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What is Sustainability?



According to the Environmental Protection Agency, "To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations." This definition encompasses the three aspects of environmental stewardship, social justice, and economic security for all people. WPI strives to implement these principles by operating the campus in a sustainable manner, by incorporating the principles of sustainability throughout our academic programs, by carrying out research that advances theory and practice in this critical area, and by positively impacting our communities.

President's Letter

This past year has seen several important accomplishments in advancing sustainability at WPI. Our theme of the WPI Strategic Plan, Elevate Impact, continues to drive our sustainability efforts on campus.

Perhaps the most noteworthy achievement of the past year is receipt of the Gold STARS (Sustainability Tracking Assessment and Rating System) ranking awarded by the Association for the Advancement of Sustainability in Higher Education. This ranking places WPI among an elite group of schools that define the standard in sustainability practices. It also provides valuable external recognition for our work.

In the past year we accomplished two major goals of our Sustainability Plan. First, we completed a Greenhouse Gas Reducation Plan for the campus. This plan calls for a 20% reduction in Scope 1 and Scope 2 emissions by 2025, using 2014 as a benchmark year. This responsible action will help to minimize WPI's impact on climate change. Second, a Green Revolving Fund was established. This fund provides major financing for projects that will increase efficiency and reduce waste on campus, and whose savings over time will sustain the fund. Projects financed by this fund will play a major role in implementing our Greenhouse Gas Reduction Plan.



Sustainability at WPI extends far beyond campus operations. It is a prominent theme in our academic programs and research. This year we saw the launch of a new Sustainability Engineering Minor. This option will enhance our students' understanding of environmental and social sustainability as they move forward as professionals in their fields. Student projects continue to produce creative perspectives on sustainability problems, such as means for harvesting hydrokinetic river current power, and enhancing biodegradability in polymers. Our faculty research, notably including the oil spill cleanup technology of Professor Ali Rangwala that has received wide recognition, has major implications for decreasing pollution and providing clean energy.

Back on campus, this past year has seen energy efficiency upgrades on three additional campus buildings (Morgan Hall, Alden Hall, and Atwater Kent Labs), expansion of recycling to the student rooms in Daniels Hall, and adoption of guidelines for integrating sustainability principles in our purchasing decisions. All of these activities are guided by the Sustainability Advisory Committee with staff, faculty, student, and alumni membership.

These accomplishments have substantial, measurable impacts on campus, but far more important are the impacts that our graduates will have throughout their careers and that our faculty are having through their research results. It has been a very good year for sustainability!

Soli

Executive Summary FY17 Implementing the WPI Sustainability Plan

"...a bold and comprehensive strategy to advance the three broad goals of sustainability: ecological stewardship, social justice, and economic security."

Accomplishments against the plan's four goals

Operations

The operation of WPI's campus and facilities will demonstrate that the principles of sustainability guide our actions as well as our academic and research programs.

- Greenhouse Gas Reduction Plan
- Green Revolving Fund
- Green Purchasing Policy
- 5% decrease in electricity consumption
- 9% decrease in water consumption
- 3.6% decrease in campus waste
- 9.5% decrease in GHG emissions since FY14

Academics

WPI's graduates will leave campus with the understanding and abilities to develop sustainable solutions to the world's problems. All WPI students, undergraduate and graduate, will have the opportunity to incorporate and critically evaluate significant aspects of sustainability in their education.

- New minor: Sustainability Engineering
- 131 sustainability related courses offered
- 9th Annual Sustainability Project Competition showcases 20 projects
- Sustainability identified as unifying theme across project centers

Research & Scholarship

Through our research and scholarly activities WPI will make significant contributions to the technologies, the policies, and the attitudes that will help assure a sustainable world.

- WPI received over \$2.5M in new research grants across several areas of sustainability
- WPI hosts 1st New England Energy Research Forum
- From E-Waste to Gold Dust
- A Rare Earth Solution
- From Red Mud to Resource
- New Technology for Oil Spill Cleanup

Community Engagement

WPI's students, faculty, and staff will be actively engaged in promoting a culture of sustainability to enhance the current and future welfare of our communities: on campus, in Worcester, for our nation, and globally.

- 34,091 hours of community service
- \$149,636 donated to charities
- 231 carabiners sold for Green Container Program
- 2 sustainability sessions added to New Student Orientation
- 2 sustainability sessions added for WPI Employee Orientation

Facts and Features



AASHE STARS Gold

This rigorous reporting framework measures sustainability performances of universities. WPI improved its past Silver rating to Gold having made strides in energy efficiency, academic programs, and sustainability research.



The Princeton Review's Green Schools 2016

The Princeton Review's recognition was given to WPI for demonstrating a strong commitment to sustainability in academic offerings, campus operations, and student activities.



Mass ECO Pinnacle Award

MassDOT recognized WPI for its exemplary contributions made towards supporting community members who use green and sustainable transportation. Contributions include Gompei's Gears, 3 dual EV charging stations, shuttle services, and Zipcars.



The Sierra Club's 2016 Cool Schools

Sierra Club, the nation's leading grass roots environmental group annually ranks colleges and universities based on sustainability programs and curriculum.

Campus Facts

- 95 acres of campus property
- 2.3 million sq ft of building space
- 6874 total FTE (full time equivalent): 5718 students, 423 faculty, and 733 staff
- student population represents 72 countries and 48 states

LEED Certified buildings

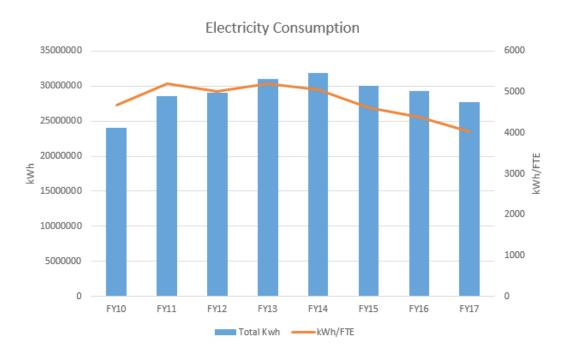
- Bartlett Center, Certified
- Faraday Hall, Silver
- · East Hall, Gold
- Recreation Center, Gold
- Foisie Innovation Studio, anticipated Gold, under construction



Operations

The operation of WPI's campus and facilities will demonstrate that the principles of sustainability guide our actions as well as our academic and research programs. WPI's project and technology-based curriculum puts the university in a unique position to find innovative solutions to improve sustainability in its daily campus operations. Student generated innovations and the application of innovative energy technology will further illustrate our motto of Lehr and Kunst for the benefit of the WPI community.

Electricity





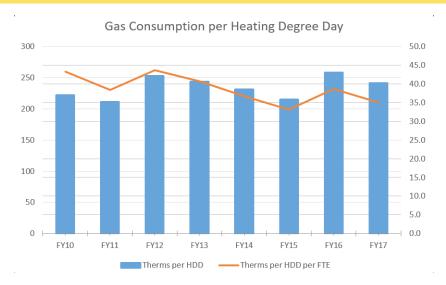
This fiscal year, the overall electricity consumption totaled 27,757,725 kWh.

The overall consumption of electricity during FY17 has decreased by 5%, or 1,548,425 kWh, since FY16.



This annual savings could power 143 average U.S. households for an entire year.

Natural Gas



*Gas consumption is affected by the number of heating degree days (HDD), which takes into account the temperatures and days which heating would have been required.

The overall gas consumption totalled 1,569,542 therms this fiscal year.

The overall consumption of gas has increased by 45,123 therms since FY16, but when normalized by heating degree days, there has been a 6% decrease since last fiscal year and a 4.7% increase since FY14.

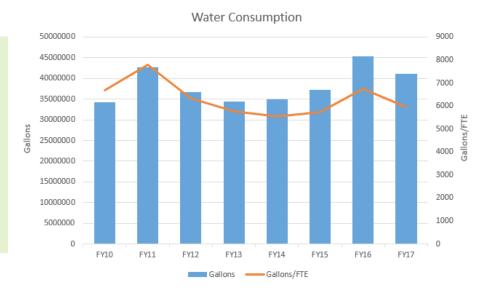


Water

The overall water consumption totaled 41,055,476 gallons this fiscal year.

The overall consumption of water decreased by 9%, or 4,195,280 gallons since FY16.

This annual savings is equivalent to filling 174,803 average sized bathtubs.



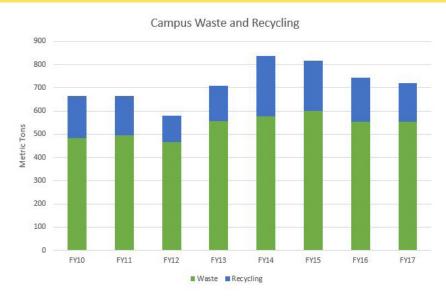


The 43 water bottle filling stations that are in our academic and residential buildings accounted for the consumption of nearly 140,000 gallons of water, while avoiding the use of nearly 1.1 million disposable water bottles.

The use of the rainwater collection cisterns buried underneath the Quadrangle helped to decrease water consumption used for landscaping irrigation.



Waste & Recycling



Thanks to the 43 water bottle filling stations, 1,080,862 plastic water bottles were diverted from landfills. The Green Team's E-waste Drive also collected and properly disposed of 9,928 pounds of e-waste.

The overall campus waste and recycling totalled 718.83 metric tons. This year's recycling rate is 22.9%, not including food diversion. The overall total has decreased by 3.4%.

This fiscal year, 58 metric tons of food waste* was diverted from the waste stream. The recycle rate including all the donated food waste is 28%.

In August, a pilot test was conducted in Daniels Hall to improve recycling performance. Waste and recycle bins were placed in every residential room along with larger collection bins in the common areas. The student response was in favor of expanding the bin program in other residential halls.

*This food waste is repurposed as animal feed at Holden Pig Farms

Retrofits

WPI's contractor in sustainable energy solutions, GreenerU, completed three major retrofitting projects this year. These buildings include Alden Hall, Atwater Kent, and Morgan Hall. The lighting in Gordon Library was upgraded to LED lighting fixtures.

Gordon Library

LED lighting

Atwater Kent

- HVAC upgrades and optimizations, occupancy sensors
- LED lighting, lighting control upgrades
- Weatherization improvements: Roof and wall air sealing, door weather stripping, casing sealing, and glazing sealing



- HVAC upgrades and optimizations, occupancy sensors
- LED lighting, lighting control upgrades

Morgan Hall

- HVAC upgrades and optimizations
- Kitchen hood controls to reduce exhaust and makeup fan speed during idle hours
- Steam shut-off valve installed
- LED Lighting, lighting control upgrades
- Weatherization and insulation upgrades: pipe insulation, door weather stripping, casing sealing



Building & Grounds



WPI follows sustainable and environmentally-friendly practices across campus. Four buildings are LEED Certified, and one more LEED Certified building is anticipated. Sustainable initiatives in groundskeeping include limited pesticide use, sourcing plantings from local nurseries, and composting plant waste material.

The Stage 4 drought conditions during the summer and fall of 2016 caused the university to take more stringent actions to conserve water in maintaining its landscaping. Rainwater was collected for irrigation purposes, and use of potable water for irrigation was stopped. Grasses were cut higher in order for roots to grow deeper and require less irrigation. And signage was placed to encourage people to stay off the grass.

Drought restrictions were finally lifted in May 2017.



Foisie Innovation Studio

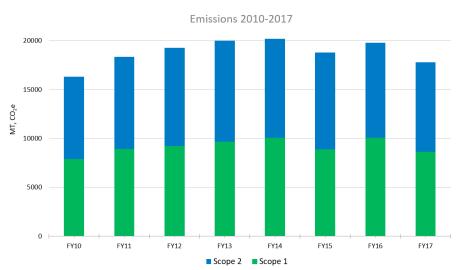
Since 8/31/16 our community has watched the construction of its newest academic and residential building, the Foisie Innovation Studio and Messenger Residence Hall. Foisie is on track to be completed in the summer of 2018, opening during the fall of 2018. The 78,000 sq. ft. building will have 2 floors of academic and maker spaces, while the residence hall will have 3 floors to house 140 students. Foisie is expected to be LEED Gold Certified, becoming the 5th LEED Certified building on campus. Some of the features include:

- Energy efficient HVAC climate control
- Water conservation appliances
- Occupany based scheduled lighting
- 100% LED lighting
- Low-e coatings on glass to reduce heat loss and gain
- Opaque wall assemblies to minimize thermal transfer
- Robotics lab, high tech classrooms, communal manufacturing, and maker spaces



Emissions

WPI monitors and reports the amount of greenhouse gas emissions produced and released into the atmosphere from our activities on campus (such as heating our buildings) and from generating the electricity that we use. The former type of emissions is referred to as "Scope 1" and the latter type as "Scope 2." We are committed to minimizing these emissions and have adopted a Greenhouse Gas Reduction Plan with the goal of achieving a 20% reduction in gross Scope 1 and Scope 2 emissions by FY2025, compared to our emissions in FY2014. These data include Scope 1 emissions due to the WPI-occupied units of Salisbury Estates.



Goal: 20% gross GHG reduction from FY14 to FY25. Achieved to date: 9.5% reduction.

Transportation

WPI has multiple options of alternative transportation to offer students, faculty, and staff. The main objective, supporting the sustainability plan, is to decrease the number of single occupancy vehicles coming to campus.



WPI has 3 dual electric vehicle charging stations, which are open to the Worcester community to use.

- 14.719 MWh was saved
- 6,182 kg of GHG emissions were avoided

Since its launch in April 2016, <u>Gompei's Gears</u> has been very successful. The Alumni Association has made a donation to provide two new bikes, totalling a fleet of 18 bikes.

1,434 active members

7,029 check outs since launch

4 locations: Quad, Salisbury, Gateway, Faraday

20% of WPI community are active users



MassRide's 'Try It Day' took place on June 20, 2017 and encouraged students, faculty, and staff to try a different method of transportation for their daily commute.



Dining Services

Chartwells, WPI's Dining Service, prioritizes the ability to give students healthy and sustainable meal options all over campus. Supporting the Sustainability Plan, WPI makes sustainable purchases by buying local produce, dairy, and seafood, minimizing transportation, which reduces GHG emissions. The following initiatives take place in the dining venues:



- Food Recovery Network provides leftover food to community members in need
- Project Clean Plate minimizes post-consumer food waste
- Meet your Local Vegan raises awareness of the benefits of a plant-based diet
- Trim Trax minimizes pre-consumer food waste

100% cage free eggs (excluding liquid eggs)

Sustainable Oceans Partnership with Monterey Bay Aquarium Seafood Watch for seafood purchases Socially and ecologically certified coffee

Poultry and pork products have reduced amounts of antibiotics following the Environmental Defense Fund standards Yogurt and milk products are free of artificial growth hormone rBGH

Pre- and post-consumer food waste is donated to Holden Pig Farms

Mindful & Conscious Eating

1 lb of beef

Traditional agriculture works harmoniously with the environment, but the trend of industrial agriculture and mass production of animal products has changed that relationship. The increase of meat production in recent decades has had serious implications for human health and the environment, affecting climate change.

A plant based diet is a healthy and sustainable alternative that also reduces your carbon footprint!



1 lb of pork

How much water?

Did you know how many gallons of water it takes to produce one pound of these foods?

Academics

WPI's commitment to sustainability is evident throughout its academic programs. Just as WPI promotes the idea of theory and practice, sustainability starts with awareness and education in the classrooms to be later applied on campus, in the real world, and globally.



Majors: Environmental and Sustainability Studies (ESS) and Environmental Engineering (EVE)

Minor: Sustainability Engineering
New minor approved in 2016
Two graduates and two enrolled students

131 sustainability related courses offered

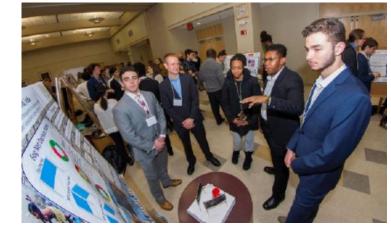


Great Problems Seminar

GPS is an opportunity for first year students to gain experience in projects that solve real world problems. There is a large focus on sustainability throughout the courses, and this 2016-2017 academic year marked the 10 year anniversary of the start of the program!

"GPS has made me feel like I could actually make a difference in the world by approaching a theoretical problem and applying it to the real world. It's opened me up to future opportunities focused on sustainability."

-Zach Huaman, *River of Mercury*



Highlighted projects:

- Providing Potable Water to Peruvian Informal Settlements by Julien Ataya, Gregory Kashmanian, Jeremy Koen, Gavin Sabol, Joseph Yuen
- *River of Mercury: Solutions for Tomorrow* by Adam Collins, Zach Huaman, MaryLouise Ross, Braden St. Jacques
- Perish to Profit: Processing Tomatoes to Generate Income Stream for Paraguayan Food Bank by Michael DeFrancesco, Sinead Flanagan, Olivia Gibbs, Emily Schneider

GPS courses include:

- The World's Water
- Food Sustainability
- Recover, Reuse, and Recycle
- Heal the World
- Biosphere, Atmosphere, Human Fears

Project Centers & Sustainability

WPI integrates its dedication to project learning and sustainability with all its global project centers. The IQP and MQP Project Centers feature myriad sustainability related project work, while solving real world problems.

<u>Stakeholder Study: Resource</u> <u>Management of Wairarapa Moana</u>

Submitted by Natalie Diltz, Jena Mazzucco, Austin Scott, Jeffrey Sirocki Advised by Robert Kinicki (CS) and Bethel L. Eddy (HU)

> New Zealand Project Center 2016 President's IQP Award

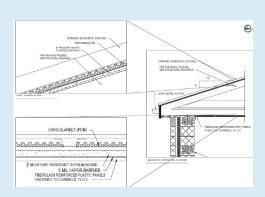
IQP



Sustainability at WPI: Food Waste Management

Submitted by Daniel Cammarata, Michael Cevallos, Camilia Dias, Augustine Kelty Advised by Suzanne LePage (CE) and Fred J. Looft (ECE)

Sustaining WPI Project Center



Green Design Alternatives for New Water Treatment Plants in Parker, Colorado (CE)

Submitted by Geneva Cabral, Miguel Velasquez, Robyn Quartararo, Ahsan A.N. Shaikh Advised by Leonard D. Albano (CE) and Suzanne LePage (CE)

WPI Stantec Project Center

MQP



Evaluation of a Solar Water
Heating System for Zero Energy Housing
(AREN)

Submitted by Ysabel, Ismael George-Richard Nowick, Leanna Sickles Advised by Steven Van Dessel (CE) and Ali Fallahi (CE)

Worcester Community Project Center

Sustainability Project Competition Envisioning Sustainable Futures

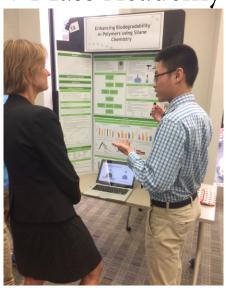
This year, the Office of Sustainability directed the 9th annual Sustainability Project Competition. This competition allows students to showcase and present their sustainability-themed projects. The winner of each of the following three categories was rewarded a \$200 prize. Featured speakers included Elizabeth Tomaszewski, Anna Gold, Bruce Bursten, John Orr, and Rob Krueger.

Judges

- Michael Carroll, Worcester Academy
- Laureen Elgert, WPI
- Peter Hansen, WPI
- Antje Harnisch, WPI
- Rebecca Hatchadorian, Arup
- Michael Kearns, Shawmut
- Christopher O'Keeffe, GWCF
- Pierre-Marie Nigay, WPI
- Andrew Palumbo, WPI
- Joseph Sarkis, WPI
- Kailash Viswanathan, GreenerU
- Ruby Woodside, Second Nature

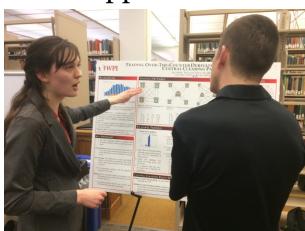
Thank you to all of our judges!

First Year + Mass Academy



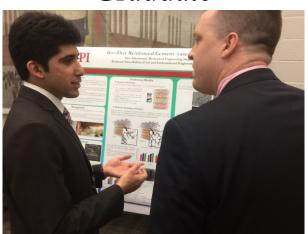
Enhancing Biodegradability in Polymers
Using Silane Chemistry
John Ta
Advisors: Christopher Lambert, Elyse
Favreau, Shloban Curran

Upperclass



Modeling Over-the-Counter
Derivative Trading with and without
Central Clearing Parties
Natalie Wellen
Advisor: Stephen Sturm

Graduate



Bio-fiber Reinforced Cement-Based Composites Sina Askarinejad Advisor: Nima Rahbar

Research & Scholarship

Research and scholarly activities at WPI make significant contributions to the technologies, the policies, and the attitudes that will help assure a more sustainable world. As WPI identifies research focus areas, it will be important that our existing strengths be leveraged to maximum benefit.

This year, WPI was awarded over \$2.5M in new research grants across several areas of sustainability. Sponsors include the National Science Foundation, U.S. Department of Agriculture, Department of Energy, NASA, The Commonwealth of Massachusetts, and more.

Oil Spill Cleanup Technology

Test burns at the Joint Maritime Test Facilities demonstrated the potential for the Flame Refluxer, a technology developed at WPI with funding from the Bureau of Safety and Environmental Enforcement, to efficiently burn oil spills while minimizing water and air pollution. Final observations show that the Refluxer promotes more complete combustion of oil and will certainly change the process of cleaning oil spills. The WPI principal investigator is Ali Rangwala.



"If we continue to lose [bee] diversity, we are going to lose diversity of wildlife, and eventually we are going to have an ecosystem collapse." -Professor Robert J. Gegear



Protect the Pollinators!

Robert J. Gegear, Assistant Professor of Biology and Biotechnology, has done extensive research focusing on protecting bees. His research has included developing a bee identification smartphone app called "bee-cology," which identifies bee-plant interactions. Additional research includes the evolution of flowers to attract birds versus bees, encouraging specialized pollinators.

Community Engagement

Community engagement that combines personal responsibility with civic engagement is critical to all three aspects of sustainability. WPI has the ability to connect with, involve, and impact our campus, the city of Worcester, the Commonwealth of Massachusetts, as well as national and global communities in powerful ways.

Sustainability on Campus

The Green Team



A student run organization dedicated to making WPI a more sustainable place and educating the WPI community about sustainability.



Recyclemania:

A nationwide competition that the Green Team promoted to improve recycling by raising awareness and distributing reusable water bottles.

E-Waste Drive:

An annual event that allows community members to safely dispose of large electronic waste. This year 9,928 pounds of e-waste was recycled.

Drive Electric:

WPI took part in National Drive Electric week, which brought electric and energy efficient vehicles to campus to be showcased and test driven. This year 5 test drive vehicles were brought on campus on 9/13/2016 and over 25 personal electric vehicles were displayed. This event was cosponored by Plug In America and National Grid.







Waste Audit:

An annual event where campus waste is sorted and surveyed, while waste and recycling practices are analyzed. The following buildings' waste was analyzed: Campus Center, Gordon Library, and Daniels Hall.

Lighting Fair:

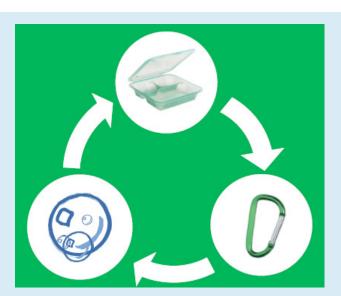
Co-sponsored by MassSAVE and National Grid, LED light bulbs are sold to students and staff at discounted rates to educate and encourage the use of efficient lighting options.

Salisbury Greenhouse

The WPI greenhouse, sitting atop the lower roof of Salisbury Labs, is an ideal education venue for reseach, course activities, and community outreach. Mike Bocka, the greenhouse manager, and Lisa Stoddard, ESS Assistant Teaching Professor, have collaborated with the Regional Environmental Council by propagating succulents, growing seedlings, and donating these to REC's YouthGrow to fundraise for their program.



To learn more about the greenhouse or if you would like a tour, contact Mike Bocka at mbocka@wpi.edu.



Reusable Container Program Keep it Green

This program is a simple way to reduce waste and be sustainable by allowing the use of reusable takeout containers rather than non-recycleable plastic containers. It is available for use in the Campus Center and the Goat's Head. Since its launch in 2016, 231 carabiners have been sold.

dinegreen@wpi.edu

6th Annual Energy Symposium "Upgrading the Grid with Renewables for a

"Upgrading the Grid with Renewables for a Sustainable Future"

WPI hosted the 6th Annual Energy Symposium in the fall to discuss the need for an electrical grid update to accommodate more renewable energy sources. Compelling presentations by experts from WPI, IEEE, and throughout the New England energy industry addressed the challenges associated with upgrading the electric power delivery system with renewable power generation. The keynote speaker was Wanda Reder, Chief Strategy Officer for S&C Electric Company in Chicago. She discussed the need to modernize the power grid, supported by a number of real-world examples of how power systems have improved in recent years.



Sustainability in our Community

Alumni Earth Day Clean Up

To celebrate Earth Day, over 160 students, faculty, staff, and alumni volunteered, totalling 480 service hours. Thanks to the partnership between WPI Alumni Association and WPI Student Activities Office, beautification projects were done in Institute Park, Elm Park, and Newton Hill. The City of Worcester Parks and Recreation Department recognized WPI for its commitment to community service by dedicating a plaque to WPI in Institute Park.





National Grid Sustainability Hub Photovoltaic Awning

The new photovoltaic awning started as an IQP by Jacqueline Campbell, Zilu Tian, and Sakiynah Howard, advised by John Orr and Patrick Cody. It currently provides solar energy and shade/heat control to National Grid's Sustainability Hub on Main Street in Worcester. This is a visual and physical representation of Worcester's efforts towards sustainability.

Bioshelter at Worcester Common Ground

In the Piedmont Street area, a bioshelter was designed and scheduled to be built by WPI students. The project began as an IQP project in 2015 by John Breen, Tom Fay, Peerapat Luxsuwong, Mark Overdevest, and Yunjae Sohn, advised by Professors Robert Hersh, Derren Robsbach, and Lisa Stoddard. It now serves to promote a sustainable and urban food production system and community development.





Worcester Water: Our Most Valuable Resource

On January 12, 2017, WPI sponsored a seminar by the Worcester Department of Public Works and Parks, where city officials explained the process and status of drinking water. This information is particularly important and relevant as Worcester suffered through drought conditions this year.

What's Next?

- Implement <u>Greenhouse Gas Reduction Plan</u>, strives for 20% reduction in Scope 1 and Scope 2 GHG emissions by FY25
- Continue efforts to reach 25% decrease of utilities consumption by FY18
- Continue efforts to reduce campus waste and increase the recycling rate
- Conduct 5-year review of <u>Sustainability Plan</u>
- Develop a structure to manage Green Revolving Fund
- Continue implementation of <u>Sustainability Literacy Assessment</u>

Acknowledgements

This report would not have been possible without the support and help of John Orr, Director of Sustainability, and Liz Tomaszewski, Associate Director of Sustainability. Additionally, the Facilities Office has been an incredible wealth of knowledge and this report would be nothing without them. And finally, thank you to every student, faculty, and staff member who gave their time and energy to contribute to this report. Thank you!

Message from the Author

The opportunity to write the Sustainability Report has truly allowed me to immerse myself into the WPI community by connecting with students, faculty, and staff. I was able to let my voice be heard in a place where my impact hits hardest, on my campus, my home. I am incredibly grateful for all the experiences and interactions I've gained from this opportunity and I can confidently say that my passion and commitment towards sustainability have only been strengthened. Thank you for all those who have encouraged and motivated me to seize every moment along with supporting me with my personal and professional goals. It is a constant reminder of what makes WPI so amazing.

-Ashley Choi, Chemical Engineering 2019

