University of Pittsburgh | Mascaro Center for Sustainable Innovation

2025-26
Research Seed Grants and John C. Mascaro Faculty Awards in Sustainability

Research Seed Grant Awards

Electrical Engineering Skills to Support Electrification Innovation: An Interdisciplinary Approach

Shanti Gamper-Rabindran, GSPIA, Law, Economics
Morgan Frank, School of Computing and Information
Brandon Grainger, Electrical and Computer Engineering

Achieving net zero emissions by 2050 to address the climate crisis requires large-scale electrification, i.e., shifting to renewable energy to power the economy (NASEM 2021). The US Congress allocated ground-breaking amounts of funding into clean energy research and development (R&D) through the CHIPS and Science Act (Reynolds 2023, Taylor 2024), both to secure US global competitiveness in green energy technologies and to reduce the cost of electrification. The major barrier to US R&D in electrification is the significant shortage of engineers to support innovation in clean energy (National Science Board 2024, NASEM 2024).

Using LoRa Technology for Long-Term Real-Time Monitoring of Ecological Systems

Cori Richards-Zawacki, Biological Sciences
Justin Kitzes, Biological Science
Daniel Mosse, Computer Science

This proposal brings together students, postdocs, and PIs from three labs (spanning two Schools: Dietrich School of Arts and Sciences and the School of Computing and Information) at Pitt, each with complementary expertise. Our shared goal is to develop and deploy real time, low cost, long range, low power ecological sensors to measure and transmit information about environmental conditions and species activity in the field. We will develop and pilot sensors that use LoRa wireless communication technology for the specific use case of detecting breeding activity of amphibians at Pitt's field station, the Pymatuning Laboratory of Ecology (PLE).

Fabrication of Low-Cost High-Capacity Ceramic Filters via Binder Jet Additive Manufacturing from Clay Feedstock and Sustainable Binders

Markus Chmielus, Mechanical Engineering and Materials Science
Ian Nettleship, Mechanical Engineering and Materials Science

Waterborne diarrheal diseases cause significant malnutrition and mortality among children under five, leading to around 443,000 deaths annually. These diseases can be prevented by removing pathogens from drinking water. Marginalized communities urgently need effective point-of-use water treatment technologies. Low-cost ceramic water filters made from local clays effectively reduce bacterial concentration by over 99% and decrease disease burden by 40-65%. A challenge with these filters is their low flow rate, providing only 1-3 liters per hour. Although sufficient for household use, higher throughput filters are needed for rural health clinics, community centers, and larger families to name a few, especially in areas susceptible to cholera outbreaks. Therefore, developing sustainable, high-capacity yet low-cost ceramic filters with improved flow rates and enhanced hydraulic conductivity is crucial for communities lacking access to safe drinking water. Therefore, this project aims to use Binder Jet Printing to create low-cost, sustainable clay-based water filters with bio or geo-polymer binders. Formulation and optimization of these natural polymer binders and intricate geometries maximize surface area and contribute to enhance bacteria elimination and water flow rate. These filters will result in cost-effective, safe, sustainable, highly permeable, complex structures ensuring rapid filtration and effective bacterial removal for safe drinking water.

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Guided Regional Anesthesia Education – A Collaboration Between the University of Pittsburgh and Lao Friends Nurse Anesthesia Hospital for Children

Richard Henker, School of Nursing

Healthcare systems in resource-limited settings like Laos face challenges in providing safe, cost-effective, and sustainable anesthesia care. The reliance on volatile anesthetic gases significantly contributes to greenhouse gas emissions, exacerbating environmental concerns. This project promotes the adoption of regional anesthesia as a sustainable alternative, reducing environmental impact, lowering costs, and improving patient safety. Through hands-on workshops and clinical rotations at Lao Friends Hospital for Children, anesthesiology residents will develop ultrasound-guided regional anesthesia skills. By integrating sustainability into anesthesia education and practice, this initiative aligns with global efforts to enhance healthcare access while minimizing its ecological footprint

Misson Driven Innovation Lab to Engage Sustainability Challenges for Public Impact

Liz Caruso, Swanson School of Engineering, Innovation & Entrepreneurship

Mission-Driven Innovation Lab integrates Innovating for Public Impact (ENGR 2811/1811) with MCSI programming. The initiative applies interdisciplinary collaboration on real-world problems to enhance sustainability education and student professional development. Through experiential learning, students engage community partners with sustainability problems to practice teamwork, lean innovation principles, project management, and public speaking. This effort is easily sustained because it leverages existing resources to create connections between programs. Growth will be driven by formal processes and partnerships, industry support, and student-driven solutions. We are equipping future change makers with the skills to tackle complex societal challenges in both public and private sectors.

Software Toolkit of Estimating and Optimizing Energy Sustainability for Quantum Computers Advancing Sustainability in a Low-Resource Setting

Junyu Liu, School of Computing and Information

This research aims to establish a practical quantum energy advantage over classical systems by developing Qenergy, a software for systematic energy estimation and optimization across quantum hardware. It explores areas where quantum computing can be exponentially more efficient in tasks like machine learning and optimization. Covering the full quantum stack-algorithms, data structures, and interfaces-Qenergy supports both near-term and fault-tolerant applications, maximizing energy sustainability. Aligned with the missions of the Pittsburgh Quantum Initiative (PQI) and Mascaro Center for Sustainable Innovation, this work has the potential to drive exponential energy savings in computing.

Sustainable Utilization of Waste Materials for Green Fuels and Bio-Chemicals

Cynthia Ofori-Boateng, Chemical Engineering, Pitt Johnstown

Pitt-Johnstown generates about 60 200 kg of organic waste materials weekly which are dumped at landfills posing environmental burdens. I am proposing to utilize waste materials like food waste, spent coffee grounds, waste cooking oil etc. from Pitt-Johnstown's cafeteria for green fuels and biochemicals in a sustainable way by incorporating the idea into a chemical engineering elective/research course. My aim is to push forward MCSI's mission of sustainability education and research across all Pitt campuses by implementing sustainability principles like the use of eco-friendly chemicals in CHE 0520 and CHE 1096 curricula to reduce and recycle waste for value-added bioproducts.