MIT News
ON CAMPUS AND AROUND THE WORLD

The Varanasi research group visits the MIT Central Utilities Plant cooling towers, where they will test their water-recapture technology with support from the new Campus Sustainability Incubator Fund.

Photo: Paul Wolff/MITOS

New fund makes MIT a living sustainability lab

MIT Office of Sustainability announces awards to multi-departmental projects that test management, design, and operations solutions on campus.

Frankie Schembri | Office of Sustainability
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The MIT Office of Sustainability (MITOS) has announced the recipients of the first-ever Campus Sustainability Incubator Fund, with $200,000 awarded between four multi-departmental projects, all of which use the MIT campus as a test bed for research in sustainable operations, management, and design.

The four project teams are lead by Kripa Varanasi of the Department of Mechanical Engineering, Randy Kirchain and Jeremy Gregory of the Concrete Sustainability Hub, Lisa Anderson of the Department of Chemical Engineering, and Danielle Dahan of the Center for Energy and Environmental Policy Research.

“The seed funds will enable researchers to explore the physical facility and social context in which they are working, living and learning,” says Julie Newman, MITOS director and convener of the fund’s Advisory Committee. Newman calls the MIT campus a “rich environment for creating and testing sustainability solutions” at both the individual and building level to ensure they work at a city and global scale.

The selection committee included members from the Department of Architecture, the

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- Randy Kirchain
- Jeremy Gregory
- Lisa Anderson
- Concrete Sustainability Hub
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Environmental Solutions Initiative, the Sandbox Innovation Fund Program, the Department of Mechanical Engineering, the Department of Materials Science and Engineering, and the MIT Sloan School of Management, among others. To be considered for funding, project teams needed to have student, faculty, and staff membership, a robust methodology for measuring outcomes, and a timeline for moving the needle on a measurable on-campus metric.

"We were looking for projects that take advantage of the interactions unique to MIT while making a measurable impact on how our campus runs day to day — those that foster collaborations between diverse stakeholders, including junior researchers, and bridge between MIT's academic and operational departments," Newman says.

Water recapture at MIT's power plant

Department of Mechanical Engineering Associate Professor Kripa Varanasi is receiving funding to test a water recapture device developed by his research group, installing it on the MIT Central Utilities Plant (CUP) cooling towers. Varanasi and his graduate students, Maher Damak and Karim Khalil, are collaborating with plant engineers Patrick Karalekas and Seth Kinderman and plant manager Jon Sepich at the CUP.

"Power plants consume a large portion of the water used on campus and around the world," says Varanasi. "Testing our device at the CUP provides us with an invaluable pilot opportunity to scale-up, debug, and de-risk the technology before launching the product to the broader power plant industry."

The Varanasi research group has developed a technology that uses electric fields to force escaping steam plumes from power plant towers into a device placed atop the cooling tower outlets. The device captures the water and reintroduces it back into the cooling cycle, reducing water losses for the plant.

The team will install their lab-scale prototype on the cooling towers of the CUP to test the device for efficiency and durability, and to optimize its performance. The researchers estimate that their device can save 15 million gallons of water per year, reducing MIT's operational costs for the CUP.

"The team at the CUP is excited to have this opportunity to work with the academic community and contribute to MIT's mission," plant manager Sepich says. "If we can help Professor Varanasi and his team be successful, then this will not only have a positive environmental and economic impact on the CUP's operation but on the power industry as a whole. We see the CUP as a valuable testing ground for energy and resource conservation measures, and we hope this is the first of many such endeavors."

Modeling the environmental impact of buildings at MIT

Two research scientists in the MIT Concrete Sustainability Hub, Jeremy Gregory and Randy Kirchain, are receiving funding to implement a quantitative approach to evaluating the life cycle economic and environmental impacts of proposed new buildings on campus.

While life cycle assessments are already conducted at MIT to calculate buildings'

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environmental impacts during the design phase, Gregory's research team has developed a new method that can be implemented earlier in building design and planning stages than current analyses. It can be used to quantify both embodied impacts (building materials and construction) and operational impacts (energy consumption), mitigating the environmental and economic impacts of new construction projects on campus.

"We are excited to have the opportunity to implement our research in MIT's building design process in order to improve our approach and reduce the life cycle environmental and economic footprint of MIT's campus," Gregory says.

The project team includes three members of the Department of Facilities: Director of Campus Construction Richard Amster, Director of Systems Performance and Turnover Wade Berner, and Sustainability Project Manager Randa Ghattas.

Evaluating the benefits of recycling laboratory gloves

The third recipient is Lisa Anderson, a research scientist in the Department of Chemical Engineering. Anderson will use her funding to investigate the net environmental benefit of recycling laboratory gloves and to explore the feasibility of expanding a pilot program launched by the department through MIT Green Labs last year.

During the six-month pilot program, participants collected more than 400 pounds of lab gloves from about 30 researchers in 10 labs. The team plans to study the feasibility of rolling out a larger glove recycling program at MIT, contingent on the results of a detailed analysis the team will conduct to compare the benefits of material recovery with the burden of the glove recycling process. If there is a net environmental benefit to glove recycling, Anderson hopes to help establish an Institute-wide program.

"Everyday when I walk into the lab, I ask myself: How do I balance research with sustainability?" Anderson says. "I think about all the resources that go into making scientific discoveries and pushing new technologies forward. Over half of a research grant can go towards overhead, such as paying for heating and cooling, that many researchers take for granted. I'm trying to bring sustainable practices into the research lab by repurposing a common consumable, uncontaminated lab gloves."

Anderson will collaborate with chemical engineering graduate students Thomas Carney and Kosi Aroh, Department of Facilities Recycling Manager Ruth Davis, faculty and researchers from the Departments of Materials Science and Engineering and Civil and Environmental Engineering, as well as several members of MIT's Environmental Health and Safety Office and Green Labs program.

Eliminating wasted energy with machine learning

Danielle Dahan, a graduate research assistant at the Center for Energy and Environmental Policy Research, is receiving funding to collaborate with Professor Christopher Knittel of MIT Sloan, Wade Berner of MIT Facilities, and undergraduate Manuel Mundo to investigate the effectiveness of the fault detection and diagnostic (FDD) software used by MIT and other

universities to prevent energy waste in HVAC systems.

For several years, MIT's FDD system has been collecting data on over 70 campus buildings, alerting staff when an energy-wasting fault is detected. Dahan will apply machine learning and data analysis techniques to this data in order to understand the actual energy savings associated with correcting different types of system faults. The project will aid MIT Facilities in determining which faults to prioritize and help inform a cost-benefit analysis of installing FDD systems in more campus buildings.

"FDD systems have the potential to detect problems in HVAC systems that go unnoticed for years, wasting significant amounts of energy," Dahan says. "This research allows us to quantify the impact of these systems and help inform policy and code requirements that promote the adoption of energy saving technologies."

Expanding the living laboratory

The fund was made possible through a gift from Malcom M. Strandberg, a software engineer and supporter of sustainable technology who is inspired by his late father, longtime MIT Physics Professor Malcom W.P. "Woody" Strandberg PhD '48. Strandberg has directed other parts of his gift to MIT's D-Lab, to the MIT Office of Engineering Outreach's STEM program, and to sustainability projects at the Priscilla King Gray Public Service Center.

Using the campus as a living laboratory to test sustainability solutions is one of the central tenets of MITOS. The winning projects also align with the recommendations of MIT's Sustainability Working Groups for on-campus sustainability priority areas: building design and construction, stormwater and land management, materials management, and green labs.

"Traditional laboratories are highly-controlled environments. The living laboratory, however, thrives on open systems, uncertainties, and diversity, but is still a place for robust science with detailed data collection and measurable outcomes," says Paul Wolff, the Living Lab project manager at MITOS. "The campus becomes a rich environment for learning and discovery under this framework, and we hope to enable more projects to take advantage of this."

The next round of applications for funding will open in 2018. For more updates and information please visit the Campus Sustainability Incubator Fund online.

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