School of Engineering & Applied Science
FY 2020 Sustainability Report

Penn Engineering

Academics
Goal: Expand opportunities for teaching, learning, and researching sustainability among students, staff and faculty.

- Darsham Bhosale and Ryan Goethals, along with teammates of John Hopkin's University, have been awarded 1st Place for the Y-Prize 2020 for their proposal of Metal Light. A sustainable lighting solution, the technology uses scrap metal to power affordable lights. They are designed with flexibility to be used in homes without electricity.
- James Pikul, assistant professor of Mechanical Engineering and Applied Mechanics, developed the MAS (Metal Air Scavenger). This technology, which can extract energy from metal surfaces by means of an oxidation process, was an important component in the development of the 1st and 2nd Place Y-Prize 2020 designs. This power source has about 10 times more energy than a solar panel and 13 times more energy than a lithium-ion battery.
- Zachary Whitlock, a Materials Science and Engineering student, and Maia Yoshida, a researcher in Bioengineering, are 2 of 7 winners of the 2020 Thouron Award to persue studies in the United Kingdom.
  - Whitlock recently worked on industrial materials and environmental impact on the Fossil Fuels, the Building Industry, and Human Health project.
  - At Penn, Yoshida is the president of Global Brigades where she led fundraising initiatives to aid in development of sustainable projects in Honduras.
- A study by Igor Bargatin, Term Assistant Professor in Mechanical Engineering and Applied Mechanics, and John Cortes, a then graduate student in his lab, with contributions by Christopher Stanczak, Mohsen Azadi, Maanav Narula, Samuel M. Nicaise and Howard Hu, proposes alternatives to extraterrestrial flight. "Nanocardboard" flyers are tiny aircrafts with a comparable weight to a fruit fly and no moving parts. The structure is similar to cardboard. One surface can be powered by the heat of light which circulates air through corrugated channels and lifts the aircraft from the ground. This technology would allow NASA to launch a fleet of aircrafts in place of a singular, larger aircraft and control them with lasers, widening their net of collectable data.
- Two Penn Engineering studies contribute new methods of storing data in light waves. Liang Feng, assistant professor in Materials Science and Engineering & Electrical and Systems Engineering, led a study that exemplifies a microlaser that can be tuned to multiple distinct OAM modes. The second study, led by Ritesh Agarwal, professor in Materials Science and Engineering, demonstrates the method of a laser's OAM mode being measured by a chip-based detector. Combined, a tunable micro-transceiver and receiver embody the two essential components for systems with the potential to increase the bandwidth density of fiber optic networks.

Physical Environment
Goal: Create and maintain a sustainable campus by increasing green space, decreasing building energy consumption and increasing education and awareness of sustainable design.

- SEAS is perusing LEED Certifications on 3 new buildings – Tangen Hall, Data Science Building, and the Vagelos Laboratory for Energy, Science, and Technology Center.
- The new Data Science Building will likely be a mass timber structure. Mass timber reduces the carbon impact of a building and would continue to sequester carbon.
- "The best form of recycling is resuse". Approximately **4.4 tons of furniture** was reused within the complex instead of trashed or sent to a recycling facility.
- **15.53 tons of small renovation trash and furniture** was recycled through Revolution Recovery.
- 2 new water bottle filling stations have been installed at SEAS, there are now a total of 14 stations. These units have counted over **303,716** diverted water bottles this year.
- All carpet installed in SEAS has a minimum of 45% recycled content, is NSF 140 and CRI Green Label Plus.

Utilities and Operations
Targets: 40% total carbon reduction in buildings by 2024 in comparison to the FY09 baseline.

- SEAS Operations provides Smart Strips that reduce energy usage by synchronizing and turning off devices.
- SEAS sctively maintains HVAC equipment in buildings to maximize performance and reduce maintenance.
- LRSM's HVAC Century Bond project will replace the aging HVAC equipment with high efficiency equipment. Old fume hoods will be either replaced or changed from constant-volume to variable-air-volume systems to drastically reduce energy consumption.
- This year, the engineering complex saw a 3.7% decrease in energy usage. the majority of this savings occured during the 4th quarter.

Waste Minimization & Recycling
Target: Improve Penn's environmental performance by minimizing solid waste through education, purchasing, infrastructure, and proper disposal. Increase Penn's overall waste diversion and minimize waste stent to landfill.

- SEAS Recycling Center recycled **6.6 tons** of electronics, lightbulbs, Styrofoam, cardboard and more through EForce.
- SEAS is promoting deskside recycling through Green Office Certifications and renovation projects.
- The CIS department has replaced disposable cups in their kitchens with permanent, ceramic mugs. 150 ceramic mugs will divert approximately **12,000** disposable cups a year.

Communications, Outreach and Engagement
Goal: Develop communications to inform the Penn community and key external stakeholders about the goals of the Climate Action Plan. Build a culture of sustainability that informs all constituents of University life.

- The SEAS Green Team continues to promote sustainability events and information for the SEAS Recycling Center, Penn recycling/waste streams, energy reduction strategies and culture change. This year the Green Team hosted an E-waste Collection Drive, where anything with an electrical plug and more could be recycled.
- The SEAS furniture reuse list serv continues to save lightly used furniture from recycling centers and landfills. **36 staff members** are enrolled and actively use the resource before purchasing new or refurbished furniture.
- **8 Green Office Certifications** have been completed in SEAS, levels 2-4. Four offices are up for re-certification.
- **3 Green Lab Certifications** are registered in SEAS.
- The SEAS Green Team has pivoted to hosting online talks focusing on sustainable education. Talks included Climate Change in Africa: Challenges and Solutions in a Globalized World, Advancing Technology to Ensure Food, Energy, and Water Security, Carbon Offsets Air Travel, Embodied Carbon and the Built Environment: A Focus on Mass Timer, A Case for Carbon Removal From Air.