

Sustainable Caltech: A Plan for a Resilient Future



Climate-adapted landscaping stretches between the Walter and Leonore Annenberg Center for Information Science and Technology (foreground) and the Avery House.

October 2024

Caltech

Introduction

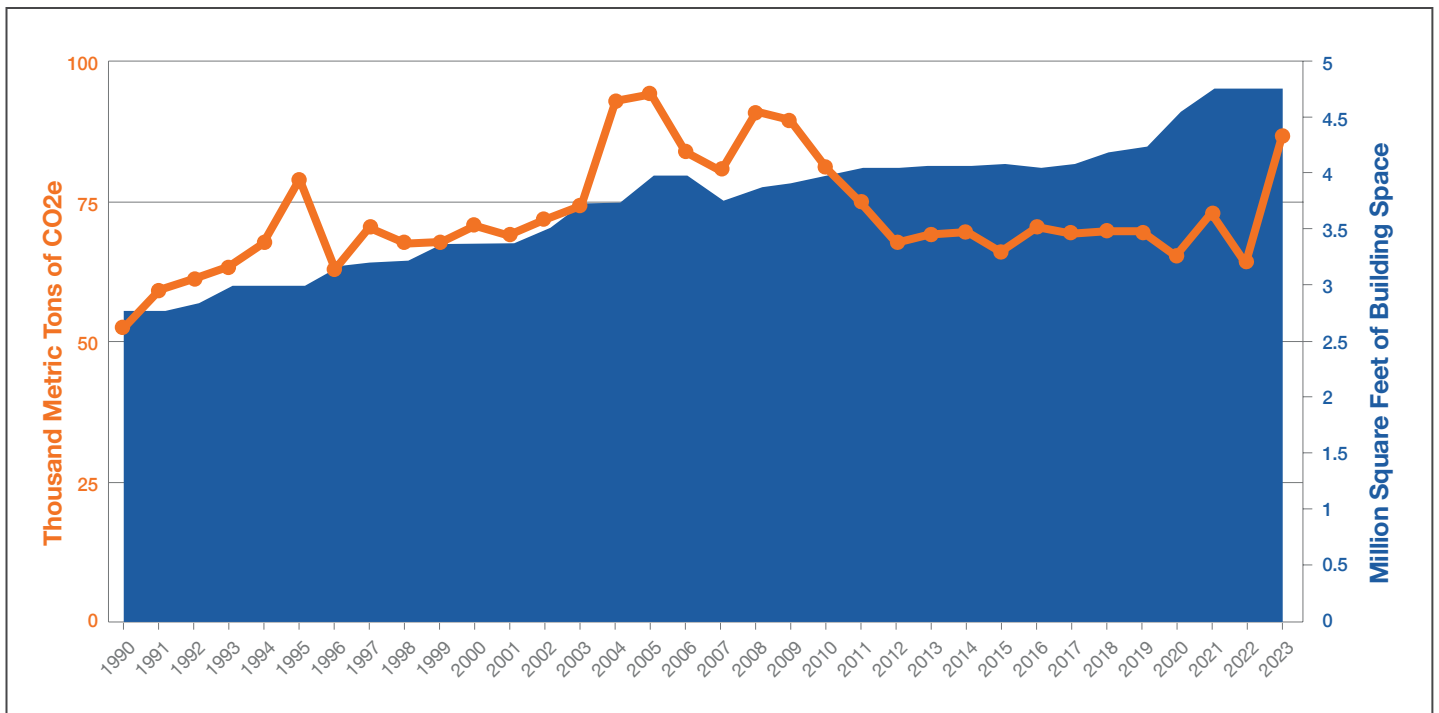
Caltech has made fundamental contributions to research on Earth’s changing climate and environment, including mid-20th century discoveries that revealed vehicle emissions as major sources of smog and lead pollution; the invention of the first instrument to precisely measure carbon dioxide in the air; and the first model of an urban atmosphere. Today, sustainability is central to Caltech research and education, bolstered by the interdisciplinary Resnick Sustainability Institute.

With environmental change intensifying as a pressing challenge for humanity, Caltech has a timely opportunity, responsibility, and need to develop resilient campus operations that match the level of its science.

Campus sustainability has been a point of pride since at least 1968, when Caltech opened its own highly efficient utility plant. Later, Caltech was the first university to publicly commit to the use of a self-managed green revolving fund, which is a pool of investment money for facilities improvements that will lead to financial savings as well as greater sustainability. Caltech has piloted sustainable building and renovation techniques for laboratories and historic facilities. Twelve buildings are certified by the U.S. Green Building Council as LEED (Leadership in Energy and Environmental Design) Platinum or Gold, the two highest levels.

In 2008, Caltech formed a committee to plan reductions to greenhouse gas emissions, which have been measured since at least 1990. The committee made 27 recommendations, including investing heavily in energy efficiency measures, installing solar panels and LED lights, building and renovating with higher sustainability standards, and replacing fleet vehicles. Twenty recommended actions have been completed, 19 of them led by Caltech Facilities. As a result, between 2008 and 2022, Caltech reduced emissions by a third, even as it opened several new buildings.

Figure 1. Caltech reduced yearly carbon dioxide emissions from 90,334 metric tons in 2008 to 63,074 metric tons in 2022. In 2023, emissions increased as Caltech purchased two-thirds of its electricity for the year from the local utility during long, unplanned outages of the campus plant that generates electricity.



With these improvements complete, Caltech has progressed to more complex sustainability efforts that require engagement, experimentation, and leadership throughout campus. These efforts draw on Caltech assets: collaboration across a range of expertise and perspectives, and a corresponding strength of relationships.

In 2023, Caltech President Thomas Rosenbaum convened a Sustainability Advisory Council to prepare a plan that identifies goals and initiatives to achieve progress in the areas of energy, water, materials, waste, land use, mobility, and emissions. The council's 12 members include students, professors, and campus operations and sustainability staff leaders; it is co-chaired by the provost and the chief operating officer and reports to the president.

The council began by reviewing Caltech's campus sustainability metrics with a focus on the most recent [annual sustainability report](#). Because Caltech Facilities has emphasized measurement and contextualization of campus sustainability since 2008, particularly in the areas of energy and decarbonization, the council has a strong foundation of valuable data.

After this initial assessment, the council categorized sustainability topics to address:

Energy and Decarbonization ([page 3](#))

Water and the Built Environment ([page 5](#))

Procurement, Waste/Recycling, and Green Labs ([page 11](#))

Transportation, Scope 3 Emissions, Reporting, and Leadership ([page 14](#))

During 14 subsequent meetings, the council studied each category, discussed opportunities for improvement, and prioritized these opportunities based on their environmental benefit, feasibility, enhancement or effects on research and education, and potential for financial savings or payback. Caltech investments in sustainability have led to substantial, long-term cost savings, and the council's recommendations here promote both environmental and economic sustainability.

This document is intended for the president and the campus community. It outlines long-term opportunities to deepen a culture of sustainability and bring operational sustainability to the level of our achievements in research and education. The **Recommendations** ([page 17](#)) clarify the most effective actions Caltech can take now.

Energy and Decarbonization

Summary

Caltech aims to purchase renewable power and modernize its energy infrastructure, eliminating everyday reliance on natural gas. Pasadena Water and Power (PWP) and Caltech will work together to select carbon-free electricity sources. Simultaneously, engineers will study what would be required to power campus heating with electricity instead of natural gas. The goal is an efficient utility system that lasts through the 21st century.

Current Status

Caltech operates its own cogeneration plant, a utility that has enabled adoption of more efficient energy technologies since the 1960s. The central plant generates electricity using natural gas and recovers waste heat from the process to generate steam, which in turn goes through a steam turbine to create more electricity. The steam is then piped through campus and used in space heating systems. Once a model of efficiency, this cogeneration system now stands in the way of full decarbonization because of its use of natural gas. Today, the cogeneration system is still needed to supply electricity and heat the campus via steam. Electrification is widely considered to be the foundation for decarbonization. Because electricity can more effectively produce hot water than steam, converting the campus from steam to hot water is a prerequisite for full decarbonization.

During an average year, the cogeneration plant produces 68 percent of the electricity used on campus; fuel cells and solar panels provide 32 percent.

Initiatives and Opportunities Discussed in Detail

The council reviewed how energy is generated and distributed on campus and learned about efforts since 2016 to strategize decarbonization and plan the evolution of Caltech's utility system and its energy sources. Caltech worked with consultants on much of this planning. The council analyzed the results of these plans to develop two recommendations:

- Reduce carbon emissions by purchasing carbon-free electricity to fulfill most of the campus's power consumption, replacing routine power generation by the natural gas-fired central plant. This purchase could reduce by 39 percent carbon emissions from energy that is generated or purchased (called scope 1 and 2 emissions), while potentially saving money.
- Complete a detailed engineering study to assess the possibility of reducing scope 1 and 2 carbon emissions by 74 percent by transitioning from a steam-based to a hot-water-based heating system (93 percent when combined with decarbonization of the fuel used in fuel cells on campus).

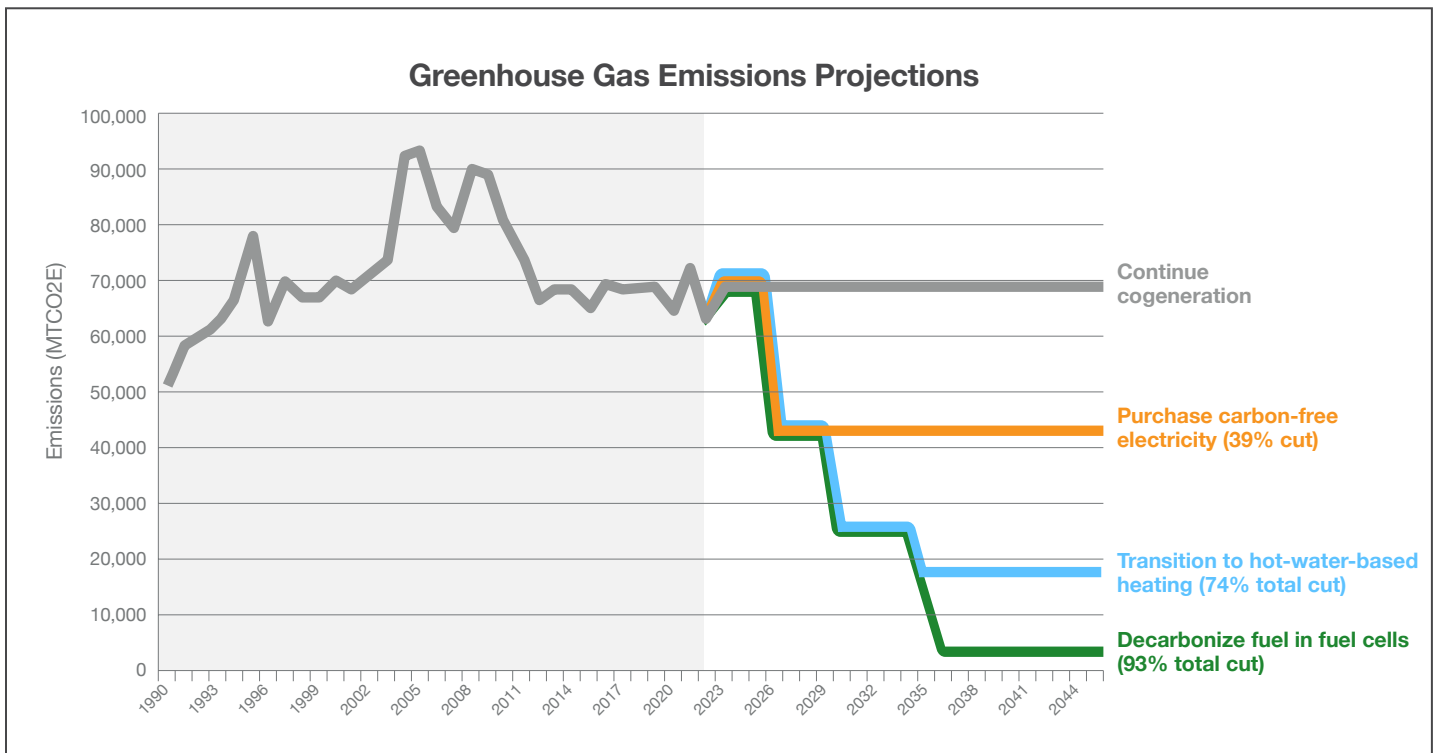
With final approval of these recommendations in late 2023 and a [public announcement](#) in January 2024, Caltech already has acted on them. It has begun work on three initiatives:

- Create a memorandum of understanding with PWP to specify common goals for renewable energy purchases, utility resiliency in the event of outages, and pricing flexibility. The memorandum is expected to be signed in November 2024.

- Hire an engineering firm to complete a thermal design study for a conversion of steam- to hot-water-based heating, specifically addressing protection of research continuity, the total project lifecycle cost, and how buildings would connect to the system. Determining the capital cost of conversion will be critical in assessing its feasibility.
- Hire an engineering firm to analyze the flow of power through the campus electrical system and study the potential to integrate distributed energy sources on campus including solar panels and fuel cells into a microgrid. This information will help the council understand how Caltech's current system can adapt to future needs and plan future resiliency.

These actions are the first steps in an effort that could reduce scope 1 and 2 emissions by more than 90 percent while improving campus resiliency and potentially creating long-term cost savings. Significant water savings are also expected.

Figure 2. Projections show that Caltech could reduce yearly carbon dioxide emissions by 39 percent by purchasing carbon-free electricity and by 93 percent by transitioning from a steam-based to a hot-water-based heating system and decarbonizing the fuel used in its fuel cells. In the graph, MTCO2e stands for metric tons of carbon dioxide equivalent.



Water and the Built Environment

Summary

To build on its progress in saving water, Caltech can prioritize the potential utility upgrades discussed earlier, study the possibility of using treated wastewater in utility plants, continue installations of climate-adapted plants, and revise its landscape plan. In buildings, the greatest sustainability gains will come from heightened design standards and prioritized repairs and upgrades.

Current Status: Water

Since 2008, Caltech has reduced its use of water by 35 percent, making significant investments in utility plant efficiency and waterwise landscaping. Caltech consumed 180 million gallons of water in 2023. Typically, most water is used in the process of generating energy, heat, and cooling for the campus. This energy-water nexus is common at universities with on-campus utility plants, including Caltech. Recent campus utility upgrades have saved water as well as energy. If it is judged to be feasible, the conversion from steam- to hot-water-based heating described earlier could reduce water use in cooling towers by up to 45 percent and save up to a fifth of the water used on campus.

Irrigation, the most visible use of water, accounts for less than 10 percent of consumption. Caltech has quadrupled the amount of drought-resistant vegetation on campus in the past decade and replaced most remaining high-water-use lawn grasses with low-water-use varieties, dramatically lowering irrigation needs while bolstering native pollinator habitats and the tree canopy. Irrigation consumption reached historic lows in 2023.

Figure 3. Caltech reduced yearly water use from 393,896 hundred cubic feet in 2008 to 240,633 hundred cubic feet (180 million gallons) in 2023. One hundred cubic feet equals about 748 gallons.

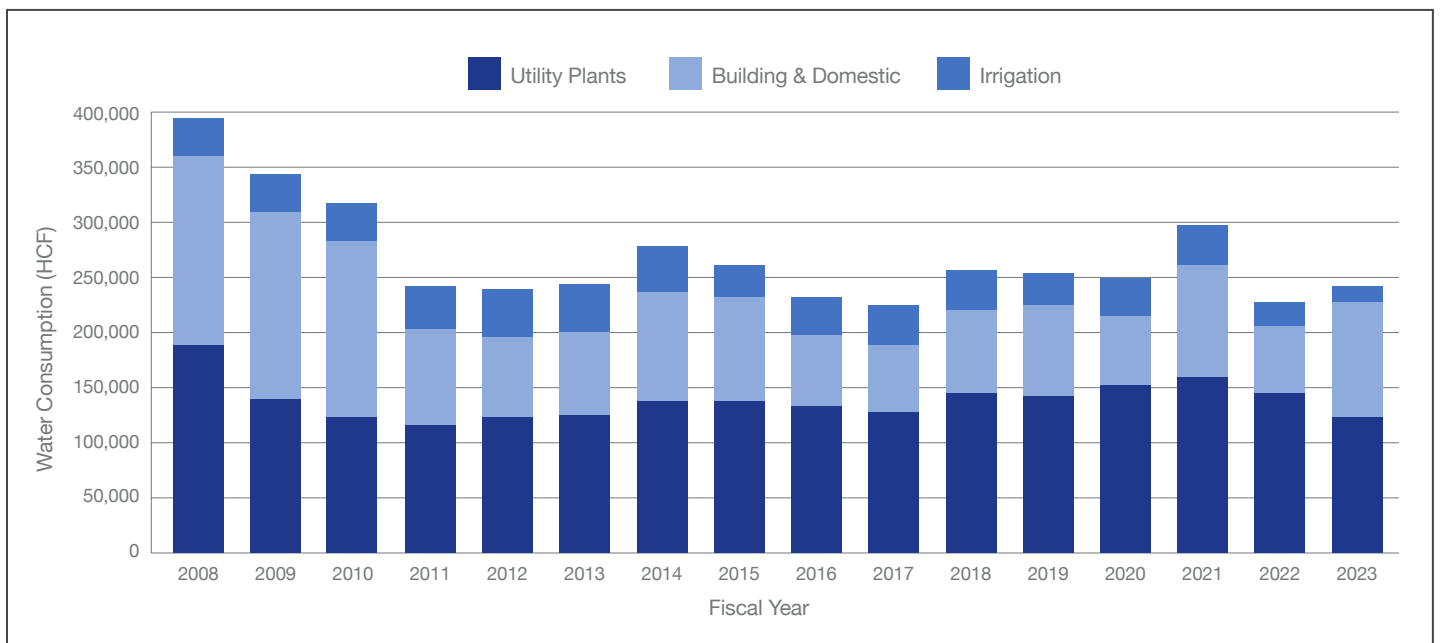
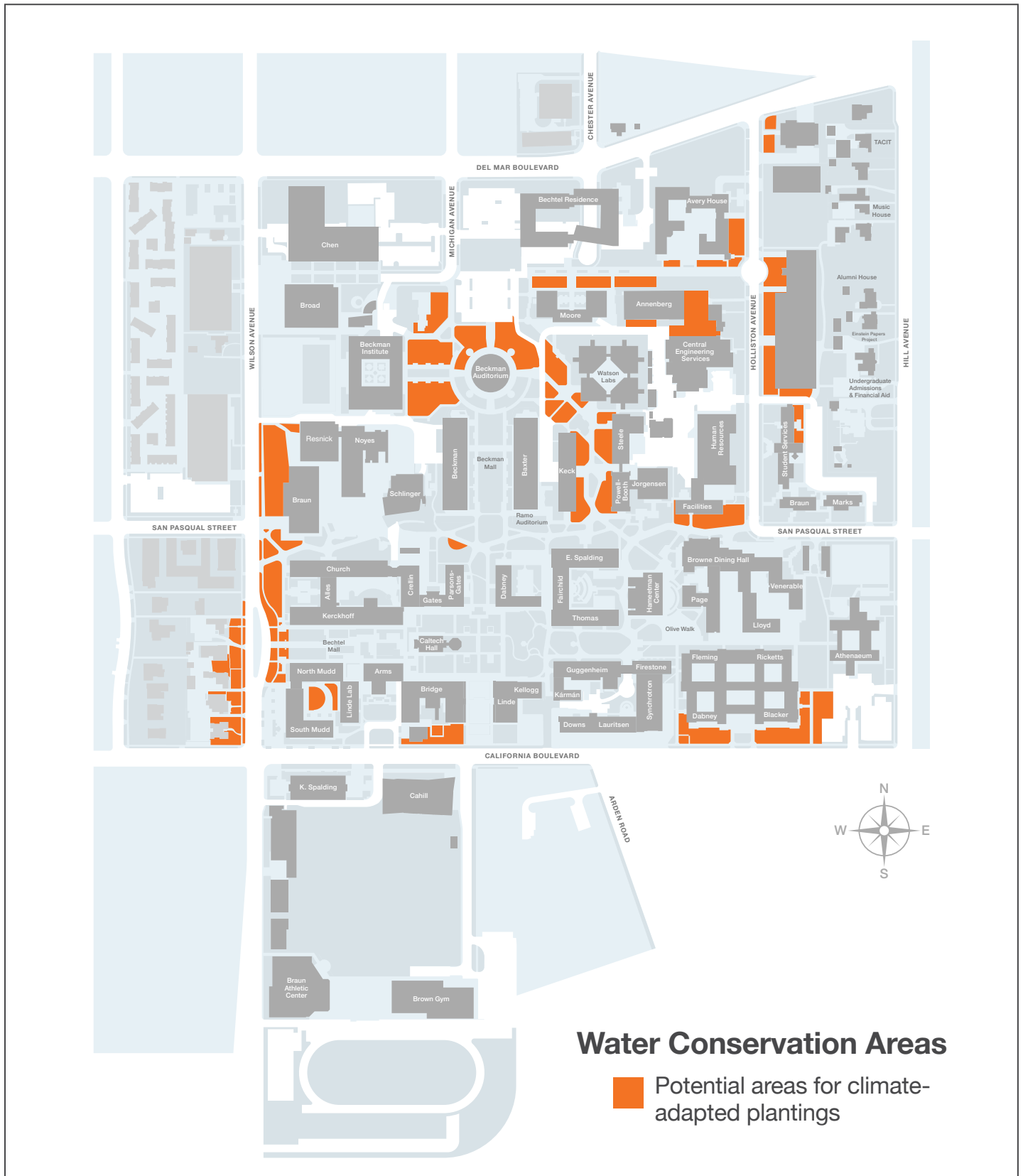


Figure 4. In this campus map, orange areas indicate 125,000 square feet of little-used lawns. Already, they are left to brown when watering is restricted. Replacing lawns with climate-adapted plants can save up to six gallons of water per square foot per year, or 750,000 gallons for these areas.



Initiatives and Opportunities Discussed in Detail: Water

The council identified a valuable opportunity to use non-potable water. Caltech uses drinking water in all industrial processes, but treated wastewater (gray water) would serve equally well. A significant reservoir of treatable wastewater is currently sent down the sewer. A 2022–2023 study by Coho Climate Advisors assessed opportunities for water conservation and recycling. Coho suggested that Caltech treat water that it has used in heating and cooling equipment, along with other campus graywater, and reuse it in its utility plant cooling towers.

Estimated costs for a moderate-sized water treatment system range from \$7 million to \$10 million, an investment paid back by reduced water and sewer expenses within an estimated 12–15 years. The cost of a Caltech system would depend on the availability of treatable water in convenient locations and the associated piping expenses.

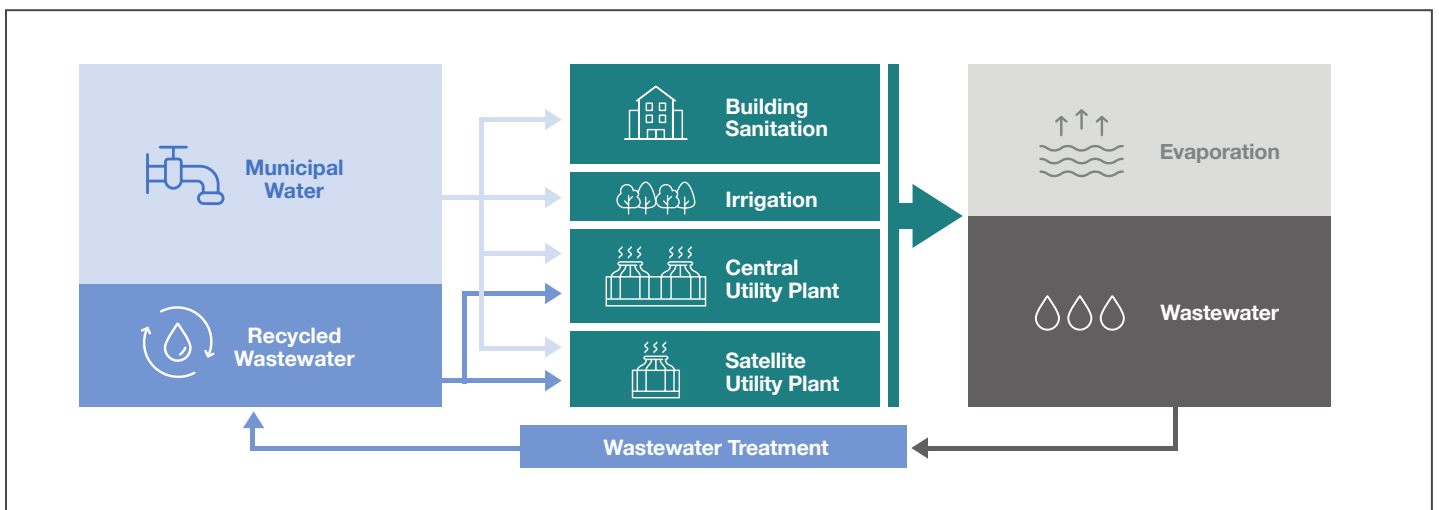
The council discussed the need to improve Caltech’s water metering. The Coho study also examined metering deficiencies, building consumption data gaps, and chemical treatment practices. Coho found a 25 percent gap between PWP’s billed totals and the sum of water data from the meters Caltech manages throughout campus. Coho suggested that Caltech improve metering as a first step in water management and also one that would benefit planning for water recycling.

Explore water recycling in utility plants and empower water management with better data.

Efficient use of water will improve Caltech’s sustainability, increase resilience, and lead to cost savings. Goals include exploring water recycling and improving data.

- a. Explore water recycling: Identify opportunities to reduce unnecessary use of potable water (figure 5).
 - i. For approximately \$200,000, conduct an engineering study of an industrial water reuse system in the central utility plant. This study will complement plans for the conversion from steam-based to hot-water-based heating. Recycling water in the utility plants could reduce water use by 44 percent.
 - ii. Explore options to use pipes designed for recycled water that already exist in Caltech buildings without adding advanced purification. Further work is needed to determine the associated costs.

Figure 5. Today, drinking water flows to buildings, irrigation systems, and the cooling towers in the central utility plant and satellite utility plant. In the future, wastewater from the buildings could be reused in the cooling towers, and water could be further recycled in the towers.



- b. Improve metering on the utility plants and water-intensive buildings to achieve 95 percent accuracy. Use the data to troubleshoot leaks and HVAC issues, plan and prioritize investments of Caltech’s green revolving fund, and verify savings. The ballpark estimate for 10–15 years of in-house or contracted metering for the utility plants and essential buildings is \$250,000 (2022 estimate). Metering every building would cost \$1 million.

Continue to convert unused lawns to waterwise landscaping and revise the campus landscape plan.

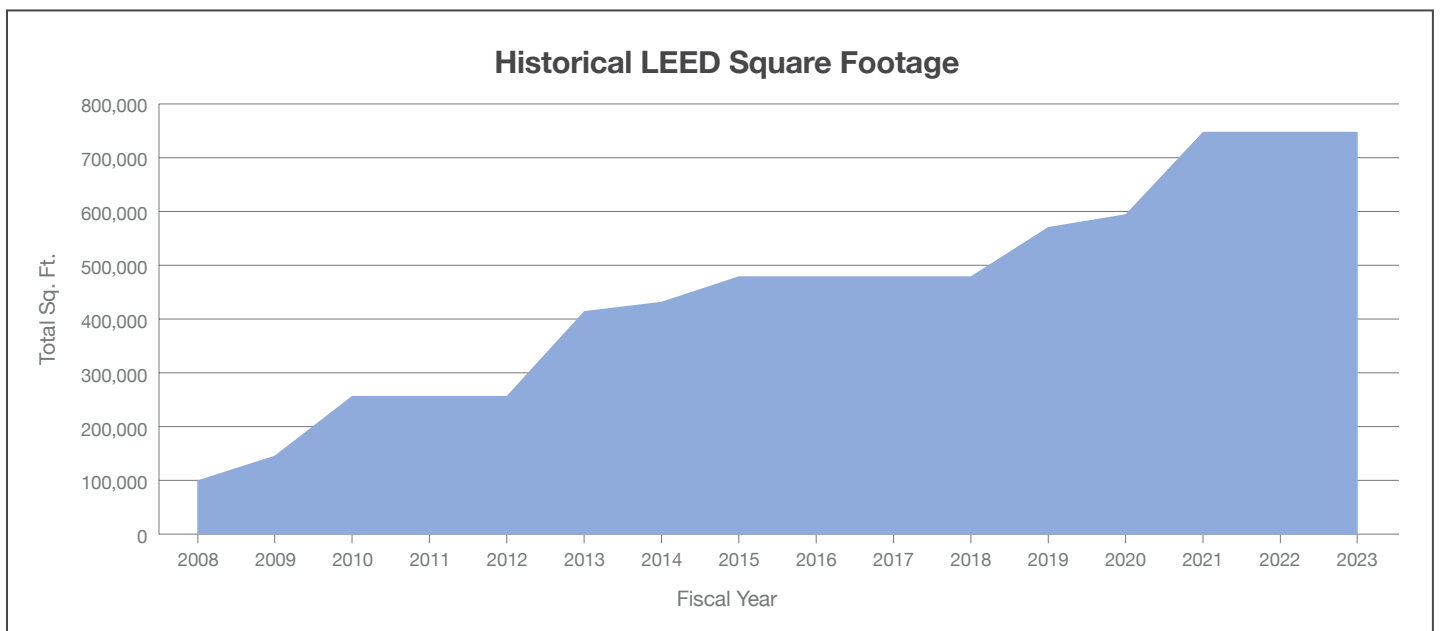
Landscaping and outdoor spaces enable collaboration, build a sense of community, and are an important and highly visible aspect of our sustainability program.

- a. Convert little-used lawns to native and climate adapted vegetation (figure 4). This step saves relatively little water, but visibly symbolizes sustainability and resilience and improves pollinator habitat. Associated costs fall within existing general budget allocations.
- b. Develop a revised landscape plan that balances climate realities with historical campus aesthetic considerations and preservation of functional green space. With a campuswide plan, Caltech can reduce use of water, fertilizers, and pesticides, better manage stormwater, and replant in the most sustainable and cohesive way after construction. Further work must be done to determine associated costs.

Current Status: Buildings

Caltech has designed buildings to LEED Gold standards for 15 years, and today, one-sixth of the gross building square footage of the campus is certified either LEED Gold or Platinum. LEED certified buildings demonstrate high performance in sustainable site selection, water efficiency, building materials selection, indoor environmental quality, access to quality transit, and energy performance. Two of the three buildings that house Caltech’s sustainability research efforts are certified LEED Platinum, and the third, the Resnick Sustainability Center, has just opened and is expected to receive Platinum certification.

Figure 6. The amount of LEED certified building space on Caltech’s campus has climbed since 2008, and two new buildings will add to the total this year and in 2026.



Many LEED criteria are now incorporated into the campus design guidelines that also influence smaller construction and renovation projects. Larger trends including industry movement toward optimized building performance and increasingly strict standards in California make the timing conducive for Caltech to heighten sustainability standards in its construction and renovation practices.

While Caltech has added new research laboratories and other buildings since 2008, campuswide greenhouse gas emissions dropped by a third thanks to sustainable design of new buildings and \$20 million in facilities improvements funded by green revolving fund investments. These improvements, including LED lighting retrofits, heat management in computing centers, and upgrades to electrical and HVAC systems, have realized more than \$25 million in energy savings to date.

One of the best opportunities to improve sustainability in existing buildings relates to fume hoods, experiment chambers that blow air outdoors to protect laboratory air quality. Fume hoods increase the need to heat and cool air and can use as much energy as three or more single family homes. Beyond replacement, simple upgrades also help. An [MIT study](#) found that “[j]udicious use of these hoods” could save that campus \$1 million per year. In 2024, a Caltech Sustainability intern created systems that alert users when fume hoods are left open and installed them on 24 hoods. The average opening height on regularly used hoods decreased by half in the first two weeks. This increases laboratory safety and saves energy: for example, closing newer, variable air speed hoods reduces their energy use by up to 40 percent.

Initiatives and Opportunities Discussed in Detail: Buildings

Improve energy efficiency.

There are still significant opportunities throughout campus to conserve energy in buildings and their heating, cooling, and ventilation systems. Conservation will complement ongoing efforts in energy management.

- a. Use analytical tools to identify the least energy-efficient buildings on campus, using a free EPA-developed benchmarking tool. During renovations of these buildings, include energy conservation upgrades and resolve inefficiencies. Associated costs fall within existing budget.
- b. Where consistent with the health of building occupants and with high safety standards, increase recirculation of air in campus spaces, returning to controlled, variable air change rates. During the COVID-19 pandemic, the campus increased the rate of introduction of fresh air into building spaces. Now, rather than exhaust air-conditioned and heated air after it passes through the building just once, Caltech can balance indoor air quality, energy efficiency, and maintenance of building infrastructure. Associated costs fall within existing general budget allocations.
- c. Inventory all fume hoods on campus to prioritize replacements and upgrades. Associated costs fall within existing general budget allocations.
- d. Continue periodic investments to sustain Caltech’s green revolving fund, which enables further energy and water conservation measures and related modernization and maintenance.

Update guidelines for construction and renovation, and prioritize buildings to improve.

State-of-the-art buildings and facilities directly support Caltech's world-class research. The opportunity to pursue more ambitious building sustainability goals has benefitted the health of building occupants (for instance by increasing access to natural light, fresh air, and better-filtered air) and reduced life-cycle costs, or the total costs of owning and operating buildings.

- a. Continue to update design guidelines to reflect innovations in sustainable building design and industry best practices. These updates ensure that smaller projects and laboratory renewals, as well as new buildings, are completed using the techniques that save the most energy, water, and resources. Associated costs fall within existing general budget allocations.
- b. In coordination with energy-use benchmarking and metering improvements, identify which building upgrades would realize the most water savings and sustainability gains. Use the information to prioritize green revolving fund investments and influence future maintenance plans and renewal projects. Associated costs fall within existing general budget allocations.

Procurement, Waste/Recycling, and Green Labs

Summary

Caltech has a timely opportunity to institute sustainability and efficiency as factors in its purchases, and a responsibility to decrease the amount of its waste that goes to landfills. Laboratories use substantial amounts of energy and materials; Caltech's Green Labs program is the seed of an approach that can improve their sustainability and efficiency throughout campus.

Current Status

Campus operations and research activities affect sustainability both upstream and downstream. Caltech spends about \$350 million per year on purchased goods and services. That buying power influences what suppliers sell. Downstream, Caltech decisions about recycling and waste disposal have environmental consequences.

Recycling, in addition to being an essential sustainability solution, saves \$253 per ton in disposal expenses. Caltech's recycling program has substantial room to grow. One of every 10 pounds of municipal waste from campus is successfully recycled. For every additional 10 percent of waste that is diverted from landfills, Caltech will save about \$65,000 per year. In the last fiscal year, Caltech spent \$442,000 to dispose of municipal waste. Caltech is hiring staff to amplify its recycling program. The projected cost savings will more than offset the associated labor costs.

Waste prevention is better still. Much of campus waste generation is tied to purchasing decisions, an area where lab managers and purchasing specialists can collaborate to improve processes. Procurement Services staff confirmed to the council that Caltech can build sustainability into purchasing decisions without sacrificing user choice or incurring additional cost. Sustainable products and equipment often last longer, are made using less energy and water, and are more likely to be recyclable.

In its 2023 recommendations, the council advised reducing single-use items in Caltech dining, an action that is reducing waste.

Purchases for laboratories offer the highest potential for sustainability gains and reduction of single-use goods. Currently, purchases are decentralized to the extent that latex gloves, common chemicals, pipette tips, and other routinely used resources are purchased by individual laboratories from an array of vendors. Coordinating bulk purchases at negotiated prices would curb waste and expense and enhance selection of sustainable products.

Caltech Green Labs, a grassroots effort with parallels at other universities, aims to engage lab managers and members in making sustainable choices. Education about sustainable options and behaviors will amplify Caltech's success in energy and water conservation, waste reduction, and sustainable design of research spaces. This program is run by a volunteer in the Division of Biology and Biological Engineering and has certified 23 labs, primarily within the division. Inspired by its certification experience, [one lab group went above and beyond](#) to find a green, healthy, inexpensive, and effective replacement for a toxic solvent.

Caltech Green Labs could expand campuswide, as parallel programs have at peer universities. This step would reduce Caltech's environmental footprint, save money through resource and energy efficiency, and connect research and education to operational sustainability.

The savings in energy, water, and materials that Caltech Green Labs has inspired to date have

not been quantified. However, the example of ultra-low temperature (ULT) freezers is telling. The program has provided 41 rebates for replacing low-efficiency ULT freezers with high-efficiency models, with each replacement saving six kWh/day. In addition, at least a dozen laboratories have saved an additional 30 percent of their new freezers' energy consumption by raising temperatures from -80 to -70 degrees after a Caltech study confirmed that the change had no impact on the types of biological samples they stored.

Initiatives and Opportunities Discussed in Detail

Focus on sustainable procurement.

Caltech can influence sustainability in its supply chain, prevent waste, and control costs. A sustainable procurement working group with reach across Caltech can identify economic efficiencies and opportunities for lab members to reduce waste, increase recycling, and otherwise be involved in sustainability.

- a. Establish a sustainable procurement committee that reports to the Sustainability Advisory Council and includes representatives from Procurement Services, Dining Services, Facilities, each academic division, Housing, Green Labs, and the graduate student and postdoctoral scholar communities. The group would identify best practices, develop training, and work with vendors and labs to streamline purchasing at better prices, prevent waste, and highlight sustainable options. The primary cost is Purchasing Department staff time. Financial benefits may be significant, depending on how enthusiastically lab members and vendors engage.

Minimize waste.

Effort invested in recycling and waste management will create a pathway for the campus to pursue ambitious goals such as zero waste. This effort will pay for itself.

- a. Expand Caltech's recycling program by hiring a lead and a coordinator to improve program management and campus participation. This hiring is approved and in progress. The anticipated substantial decrease in waste, an important sustainability improvement, will more than cover the associated labor costs.
- b. As part of this expansion in the recycling program, orient faculty, postdoctoral scholars, students, and staff to Caltech's recycling practices and, working with Dining Services and Buildings & Grounds, define a zero-waste event standard, in which events divert at least 90 percent of their waste.
- c. With Dining Services, establish a donation process to minimize food waste, partnering with local food pantries and creating a campus pantry for food-insecure Caltech community members. Continue to compost unusable waste from food preparation. Associated costs will depend upon the donation process.
- d. Determine how to increase the rate of campus waste diversion to at least 50 percent in the next five years, preventing more than 800 tons of waste and \$200,000 in expense annually. Further work must be done to determine associated costs.
- e. Prioritize reduced consumption and reuse by creating chemical inventories, shared resource inventories, and equipment maps for shared use.

Expand Caltech's Green Labs program.

Caltech has designed some of the most sustainable laboratory buildings in the country. Their full potential to be sustainable can be realized only with participation from lab members. Expanding the Caltech Green Labs program will engage students, postdoctoral scholars, and researchers in day-to-day sustainability practices to benefit educational outcomes and all other priority initiatives listed here.

- a. Expand Caltech Green Labs to all divisions, hiring a full-time program coordinator and establishing a leadership committee of representatives from each academic division, Environmental Health and Safety (EH&S), and the sustainability office within Facilities.
- b. Establish a Caltech Green Labs pilot fund of \$25,000 to provide one-time grants to labs.
- c. Just as EH&S enlists lab members to flag safety issues, ask interested lab members to identify opportunities to save energy and resources and prevent waste, especially those actions that will improve operations or pay for themselves.

Transportation, Scope 3 Emissions, Reporting, and Leadership

Summary

The opportunities addressed in this plan require participation from the campus community, and sometimes community partners. This is especially true for concerns related to transportation and scope 3 emissions. (Scope 3 emissions are greenhouse gases generated by activities that Caltech causes but does not control, e.g., employee commuting, business travel, procurement, and solid waste.) To minimize such indirect emissions requires creativity, data, and, especially, communication among students, postdoctoral scholars, staff, and faculty. Involvement of the campus community and our civic partners is well timed as Caltech's educational curriculum and research more deeply integrate sustainability.

Current Status

High-quality data on commuter trends traces back to the early 2000s because Caltech surveys employees annually about how they commute, as required by the California Air Resources Board. With a relatively modest set of commuter incentive programs, commuting patterns held steady until 2020 but increasingly struggled to meet air quality regulations and stressed parking availability. The COVID-19 pandemic temporarily caused many campus employees to work from home, but commuting has almost entirely returned to pre-COVID patterns.

At Caltech, 59 percent of the campus community reaches campus without driving alone (figure 8), instead walking, bicycling, carpooling, telecommuting, or traveling by bus or rail. Many more are interested in doing so. Caltech meets requirements for reducing the number of single-occupant vehicles on campus, but there is potential to do more by implementing the existing Transportation Demand Management Plan. This 2019 plan, suspended by the onset of the pandemic, highlights incentives and other means to help people avoid driving alone.

Such programs will most significantly benefit Caltech's 2,400 campus employees. Two thirds of staff members drive alone to campus. Many staff commutes are short: 43 percent of staff travel fewer than five miles and 69 percent travel fewer than 10 miles (2019 data). Staff also have the longest average commutes, in part because of local housing unaffordability, and they incur the highest commute-related costs in time and money.

People will feel more comfortable traveling to campus without driving when transit, walking, and bicycling are safer and their bicycles and scooters are more secure on campus. The LA Metro system has improved its network, which is now free for Caltech students and staff, but concerns about crime have pushed away riders. Meanwhile, [Pasadena recently halved pedestrian fatalities](#) between 2019 and 2022, although in 2021, it still was [the 11th most dangerous](#) California city among the 60 its size for crashes involving pedestrians. Caltech has expressed support for Pasadena's pedestrian safety efforts. Protected bikeways have opened within blocks of campus. In response to campus community members' engagement in improving safety, Caltech staff created a QR-coded form that is used to report accidents and near-misses close to campus to Security and EH&S. Community members also report stolen property to Security: in 2024, this has included 18 bicycles, two electric bicycles, and two electric scooters.

Sustainability-linked communication among students, staff, and faculty is increasing, but the council found significant room to improve communication about sustainability goals and programs. Recently, Facilities, the Office of Strategic Communications, and other campus

departments have together amplified the achievements of labs that champion sustainable processes. These departments collaborate to make clear that Caltech cares about operating its campus, educating students, and producing research in a sustainable manner. The goal is communication that engages the creativity of the entire campus community.

Today, Caltech is focused on addressing scope 1 and 2 emissions and improving sustainability in areas where it has control or powerful influence. The discovery process to quantify and report scope 3 emissions is ahead. Caltech can benefit from readily available examples set by peer institutions that participate in the Ivy+ Sustainability Consortium. Caltech also could use carbon and sustainability reporting systems, including options that rank sustainability operations relative to other institutions. The effort to characterize and quantify scope 3 emissions will equip those who create Caltech's next sustainability plan with sound data.

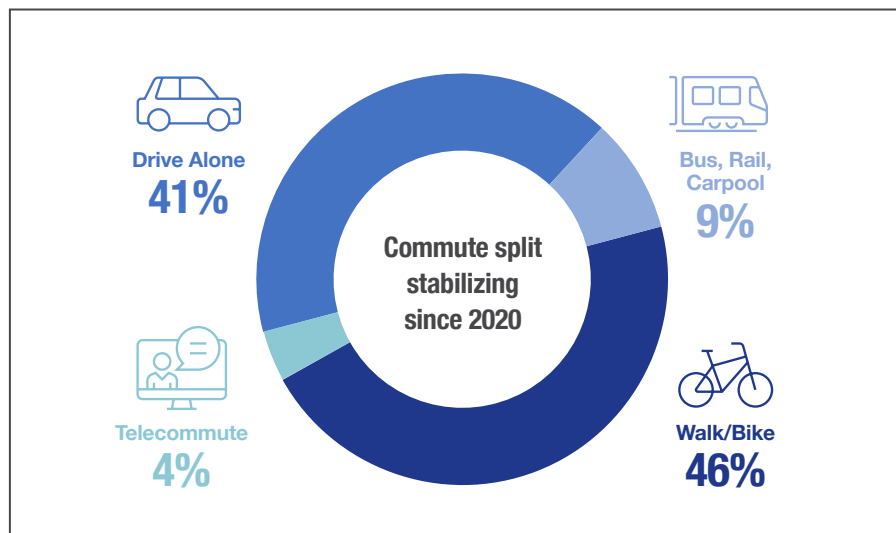
Initiatives and Opportunities Discussed in Detail

Implement the existing transportation plan and increase pedestrian and cyclist safety and security.

It is in Caltech's best interest to improve mobility. Except where outlined, costs for the initiatives below are covered within existing general budget allocations.

- a. Implement the pandemic-deferred 2019 Transportation Demand Management Plan, promoting green commuting modes in coordination with Human Resources and the Office of Strategic Communications, to measurably reduce rates of driving alone and increase use of transit, carpools, and vanpools.
- b. Encourage sustainable commuting by significantly reducing campus theft statistics for bicycles and scooters through increased Security presence (in progress) and tools such as secure bike storage (an additional cost).
- c. Partner and advocate with the City of Pasadena to improve pedestrian and bike safety on streets adjacent to campus through measures that calm traffic and improve traffic signals and crosswalk safety (in progress).

Figure 7. Most Caltech community members commute to campus without driving alone.



Assess Caltech’s most indirect emissions and engage the entire campus community in sustainability.

To continue its journey to sustainability, Caltech must study and address its scope 3 emissions and further engage its community in saving resources. Reaching those goals involves measurement and communication initiatives that fit within Caltech’s existing budget and potential additional investments. Gathering scope 3 data will identify potential cost savings and lay the foundation for future sustainability planning.

- a. In partnership with the Office of Strategic Communications, increase communication about sustainability to increase the success of initiatives that require campuswide engagement.
- b. Begin diligent tracking for a complete scope 3 inventory, including purchased goods and services, by 2030. Consider applying to the [Times Higher Education University Impact Rankings](#) or a similar sustainability ranking system, a process that would incur some costs and a commitment of time to collect and report information.
- c. Identify regular points of contact for sustainability matters in campus departments and student organizations, activating a network of partners to accomplish sustainability goals.

Recommendations

After identifying the primary long-term opportunities for each sustainability category as described in this plan, the Sustainability Advisory Council prioritized utility decarbonization initiatives that are underway now and ranked additional goals as follows:

- 1. Improve energy efficiency.**
- 2. Expand Caltech's Green Labs program.**
- 3. Explore water recycling in utility plants and empower water management with better data.**
- 4. Minimize waste.**
- 5. Focus on sustainable procurement.**
- 6. Implement the existing transportation plan and increase pedestrian and cyclist safety and security.**
- 7. Update guidelines for construction and renovation, and prioritize buildings to upgrade.**
- 8. Continue to convert unused lawns to waterwise landscaping and revise the campus landscape plan.**
- 9. Assess Caltech's most indirect emissions and engage the entire campus community in sustainability.**

The council then identified the most effective actions Caltech can take now to begin making progress on these goals. The council presents its formal recommendations in the following chart. If these actions are approved, the council will track and ensure progress on them over the next five to 10 years. Swift accomplishment of these steps will put Caltech in a good position to achieve the larger goals ranked above.

Recommended Near-Term Actions

Action	Description	Impact	Resources/Funding	Status
Pursue carbon-free power.	Pursue largely carbon-free energy to replace the cogeneration system as a source of minimum daily power.	Decarbonizes scope 1 and 2 emissions by 39%	Allocation of existing staff resources. Future purchase agreements will impact central utility budget.	In progress, MOU currently being signed with PWP
Study a transition to hot-water-based heating.	Complete a detailed engineering study to further assess the viability of a transition from a steam-based, natural gas fueled system to an electrically driven hot-water-based heating system.	Can lead to decarbonization of scope 1 and 2 emissions by 74%, and 20% campus-wide water savings	Study funded through utility distribution reserve. The conversion is a multimillion dollar cost over 10 years.	Study due Oct 2024. Process would take a decade if judged to be feasible.
Benchmark buildings' energy consumption.	Benchmark energy use in core campus buildings using Energy Star Portfolio Manager to identify buildings to prioritize for repairs and sustainability improvements.	Identifies where green revolving fund investments will yield the most environmental benefit and cost savings	Allocation of existing Facilities staff or volunteer time for data entry into Energy Star Portfolio Manager	Not yet started, likely complete within a year
Increase recirculation of treated air.	Prioritizing the health of building occupants, return where appropriate to controlled, variable air change rates, recirculating air while protecting air quality.	Saves energy, protects equipment, and maintains healthy indoor air quality	Allocation of existing Facilities staff time for assessments	In progress, likely complete within a year
Invest in core campus water metering.	Install water meters to provide data about our largest water users, the central utility plant and satellite plant, and install meters that summarize campus use.	Reveals opportunities to save water and money. Enables study of water recycling	\$250,000 in capital costs plus funding from the utility distribution reserve for maintenance and monitoring	Not yet started, would take a few years
Increase waterwise landscaping.	Convert little-used lawns to waterwise landscaping.	Saves water, benefits pollinators, and benefits stormwater management	Allocation of existing Facilities staff time and materials for landscape conversion	In progress

Recommended Near-Term Actions (continued)

Action	Description	Impact	Resources/Funding	Status
Hire recycling staff.	Hire a recycling lead and recycling coordinator to ramp up the recycling program and identify opportunities to improve it.	Reduces waste and its impacts. Avoids \$253/ton in disposal costs	A 30% diversion rate will offset incurred costs of \$150,000 per year	In progress
Create a sustainable procurement working group.	Gather a group of experts to gather data and engage vendors, with the aim of sustainable changes to campus procurement processes.	Reduces waste and inefficiency; improves engagement in sustainable procurement	Allocation of existing staff time for gathering working group members	Not yet started, likely complete within a year
Hire Green Labs coordinator and provide a program budget.	Hire a full-time program coordinator to expand Green Labs initiatives to all divisions and provide a corresponding budget.	Identifies optimal sustainability investments and engages lab users in conservation	Requires \$125,000 per year plus a small budget; opportunity exists for cost sharing	Not yet started, likely complete within a year
Increase pedestrian safety protections.	In partnership with the City, increase measures to protect pedestrians on streets adjacent to campus. In concert, reduce bicycle and scooter theft.	Reduces the number of people who drive alone, improves safety	Some costs will be accounted for within construction budgets.	In progress
Complete a scope 3 inventory.	Using data produced by other actions in this memo, complete a third-party verified scope 3 inventory, including purchased goods and services.	Provides data to quantify and enable reduction of Caltech's carbon footprint	Allocation of existing staff time to gather information	Not yet started, begin after most items complete

Submitted to President Thomas Rosenbaum, October 17, 2024, by:

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