

Caltech's Green Gateway



The Resnick Sustainability Center's design will reflect the Institute's innovative approach to education and research in environmental issues.

By Kimm Fesenmaier

In the fall of 2024, students and researchers across Caltech will have a new hub from which to investigate challenges in global sustainability. Gracing the western edge of campus, the building, which will be known as the Resnick Sustainability Center (RSC), will aim to inspire onlookers with a three-story-high undulating glass facade supported by a mass-timber frame and a slew of sustainable building features. But beyond these attributes, it will also serve as a defining component of a major sustainability effort on campus.

That endeavor, which touches everything from research and education to diversity and inclusivity, has been fueled by the \$750 million pledge from Lynda and Stewart Resnick, owners of The Wonderful Company, in 2019. Its goal: to focus and harness the Institute's many talents to tackle issues related to energy and the utilization of resources in a world experiencing rapid climate change.

"In certain ways, Caltech is conducting an experiment that really hasn't been done in sustainability," says Jonas Peters, director of the Resnick Sustainability Institute (RSI), which was originally established in 2009 with a gift from the Resnicks and a matching gift from the Gordon and Betty Moore Foundation. "We are building an institute that really tries to pull, essentially, all of the campus toward problems in sustainability. We need all hands on deck."

The Resnick building, designed by the Yazdani Studio of CannonDesign, will replace the now-demolished Clifford S. and Ruth A. Mead Memorial Undergraduate Chemistry Laboratory, home to Caltech's undergraduate chemistry labs for 40 years (see Endnotes, page 40). Unlike the stand-alone Mead, the new building will incorporate a breezeway through the structure that allows pedestrians to access the walkways beyond. In this way, it will serve as a gateway of sorts connecting the northern and southern parts of campus along Wilson Avenue.

True to the center's name and purpose, it will incorporate a variety of sustainable materials and features. The 79,500-square-foot project, which includes an underground level, is not only on track to earn LEED platinum certification, the highest level of the LEED (Leadership in Energy and Environmental Design) rating system, but, more importantly, is designed to open new figurative portals to sustainability in the realms of research, education, and societal impact.

Sustainability education

In addition to supporting research and discovery, the RSC will serve as an educational gateway. The undergraduate chemistry labs formerly housed in Mead Lab will all be relocated to the second floor of the Resnick building. Since all Caltech first-year students must take an introductory chemistry lab course, every Techer will have at least one course in the new building. They will be introduced to the concept of sustainability through a reimagined curriculum that grounds their education in an understanding of society's environmental challenges and instills an imperative to search for solutions across disciplines.

"We went beyond just thinking about the really important task of moving the undergraduate chemistry labs and thought about how to bring the ethos of sustainability into play in this new space and make this whole floor a real resource for campus," says geochemist Jess Adkins.

Since November 2019, he and chemist Theo Agapie (PhD '07) have led an education committee charged with exploring paths to better implement sustainability education across campus. The committee recommended that the RSC building include flexible lab and storage areas that could meet the needs of sustainability-related courses from other divisions, and also provide state-of-the-art laboratory space for chemistry training.

One of the three teaching lab spaces on the second floor is being designed as a flexible research and learning space that could be used for courses in different divisions. It will include storage space not only for chemical equipment but also for instrumentation and materials for labs in biology, geology, and applied engineering. This will enable courses to cross the traditional boundaries of the disciplines as well. For instance, a chemistry class using this space might go out into the field, perhaps to one of the ponds around campus or up into the San Gabriel Mountains, to collect soil samples and bring them back to the lab to analyze in a variety of ways throughout the term, including using the microscopes common in biology and geology classes.

“That’s very different than anything that’s currently in the undergraduate chemistry curriculum,” Adkins says. “The building will now be equipped for this interdisciplinary flavor of lab space.”

The education committee also conducted a review of courses offered on campus and the locations in which they are taught. The review revealed a strong need for more spaces that can accommodate between 40 and 100 students and can be used as active-learning, or “flipped,” classrooms. In such spaces, unlike traditional lecture halls, students sit around tables, allowing instructors to easily switch between lectures and more interactive, collaborative activities. STEM education research has established that such classrooms provide students with better learning experiences.

As a result, the Resnick building will also include two 48-person, active-learning classrooms. Designed in consultation with experts from Caltech’s Center for Teaching, Learning, and Outreach, these contiguous rooms will be connected by a retractable wall that can be pushed open to make one larger space.

“It was quite apparent that as we move forward with sustainability education, there will be a strong need for classrooms like these that promote active learning,” Agapie says.

Changes are also coming to the curricula that will be taught within those innovative classrooms. The education committee recommended that, rather than develop a single new core course that focused on sustainability, existing courses should be infused with sustainability concepts. This could be done by working in more sustainability-related examples, problem-set questions, field trips, and exercises.

For example, when core instructors introduce Beer’s law, which states that the absorbance of a solution, including a gaseous solution, is directly proportional to its concentration, they might explain the basics of the greenhouse effect. A discussion of predator–prey relationships could be employed to illustrate systems thinking, which seeks to



Above: Architectural rendering of the Resnick Sustainability Center showing the breezeway.

understand individual behavior by looking for broader, complex structures and relationships, such as ecosystems. In tandem, faculty members are creating new sustainability-related courses, such as a course called Climate Change Impacts, Mitigation, and Adaptation, which was offered in the second term of the 2021–22 academic year by a team of faculty members from across Caltech: Paul Wennberg, the R. Stanton Avery Professor of Atmospheric Chemistry and Environmental Science and Engineering; Neil Fromer, executive director of programs for the RSI; and Jean-Laurent Rosenthal (PhD ’88), the Rea A. and Lela G. Axline Professor of Business Economics.

As of this academic year, Caltech has begun to offer an undergraduate option in environmental science and engineering with tracks in chemistry and physics.

Such changes are likely to have an impact on Caltech’s inclusion and diversity efforts as well: studies show that students from historically marginalized racial and ethnic minorities, along with first-generation college students, are seeking out programs that have direct community impact. Programs in sustainability, like those being envisioned and implemented at Caltech, can fit that bill, the faculty members noted.

Agapie says this was evident at a recent Future Ignited workshop hosted by Caltech, where undergraduate students of color from across the country were given the opportunity to speak with Caltech faculty members about graduate school options and prospects.

“RSI and sustainability really spoke to people who might not see themselves following a typical path to the traditional disciplines,” he says.

Sustainability research

Unlike the vast majority of Caltech research facilities, the new building will not house individual faculty members

and their labs. Instead, it will provide equipment, space, and resources divided among several research centers designed to support the core initiatives launched by the RSI: Sunlight to Everything; Climate Science; Water Resources; and Ecology and Biosphere Engineering.

“We decided that there was a critical need for new types of facilities with new capabilities to execute the research mission that we are pursuing,” Peters says.

When it opens, the Resnick building will house four centers that will each offer specialized equipment and resources. Each will benefit from the expertise of a staff scientist who can support researchers using the specialized equipment and resources the center offers.

“It’s facilities like these, with brilliant staff who keep them running and who collaborate closely with faculty and students and postdocs, that really makes breakthrough research at Caltech much more possible than it would otherwise be,” Peters says.

The **Solar Science and Catalysis Center (SSCC)** will build on Caltech’s established expertise in the solar energy realm. A particular focus will be on the synthesis of new materials that can harness solar energy to make renewable fuels as well as those needed to speed up the chemical reactions that convert ubiquitous natural resources like air and water into usable energy-rich molecules. The new building will also include a “solar roof,” where photovoltaic devices can be tested under real-world conditions.

The **Remote Sensing Center (RSC)** will be Caltech’s first dedicated campus space in which faculty and students can develop and guide satellites of different sizes designed to measure or monitor soil moisture, sea levels, and methane emissions, among other activities.

The **Ecology and Biosphere Engineering Facility (EBEF)** is designed to support innovative interdisciplinary research to understand how diverse life-forms, from microbes to insects to plants, interact with their environments. EBEF researchers will cultivate, analyze, and manipulate diverse organisms in environmental contexts. The facility will allow for the control and visualization of gene expression at single-cell resolution, and will empower researchers to engineer ecosystems at their most fundamental level. Researchers will also be able to conduct soil studies under variable conditions, facilitating studies of organisms and how they respond to changes in climate as well as in resources such as water.

The goal of the **Translational Science and Engineering Facility (TSEF)** is to provide space for the Caltech community to pursue demonstration projects that cannot be accommodated in existing labs: to scale up and test early-stage

technologies for potential translational impact. The space is designed to maximize flexibility to serve a wide range of projects. It will also include a high-bay space that will allow for research on larger structures, such as satellites and industrial-scale chemical-processing equipment.

While Peters notes that the vision for the building, and the reimagined approach to sustainability-related curricula and research it has sparked, might seem ambitious, he has already seen the power of problems in sustainability to engage a broad swath of the Caltech community and how creative their cross-disciplinary approaches to solutions can be.

“Once you shine attention as well as resources on these problems, you tend to draw remarkably capable people in,” Peters says. “After all, these are issues that affect us all.” 🗨️

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