction to engineering aspects of environmental quality control.

Click here to see complete list of sustainability-related courses

Sustainability Leadership Program

The Sustainability leadership Program is a developing program that provides students with the opportunity to gain experience and recognition as leaders in sustainability. The goal of the program is to provide students with the essential background to align their educational program for a lifelong leadership in meeting the world's sustainability challenges.

GPS

Great Problems Seminar(GPS) is a optional two-quarter project-based course offered to first-year students. This course both introduces them to the projectbased learning system at WPI and gets them thinking about ways to solve major global issues. Examples of the projects follow below.



Don't Let Solar Go To Waste

Students: Nicole Close, Sofia Eckerson, Adison Quattlander, Mackenzie **Appleyard**

Advisors: Geoffrey Pfeifer, Marja Bakermans

US recycling of solar panels is not regulated resulting in waste

- · Regulations that hold manufacturers reasonable should be created
- Panels should be Durable recyclable and long lastering



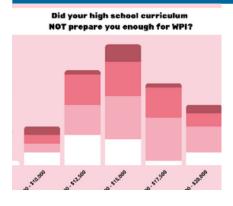
Bambottle Industries: Reducing Plastic Circulation

Students: Allen Cheung, Andrew Cunningham, Marcel Guzik, Jameson Courtney

Advisors: Sean Kelly, Sarah Francis

Single use plastic bottles are one of the most common nonbiodegradable items disposed of

- Bamboo is a sustainable alternative to plastic bottles
- Testing was conducted on the bamboo processing procedure
- Blue prints were created for bamboo bottles



Girls on a Mission Preventing Education Inequality

Students: Nylah Andrews, Meghan Doane, Ashleigh Perez, Ava Labik Advisors: Geoffrey Pfeifer, Derren Rosbach

High school education quality affects WPI students ability to preform academically

- · Surveys were conducted
- Students are in favor of:
 - Tutoring services covering more basic and specific material
 - More preliminary course offerings

IQP

Interdisciplinary Qualifying project is a 3 course team project completed by third-year students. This is either completed off campus at the 45 of center around the work or on campus. Below are the Presidential Award Finalists:



Mobile Farm Stand: A Vehicle for Education

Students: Minh Anh Kieu (BME), Noah C. Brennick (PW),

Sophia H. Cheng (ME/RBE), Darius Luo (AE)

Advisor: Derren Rosbach



Akyem Dwenase Sanitation

Students: Elaine Chen (CS), Ruchita Y. Choksey (ME),

Danielle D. Upton (CME), Casey J. Willis (ME)

Advisor: Robert Krueger



<u>Launching a Competitive Robotics Team for Physically Active</u> Youth

Students: Augustine K. Asumadu (MIS), Devan Blechinger-Slocum (ME),

Margaret R. Gunville (ME), Sarah A. MacDonald (BME)

Advisors: Nancy Burnham, Alexander Smith



The Role of Wetlands in the Ruamahanga Catchment

Students: Caroline E. Dalton (CE), Daniel C. Dietrich (ME),

Meng Lian (CME), Brooklynn Paris (BME) Advisors: Fred Looft, Ingrid Shockey



Therapeutic Gardening

Students: Matthew B. Adams (ME), Christopher R. Davenport (AER), Mairead E. O'Neill (CS), Ciara R. Young (CME)

Advisors: J. Scott Jiusto, Gbetonmasse Somasse

MQP

The major qualifying project (MQP) is a senior capstone team project for undergraduates to do within their major(s). Below are the MQP winners of the Provost Awards that closely relate to sustainability:



An Application for Workers' Compensation Claims: Actuarial Mathematics

Students: Lexi Ferrini, Allison Lambert, and Donovan Robilard

Advisors: Jon Abraham, and Barry Posterro



WPI Campus Center Feasibility Study for LEED O+M Certification: Architectural Engineering

Students: Darius Luo, Erin Venard, and Hannah Whitney Advisors: Leonard Albano, Soroush Farzin, and Shichao Liu



Feeding Device for Premature Infants in Low Middle-Income Countries: Biomedical Engineering

Students: Hannah Borges, Alexis Nichols, Shreya Puttagunta, Meghan

Slaney, and Chris Son

Advisors: Solomon Mensah, and Dirk Albrecht



Lead and Copper Corrosion in Drinking Water Systems: Environmental Engineering

Students: Benjamin Beliveau, Lillian Taylor, and Delaney Tedtsen

Advisor: Jeanine Dudle



Repurposing PLA into 3D Printing Filament: Mechanical Engineering

Students: Anna Catlett, Dominick Gravante, Casey Willis

Advisor: John Sullivan

Global School

The Global School is a new academic school created in 2020 at WPI. It includes undergraduate and graduate project based programs that foster interdisciplinary, purpose-driven global research, most of which closely relate to the Sustainable Development Goals. The Global School plays key role in project based learning by coordinating the Great Problems Seminars and Interactive Qualifying Projects Program. It also includes new graduate programs and seminar programs.



Community Climate Adaptation MS degree program

This new offering is a collaborative, research-based, joint-degree program offered through WPI's Department of Integrative & Global Studies (DIGS) and the Department of Civil & Environmental Engineering (CEE).



The Global School Event Series

The event series was a month program in which people could learn about and get involved with the global environmental challenges. Examples of events include: Oceania: Place, Place-making and Environmental Justice and Fronteras reimaginadas: Reimagining Borders in Latin(x) America

14th Annual: Sustainability Project Competition

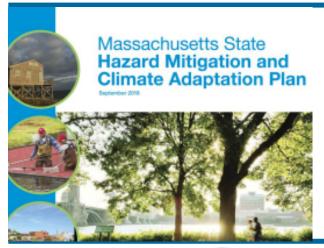
The Sustainability Project Competition is a yearly event that highlights and celebrates project in our community that help create a sustainable future and support SDG goals. The winners from 2021-2022 are shown below.



First Year

Benjamin Mason (RBE), Nicholas Tomasetti (ChE), Nicolas Alvarado (ME), Benjamin Tate (MAC), and an anonymous student (BME) Advisors: Dr. Marja Bakermans, Dr. Geoffrey Pfeifer, Elaine Chen (PLA)

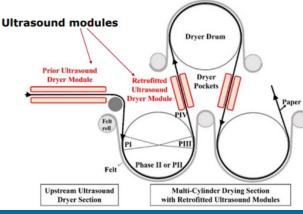
<u>Using Media to Influence Agricultural</u> <u>Perceptions on Climate Change</u>



Undergraduate

Rafaello Adler-Abramo (STP) Advisors: Crystal Brown (SSPS)and Stephen McCauley (DIGS)

Massachusetts Climate Resilience
Policy, Planning, and the Needs of
People with Disabilities: Paths to
Improvement



Graduate

Munevver Elif Asar Sarikaya (ME) Advisor: Jamal Yaqoobi (ME)

Reducing Carbon Footprint of Energy-Intensive Industrial Drying by Novel Drying Methods

Research and Scholarship

WPI makes it a point to create a more sustainable future by investing in sustainability research in all disciplines. The estimated funding for research is continuing to increase. This section includes examples of research and scholarship that took place over the last academic year, from a wide variety of different disciplines and majors.



Over \$20M

Estimated funding for sustainability-related research

Researcher Yu Zhong awarded DOE grant on project to improve production of hydrogen fuel

Yu Zhong is investigating chromium-resistant materials for oxygen electrodes used in Solid Oxide Electrolysis Cells (SOECs). This is intended to increase the longevity and performance of SOECs as a more efficient and cost-effective way to product hydrogen.



WPI receives grant to increase participation of women in STEM doctoral programs

The Henry Luce Foundation has awarded WPI \$276,000 to support women starting a doctoral program in computer science and physics. These are programs where women are significantly underrepresented, which is something WPI is hoping to change.





Preventing Wildlife-Trafficking

Principle Investigators: Professors Renata Konrad (Business) and Kyumin Lee

(Computer Science)

Led by Konrad and Lee, this team is seeking to use analytic tools to prevent wildlife-trafficking, a project that has been funded by a National Science Foundation grant. With the utilization of advanced analytic tools and partnerships with law enforcement agencies, the project is seeking to better understand the supply chains of wildlife-trafficking in order to detect and disrupt this practice. This research is also bringing project-based learning opportunities to WPI undergraduate students in data science and industrial engineering.



Prevent Wild Fires by using International Space Station

Principle Investigator:

Dr. James Urban (Fire Protection Engineering)

In order to prevent wild fires, Dr. James Urban is developing a controlled fire experiment for the International Space Station to better understand the effect of gravity on fire. This will provide information to help us develop more accurate models for wild fire prediction to help reduce impacts of forest fires.



Negative-Emission Construction Material

Principle Investigators: Suzanne Frances Scarlata (Chemistry & biochemistry) and Bioand Nima Rahbar (Civil, Environmental & Architectural Engineering)

In an effort to reduce the emissions created by concrete Dr. Scarlata and Dr. Rahbar invented a Enzyme Construction Material(EMC), which can self-heal and absorb CO2, a greenhouse gas. The EMC is strong, affordable and can absorb 18 pounds of CO2 per square yard vs the 400 pounds of CO2 per square yard that traditional concrete emits.



Turning Bamboo into Biofuels

Principle Investigators: Michael T. Timko (ChemE), Geoffrey Tompsett, (ChemE), and Ali Azeko Salifu (BME)

In an effort to make biofuels more accessible in developing countries, this team is working to make biofuels from bamboo. This is done by milling the bamboo, using an enzyme treatment to convert the bamboo into simple sugars, and then fermenting the sugars into biofuels. This may be an alternative for developing countries where bamboo can grow can grow, even in land areas that don't support growth of most other plants. The group is also working to convert food waste to fuel and cooking oils into other products.

Community Engagement

One of WPI's sustainability objectives is to maintain a "culture of sustainability", in which all WPI community members are engaged in activities that embrace and advance sustainability. This section will detail some of the groups on campus that strive to communicate sustainability impacts across all organizational, community, and academic activities.



Living and Learning Laboratory

WPI's Sustainability Laboratory for Living and Learning (SL3) is a virtual laboratory that supports and promotes an engaged campus community in all three aspects of sustainability – environmental stewardship, economic security, and social justice. The laboratory is coordinated through the Office of Sustainability, with efforts that integrate our academic programs, project-work, and innovative research and scholarship with community engagement, facilities and operations.



Sustainability Ambassadors

Sustainability Ambassadors is a program for students to encourage a more sustainable community on campus. They collaborate with organizations such as Greek Life and Chartwells to ensure that WPI organizations are aware of the environmental impact of their actions and increase their progress towards a more sustainable community. This year 7 students were engaged in the ambassadors' program. The ambassadors worked with the Office of Sustainability, Gordon Library and the Green Team to put together the Climate Action Fair in April.



Sustainability Clubs

WPI has numerous student-led organizations committed to sustainability on and off campus. These clubs support a variety of SDGs and all three pillars of sustainability. There are 25+ sustainability-related clubs, many of which are listed below.



Sustainability-focused clubs

- Green Team
- Engineers Without Borders
- Food Recovery Network
- Habitat for Humanity
- Vegetarian Club
- Enactus
- Gender Equality Club
- Green House and Horticulture Club
- American Academy of Environmental Engineers and Scientists
- Period at WPI
- SPARC

Sustainability-related clubs

- Outing Club
- Girls Talk Math
- Donate Life
- Alliance
- Special Olympics Club
- Cycling Club
- American Cancer Society
- Meditation Club
- Cyber Security Club
- Society of Women Engineers
- Exploredreams
- RoboKids
- Running Club
- Karate Club

Green Team

The Green Team's mission is to create a more sustainable community through environmental activism and education. Additionally they work to develop, implement and hold WPI accountable for the Green Team's Environmental standards and goals.

This club also hosted several events throughout the academic year. To shine a light on the wastefulness of the clothing industry they organized a clothing exchange which served the dual purpose of reducing emission from clothes and raising donations for a local shelter.

Divest WPI is a movement led by the Green Team to urge WPI to take their endowment out of fossil fuels and invest in more sustainable endeavors. This not only encourages carbon emissions but also shows WPI's endorsement of this industry. The Green Team's protest urges WPI to get out of this industry in the next five years like many other universities have done.

"[We] educate WPI community members of our environmental impacts on the world and to provide an outlet for climate change, sustainability, and environmental justice related activism."

- Gabriel Espinosa, Green Team President



Engineers Without Borders

EWB is an organization focused on social economic empowerment . They "conduct engineering projects to help communities meet their basic needs, while also empowering them to maintain and expand on the projects" -Cole Parks, EWB Vice President

Their current project is the designing and implementation of a rainwater catchment and filtration system in a community in Ecuador which does not have a reliable source of drinking water. The current design is a slow sand filtration system and rainwater harvesting tanks made with easily accessible material so that the community can expand the project without additional help.

Due to COVID travel to Ecuador was canceled for the previous two summers. Engineers Without Borders hopes to continue their normal travel schedule in the coming academic year.



"[We] conduct
engineering projects
to help communities
meet their basic
needs, while also
empowering them to
maintain and expand
on the projects"

Cole Parks, EWBVice President

Lamda Chi Alpha

Lamda Chi Alpha is a fraternity at WPI which has done significant work towards the sustainability goal of No Hunger. During Thanksgiving, Lamda Chi Alpha held a food drive that raised 300,000 pounds of food to help the hungry.



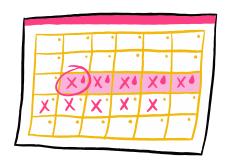
SPARC

Students Preventing Sexual Assault and Rape in our Community (SPARC) is a club with the goal of preventing sexual violence within our campus. They hosted several events this year including *Take Back the Night*; a safe place to talk about sexual violence and letter to survivors of sexual assault.



The Period Agenda

The Period Agenda focuses on providing menstrual products to those in need, both on the WPI campus and in shelters throughout the Worcester community. This year they have continued their efforts to create a more period-friendly campus by hosting educational sessions, mental health events and providing free period products in WPI bathrooms.



Habitat for Humanity

Habitat for Humanity WPI is a not for profit focused of fundraising and volunteering to prevent homelessness and help the 2 billion people living in poverty. This year they have hosted several fundraising events and volunteered with ReStore.



Food Recovery Network

Food Recovery Network is a national organization with the goal of taking surplus food from dining halls and donating it to local homeless shelters. WPI's chapter began in 2015 and FRN has been delivering to shelters in Worcester. The average donations are 100 pounds per week!



Alliance

Alliance is a club supporting the LBGTQ+ community in WPI. It hosts weekly meetings and creates an opportunity for LBGTQ+ people to have important discussions. This past year, the club hosted an event protesting the murder of African American trans women, advocated for mental health support on campus for the LBGTQ+ community and hosted a stand for trans visibility day.



Climate Action Fair

The Climate Action Fair was a multi-club and organization collaboration focused on education about environmental issues and increasing community involvement in climate action. This was part of the *Spring Forward* initiative.



















Conclusion

WPI takes many steps to encourage sustainability involvement our community and beyond. Over the past year WPI has experienced a decrease in almost all resource consumption per student and major efforts in our community to increase sustainability awareness, projects and research. Though this report cannot highlight every sustainability action it provides an insight into the community's efforts in sustainability over the past year. Looking forward, WPI will continue to create a sustainable community and tackle the unique challenges that the future presents.

Acknowledgments

This report is truly a community effort and I am thankful to everyone who has contributed to its creation. The main contributors to the report are Paul Mathisen, Director of Sustainability and Nicole Luiz, Energy and Sustainability Manager. Thanks goes out to the people who contributed to the report, data tracking and research required to make this document:

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