Sustainability Report
2018 - 2019

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WPI

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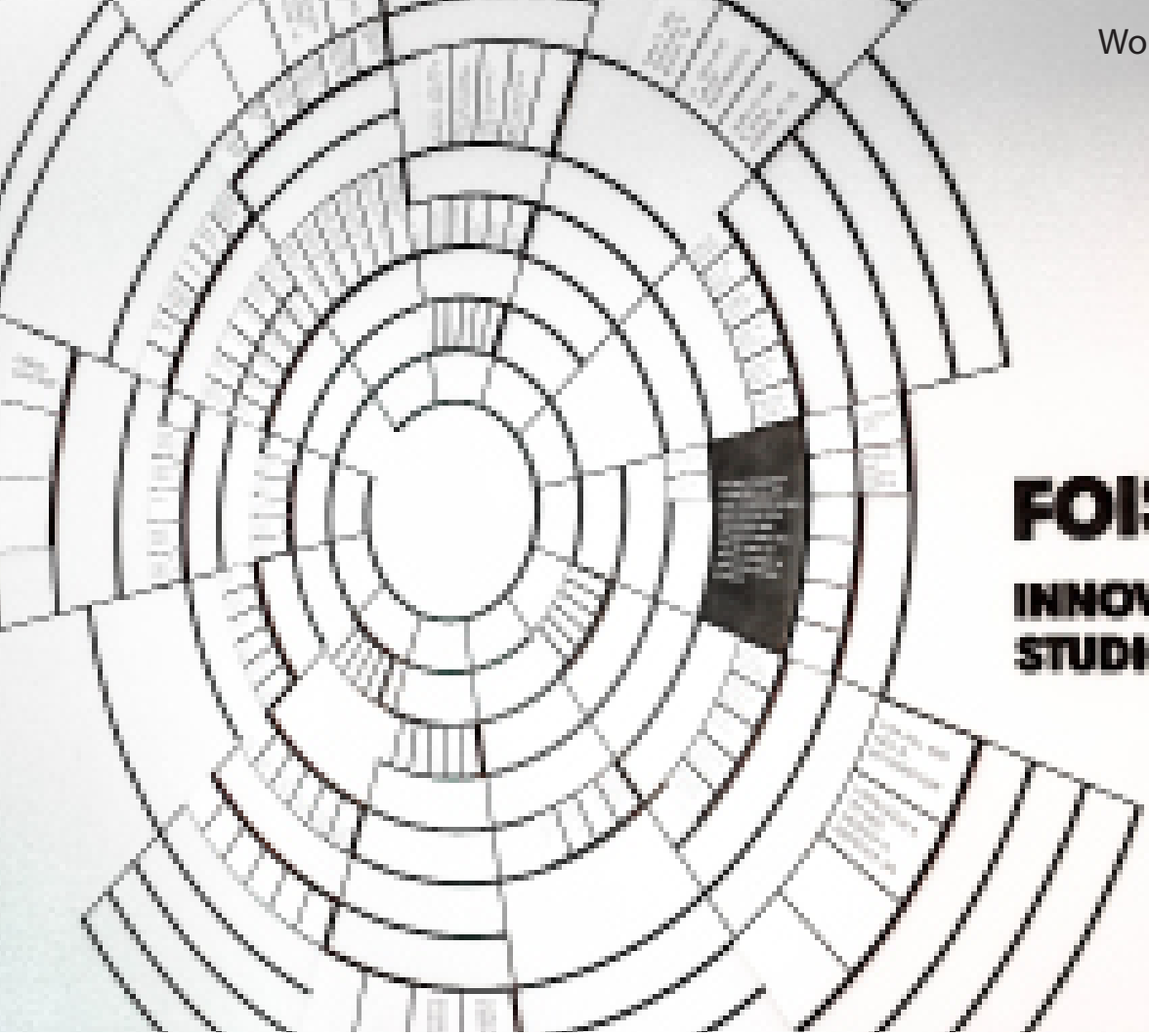

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LETTER FROM THE PRESIDENT

It is a pleasure to provide this report highlighting WPI's sustainability progress and accomplishments over the past year. As an institution of higher learning, we are dedicated to the education and preparation of our students for leadership and contribution to society. We know that education is much more than learning in a classroom or laboratory––it's about helping our students stretch their curiosity and challenge themselves, both in their studies and in the communities their studies will impact. These societal impacts are evident throughout this year's sustainability programs, initiatives, and successes.

Concepts of sustainability are embedded in the fabric of our academic programs through coursework, projects, and research so our students can see the impact of their work and learn the intangible aspects of how their efforts affect humanity and the environment. Over the past year, our students' project topics were broad and far-reaching, from sustainability issues affecting local communities, such as a Major Qualifying Project (MQP) studying how we can recreate steam power at WPI, to sustainability around the world, with a Great Problem Seminar (GPS) project addressing soil conservation in Haiti and an Interactive Qualifying Project (IQP) studying food sustainability in Morocco.

Sustainability was also a prominent theme with our faculty research initiatives. In 2019, WPI hosted the first annual Research, Discovery, and Innovation Symposium (ReDI) that provided faculty a forum to share new discoveries and ideas with colleagues and external collaborators. We saw sustainability reflected throughout, from research on the green supply chain and the circular economy to materials for solar energy to and self-healing coatings for structural concrete.

As a university, we are continuing to identify ways to make our facilities and operations for our physical campus more sustainable. This past year we have decreased energy and water consumption per full time employee while constructing new buildings and increasing our student population. Through the use of our Green Revolving Fund, we are installing controls in a number of buildings and replacing LED lighting in parking lots and the exterior of several buildings. Recycling rates have also improved, and we continue to expand alternative transportation alternatives. Throughout the year, our students inspire all of us to decrease waste through their annual campaigns to eliminate single-use plastics, hold clothing drives, and initiate petitions to decrease energy usage.

This is an exciting time for sustainability at WPI. As one of our core foundational underpinnings, sustainability inherently incorporates diversity, equity, and inclusion, entrepreneurship, innovation and value creation, design thinking, project-based learning, and STEM education. These cross-cutting themes will factor into work that is underway to update our sustainability plan, which includes goals, objectives, and tasks for advancing sustainability in our academics, research, community engagement, and operations and facilities. In addition, the development of The Global School provides an ideal opportunity to further our efforts to address sustainability and have a global impact.

I know you join me in celebrating these successes and I appreciate your contributions as we strive to position WPI as a leader in sustainability efforts on campus, in the Worcester community, and globally.

Laurie Leshin
President, WPI

AT A GLANCE

WHAT IS SUSTAINABILITY?

According to the United Nations, sustainability is defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." At WPI, we embrace sustainability and encourage all community members to view their decisions in relation to the impact they will have on the future, focusing on areas such as resource conservation, environmental consciousness, and social justice.

WHY DOES SUSTAINABILITY MATTER TO WPI AND HOW DO WE PUT IT INTO PRACTICE?

This sustainability report is our 11th annual report to the community summarizing our progress toward sustainability. The report includes an Executive Summary for the reader who desires a quick view of WPI's resource consumption, emissions generation, academic programs and research, and community initiatives. Those who take the time to read the full report will get a sense of how closely aligned WPI is to the three sustainability pillars: environmental stewardship, economic stability, and social justice.

The operations section of this report illustrates the reductions in electricity, natural gas, and water consumption over the past year (and often longer) per FTE (full-time equivalent). WPI is well on its way to meeting its commitment to decrease GHG emissions by 20% by 2025. WPI has also progressed with an increase in its recycling rate. Our efforts to reduce our resource use and emissions are supported by the Offices of Sustainability and Facilities (with additional support of the Green Revolving Fund) and a variety of student initiatives.

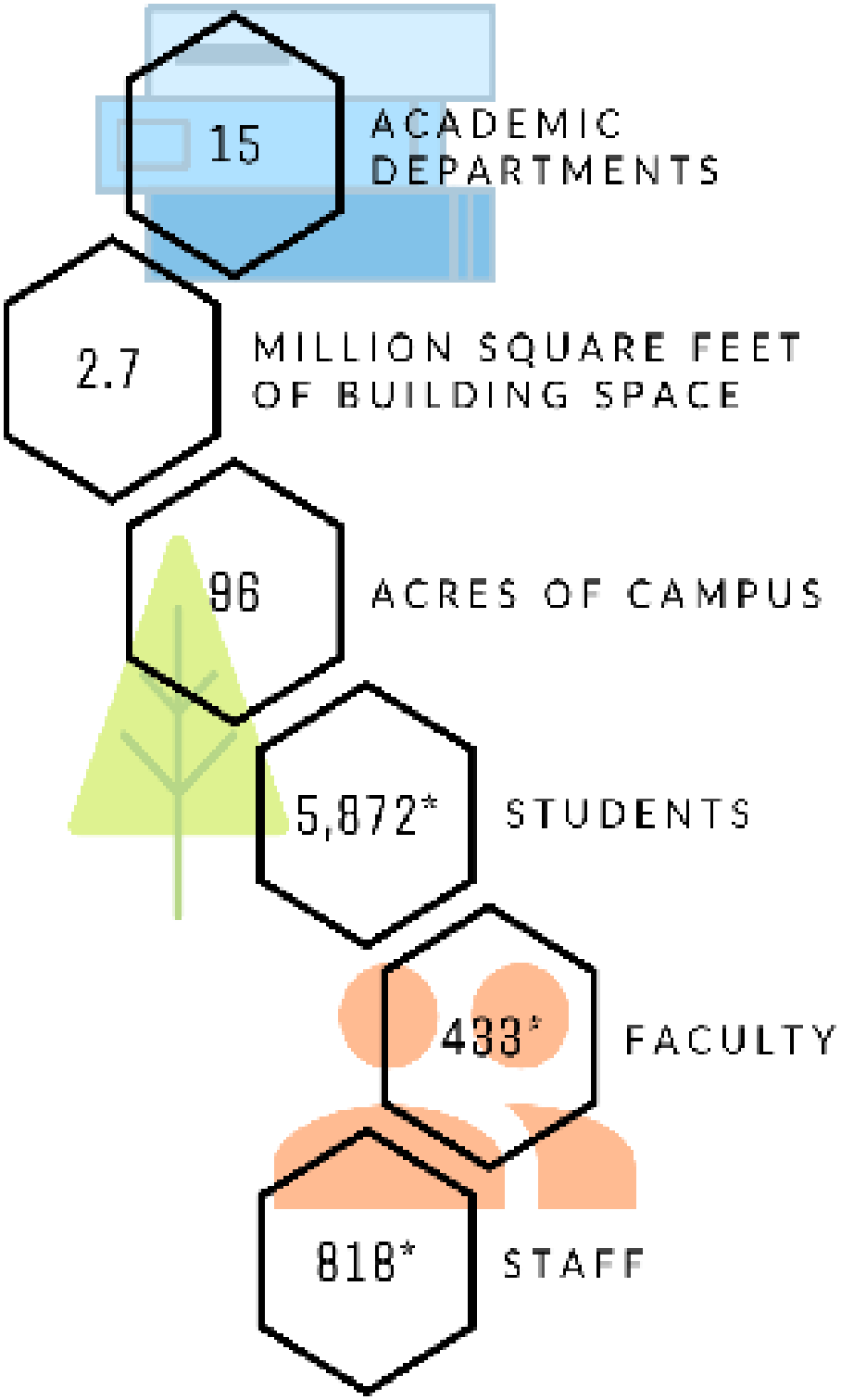
The sections on academics and research include many examples of sustainability-rich student projects and a number of examples to illustrate the breadth of our faculty research. Data on coursework is presented, and student competitions are highlighted. Faculty research spans from developing approaches to capture carbon dioxide, to discussions about the moral dilemmas created by the environmental crisis. WPI also hosted a number of highly visible sustainability-themed collaborations and conferences.

The last section of the report discusses community engagement. Here the reader will learn about WPI's student clubs and groups. The reader will also learn about the myriad student initiatives that result from a passion about their environment: lobbying to remove Styrofoam and single-use straws, successful e-waste drives and waste audits, and clothing drives. Community engagement efforts continue to move our community forward, from our day-long Climate Summit to the weekly noontime meditation in Gordon Library's Reflection Space.

WPI's year in sustainability was an ambitious year and a successful one. As WPI launches a new sustainability plan in 2020, the institute will have an even higher sustainability standard to meet. Through coursework and projects, research, daily maintenance and operations, students, staff, and faculty strive to make the WPI community and the world stronger and more sustainable. We appreciate the efforts of all of our community members in these efforts.

AT A GLANCE

WPI STATISTICS



*DESIGNATES FULL-TIME EQUIVALENT

EXECUTIVE SUMMARY
SUSTAINABILITY REPORT

2018-9

The Office of Sustainability is committed to helping the WPI campus and community become more sustainable in everyday life. The Sustainability Plan, created in 2012, has helped guide efforts to reduce natural resource consumption and take actions to reduce our impact on the planet and its inhabitants. Since the publication of the Sustainability Plan, the campus has seen a decrease in resource consumption as well as more popularity in sustainability-related course offerings and project opportunities. The following sections summarize WPI's sustainability efforts and accomplishments in the areas of operations, academics, research, and community engagement. We can look forward to the publication of the new Sustainability Plan in 2020, as well as future decreases in resource consumption.

OPERATIONS

On-the-Go reusable containers available at dining locations

Decrease in total electricity by 13% and water consumption by 5%

Decrease in natural gas consumption per heating degree day per full-time equivalent by 6%

1,156,522 water bottles saved from disposal through the use of water-bottle filling stations

15% decrease in total Greenhouse Gas emissions and 25% decrease per full-time equivalent

Foisie Innovation Studio certified LEED Gold (5th LEED certified building on campus)

Recycling rate of 32.7%

Water drainage from Recreation Center used to water plants on campus

Conversion to LED lighting in building interiors and parking lots

ACADEMICS

80% of academic departments offer sustainability-related coursework

101 sustainability-related undergraduate courses

50 sustainability-related graduate courses

30% of Interactive Qualifying Projects with sustainability-related topics

9+ Great Problems Seminar courses focusing on sustainability

Annual Sustainability Project Competition highlighting sustainability-focused student projects

RESEARCH

7,000,000 dollars, the estimated amount of funding and grants received for sustainability-related research projects this year

Projects focusing on clean energy, farm animal production, resource consumption, and more!

7+ research centers and laboratories on campus focused on sustainability

Events focusing on global public safety and the impact of sustainability on the future of work

9th Annual Energy Symposium held on campus

First annual Research, Discovery, and Innovation Symposium held on campus

COMMUNITY ENGAGEMENT

Switch from styrofoam to locally sourced plastic cups at Planet Smoothie

Library book exhibits focusing on sustainability-related books and movies

Over 40 unique electric vehicle users make use of charging stations on campus

WPI ranked 3rd out of 148 schools participating in the food diversion category of the Recyclemania competition

10+ clubs focusing on sustainability or sustainable practices

Two farmers markets held on campus during the fall, resulting in the sale of over 3,000 pounds of fresh fruits and vegetables

1,000+ Gompei's Gears bike share users created over 3,600 bike rentals

Over 7,000 pounds of electronics recycled during the electronics waste drive

Discontinued usage of plastic bags, single-use straws and promotion of reusable straws on campus

Creation of a space in the library for students to clear their heads, destress, and reflect

Clothing drives held on campus over the course of the year

Participation in Solar Decathlon Africa in September 2019

FINAL THOUGHTS...

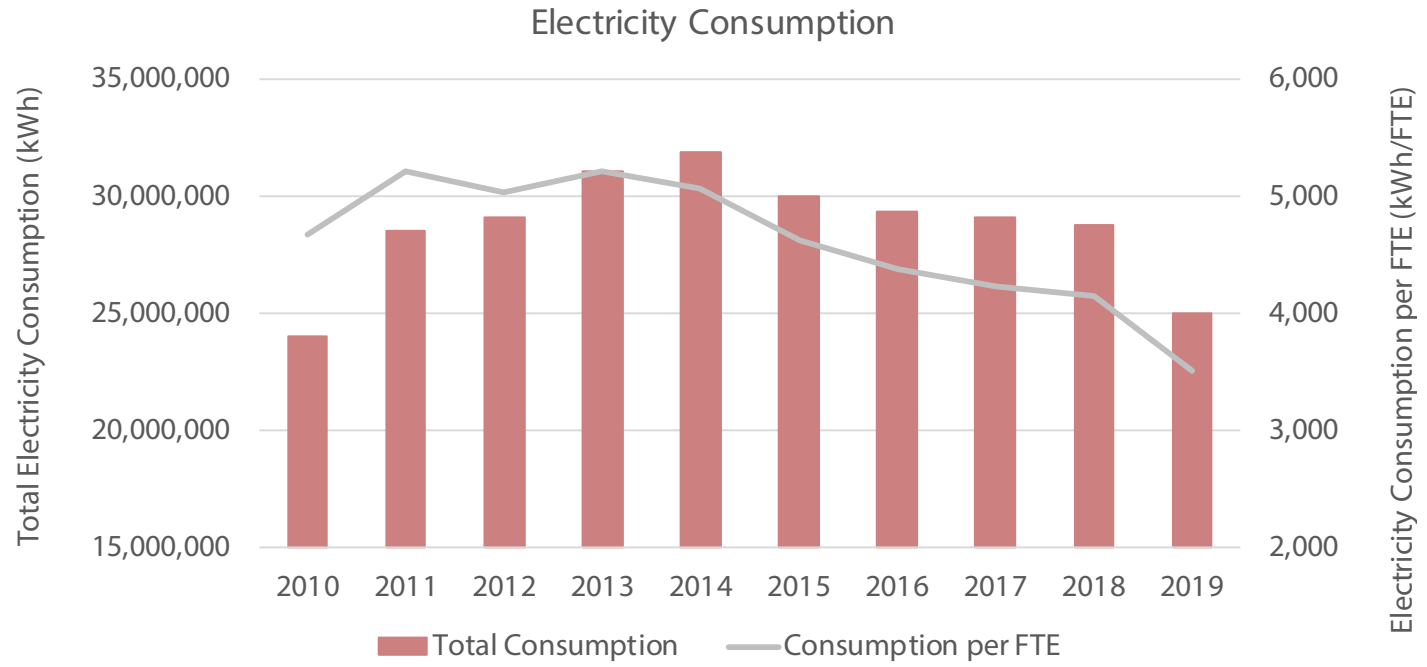
While this report highlights many of the accomplishments and advances the WPI campus and community have made in relation to sustainability, there is naturally information that we were unable to fit into this report. This report is meant to highlight some of the exciting sustainability initiatives and events on campus, as well as WPI's progress towards the goals set through the Sustainability Plan. More information on this plan, as well as many sustainability initiatives and events can be found at wpi.edu/+sustainability.

OPERATIONS

Over the course of the year, WPI tracks the consumption of resources such as water, electricity, and natural gas. The following section provides an analysis of how WPI's resource consumption has changed over the past 10 years and explores WPI's efforts to become more environmentally friendly and sustainable in its daily operations. In this section we will review the yearly electricity, natural gas, emissions, water, and waste data. We will also highlight sustainability efforts carried out by dining services and facilities.

ELECTRICITY

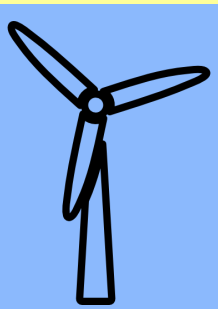
As a society ever dependent on technology, electricity is a major part of our lives and is used daily. Powering lights and computers, air conditioners, electricity is all around us. In order to produce the electricity we consume, energy must be generated. In most cases, this energy comes from burning non-renewable, carbon dioxide-emitting resources, harming our environment. With this in mind, WPI has set forth on a path to reduce electricity consumption and has taken steps to make the campus more energy efficient, such as replacing light bulbs with LED bulbs that consume less energy and installing motion sensors that can turn lights off when a space is vacated. The figure below illustrates the changes in electricity consumption over the past 10 years and shows we are on a positive path with the decrease of total electricity consumption and a decrease in electricity consumption per FTE.

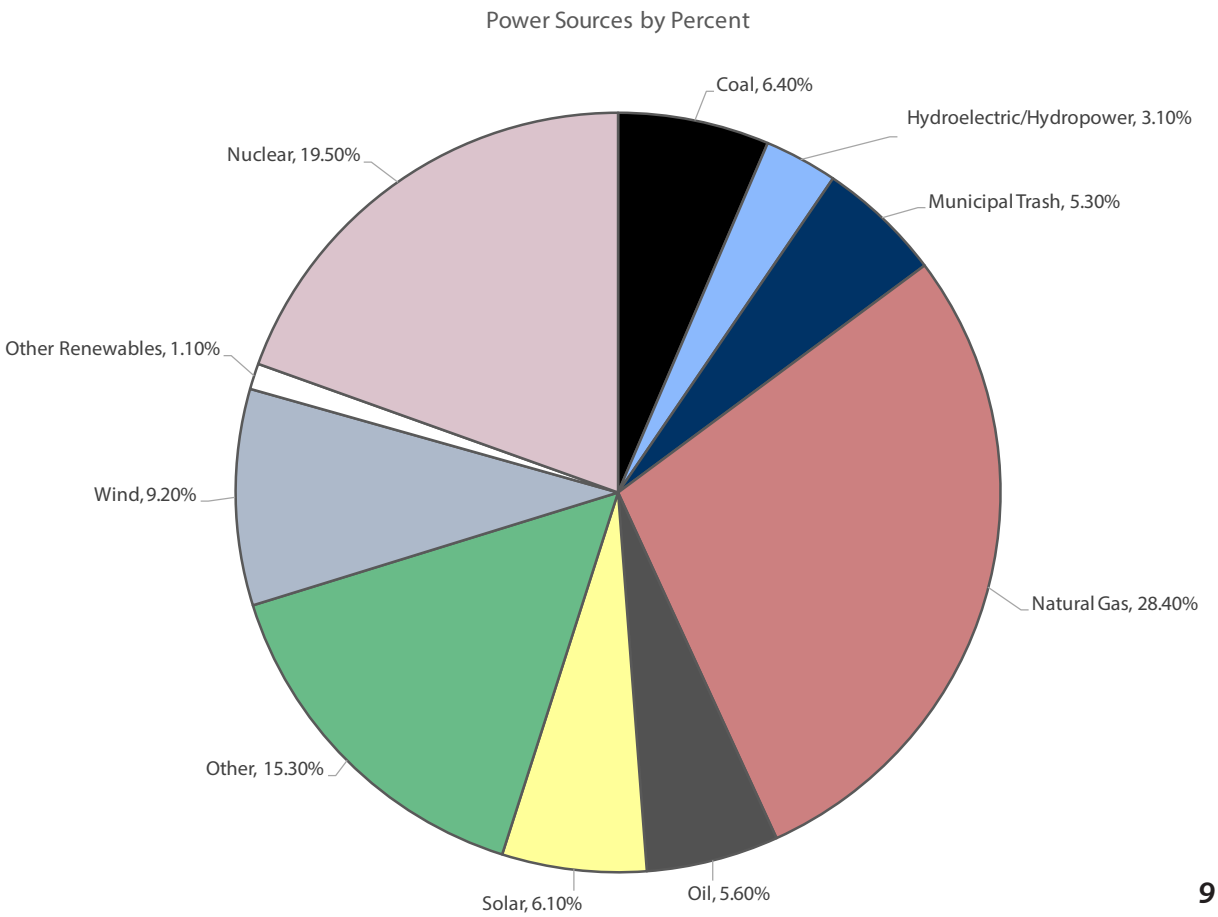


The data in this graph represents the electricity usage by all campus buildings and properties for each of the fiscal years listed. Measurements are made in kilowatt hours (kWh). One kilowatt hour represents the amount of power consumed by a 1,000 watt appliance in one hour. Using a laptop continuously over the course of the day typically uses 1 kWh of electricity.

ELECTRICITY

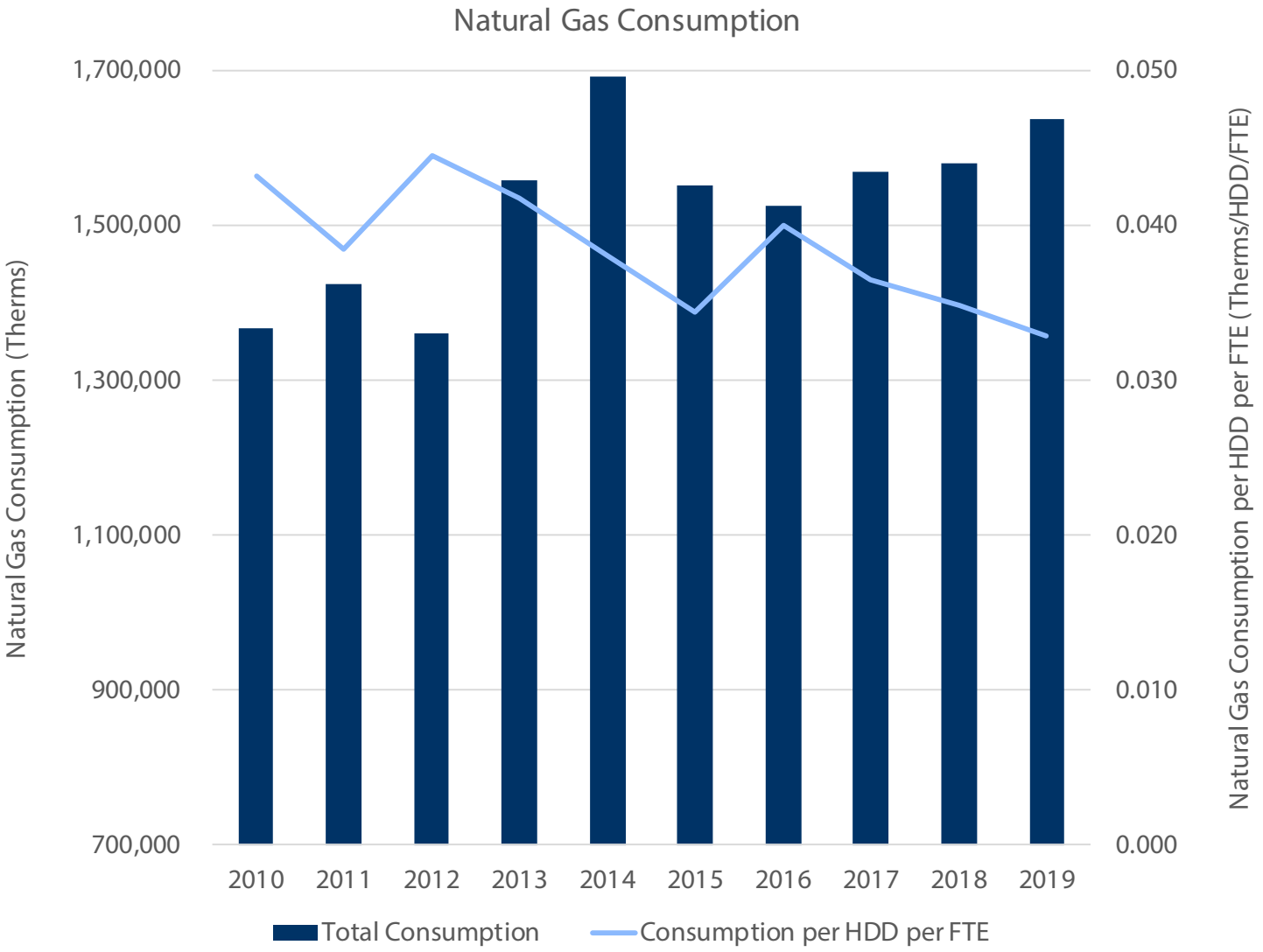
Every year, WPI's electricity vendor provides a list of power sources, by percent, used to generate the electricity used by their customers in a year. The chart below details the power sources by percent for 2018, with a year being defined as the period from January 1, 2018, to December 31, 2018. For 2018, an increase in the use of solar and wind power was seen. This trend towards higher usage of renewable sources is very positive and will help WPI be more sustainable as a whole.





NATURAL GAS

In addition to electricity, WPI uses natural gas as an energy source to help power heating systems on campus. The figure below shows WPI's total natural gas consumption, in therms, for the last ten years along with the natural gas consumption per heating degree day (HDD) per full-time equivalent (FTE). This year, WPI reached the lowest natural gas consumption per HDD per FTE in comparison to recent years. This trend is a positive sign in regard to sustainability, as it shows that less natural gas, per person, is being used to heat buildings during days when the average temperature is less than 65ºF.



The data in this graph represents the natural gas consumption by all campus buildings and properties for each of the fiscal years listed. Natural gas consumption is measured in therms. One therm is equivalent to 100,000 British Thermal Units (BTUs). This unit is also equal to the amount of energy required to raise the temperature of one pound of water by one degree Fahrenheit.

When measuring the natural gas consumption per HDD per FTE, heating degree days must be determined and summed. An HDD is a day during which the average temperature is below 65°F. For each HDD, the average temperature is subtracted from 65°F and the sum of all of these numbers is found to determine the total heating degree days for the year.

EMISSIONS

Excessive greenhouse gas emissions negatively impact the environment as these gases trap excess heat in the earth's atmosphere, raising the average global temperature and causing a range of environmental impacts, such as rising sea levels and extreme weather events. Through WPI's Greenhouse Gas Reduction Plan, the campus committed to taking steps to reduce gross Scope 1 and Scope 2 Greenhouse Gas emissions by 20% between 2014 and 2025. Since 2014, WPI has seen a 15% decrease in Greenhouse Gas emissions and a 25% decrease in emissions per full-time equivalent (FTE).

SCOPE 1:

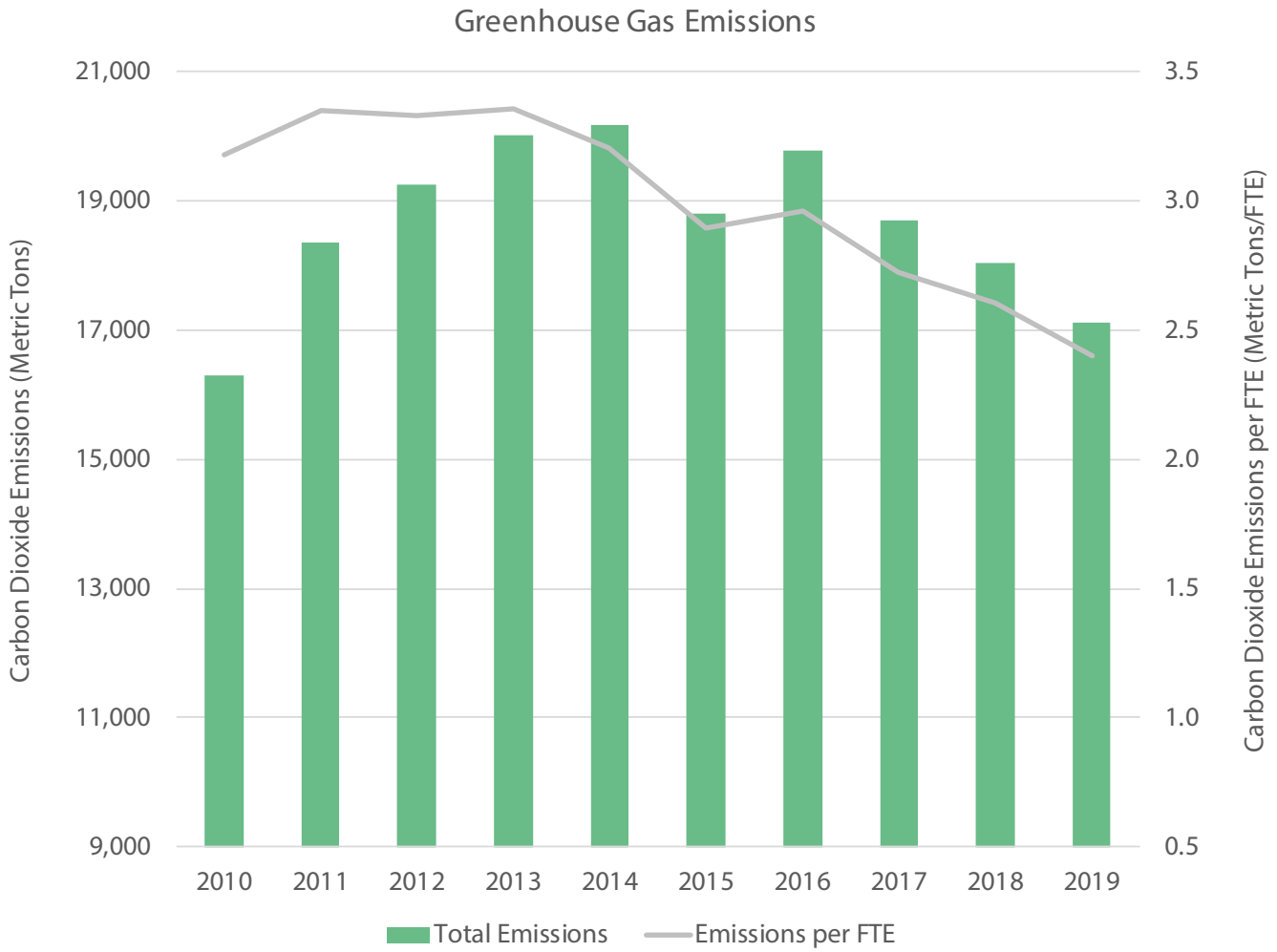
Direct emissions from sources that are owned or controlled by WPI.

Examples: WPI Facilities and Campus Police vehicles, boilers

SCOPE 2:

Indirect emissions generated by energy purchased by WPI.

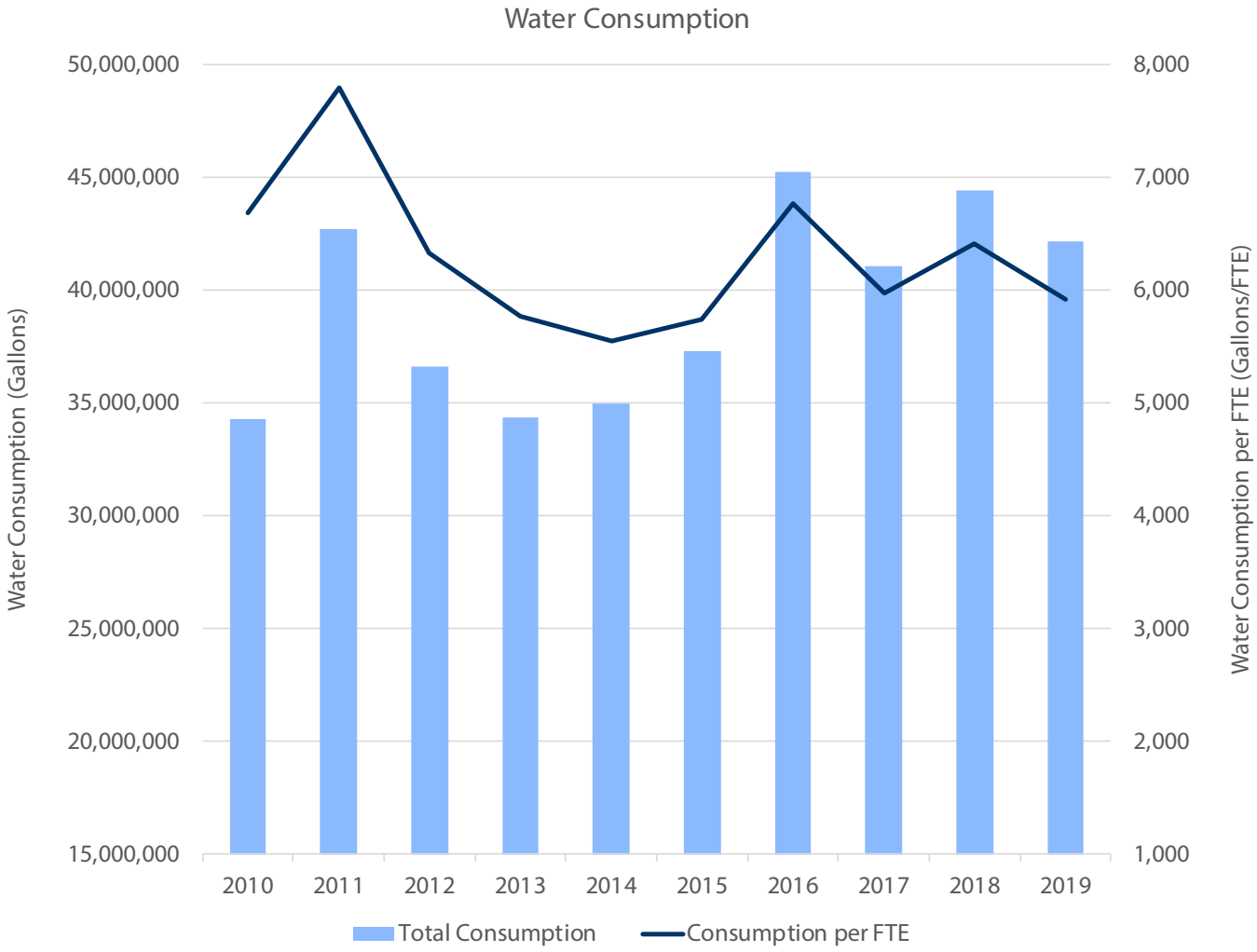
Example: Energy provided by electricity providers



The data in this graph represents the Scope 1 and Scope 2 Greenhouse Gas emissions on campus in the past year. Data includes natural gas and electricity totals as well as gas totals for WPI-owned vehicles. This value is represented in metric tons. Conversion factors are used to convert from therms, kWh, and gallons to metric tons.

WATER

Sustainable use of water is necessary for life. Typically, the average human needs to drink between half a gallon and a gallon of water a day to remain healthy. Water also is used by many industries, such as food production and farming, so it important to conserve the water available to us. Students are encouraged to help conserve water on campus by taking steps such as cutting down shower times and remembering to turn off the faucet when brushing their teeth. Data on WPI's water consumption over the past 10 years is provided below.



The data in this graph represents the water usage by all campus buildings and properties for each of the fiscal years listed. Water consumption is measured in gallons.

WATER BOTTLE FILLING STATIONS

In an effort to encourage students to forego the use of plastic water bottles, water bottle filling stations are located across campus, allowing students to fill up their reusable water bottles. Each station keeps a count of the number of 20 oz. plastic water bottles saved, allowing the WPI community to track how the usage of a reusable bottle helps the school minimize the disposal of single-use plastics and become more sustainable.

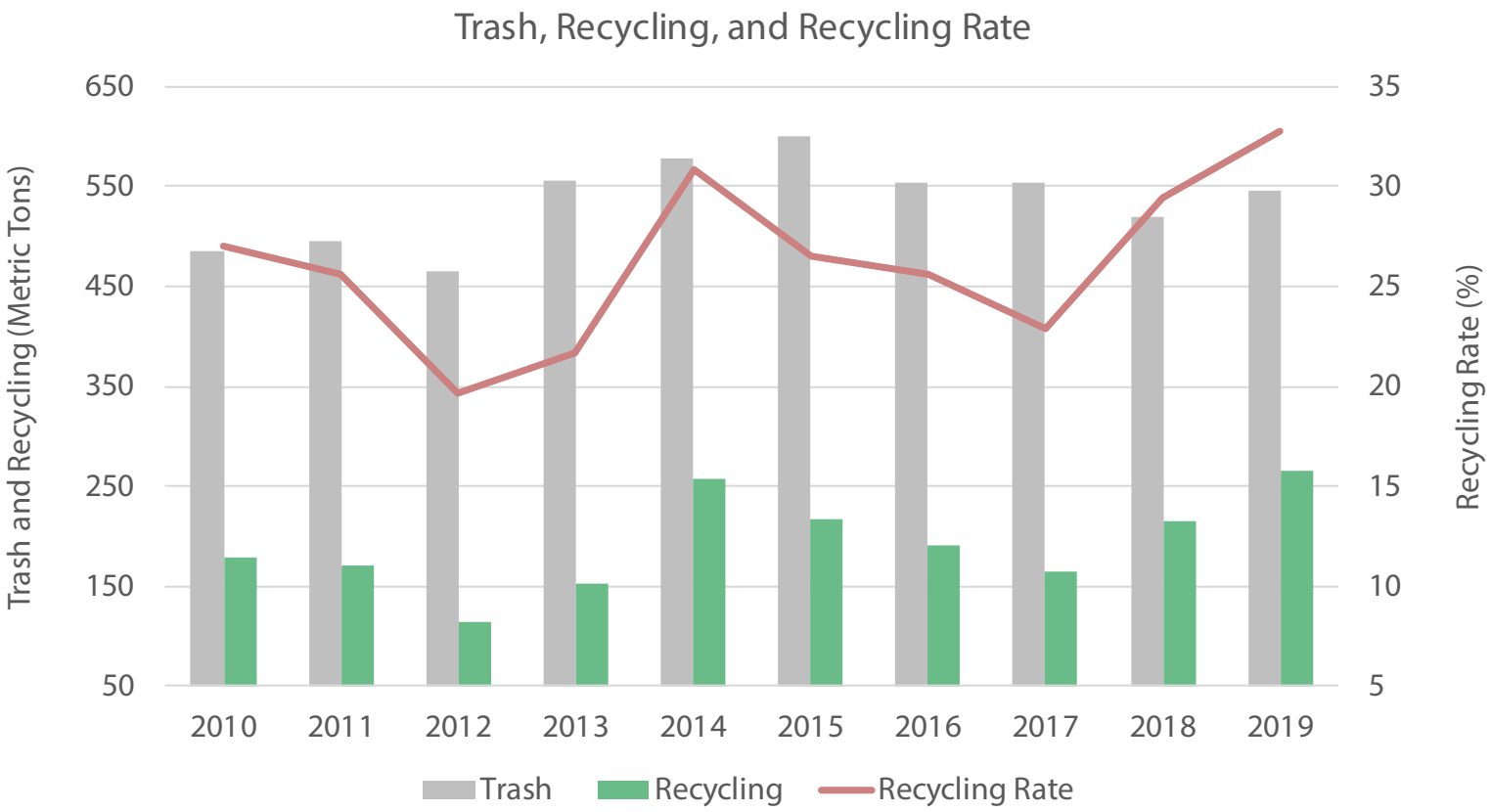
1,156,522 water bottles saved from use

When put end to end, 1,156,522 water bottles would extend from WPI to the Bronx, NY

The water used to fill 1,156,522 water bottles is enough to fill over 2,500 standard size bathtubs

WASTE

With the creation of the first WPI Sustainability Plan in 2012, the campus committed to working towards reducing waste on campus. This year, WPI reached an all-time high recycling rate of 32.7%, an increase of 3.3% in the past year. As the school works toward reaching its goal of a 45% recycling rate, the implementation of new food waste and recycling containers has helped in the move toward more sustainable waste disposal practices. More information about WPI's waste reduction initiatives can be found at https://www.wpi.edu/offices/sustainability/waste.



The data in this graph represents the waste and recycling produced by all campus buildings and properties for each of the fiscal years listed. Recycling totals include single-stream recyclables, re-purposed food waste, and miscellaneous recyclables. All measurements are provided in metric tons, which is approximately equal to 2204.62 lbs.

DINING SERVICES

With so many students, faculty, and staff invested in sustainability, it is not a surprise that WPI Dining Services also commits to making the campus more sustainable. At each of the dining locations on campus, Dining Services staff work to re-purpose food waste and food scraps so that nothing goes to waste.

Kitchen staff save vegetable scraps to incorporate into homemade broths.

Seafood is purchased sustainably, through the Sustainable Oceans Partnership. Meats and poultry purchased are antibiotic-free and eggs are certified cage-free.

Food that has not been placed on the service line can be re-purposed by kitchen staff for menus on the following day.

Participation in the Buy Local Program allows for local products to be purchased when possible.

On the Go reusable containers are available for students, faculty, and staff. Additionally, Plastic straws have been replaced with paper straws.

Food trimmings from food preparation, food waste that students scrape from their plates, and unusable food scraps are sent to a local pig farmer.

Use of dedicated food waste containers prevent food waste from being sent to landfills.

Unserved food from Dining Services is packaged and sent to Friendly House and the Veterans Home.

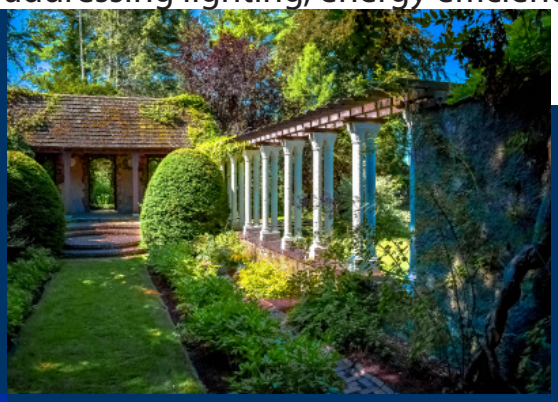
An example of re-purposing leftovers is the garlic bread at the Goat's Head Restaurant that is made into salad croutons.

BUILDINGS & GROUNDS

This section features the sustainability in our existing buildings and new sustainability projects, such as those addressing lighting, energy efficiency, and water management.

East Hall (2008)
Recreation Center (2012)
Foisie Innovation Studio and Messenger Hall (2018)

LEED Gold Certified



Outdoor lighting fixtures replaced with LED bulbs for better energy efficiency.

Improved motion sensing and manual overrides for Recreation Center lighting.

Faraday Hall (2013)

LEED Silver Certified

Water drainage from Recreation Center collected and used to water plants.

Lights in East Hall and Founders Hall replaced with LED bulbs for improved energy efficiency.

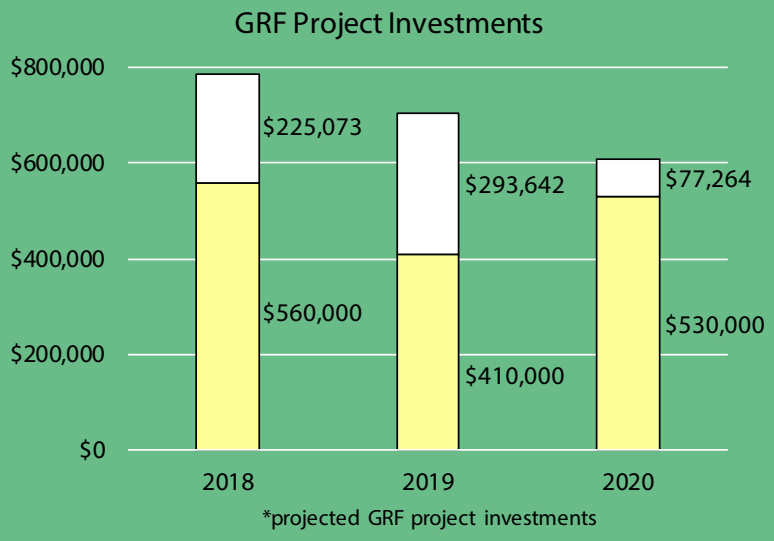
Environmentally-friendly salts used for snow and ice removal during winter months.

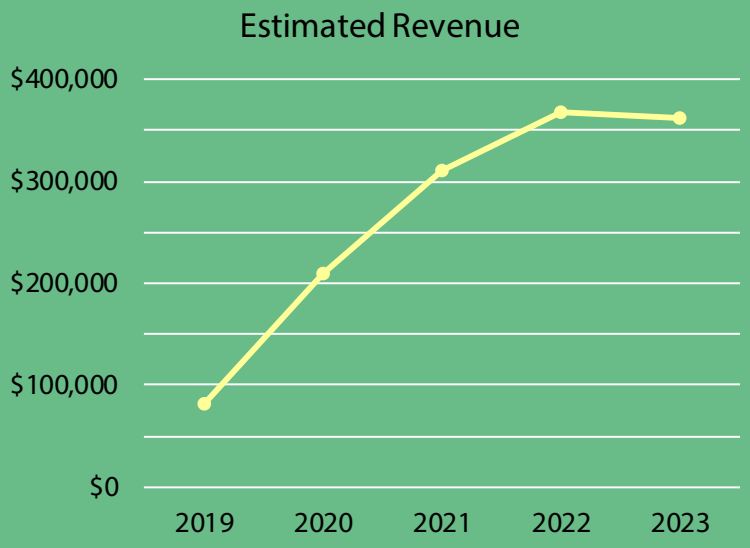
Bartlett Center (2006)

LEED Certified

GREEN REVOLVING FUND

The Green Revolving Fund (GRF) provides funding for projects that increase WPI's sustainability by reducing resource consumption and increasing efficiency. The GRF, which initially was funded with a $1.5 million dollar seed by WPI, focuses on investing money into sustainable projects that will not only make WPI a greener campus, but will generate cost savings over time. These savings are reinvested into the GRF to support future projects that will conserve resource use. The investments, estimated revenue from savings in utility costs, and funded projects are summarized below.





Recreation Center Upgrades

After completing HVAC and automated control retrofits to the Recreation Center last year, funds from the GRF were invested in upgrading the lighting systems. Sensors in the Recreation Center courts were upgraded to improve motion sensing capabilities and a manual override was added to allow the pool lights to be turned off when the space is unoccupied.

Outdoor Lighting Upgrades

Over the past year, outdoor lighting fixtures on campus were replaced with more energy-efficient LED fixtures. The conversion to LED lighting saves energy, and the light bulbs last longer, leading to even higher savings that can be invested into other projects.

Residence Hall Lighting Upgrades

During the past year, lighting fixtures in the Founders and East Hall residences were replaced to improve energy efficiency. Additional funding in the GRF has been put aside for other LED lighting upgrades on campus.

Upcoming and Ongoing Projects

Harrington Auditorium Retro-Commissioning

Co-generator Feasibility Study

Green Community Fund Phantom Load Project

LED Lighting Conversions

ACADEMICS

As a school whose curriculum is focused on project-based learning, WPI challenges students to analyze real-world problems to find unique and sustainable solutions. Some aspects of sustainability are incorporated in many of the courses. From learning about material selection and recyclability to environmental issues in literature and the media, students are exposed to sustainable practices and decision-making in all programs of study. With the many course options, minors, and concentrations offered, students can choose to focus their major toward their personal interests and passions. This section will feature programs of study, courses, Great Problems Seminar, Interactive Qualifying Projects, Major Qualifying Projects, and the annual Sustainability Project Competition.

PROGRAMS OF STUDY

Representative Undergraduate Majors

Architectural Engineering (BS)
Civil Engineering (BS)
Environmental Engineering (BS)
Environmental and Sustainability Studies (BA)
Mechanical Engineering (BS)
Society, Technology, & Policy (BS)

Minors

Architectural Engineering
Environmental Engineering
Environmental and Sustainability Studies
Mechanical Engineering
Sustainability Engineering

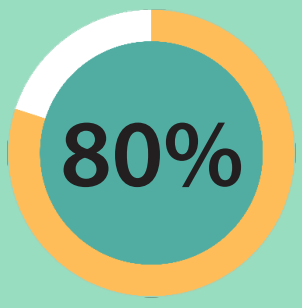
Representative Graduate Majors

Civil Engineering (MS, PhD)
Environmental Engineering (MS)
Mechanical Engineering (MS, PhD)

Certificate Programs

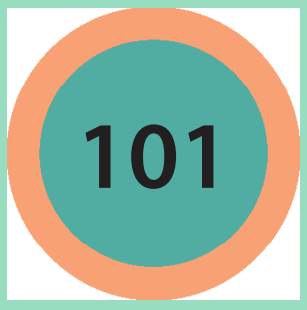
Power Systems Engineering
Water Quality Systems
Water Resources

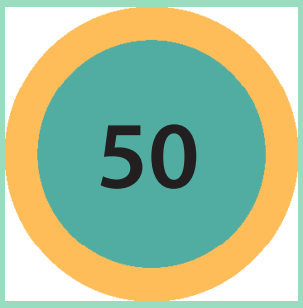
SUSTAINABILITY COURSES



DEPARTMENTS OFFER SUSTAINABILITY FOCUSED COURSES

NUMBER OF SUSTAINABILITY FOCUSED UNDERGRADUATE COURSES





NUMBER OF SUSTAINABILITY FOCUSED GRADUATE COURSES

COURSE SAMPLING

A full list of sustainability-focused courses can be found at wpi.edu/+sustainability

BB 1045
Biodiversity

This Biology course examines the breadth, patterns, mechanisms, conservation of biodiversity, and threats to biodiversity. Assesses management and engineering strategies for the biodiversity crisis.

EN 2237
American Literature and the Environment

This English course examines the many ways in which dramatists, essayists, filmmakers, novelists, and poets have articulated ecological and environmental concerns such as the effects of technology on the environment and issues of conservation and sustainability.

ENV 2700
Social Media, Social Movements, and the Environment

This Environmental and Sustainability Studies course introduces the phenomena of social and environmental movements, theories on why they succeed and fail, and how social media has changed the landscape of social mobilization.

AREN 3025
Building Energy Simulation

This Architectural Engineering course focuses on practical applications of building energy simulation and design.

CE 3070
Introduction to Urban and Environmental Planning

This Civil Engineering course introduces the social, economic, political, and environmental factors that affect the complex relationship between the built and natural environment.

ENV 3100
Adventures in Sustainable Urbanism

This Environmental and Sustainability Studies course examines the history of sustainable development, its antecedents, and factors that have influenced its evolution.

ME 4821/ME 5358/ MTE 558
Plastics

This Mechanical Engineering course introduces the processing, structure, property, and performance relationships in plastic materials. Investigates pertinent issues related to environmental degradation and recyclability.

AE 5105/ME 5105
Renewable Energy

This Aerospace and Mechanical Engineering Course provides an introduction to renewable energy, outlining the challenges in meeting the energy needs of humanity and exploring possible solutions.

BUS 547
Energy Management

This Business course examines a broad spectrum of energy auditing methods, energy management planning and energy management topics important to future energy professionals, business managers and leaders. The course includes a project that applies energy management concepts to an actual energy audit.

CE 563
Industrial Waste Treatment

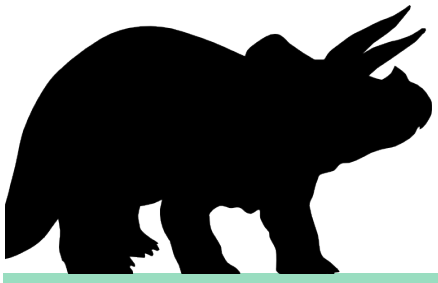
This Civil Engineering course focuses on industrial wastes in the context of legislation; the magnitude of industrial wastes; effects on streams, sewers and treatment units; physical, chemical and biological characteristics; pretreatment, physical treatment, chemical treatment, and biological treatment methods; and wastes from specific industries.

GREAT PROBLEMS SEMINAR

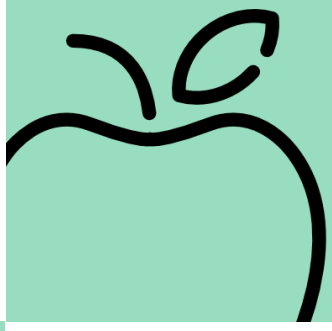
First-year students have the opportunity to jump into WPI's project-based learning through the Great Problems Seminar. This two-term course allows students to solve critical problems in the world around them. These courses, all of which focus on some aspect of sustainability, cover a range of topics and, in each course, students are exposed to both the technical and social aspects of the problems that surround them, preparing them for future project work at WPI and in the workplace. Sustainability is inherent in the topics of all of the winning projects, which are listed on this page. For more information on the Great Problems Seminar, visit wpi.edu/+gps.

2018-2019 GPS COURSE OFFERINGS

Extinction: Who Will Survive?

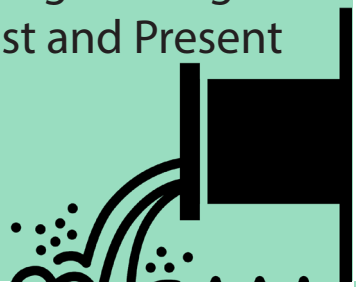


Feed the World



Heal the World

Humanitarian Engineering: Past and Present



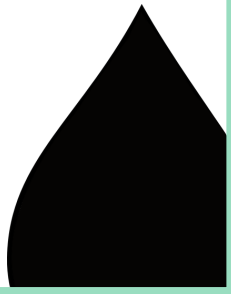
Livable Cities

Power the World

Recover, Reuse, Recycle

Shelter the World

The World's Water



GPS POSTER COMPETITION WINNERS

Every year, the GPS Poster Competition is held to allow first-year students participating in GPS courses to showcase their unique and innovative solutions to critical real-world problems. A project team from each course is selected as a poster competition winner and one group is chosen as the People's Choice Winner.

PEOPLE'S CHOICE WINNER

Heal the World

An App to Improve the Mental Health of Breast Cancer Patients

Students: Kylie Belanger, Corinne Saucier, Laura Staugler

Instructors: Reeta Rao and Elisabeth Stoddard

Extinction: Who Will Survive?

The Karner Blue Butterfly: Best Management Practices

Students: Emma Fountain, Mickaela Gunnison, Anxhelo Ripa, Antoine Rodriguez

Instructors: Marja Bakermans and David Spanagel

Shelter the World

Storm Resistant Affordable Housing in Agra, India

Students: James Englander, Troy Otter, Erin Thibeault, Joshua Thomas

Instructors: Soroush Farzin-Moghadam and Courtney Kurlanska

The World's Water

Education & Filtration of Arsenic Contaminated Drinking Water in Nawalparasi, Nepal

Students: Isabel Alvarado Blanco Uribe, Leslie Mateo, Paul Pacheco, Matthew Plympton

Instructors: Elisabeth Stoddard and Derren Rosbach

Recover, Reuse, Recycle

Waste to Wealth: Utilizing Waste Plastics and Copper Slag to Produce Value-Added Materials

Students: Katherine Bishop, Victoria Carreiro, Madison Rutherford, Yoni Weiner

Instructors: Brajendra Mishra and Diran Apelian

Livable Cities

Kelley Square Redesign

Students: Ryan Astor, Alex Mondro, Maggie Reiter, Daniel Tengdin, Tony Tesoriero

Instructors: Marja Bakermans and Geoffrey Pfeifer

Feed the World

The Lean, Mean, Microgreen Machine

Students: Katherine Doucette, Tim McCarthy, Nathan Morin, Peter Nikopoulos

Instructors: Michael Johnson and Robert Traver

INTERACTIVE QUALIFYING PROJECT

Every WPI student is required to complete an Interactive Qualifying Project (IQP) in order to meet WPI's graduation requirements. Many students complete these projects over the course of one term, during their third year, and travel either domestically or internationally to one of many project sites. These projects, which allow students to apply science and technology, as well as social science, to a real-world problem, are often focused around improving or maintaining sustainability in the communities within the student teams' work. The importance of sustainability in the IQP is highlighted in the President's IQP Awards.

PRESIDENT'S IQP AWARDS

The President's IQP Awards are given each year to student teams demonstrating outstanding effort in the conception, performance, and presentation of its Interactive Qualifying Projects. Here are last year's recipients:

President's IQP Award Winner

Reducing Flood Risk in Shkodra Through Community Engagement
Students: Kylie Dickinson, Donald Dione, Sarah St. Pierre, Tyler Weiss
Advisors: Leslie Dodson and Robert Hersh

President's IQP Award Runner-Up

Developing Drowsy Driving Mitigation Strategies for Himachal Pradesh
Students: Sierra Palmer, Glenndon McCormick, Nicolas Fabbrini
Advisors: Ingrid Shockey, Seth Tuler, Varun Dutt (IIT)

President's IQP Award Finalists

Weighing Perceived Values of Tinguely's Sculptures Against Technically Advanced Conservation
Students: Erik Langberg, Thomas Mackintosh, Stephanie Marcucci, Eli Skeggs
Advisor: Daniel DiMassa

Exploring Community Perceptions of Rural Wastewater Treatment Development: A Case Study on Kamenicë, Korçë
Students: Ryan Herrmann, Fang Han, Morgan DeAngelis, Dasia Aldarondo
Advisors: Leslie Dodson, Robert Hersh

Designing a Sustainable Water Supply Network for El Cuerpo de Bomberos Training Practices
Students: Talon Boie, Kerry Muenchow, Theodore Vangos, Kelly Vodola
Advisors: James Chiarelli, Stephen McCauley

IQP PROJECT SAMPLING

For their IQP each student or team is given the opportunity to complete their project either on campus, or at one of many project centers around the nation and world. Many of these projects have components related to sustainable practices and technology. The following projects and project centers represent a small selection of the sustainability-themed IQP's completed in the past academic year.

Rabat, Morocco

Solar Decathlon Africa: Artisanal Design Features for Team OCULUS Net-Zero Solar House

Students: Ann Le, Allison Sichler, Dakota Payette, Jonathon Brownlow

Advisors: Tahar El-Korchi, Steven Van Dessel, Fabienne Miller

Monteverde, Costa Rica

Developing a Reinvestment System for Sustainable Initiatives in the Bellbird Biological Corridor

Students: Chloe Adler-Mandile, Matthew Burd, Julia Davenport, Noah Parker

Advisors: Courtney Kurlanska, Melissa Belz

San José, Costa Rica

Determining the Feasibility of a Bee Honey Value Chain

Students: Daniel Pelaez, Luke Lindholm, Natalie Green, Rachel Quinlivan

Advisors: James Chiarelli, Jefferson Alex Sphar

Zurich, Switzerland

Virtual Energy Hero: Virtual Reality Gamification of Smart Energy - Smart City Technologies

Students: Nicholas Fleury, Aislinn Harte, Adam Ramram

Advisors: John Orr, Dirk Albrecht

Worcester, United Kingdom

Skills for Tomorrow: Hereford Student Conference
Students: Benjamin Bridges, Thomas Kim, Selena Livramento, Dylan Snay
Advisor: James Hanlan

Boston, Massachusetts

Addressing Vulnerabilities and Emergency Power Capacities in the Wastewater Sector of Massachusetts
Students: Faria Kader, Michael Kirejczyk, Marylouise Ross
Advisor: Seth Tuler

Sustainable Food Systems

Creating a Resilient Watering System to Benefit Kids with Exceptional Needs at Farm and Nature-Based School
Students: Virginia Adams, Connor Murphy, Cassandra Salafia, Kyle Werra
Advisor: Elisabeth Stoddard

STEM Education

Building a Sustainable Volunteering Structure Connecting Worcester Polytechnic Institute and Local Community-Based Organizations
Students: Guadalupe Lira, Sarah O'Neil
Advisor: Kathy Chen

Sustaining WPI

WPI Food Waste Management: Assessment and Reduction
Students: Steven Trvalik, Jenny Penaloza, Junaid Rathore, Augustus Moseley
Advisors: Suzanne LePage, Derren Rosbach

MAJOR QUALIFYING PROJECTS

To meet WPI's graduation requirements, every WPI student completes a Major Qualifying Project (MQP). These major-focused projects are typically completed on campus over the course of three to four terms during a student's senior year. These projects challenge students to apply their experience and knowledge to complete a project in their major field, gaining experience in effective communication and identifying scientific, social, and ethical dimensions of a problem. Many MQPs have components of sustainability integrated into the project work. The following projects represent a selection of the sustainability-themed MQPs completed in the past academic year.

Recreating Steam Power at WPI
Students: Michael Cooke, Thomas Kouttron
Advisor: Robert Daniello

Process Improvement at Stacy's Pita Chips
Students: Samuel Bacchiocchi, Daniela Baez, Michael Brooks, Nicholas Lewis, Miguel Vargas
Advisors: Walter Towner, Helen Vassallo

(GREEN) Greenhouse Redesign for Elementary Educational Needs
Students: Adam Wharton Wallace Peternell, Daniel Barra, Daniel Timothy Ottey, Jonathan Toomey, Kathleen Nugent, Sean Traynor
Advisor: Ahmet Sabuncu

A Biodegradable Alternative to the Single-Use Cup
Students: Jessica Hanley, Peter Ross, Rose Lewis, Ryan Herrmann, Tess Hudak
Advisors: Walter Towner, Sarah Wodin-Schwartz

Ellie's Spirit
A Visual Novel to Educate Elementary and Middle School Students on Environmental Issues around the World
Students: Abdah Anabellah St. Fleur, Karl Rosenfeld, Laura Sawin
Advisors: Edward Gutierrez, Brian Moriarty, Charles Lee Sheldon

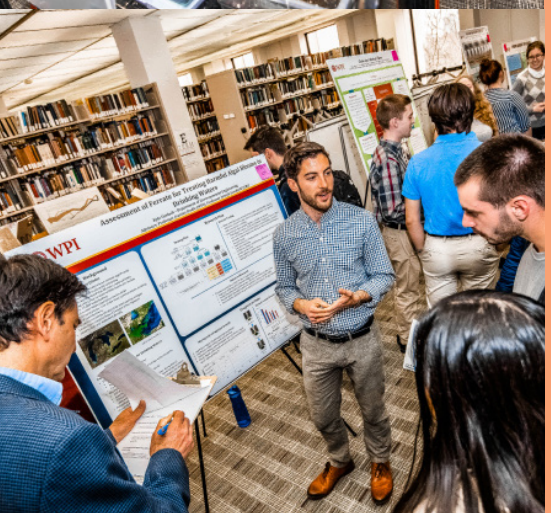
Resurgence Tower - eVolo Skyscraper Competition
Design of a Sustainable, Cost-Effective, and Innovative Skyscraper for the eVolo Competition
Students: Antoine Harris, Caitlyn Peterson, Emily Mowatt, Michael Brady
Advisor: Soroush Farzin-Moghadam

Universidad Tecnológica de Panamá: Baseline Sustainability Study and Water Management Systems
Student: Abigail Ismail
Advisors: Tahar El-Korchi, Peter Hansen, Aaron Sakulich

WPI Combined Heat and Power Feasibility
Students: Charles Steele, Daly Place, Rosie McCarthy
Advisors: Sharon Johnson, Brian Savilonis

ANNUAL SUSTAINABILITY PROJECT COMPETITION

On Wednesday, April 10, 2019, the annual sustainability project competition was held in the Gordon Library. This competition, now in its 11th year, is sponsored by the WPI Office of Sustainability, Environmental and Sustainability Studies, and the George C. Gordon Library. It is held to showcase student projects addressing one or more of the main aspects of sustainability: environmental stewardship, social justice, and economic security. Exceptional undergraduate first year, undergraduate upperclassmen, and graduate student projects were each awarded a cash prize of $300.



COMPETITION JUDGES

WPI

Natalie Farny
Katherine Foo
Ronald O'Brien
Anne Ogilvie
Peter Thomas
Michael Timko

Tighe & Bond

Wayne Bates

Massachusetts Department of Environmental Protection

Michael DiBara

Worcester Regional Chamber of Commerce

Alex Guardiola

Waste Management

Michelle Lee Guiney

Quinsigamond Community College

Kathy Rentsch

Thanks to our Competition's Judges!

SUSTAINABILITY PROJECT COMPETITION WINNERS

Undergraduate: First-Year

Soil Conservation in Haiti

Students: Evelyn Mortimer, Carley Nicole Gilmore, Benjamin Workinger
Advisors: Derren Rosback, Elisabeth Stoddard

Undergraduate: Upperclassmen

GrowBox (Video)

Students: Marc Printz, Nathan Rosenberg, Austin McCalmont, Kay Vail, Ethan Merrill, Ema Mehuljic
Advisor: Gina Betti

Graduate (tie)

Setting Smart and Low-Cost Hybrid Drying Systems

Student: Hicham El Ferouali
Advisors: Naji Abdenouri, Said Doubabi, Tahar El-Korchi, Jamal Yagoobi

Graduate (tie)

Fundamental Understanding of Bound Water Removal in Paper Drying Process: Microscopic Approach

Student: Zahra Noori
Advisors: Jamal Yagoobi, Burt Tilley

RESEARCH

7,000,000

dollars, the estimated amount of funding received for sustainability-related projects this year

7+

research centers and laboratories focused on sustainability

Sample Research Centers and Labs

Center for Resource Recovery and Recycling (CR^3)

Geo/Water Resources Laboratory

Renewable Energy Innovations Laboratory

Electrochemical Energy Laboratory

Integrative Materials Design Center (iMdc)

Fuller Environmental Laboratory

Energy Research Group

Over the course of the year, many professors led research projects focused in sustainability. Whether this research is grant-funded or part of an established research center on campus, there are always sustainability-focused and sustainability-related projects going on. This section represents a selection of research projects, research centers, and research-related events from the past academic year that have a focus on sustainability. For more information about research projects at WPI, visit wpi.edu/+research or the research tab at wpi.edu/+cee.

ALTERNATIVE SUSTAINABLE MATERIALS FOR SOLAR CELLS AND CATALYSTS

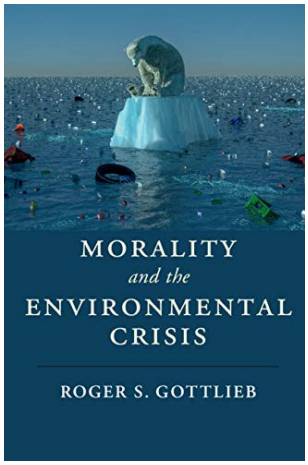
Pratap Rao, associate professor of the mechanical engineering department, heads the NanoEnergy Lab and is currently completing research in the area of clean energy. Rao, who received a grant to train students to become innovators in clean energy, noted that "The NanoEnergy Lab… is currently investigating alternative sustainable materials for solar cells and catalysts that require less energy to produce, and contain fewer rare or toxic elements than today's materials." His research in the past has focused specifically on finding more cost effective ways to use water to produce clean hydrogen fuel as an alternative to non-renewable fossil fuels.

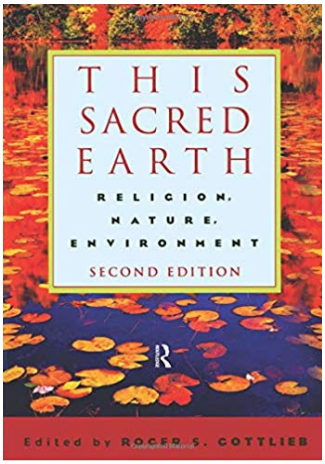
ALTERNATIVES TO MITIGATE AND ADAPT TO CLIMATE CHANGE

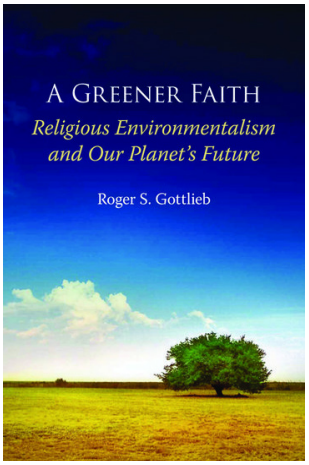
Professor Jennifer Wilcox, of the WPI Chemical Engineering Department, focuses her research on energy and the environment. Wilcox is specifically interested in developing mitigation and adaptation strategies to minimize the negative impact of fossil fuels on the climate and environment. In a TED Talk given in April of 2018 focused on carbon capture, Wilcox noted that research and funding to build synthetic forests to aid in carbon dioxide (CO_2) capture "could just enable us to preserve not only the Amazon, but all of the people that we love and cherish, as well as all of our future generations and modern civilization." Along with her research, Professor Wilcox encourages individuals to avoid CO_2 emissions as this is much easier to accomplish than removing the CO_2 after it is in the atmosphere.

MORALITY AND THE ENVIRONMENTAL CRISIS

Roger Gottlieb, professor of philosophy, is internationally known for his work as a leading analyst and exponent of religious environmentalism. In April, WPI's Gordon Library hosted a "Meet the Author" event featuring Professor Gottlieb, in which he discussed his new book, *Morality and the Environmental Crisis*. This book focuses on the emotions and moral dilemmas brought forth by the environmental crisis, covering topics such as the value of nature and how to face environmental despair. He has published two online essays on related topics this year, and also has given evening talks for community organizations. Gottlieb has published other works focusing on the environmental crisis, including *A Spirituality of Resistance: Finding a Peaceful Heart and Protecting the Earth*, *A Greener Faith: Religious Environmentalism and our Planet's Future*, and *This Sacred Earth: Religion, Nature, Environment*.







UNDERSTANDING THE SUSTAINABILITY OF FARMED ANIMAL PRODUCTION

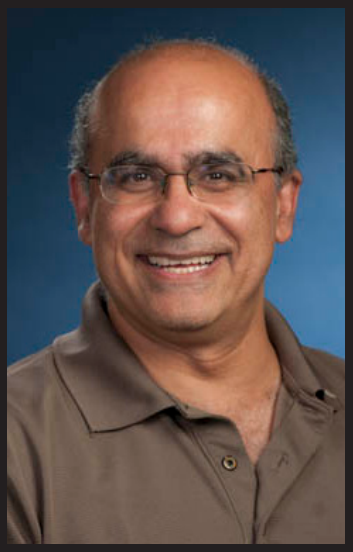
Assistant teaching professor Lisa Stoddard's research interests cross through the intersection of nature, society, and social justice. Some of her work addresses the impacts of farmed animal production on the environment and local communities. She contends that the vulnerabilities of animals, humans, and ecosystems are necessarily interconnected and a systems approach is needed to fully address these relationships. This research includes a vulnerability assessment of North Carolina's hog industry, with consideration of the factors leading to the potential outbreaks of foot and mouth disease. Her recent efforts include the development of the WPI's Farm Stay Project Center, where students complete sustainability projects while living in a yurt village on a 58-acre working farm and nature education center.

REDUCING THE IMPACTS OF HARMFUL ALGAL BLOOMS ON DRINKING WATER SUPPLIES

Harmful algal blooms (HABs) occur when specific forms of algae grow out of control and produce harmful and even toxic compounds. Cyanobacteria, or blue-green algae, are one type of algae responsible for an increasing number of HABs in surface waters throughout the U.S. When a cyanobacterial bloom occurs in a water supply system, it can contribute to taste and odor issues and can potentially release harmful cyanotoxins into the water. Professor Jeanine Dudle, associate professor of civil and environmental engineering, is working to develop new options for treating cyanobacteria in drinking water systems. Current treatment options can be costly, and can release organic material that is a precursor for disinfection byproducts. She and her students are using bench scale studies to investigate the use of ferrate (Fe(VI)) as an alternative oxidant by measuring its effect on algal cells. Initial results indicate that the ferrate has potential for use during harmful algal blooms, and could help to ensure sustainability of surface water resources.

SOCIETY, TECHNOLOGY, AND RESOURCE CONSUMPTION

Professor Joseph Sarkis's research and teaching interests revolve around the fields of operations, supply chain management, and sustainability. He contends that the largest contributors to greenhouse gases, such as the transportation industry, must rely heavily on technological fixes to become more sustainable. Given the current state of resource usage, sustainable supply and technology management are central to environmental resources and emissions issues. Sarkis maintains that environmental impact is a function of population, affluence, and technology. Since population and affluence are socially sensitive, society typically focuses on technology for its solutions. He reminds us that technology comes with unintended consequences; without social behavior and consumption changes included in technological or innovation policy, sustainability from technological solutions is unlikely to result.



RESEARCH EVENTS ON CAMPUS

WPI hosted numerous research-focused events this year. Below is a sampling of research events with a sustainability theme.

Center for Global Public Safety Stakeholders' Forum

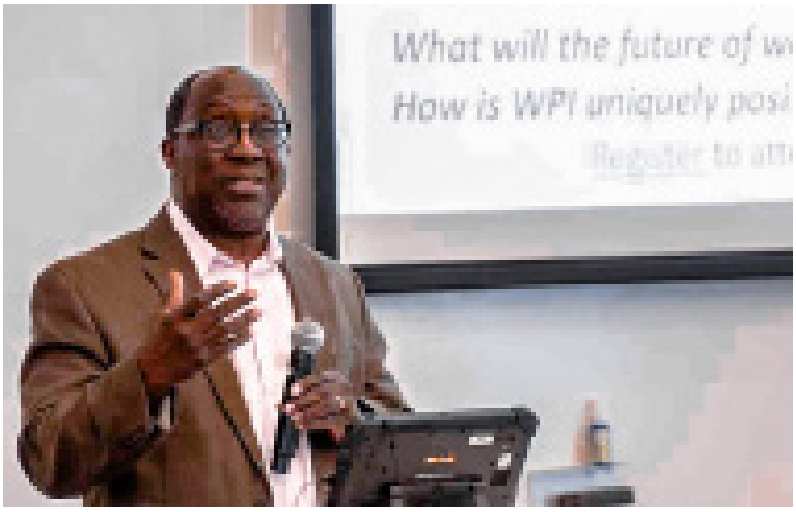
WPI's Center for Global Public Safety hosted its 2nd Annual Industry Stakeholders' Forum on March 27, 2019. CGPS aims to create partnerships with members of industry, academia, and local agencies to identify and address pressing concerns in public safety at both local and global levels. This year's theme was Energy Initiatives & Their Impact on Public Safety. The event was designed to identify the greatest research needs that impact global public safety. Its goal is to develop approaches to integrate the expertise available at WPI and develop alliances that will support the development of safer and more resilient communities worldwide.

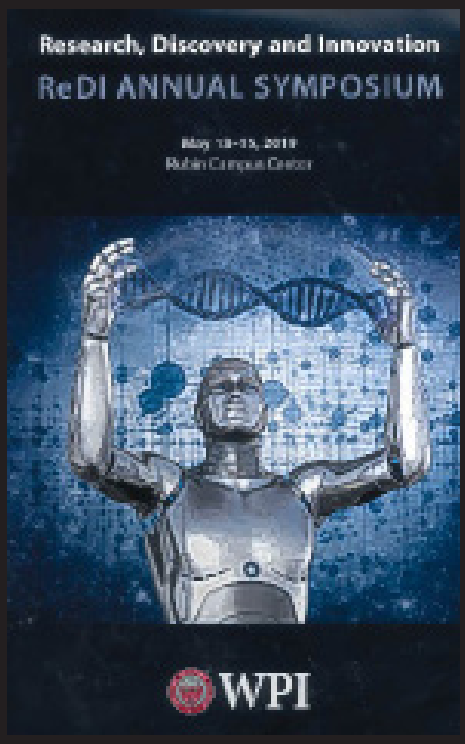
Sustainability and the Cross-Cutting Thematic Areas

A workshop highlighting the initiative to advance and coordinate WPI's research and educational activities in a number of interdisciplinary areas was held on March 3-7, 2019. This initiative builds on the strengths in WPI's departments as well as a number of core areas that serve as foundational underpinnings that support and align our mission in these cross-cutting areas: (1) sustainability, (2) diversity equity and inclusion, (3) innovation entrepreneurship, and value creation, (4) project-based learning and STEM, and (5) design thinking and maker culture. Sustainability research and education initiatives were common themes in each of the interdisciplinary groups.

Future of Work

A workshop on the Future of Work was held on March 7, 2019 in association with the showcase on cross-cutting interdisciplinary areas described on the previous page. This event provided global, academic, and social perspectives on the Future of Work, including a discussion on how sustainability and other core values affect the future of work and workers. The event included presentations providing a global perspective, an academic entrepreneur's perspective, and a social entrepreneur's perspective.





Research, Discovery, and Innovation (ReDI) Annual Symposium

Held on May 13-15, 2019, this program is intended to provide an opportunity for WPI faculty to share research discoveries and ideas with their colleagues and partners, and also provide an opportunity to expand upon external collaborations. The symposium included introductions to cutting-edge research lightning talks and presentations on recent research and innovations by WPI alumni, faculty, and post doctoral students. The themes of the four cross-cutting and foundational underpinnings were integral to the discussions. The event culminated with presentations and a panel introducing case studies demonstrating the potential for the circular economy. The circular economy is an economic system in which waste is eliminated and effectively reused to promote sustainable use of resources.

WPI's 9th Annual Energy Symposium

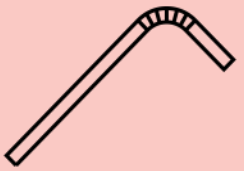
WPI's 9th Annual Energy Symposium was held in September and was sponsored by WPI's Power Systems Program and Academic and Corporate Engagement. With a theme of "The Future Grid: Smart, Renewable and Resilient," the primary objectives were to share current opportunities and challenges in building the future power grid, learn about recent examples of storage integration, applications of big data, cybersecurity initiatives, understand advances in power engineering education, and motivate current students to consider careers in the industry.

COMMUNITY ENGAGEMENT

SUSTAINABILITY INITIATIVES ON CAMPUS

Over the course of the year, individuals can participate in various sustainability initiatives around campus. While there are many annual events run by offices and clubs, many choose to start their own sustainability initiatives with the support of a club, friends, or even a WPI department or office. The following initiatives represent a sampling of the many sustainability ideas promoted over the past year on campus.





SWITCHING FROM STYROFOAM

In the fall of 2018, faculty, and staff welcomed Planet Smoothie and Auntie Anne's Pretzels onto campus, located in the newly-built Foisie Innovation Studio. While these two food spots became popular on campus, some members of our community quickly became concerned about Planet Smoothie's use of Styrofoam cups. Styrofoam is an inexpensive polystyrene foam that has insulating properties and is known for its light weight. However, this material is often not recycled as it involves a very complex, expensive process to do so. Additionally, Styrofoam is produced as a byproduct of petroleum, a nonrenewable energy source, and, based on recent research, it is believed that this product can act as a carcinogen. For these reasons, students began a petition to eliminate the use of Styrofoam cups at Planet Smoothie. The petition, signed by hundreds of members of the WPI community, helped spur the switch from Styrofoam to recyclable plastic cups. While the corporate office of Planet Smoothie was already planning a transition from styrofoam cups, the concern of the WPI community allowed our location to switch to locally sourced plastic cups ahead of the corporation-wide transition.

PROMOTING REUSABLE STRAWS

Over the course of the year, the WPI campus has seen an increase in the promotion of reusable straws. Resident advisors across campus, sororities (such as Chi Omega), and organizations (such as the Green Team) held events promoting the transition to metal or silicone straws. This transition is important as plastic straws are not recyclable because of the difficulty with their small size and the additives in the formulation to provide color. Because they cannot be recycled, they often end up in oceans where marine animals can mistake them for food, harming or even killing them. Current data estimates the yearly straw consumption in the United States at 180 billion per year. During the school year, Dining Services removed straws from the Morgan Dining Hall, and the Library Cafe began an initiative to make straws optional.

OFFICE OF SUSTAINABILITY INITIATIVES

SUSTAINABLE OFFICE SUPPLY ORDERING

During this past academic year, one of the student sustainability interns with the WPI office of sustainability worked on a project focusing on promoting more sustainable practices for ordering office supplies. This intern, Ema Mehuljic, researched commonly ordered office supplies. Her goal was to ultimately promote the decrease of the use of these supplies and the frequency of order placement and to inform the WPI community of the environmental issues associated with these products. However, as many of these supplies are necessary for office operations, she also focused her efforts on promoting the consolidation of orders so that offices make larger orders less often to cut down on fossil fuel usage in transportation and excess waste production from packaging.

Number of orders processed:

- WBMason – 2710 orders/ year
- Staples – 440 orders/year

GHG produced from deliveries:

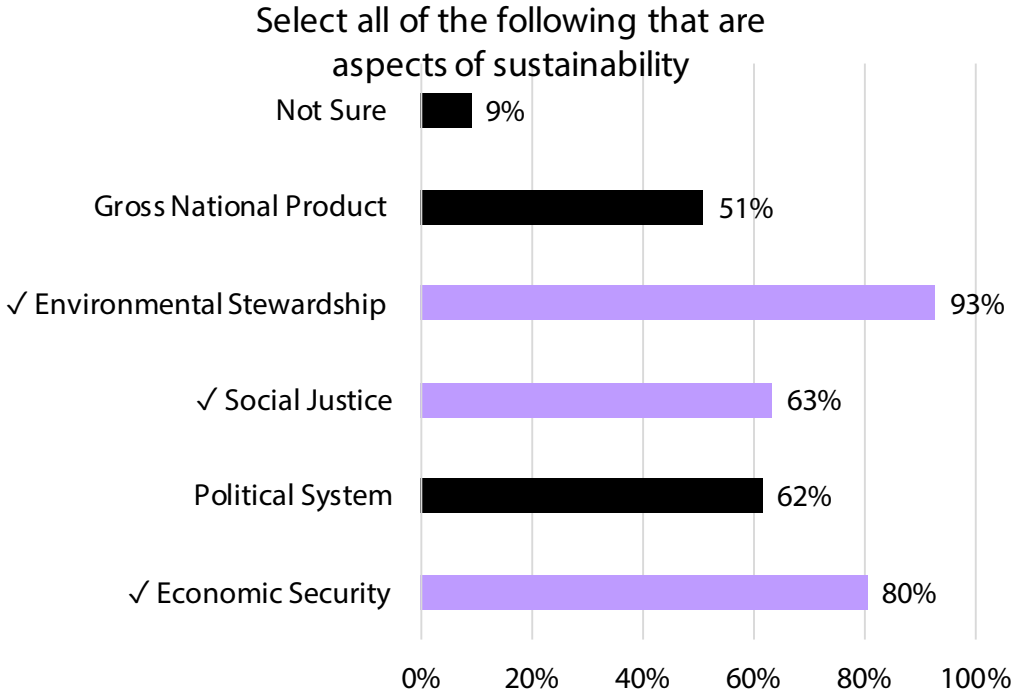
- 7200 pounds of CO2 / year (WBMason) or 3.6 tons of CO2

cardboard disposed of in 2016:

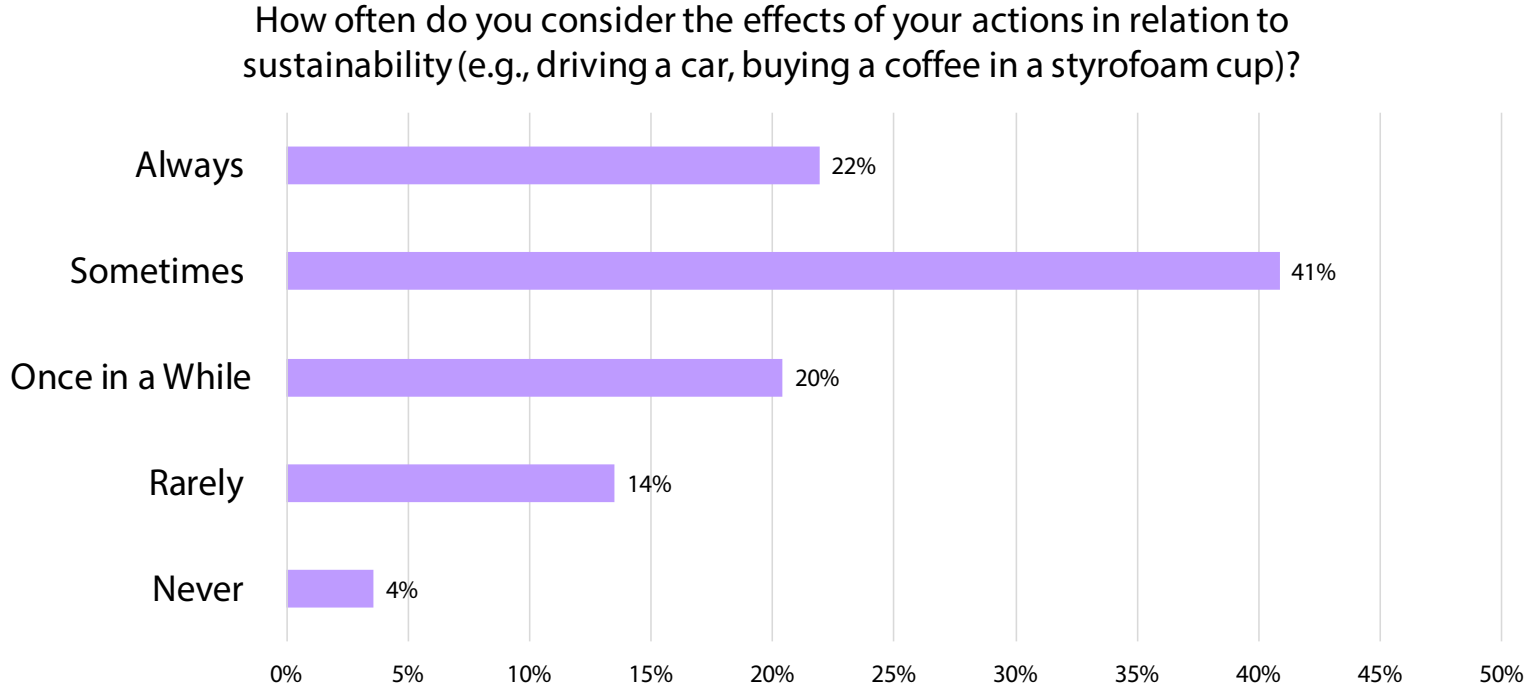
- 260,000 pounds

SUSTAINABILITY LITERACY SURVEY

The Office of Sustainability conducts an annual sustainability literacy survey during the fall, asking questions about student knowledge and understanding of sustainability. When asked to rank the importance of various topics with respect to sustainability, students ranked clean energy, clean air, clean water, and preserving the natural environment the highest. Based on the survey results, it was determined that most students were fairly knowledgeable on the subject of sustainability and understood basic concepts of sustainable practices, climate change, pollution, and gas emissions.



The two graphs on this page represent some of the questions asked in the sustainability literacy survey. Both questions gauge student understanding of sustainability. In the question shown on the left, student understanding of sustainability is gauged based upon which topics they correctly identify as aspects of sustainability. In the question shown below, student understanding of and interest in sustainability is gauged based upon how frequently they consider the effects of their actions in relation to sustainability.



TRANSPORTATION

To reduce greenhouse gas emissions, WPI hopes to reduce the usage of single-occupancy vehicles as these have high greenhouse gas emissions per passenger mile in comparison to other transportation options. WPI hopes to instead promote ride-sharing, bicycling, and shuttle services as these have a lower greenhouse gas emission per passenger mile. This year Kyle Corry, a Sustainability Intern, researched ways to decrease the number of single-occupancy vehicles coming to campus. He researched several ride share companies as well as worked with the MassDOT to engage our community in learning about alternatives. A "Meet-Your-Match" ride share event was held to allow interested staff and faculty to find potential ride-share partners. A "Try-It" day was held to encourage car commuters to try alternative options like biking, taking the WRTA, or ride sharing. The following pages give a brief overview of transportation options available on campus and around the Greater Worcester Area. More information can be found at https://www.wpi.edu/offices/sustainability/transportation-options.

CITY TRANSPORTATION

Commuter Rail

At Union Station, the MBTA Commuter Rail provides low-cost public transportation from Worcester to Boston. Students, faculty, and staff can use this commuter rail for trips to the Boston Project Center, or may use it to travel to Logan Airport or to catch a Red Sox game.

Trains

While the commuter rail is a popular transportation option, Union Station also offers Amtrak services, allowing commuters to travel to and from over 500 cities across the country.

Buses

For transportation around Worcester, the Worcester Regional Transit Authority bus system provides transportation across the city. Greyhound and Peter Pan buses also operate out of Union Station, providing inter-city transportation.

WPI TRANSPORTATION

Carpool World

Carpool World is a free service that allows WPI community members to find rideshare options. Individuals registered for the program can search for others seeking to carpool based upon similar location, schedule, and driving preferences. Those interested can visit www.carpoolworld.com/wpi

CityRide

During the academic year, the CityRide shuttle operates on Friday and Saturday nights, transporting students from WPI to locations such as Union Station and The Shoppes at Blackstone Valley. The full schedule is typically posted online and in on-campus residence halls at the beginning of the academic year.

MassRIDES

MassRIDES, a free program run by the Massachusetts Department of Transportation (MassDOT), partnered with WPI this year to encourage use of alternative and sustainable commuting options.

Gateway Shuttle

The Gateway Shuttle operates during the academic year on weekdays during business hours, it has pickup and drop-off locations across campus at Faraday Hall, Gateway Park, 85 Prescott Street, Founders Hall, Bartlett Center, and Salisbury Estates. More information and the full schedule can be found on the WPI campus transportation web page.

The Evening Shuttle

During the academic year, the evening shuttle provides early evening to late night service from Sunday to Saturday. The shuttle has pickup and drop-off locations at Faraday Hall, Gateway Park, 85 Prescott Street, Founders Hall, Kaven Hall, Bartlett Center, Morgan Hall, Price Chopper, and Salisbury Estates. More info and a full schedule can be found on the WPI campus transportation web page.

Student Night Assistance Patrol (SNAP)

In addition to the evening shuttle, WPI also provides transports within a one-mile radius of campus via the Student Night Assistance Patrol. Students can travel between campus and off-campus buildings within a one-mile radius of campus, as well as to Union Station. SNAP operates throughout the academic every day. Students can reach a SNAP dispatcher by calling 508-831-6111. More details can be found on the WPI campus transportation web page.

For more information on transportation options, visit https://www.wpi.edu/offices/sustainability/transportation-options


ALTERNATE TRANSPORTATION ON CAMPUS

Zipcar

Zipcar, a car-sharing service, provides an additional transportation option for those on campus looking to reduce their carbon footprint. Many Zipcars are fuel efficient and hybrid, reducing fuel consumption and carbon emissions. Additionally, Zipcars provides the convenience of driving a car without the ownership costs. In 2019, there were over 500 Zipcar members who drove approximately 11,000 miles per month.

Electric Vehicles

For students, faculty, and staff on campus with electric vehicles, WPI provides free electric vehicle charging. The three dual Chargepoint 4000 Series chargers provide six charging ports. These charging stations are located in the Park Avenue Garage, with two located in the interior of the garage near the football field, and one located at the exterior of the garage near the garage entrance. Over 40 unique drivers use the stations each month, resulting in more than 300 charging sessions. The evusers@wpi.edu email alias provides electric vehicle drivers with a space to communicate regarding scheduled maintenance or any issues of concern.

Gompei's Gears

Gompei's Gears is WPI's free bike share program available for the entire WPI community. Individuals can sign up for the program using the Movatic app. Bikes can be rented from four convenient locations: The Quad, Salisbury Labs, Faraday Hall, and Gateway, and can be rented for up to eight hours. Bikes must returned to their original location. This program provides the opportunity for individuals to get across campus and off-campus in a more timely and energy efficient fashion in comparison to walking or driving a car. In 2019, over 1,000 Gompei's Gears members created over 3,600 rentals. Gompei's Gears does not operate between the end of B-Term and mid C-Term.

CLUBS AND ORGANIZATIONS

We are thankful for the many contributions made by our clubs and organizations to sustainability. Some of the activities of our most active sustainability clubs follow:

Green Team

An organization dedicated to promoting and increasing sustainability on campus, the Green Team hosts several events every year to raise awareness of environmental and sustainability initiatives within WPI, Worcester, and beyond. Major events such as the waste audit, the energy-efficient lighting fair, the E-waste drive, and the Recyclemania competition help the organization involve our community in sustainability efforts. The Green Team also oversees Gompei's Gears Bike Share.

"Being in a leadership role on the Green Team has helped me to incorporate more sustainable practices into my daily life, such as reducing my energy consumption and never wasting food. The club gets to see a unique perspective of the campus through our projects and events, and that has helped me become more aware of the areas that WPI excels in and which it could improve in regarding sustainability. [It also has allowed me] to see that there is a lot of student interest in having a sustainable campus and that many students are willing to change their habits to become more sustainable."

Kyle Corry, former Green Team President

Greenhouse and Horticulture Club

The Greenhouse and Horticulture Club is all about plants. The members meet weekly in the greenhouse in Salisbury Labs and are taught plant care skills so that they are able to perform general maintenance tasks. The club also plans trips to nurseries and botanical gardens.

Food Recovery Network

The Food Recovery Network is dedicated to rescue surplus food from dining halls and events around campus, bringing it to Friendly House, a local non-profit serving under-served and under-resourced families in Worcester. This organization strives to raise awareness about food waste and food insecurity, while also building relationships with the Worcester community through their outreach efforts to reduce food waste on campus.

Global Humanitarian Alliance

An organization devoted to enhancing diversity on campus, the Global Humanitarian Alliance seeks to accomplish their mission through creating engaging "beAware" talks on topics such as migration and the humanitarian crisis.

Habitat for Humanity

An organization on campus that partners with the local Worcester Habitat for Humanity affiliate, the Habitat for Humanity club employs volunteers to help advocate, fundraise, and build in order to help decrease the billions of people around the world living in slum housing, and over 100 million that are homeless.

Outing Club

This club strives to enable students to experience and get involved in outdoor activities, instilling in them a greater sense of respect and responsibility for the care and upkeep of the environment. This club also adheres to the "leave no trace" mindset in an effort to protect the environment and leave things exactly as they found them.

CLUBS AND ORGANIZATIONS

American Academy of Environmental Engineers and Scientists (AAEES)

This organization aims to develop and promote opportunities for WPI students interested in Environmental Engineering, provide access to benefits and programs offered by the national organization, foster professional development of students, and provide a community for Environmental Engineers at WPI.

"The American Academy of Environmental Engineers and Scientists has provided me with a strong support system of fellow Environmental Engineers, from current students to alumni. AAEES has expanded my understanding of the environmental field and how important our work is, especially as we face more and more climate challenges."

Stephanie Salerno, AAEES President

Engineers Without Borders

Engineers Without Borders (EWB) is a chapter of EWB-USA that seeks to build a better world through engineering projects that empower communities to meet their basic human needs and equip leaders to solve the world's most pressing challenges. Every year, students have the opportunity to travel to complete an engineering project and, the WPI chapter in particular, focus primarily on increasing water security. This past summer, students continued working on the current project in Conchan, Ecuador, after recently completing a project in Guachtuq, Guatemala.

Vegetarian Club

The Vegetarian Club consists of vegetarians and vegans dedicated to providing support and resources for those living, or seeking to live, a vegetarian or vegan lifestyle. The club works in a non-judgmental way to promote the benefits of vegetarianism and veganism to the WPI campus.

"It continues to be a privilege to be club advisor to a group of such earnest and ethically-minded students. In my experience, many WPI students are concerned about a variety of social, ecological, and ethical problems... the students I advise in the Vegetarian Club, who have worked hard to raise consciousness on our campus... Sustainability, they teach us, matters. But it also matters what we are sustaining, and how."

John Sanbonmatsu, Vegetarian Club Advisor

Students for a Just and Stable Future

An organization that envisions a world where all living beings are getting their needs met and people are resolving their conflicts peacefully, the WPI branch of Students for a Just and Stable Future (SJSF) set a goal to engage the campus in addressing the climate crisis. The organization hopes to make the campus more aware of the actions individuals can take to address the global climate issue. The club also holds screenings of documentaries that look into the clothing, food, and oil industries. The club hopes to spread the message of the truth behind the products that each of us enjoy every day.

This list represents only a selection of clubs and organizations at WPI. For a full list, as well as club contact information, visit https://wpi.campuslabs.com/engage/

WPI NEWS AND EVENTS IN SUSTAINABILITY

Over the course of the year, many events occur on campus that focus on promoting sustainability and sustainable practices. During this time, many students, faculty, and staff also work on projects, whether personal or academic, that focus on sustainability in some respect. The following pages highlight some of these events and projects that have taken place in the past year. While this list is not exhaustive, it gives a brief glimpse of sustainability initiatives and projects, many of which are student-driven.

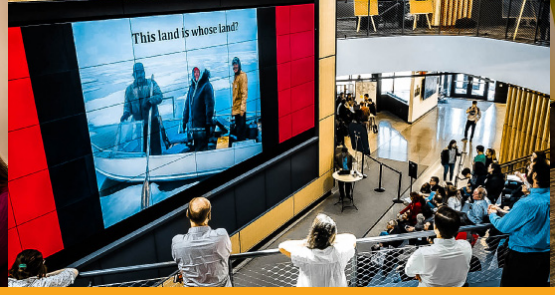
FARMERS MARKETS ON CAMPUS

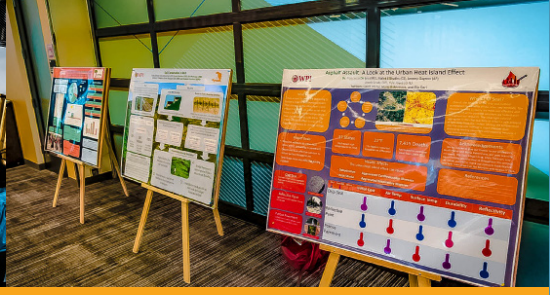
In the fall, two farmers markets were organized by WPI Dining Services. These farmers markets provide our community members the opportunity to buy fresh, local fruits and vegetables. For this event, WPI partnered with Dick's Market Gardens, a family farm in Lunenburg, MA and saw the sale of approximately 3,630 pounds of fresh fruits and vegetables. Recently, WPI also brought a Community Supported Agriculture (CSA) program to campus. Each participant in the CSA received a weekly produce delivery consisting of fresh in-season fruits and vegetables from a local farm. Both of these programs, which support local farms, are very sustainable as they not only encourage healthy eating, but also encourage support for local vendors.

RECYCLEMANIA

Every spring, the Recyclemania competition occurs over the course of 8-weeks. Colleges and universities across the United States and Canada participating in the competition send weekly weight summaries of the amount of recycling and trash collected. Data is evaluated on a per capita basis and schools are ranked based upon these results in areas such as recycling rate and food diversion. For the 2019 competition WPI ranked as follows:

DIVERSION	PER CAPITA CLASSIC	FOOD DIVERSION
41.493% recycling rate	14.725 lbs of recycling/person	31.51 points
Ranking: 57 out of 159 schools	Ranking: 52 out of 214 schools	Ranking: 3 out of 148 schools



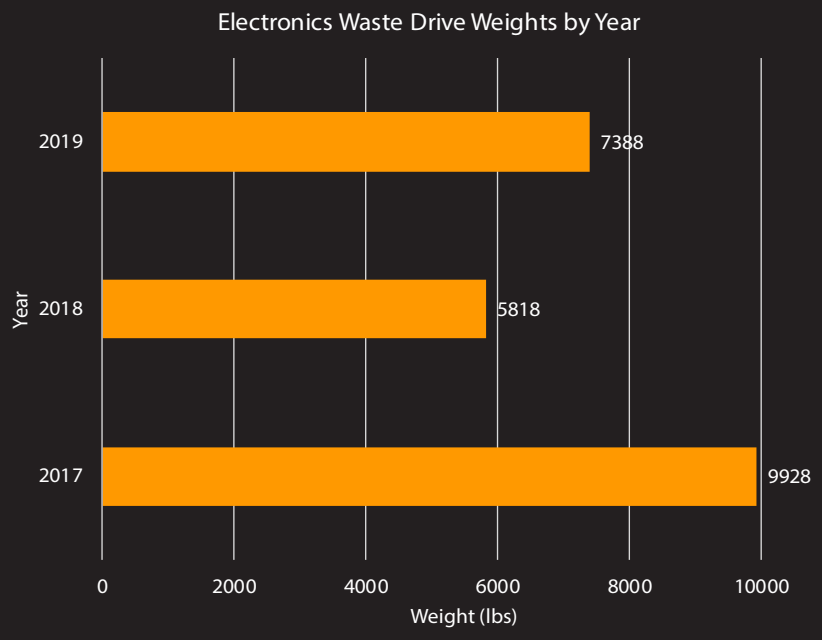


2019 CLIMATE SUMMIT

Once a year, a climate summit is held on campus, bringing together the WPI community and guest speakers, researchers, and scientists. This event, held on April 3, 2019, was sponsored by the Global Lab, Innovation & Entrepreneurship, the Social Justice Series, the Office of Sustainability, and Environmental & Sustainability Studies and was held in the recently opened Foisie Innovation Studio. Short "lightning talks" were given by students, faculty, and staff interested in sharing their perspectives or research on improvements in sustainability and climate change. Faculty, staff, and students held demonstrations and poster presentations on topics of environmental issues, activism, and climate change. Artist-in-residence Ana Rewakowicz spoke during the summit and showcased some of her art pieces focusing on the ever-growing issue of water sustainability in our society. During the summit, a World Cafe was held, allowing individuals to discuss how climate change affects our lives and how it plays a role in coursework, research, and community engagement.

ELECTRONICS WASTE DRIVE

On Monday, April 8, the 8th Annual Electronics Recycling Drive (e-waste drive) was held on the Quad. The Green Team and the Office of Sustainability partner to run this event that allows students and staff to dispose of unwanted or broken electronics in an environmentally friendly manner. This drive allows for the collection of any electronics (with the exception of large appliances). This year's e-waste drive collected 7,388 pounds of material. Data from the past three years of the e-waste drive is shown in the figure to the right.



ANNUAL WASTE AUDIT

The eighth annual waste audit was conducted on April 11, 2019, by members of the Green Team and Office of Sustainability. Bags of trash and recycling were collected, consisting of one building's waste produced in a single day. Contents of the bags were weighed before and after being sorted. The actual and potential recycling rates were calculated, as well as the true recycling rate after determining the quantities of trash and recyclables placed in the wrong bin.

SUSTAINABILITY AT GORDON LIBRARY

Book Exhibits

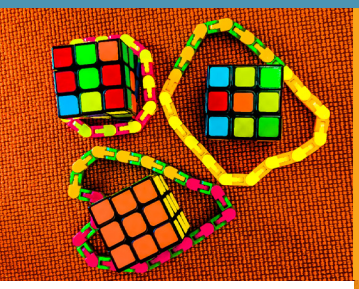
During the month of April, WPI Gordon Library showcased a collection of books and DVDs to celebrate Earth Day (April 22). This collection covered many topics in sustainability, such as renewable energy, sustainable design, and upcycling. During this month, the library also created a table exhibit showcasing climate-related books in preparation for the Climate Summit on campus. For this event, the library created a virtual display to showcase a new Climate Change Research Guide that allows access to resources related to climate change and global warming.

Food for Fines

For those with library fines from overdue materials, the library accepts non-perishable food donations as a method of payment. For each food item, a $5 fine or fee can be waived. These donations are collected and given to local food banks and organizations.

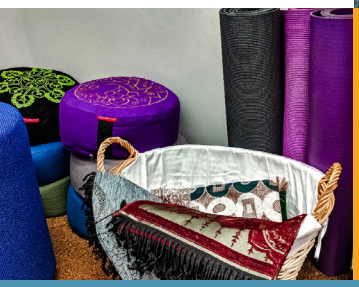
Tagging Projects

In an effort to promote sustainability at the library and raise awareness of the topic, Gordon Library is making make publications more accessible. In a project run by Lori Ostapowicz-Critz, the library is adding tags (including sustainability-themed tags) to IQP and MQP projects online so that it becomes easier to find undergraduate projects. The library also continues to look for ways to promote and contribute to sustainability by conducting its annual student survey.



The reflection space at a glance...

"This place is amazing, I love the colors, texture and view. Thank you so much"



"I'm just glad you guys are doing this, great job! Keep up the good work"

New Reflection Space

At the beginning of the academic year, the WPI Gordon Library launched a new space on the first floor designated for reflection or prayer. This update to the library comes on the heels of librarians noticing prayer rugs placed on the ground floor by students who wanted to pray. This space provides students the chance to reflect, think, and pray - all of which are essential parts of the lives of many students.

This Reflection Space allows students to clear their heads and destress - helping them come up with new ideas and think through problems. This can help students in thinking more sustainably as, when we are given the chance to uncloud our minds, we can think more clearly and rationally about environmental, financial, and social issues that plague our society.

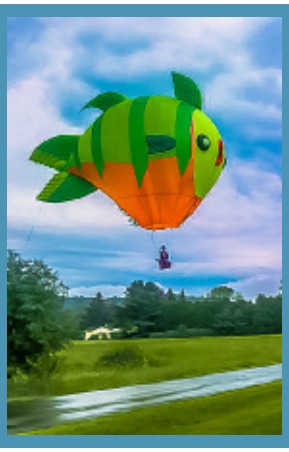
GREAT MINDS AND GRAND CHALLENGES SCHOLAR PROGRAMS

This past year WPI announced a new program, the Great Minds Scholars Program, to begin in the fall of 2019 that will assist high-achieving, Pell-elligible students from Worcester Public Schools in covering tuition costs left over after merit and need-based scholarships and financial aid are applied. These students, who are from low-to-moderate income families, will not only be able to attend Worcester Polytechnic Institute, but also will be provided with a housing stipend so that they can live on campus as part of the residential student experience. This program, as well as other outreach programs, will help WPI as it attempts to attract a more diverse community of students who will each bring their own ideas to the table. As diversity increases at the school, innovative and sustainable practices will thrive as new students from different backgrounds bring their unique ideas and perspectives. While this program currently is only available for Worcester Public Schools students, WPI hopes to expand the program with an ultimate goal of granting 50 scholarships per year to students across the country. In addition to this program, current WPI freshmen and sophomores are eligible to apply to the Grand Challenges Scholar Program which focuses on providing engineers with the tools to positively impact the world and its inhabitants with their work. This program, specifically focuses on preparing engineers to complete work in areas such as sustainability and healthcare.

CLOTHING DRIVES ON CAMPUS

Over the course of the year, multiple clothing drives were held on campus, encouraging students to donate their clothes rather than throw them away. This practice of donating old clothes is important to sustainability as it reduces the quantity of clothing placed in landfills and cuts down the demand for clothing production as items are reused. With the incorporation of plastic fibers into many fabrics, the reuse of clothing is especially helpful for the environment as plastics take a long time to break down in landfills and are a major cause of pollution in oceans. During the week of April 1st, a spring clothing drive was held at The Fountain and the Campus Center. This clothing drive, organized and run by the Swimming & Diving Team, Alpha Phi Omega, and the Arnold Air Society, collected clothing and donated it to the local Goodwill. Before heading home for the summer, two Faraday Hall resident advisors organized a clothing drive on the main floor of the dorm for students to drop off unwanted clothing before going home for the summer. During the drive, Faraday Hall residents were allowed to take any clothing items and the remaining clothes were sorted, packed, and delivered to Abby's House, Safe Homes, and Veterans, Inc. When asked about what motivated them to hold the clothing drive, they noted that "as students pack up, they… find clothes they [aren't] wearing anymore… [and] a clothing drive would be a good way for the residents to get rid of their clothing while also being good for the community."

SUSTAINABLE AVIATION



Have you ever considered designing your own vehicle? Before Jeremy Trilling began as a freshman in the fall of 2018, he did just that. Instead of coming to WPI immediately after graduating from high school, Trilling, who has a special interest in electric transportation took a gap year during which he worked with Joby Aviation and met with Google co-founder Larry Page, to discuss both his past and future electric vehicle plans and designs. During the past year he also worked with Kitty Hawk, a company with interest in the field of sustainable aviation. Since starting as a student at WPI as a member of the class of 2022, Jeremy continued to focus his efforts on sustainable aviation and has recently begun working on a project to add electric propulsion to a hot air balloon, which he noted will help him "get a better grasp on large-scale dirigible lighter-than-air motion to further inform the design of a solar electric personal airship." By transferring to electric transportation, rather than fuel transportation, we would be able to conserve energy, allowing us to live more sustainably, as electricity can be generated in many renewable ways, such as through solar power. Trilling noted that he is "thrilled to continue developing and testing [various] subsystems… [and] working towards the vision of sustainable aviation while at WPI" and hopes to eventually "create high altitude tiny houses using these developments."



TOUCH TOMORROW

On June 8th, WPI hosted Touch Tomorrow, a festival of science, technology, and robotics. The WPI Office of Sustainability, along with the Department of Civil & Environmental Engineering, hosted three activities at this festival exploring topics within the fields of civil, environmental, and architectural engineering.

BUILDING TOMORROW

In this fun and interactive exploration of civil, environmental, and architectural engineering, individuals learned about how WPI students designed and built a zero-net-energy house for the international Solar Decathlon. Participants were able to see how tall buildings and other structures react to earthquakes by building and testing their own model bridges and space frames on shake tables. Other exhibits included an augmented-reality sandbox showing land elevations and 3D printers in action.

SUSTAINABILITY IN ACTION

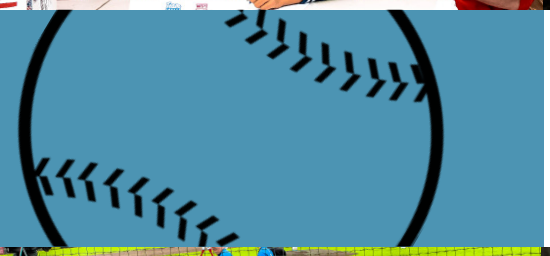
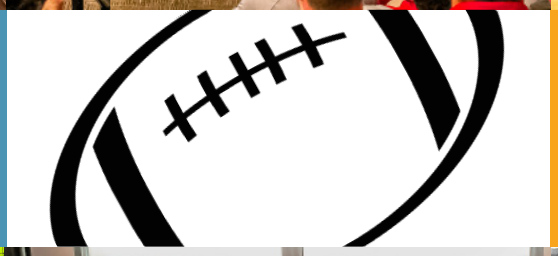
In this exhibit, individuals learned about we can reduce our energy usage and our impact on our valuable water resources. A demonstration of groundwater and storm water systems and impacts was given by members of the sustainability office and representatives of the Massachusetts Department of Environmental Protection Think Blue Campaign. Participants were also given an opportunity to power light bulbs using bicycle pedals to see the difference in energy requirements of incandescent and LED light bulbs. Individuals interested in Sustainability at WPI were also provided with information on taking a self-guided sustainability tour of campus.

MAKE A SPLASH!

In a water-based activity, participants investigated the topic of buoyancy by building a boat from LEGOs and discovering what makes it float or sink. In a gravity-defying feat, individuals saw how adding water to soil creates capillary attraction that can hold the soil together and give it strength.

WPI ATHLETIC TEAMS PARTNER WITH TEAM IMPACT

Did you ever dream of becoming a varsity college athlete when you were young? Did you ever imagine being drafted onto a professional athletic team? This year, three of WPI's athletic teams partnered with Team IMPACT, to make this dream a reality for three youth with serious and chronic illnesses. This program encourages sustainability in social justice as it strives to bring equal opportunity to all, by giving chronically ill children the chance to join a varsity college sports team. This past year, the football team, baseball, and basketball teams all "drafted" a child onto their respective teams to give them the opportunity to form a special, lifelong bond. Athletes, coaches, and athletic staff are extremely impacted by this program and, in many ways, these young children teach them even more valuable lessons than they can teach the children. Mike Callahan, the head baseball coach for WPI, noted that "Team IMPACT has been a great experience" and the child partnered with the baseball team "is an outstanding young man and has brought a lot of energy and enthusiasm" to the program. This connection to the community and the display of strength of these youth as they battle their respective illnesses can teach WPI students a valuable lesson in appreciating the blessings they have received in their lives, fostering the development of a more mindful outlook. Mindfulness can help students better recognize ways in which they can act to be more sustainable, making individuals more aware of their environment and encouraging them to evaluate their choices and actions to improve wellness and build better relationships.




SOLAR DECATHLON AFRICA

Last September, a group of WPI students and faculty participated in the Solar Decathlon Africa as part of Team OCULUS, a collaboration between WPI, L'École Nationale Supérieure d'Arts et Métiers and L'Ecole National Supérieure d'Informatique et d'Analyse de Systèmes in Morocco, and the African University of Science and Technology in Nigeria. This competition, which previously featured a WPI team in the 2013 China competition, challenges participants to work in multidisciplinary teams to build and operate a dwelling with a net-zero energy consumption. The team, which has been working on this project for almost a year both on-campus and in Morocco, has focused their design process on architecture, engineering, innovation, renewable energy, and social consciousness.

During this time, the team of students and faculty received input from select interactive qualifying project teams working at the Morocco Project Center. The building designed for the competition included a natural cooling system, a water collection and treatment system, and solar energy. The design incorporated a geodome design to mimic the popularity of open spaces, such as the courtyards in Moroccan architecture. An oculus, a round opening or window, from which the team takes its name, was also featured in the design to help maximize the heat efficiency of the structure. Team OCULUS used materials native to Morocco through collaboration with local artisans. WPI's work with project centers in Africa, such as in Morocco, allowed the team to better understand the resources offered by the area, as well as their local needs, allowing them to make more informed decisions and plans for their design. Team OCULUS placed 10th in the competition.

> *"The work is very hard but super fun when you actually see the house taking shape... [and] the OCULUS team working as one. -MQP Student"*



FINAL THOUGHTS

In the years since the release of the WPI Sustainability Plan, the campus has begun to see decreases in resource consumption and increases in the presence of sustainability related courses, events, and projects carried out on campus. While we would love to highlight all that has happened in reference to sustainability, this report is only able to give a glimpse into the progress that was made and the initiatives that were carried out during the 2019 fiscal year. With the publication of the next Sustainability Plan slated for 2020, we can look forward to seeing how the campus can become even more sustainable in the years to come. Each and every one of us have an impact on the environment around us and can make a positive impact on our environment, the community, and the world.

ACKNOWLEDGMENTS

Over the course of the year, students, faculty, and staff across campus participate in sustainability initiatives. These individuals have helped WPI move forward to become a more sustainable campus. This sustainability report was crafted with the input and help of countless students, faculty, and staff, some of whom are listed below.

OPERATIONS DATA

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Joe Kraskouskas

SUSTAINABILITY EVENTS AND NEWS

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Faria Kader
Sadie Dominguez
Kenza El Korchi
Michael Callahan
Mark Therrien
Charles Eggen
Jeremy Trilling
Mihail Bocka
Lori Ostapowicz-Critz
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Steve McCauley
Leslie Dodson

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Virginia Adams
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Faria Kader

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Linnea Paton
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Stephanie Salerno

THE SUSTAINABILITY TEAM

Special thanks go to Paul Mathisen, Director of Sustainability, and Liz Tomaszewski, Associate Director of Sustainability. Both have spent countless hours helping make this report possible and have provided valuable insight throughout the creation of this document.

MEET THE OFFICE OF SUSTAINABILITY TEAM

DIRECTOR OF SUSTAINABILITY

Paul Mathisen

Professor Mathisen joined the Office of Sustainability as Director in 2018, and he continues to teach and conduct research in the areas of water resources and environmental engineering. He enjoys challenging himself to learn new ideas and concepts, which he can then apply to solve problems that can make a difference for other people. WPI's curriculum and projects program provide the perfect environment for fostering these opportunities. Paul looks forward to working with WPI students, faculty, and staff to further sustainability initiatives across the curriculum and in the WPI, Worcester, and global communities.

ASSOCIATE DIRECTOR OF SUSTAINABILITY

Liz Tomaszewski

Liz Tomaszewski is also Facilities Systems Manager and Campus Ombudsman. She is a member of the AASHE (Association for Advancement of Sustainability in Higher Education) Advisory Council and serves as an AASHE mentor. Liz enjoys advising the WPI Green Team and looks forward to advancing sustainability initiatives, particularly in the areas of operations and community engagement.

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Ema Mejulic
Chemical Engineering and Environmental and Sustainability Studies, Class of 2020

Sarah O'Neil
2018 Report Author, Mechanical Engineering, Class of 2020

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Robotics and Aerospace Engineering, Class of 2020

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