University of Colorado Boulder

Sustainability Report

University of Colorado **Boulder**

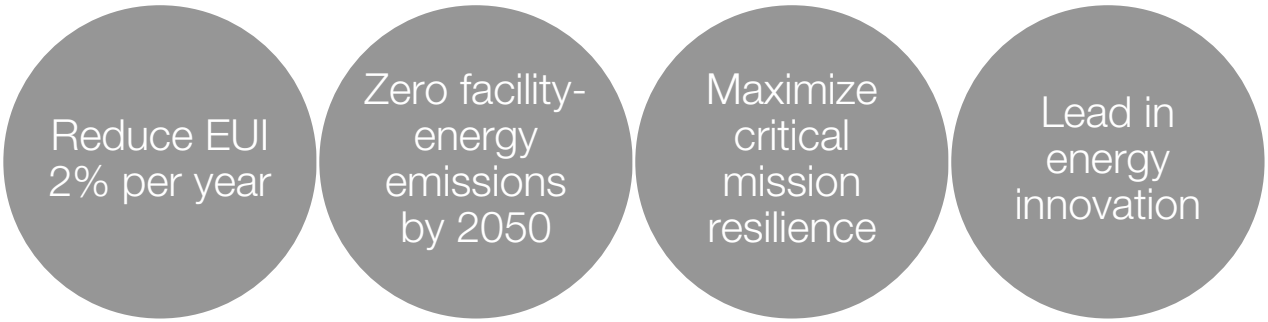
Contents

Introduction

The University of Colorado Boulder continues to make strides in advancing sustainability in 2022 thanks, in part, to the Chancellor's Call to Climate Action which included the establishment of a campus-wide Sustainability Council and a strengthening of the campus greenhouse gas (GHG) emission reduction goals to carbon neutrality by no later than 2050. Like all university campuses, we continue to both navigate and learn from the COVID-19 pandemic related to opportunities to address energy, waste, and space use in particular.

The University of Colorado Boulder's *2021 Campus Master Plan* (CMP) was approved by the Board of Regents in February 2022. The CMP envisions an integrated approach to sustainable and resilient planning and development that supports the mission of the university while seamlessly integrating and enhancing the campus's relationship with its environment. As precursors to this work, the campus engaged in multiple strategic planning efforts that informed the *2021 Campus Master Plan* including the campus's first *Energy Master Plan* and the updated *Transportation Master Plan* which provided sustainability-related recommendations.

The *Energy Master Plan* (EMP) establishes the university's approach to realizing a financially sustainable energy program that focuses on energy efficiency, greenhouse gas (GHG) emissions reductions, and provides a reliable energy supply that enables and enhances the campus' mission of education and research. The EMP's four main goals are:



The first goal is focused on energy efficiency and set targets to reduce energy use intensity (EUI) of our buildings by an average of 2% per year and by a total of 30% in 2035. The campus will minimize energy consumption by meeting ambitious benchmarks for both existing and new facilities, avoid additional consumption where possible through optimized use of space and infrastructure, and engage the campus community in a culture of energy conservation.

The second goal envisions decarbonizing campus facility-tied energy use by 2050 through the transition to clean thermal energy and implementation of a financially viable mix of on-site and regional clean electricity. This includes 100% emissions reductions for facilities by 2050 and 100% clean electricity by 2050.

The third and fourth goals aim to enhance energy resilience for mission-critical facilities, research and operations, and establish University of Colorado Boulder as a world-leading living-learning laboratory focused on collaboration between students, faculty, staff, and the community through research and deployment of innovative energy solutions with a positive global impact.

Above: Image from the 2022 Campus Master Plan

The CMP builds upon parallel planning efforts in the *Energy Master Plan* by outlining a specific approach to the planning of utility infrastructure investments that position University of Colorado Boulder to reduce its carbon dependency. Such considerations include renewable energy sources and technologies such as geothermal and photovoltaics.

In 2021, the University of Colorado Boulder also completed a *Transportation Master Plan* (TMP). The TMP communicates a strategy for a transportation system that demonstrates the university's leadership in energy conservation. The CMP incorporates and extends many of the recommendations in the TMP that advance University of Colorado Boulder's sustainability goals, including improved access to fast and frequent transit to reduce single-occupancy vehicle use, enhanced pedestrian priority corridors to encourage walking and biking, and the designation of mobility hubs and transit centers to efficiently organize multimodal transportation alternatives to help meet the university's climate commitment.

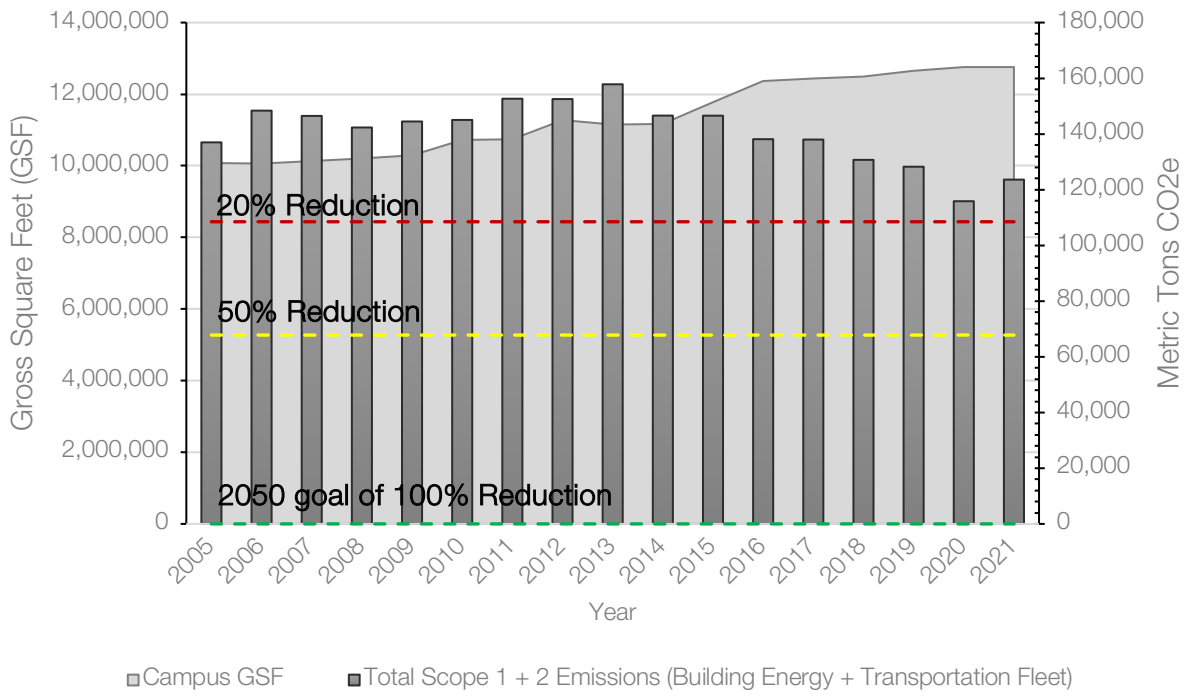
Sustainability Metrics

As we headed into the 2020-2021 academic year, COVID-19 mitigation protocols required a significant increase to the operating levels of our building mechanical systems to maximize the use of outside air and increase the quality of filtration in ventilation systems. All these issues impacted total building energy use and may have also had an impact on fuel use for campus transportation fleet assets. These protocols remained in effect for the entire 2021 calendar year and likely affected typical trendlines.

Greenhouse Gas Emissions (GHG)

In calendar year 2020, the University of Colorado Boulder's gross scope 1 and 2 (building energy and transportation fleet energy usage) greenhouse gas emissions were 115,860 metric tons of CO2e, representing a 12,391 metric ton decrease of CO2e from 2019 reported levels. This data is being analyzed to better understand how the campus emissions profile may have been impacted by the pandemic based on changes that were made to campus operations. In the spring and summer of 2020, campus operations and building operations were significantly curtailed. As campus resumed more intensive building operations in AY20-21, the campus' 2021 gross scope 1 and 2 greenhouse gas emissions were 123,617 metric tons of CO2e.

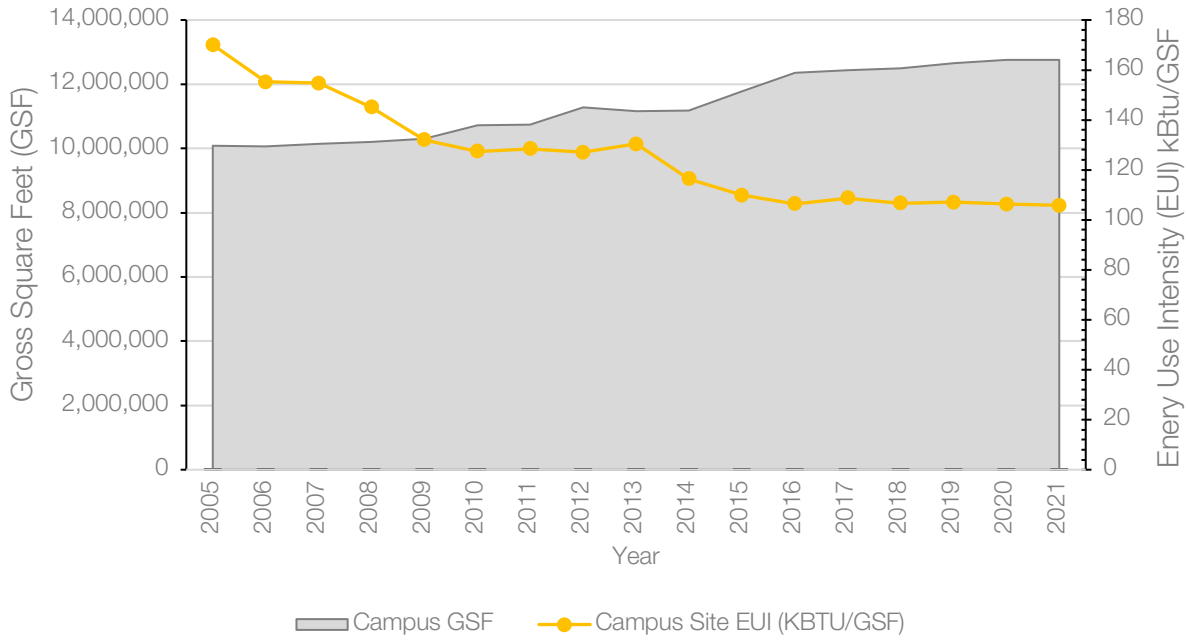
University of Colorado Boulder Scope 1 & 2 GHG Emissions vs. Campus Growth



Energy Consumption

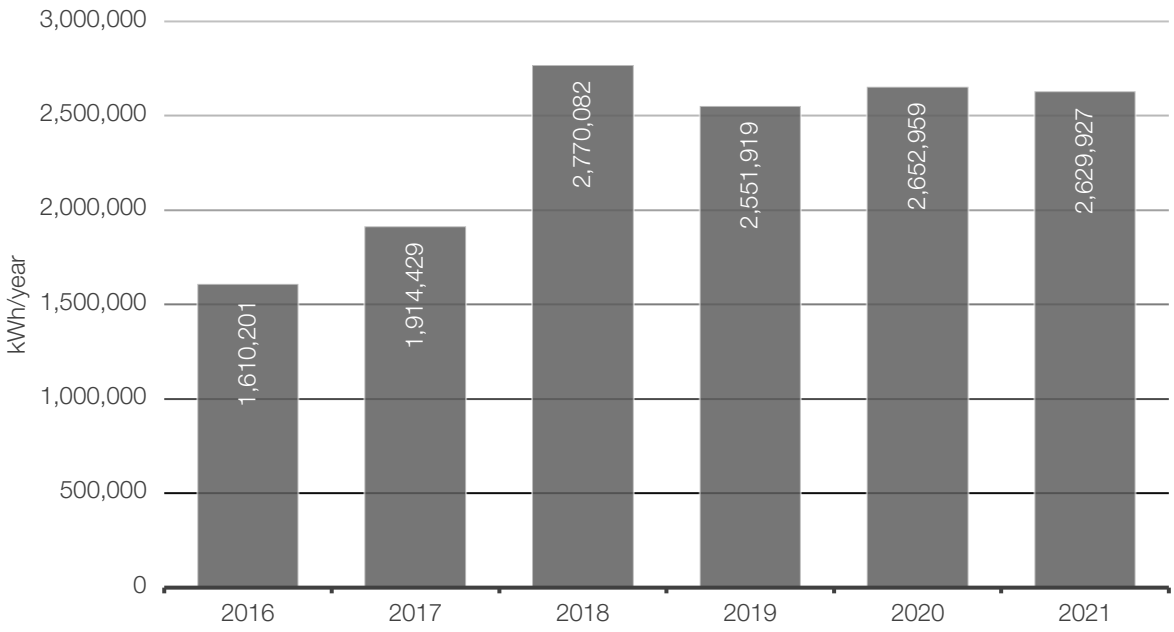
In alignment with the other campuses in the system, the University of Colorado Boulder is using Energy Use Intensity (EUI) to track and trend building energy consumption. The campus EUI reported in 2019 was 107 kBtu/SF. The EUI for 2020 and 2021 remained steady at 106 kBtu/SF. In calendar year 2021, the campus building energy consumption was 1,349,902,294 kBtu measured across 12,757,948 GSF of building inventory. Small buildings, such as sheds and small utility structures, were excluded from the data. The campus energy team continues to analyze this data and better understand where we have opportunities to implement conservation measures. COVID-19 protocols do have an impact on this metric. Although some buildings are seeing lower occupancy levels, mechanical systems are being operated for longer hours and at a greater intensity to increase the use of outdoor air and filtration rates.

University of Colorado Boulder Campus Growth (GSF) vs. Energy Use Intensity (EUI)



In the 2021 calendar year, 2,626,927 kilowatt hours of solar were produced from 15 different arrays. The increase from 2016 to 2018 is the result of additional arrays installed. Typical degradation of the solar array panels, as well as fluctuations in weather, contribute to the variation illustrated since fiscal year 2018.

University of Colorado Boulder Annual Solar Production



Right: The Indoor Practice Facility, with its 850kW rooftop solar PV array, was designed to be a net zero energy facility with the ability to "export" energy to the adjacent Champions Center.

Built Environment

The University of Colorado Boulder's average campus Facilities Condition Index (FCI) was 55% at the end of 2021. The campus remains committed to slowing the growth of its Deferred Maintenance (DM) backlog and making investments toward renovating and repairing its existing building inventory. Over $66.7M of DM is projected to be retired in the next three years as the long-range maintenance plan is executed. The University of Colorado Boulder completed the baseline Facility Condition Assessments for the General Fund building inventory in 2020 and will reassess facilities on a five-year cycle, auditing the building condition of approximately 20% or 1.3M square feet annually. Additionally, in FY22 the campus increased the small project DM budget allocation by $10M annually. This will have a positive impact in slowing the maintenance backlog growth and help to extend the life of many of our critical building systems.

Fleming Building Renovation

- $9.7M DM estimated to retire
- Pursuing LEED Gold
- Phase 1 – 2020 completion
- Phase 2 – 2023 completion

IMIG Music Building Addition

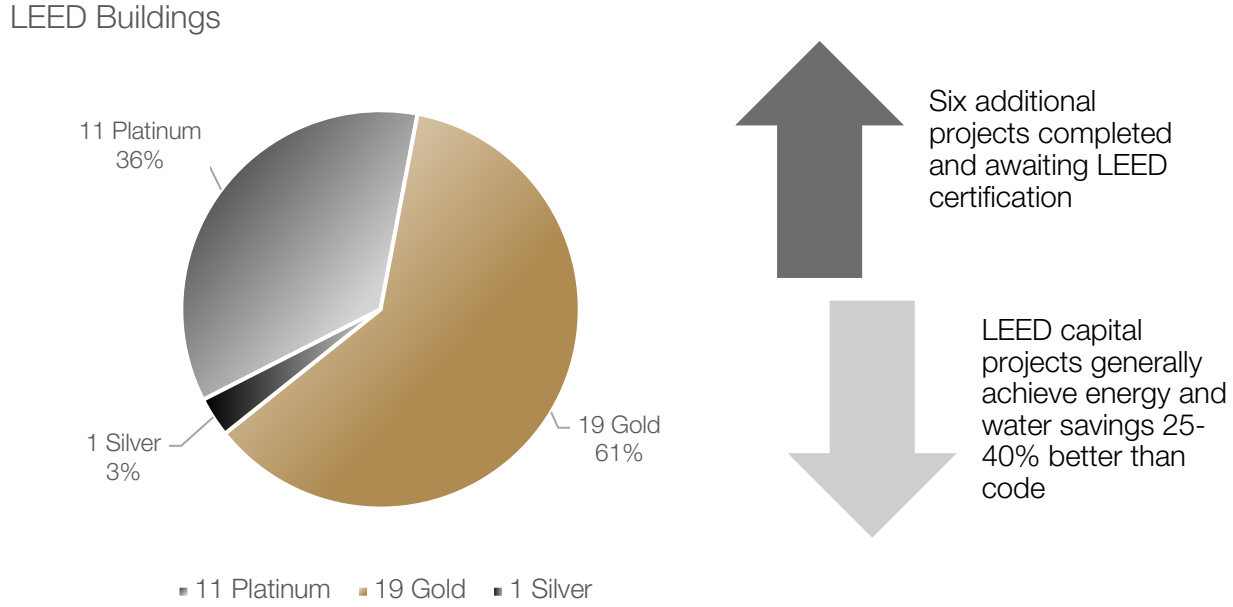
- $7.6M DM retired
- Pursuing LEED Gold
- Completed in 2021

Lucile Berkeley Buchannan Building (formerly the Education Building)

- $7M DM retired
- Controlled maintenance
- Planned completion 2022

LEED Buildings on Campus

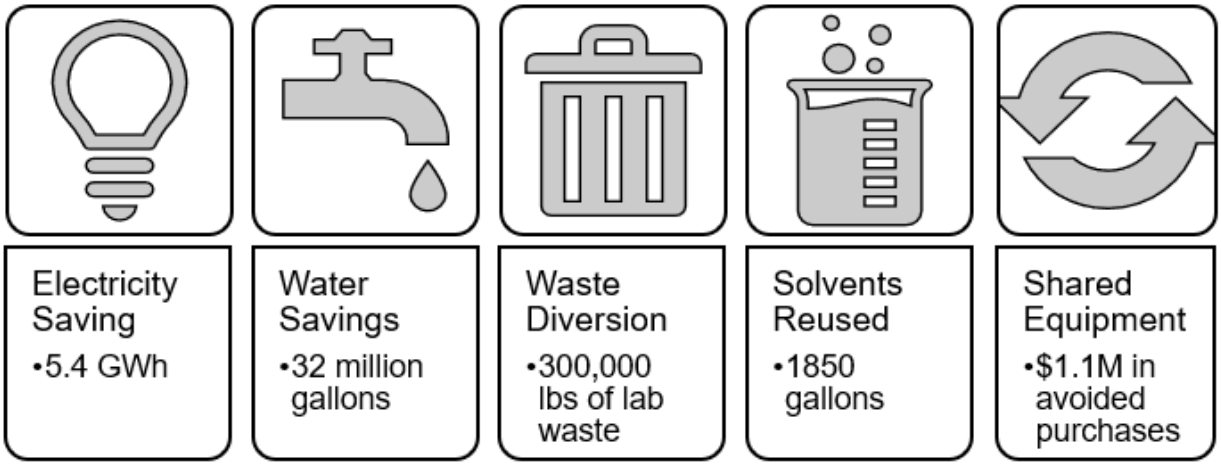
The University of Colorado Boulder has 31 LEED-certified projects across campus. This includes 11 Platinum, 19 Gold, and one Silver certification. The campus also has six additional projects that have completed construction and are awaiting LEED certification. LEED capital projects generally achieve energy and water savings between 25-40% better than code.



Green Labs

The University of Colorado Boulder's Green Labs Program leads and partners with lab members and campus stakeholders to realize the efficient use of resources within campus laboratories. Within the past five years, CU Green Labs has also 1) founded the BioCore Shared Instrumentation Program in partnership with three lab departments resulting in at least $3 million in avoided equipment purchases, and 2) partnered with facilities management to achieve campus-wide monitoring of ultra-low temperature freezers to protect research samples and 3) conducted a pilot to integrate green chemistry education into the introductory chemistry course in partnership with the Director of Chemistry Instruction.

Between FY17 and FY21, the program helped achieve:



Space Utilization

The future of work guidance and trajectory will provide increasing opportunities to repurpose administrative office space to solve critical space needs on campus. Campus guidance reduces dedicated workspace counts based on employee work modality. As more groups adopt these guidelines, reductions in total office space needs are anticipated, increasing the potential for adaptive reuse. As an example, a business unit released approximately 3,400 SF of space that a research unit will backfill for office space. Another campus unit is test piloting new hybrid work modalities, potentially releasing up to 7,000 SF of space (approximately 38 office and office support spaces), which equates to approximately 31% of the space that they currently lease. The lease savings would amount to $152,000/year (a 30% savings).

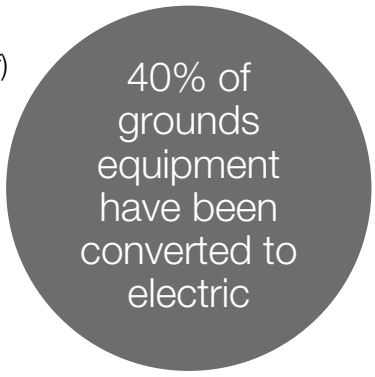
Water Usage and Grounds Maintenance

Water Consumption

Water consumption on University of Colorado Boulder's campus remained the same as the previous year. The University of Colorado Boulder sustainably plants and irrigates its landscapes with non-potable water through its water rights. Given the risks associated with drought and water scarcity in Colorado, it will be essential to continue our efforts to reduce landscape water demand through mixed meadow and prairie grass restoration among other native and adaptive planting choices. The Campus Master Plan defines the sustainability framework through a range of execution strategies including promoting bio-habitat diversity, native plant species, pollinators and increasing the size of the tree canopy on our campuses through early implementation of a tree planting plan coordinated with future development plans. Care was taken in the landscape guidelines to emphasize a palette of locally sourced materials to lower the embodied carbon of the campus. A native and adaptive planting palette helps to reduce campus irrigation needs during typical years and improves the likelihood of plant survival during periods of drought and stress. As climate change will increase the likelihood of both drought and severe flooding, the master plan is designed to respect existing waterways and expand the stormwater management network.

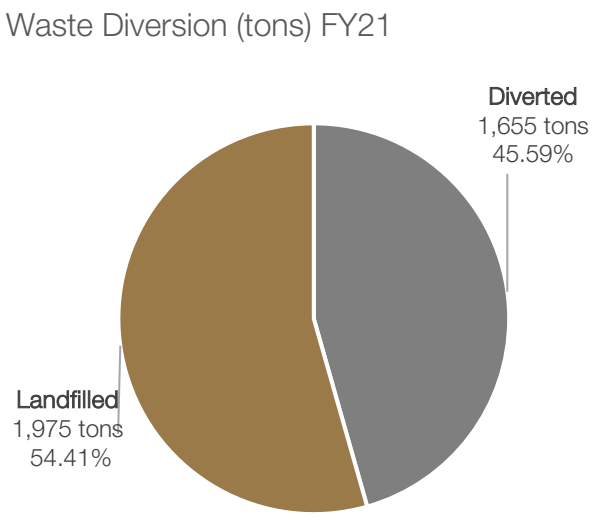
Grounds Maintenance

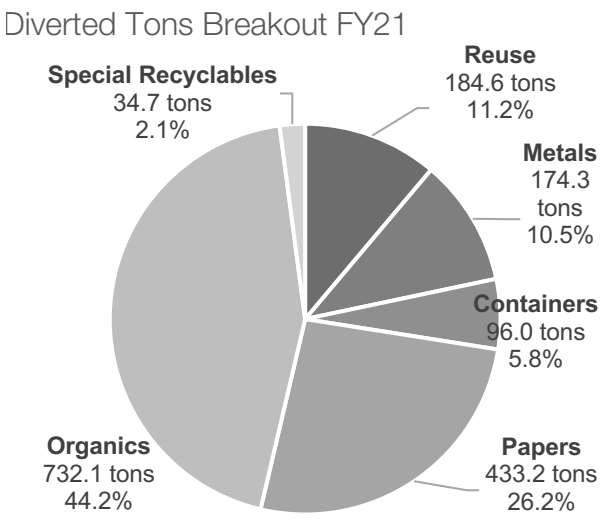
All Outdoor Services divisions (Forestry, Grounds, Irrigation, and Turf) have begun the transition to electric equipment for use in daily operations. Electric equipment currently in use includes string trimmers, handheld and backpack blowers, push mowers, snow blowers, portable power stations, trim saws, and pole saws. This effort over the past four years has yielded valuable information to the manufacturers, to campus in the form of a true operating cost, and to our colleagues on other campuses.



Waste Diversion

The University of Colorado Boulder's solid waste management activity for fiscal year 2020-2021 (FY21) was also significantly impacted by the COVID-19 pandemic. Overall collection volumes were down by approximately 26% (1,268 tons) for all materials, and significantly reduced the amount of material processed via the campus Grounds and Recycling Operations Center. A 45.59% waste diversion rate was achieved for FY21 which represents a 5% decrease from the 50.65% diversion rate achieved in FY20. Nearly all material streams showed large reductions in total volumes collected. The amount of waste produced on campus continues to be evaluated as campus operations continually adapt to the changing dynamics of the pandemic.





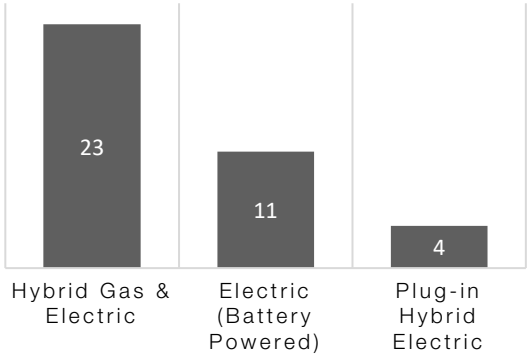
Left: During the 2020 Football Season, Ralphie's Green Stampede adapted our efforts to help our fans celebrate sustainably at home. To uphold the mission, we hosted a commuter-friendly drive-thru for Buffs to snag a Sustainable Gameday Pack, which included Ball aluminum cups and Eco-Products service ware.

Transportation

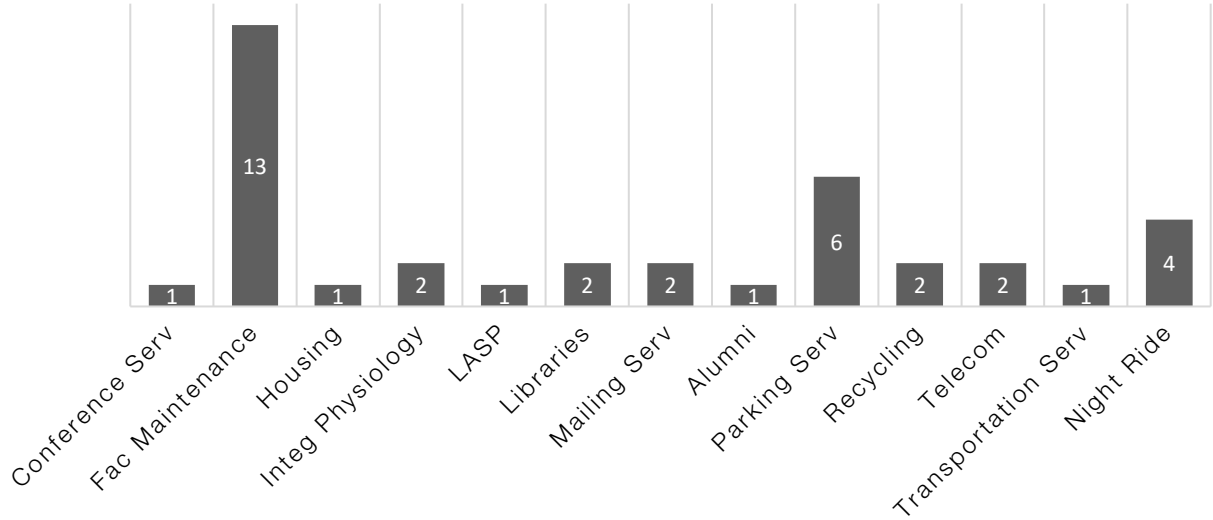
The University of Colorado Boulder remains committed to reducing greenhouse gas emissions produced by transportation fleet operations. The campus is tracking toward achieving its goal of replacing four older diesel buses with electric battery buses by 2026. The campus was awarded two separate EPA (Environmental Protection Agency) Diesel Emissions Reduction Act (DERA) grants totaling $1.7M, that provide a 45% cost share for the campus to purchase four battery electric buses. The first two are on track to be received by the end of 2022 and two are planned to be received in late 2023.

Additionally, the University of Colorado Boulder continues to transition to alternative fuel vehicles within its inventory of fleet vehicles. The campus total fleet inventory is 447 vehicles with 38 vehicles that are either hybrid gas/electric, plug-in hybrid, or fully battery electric. The campus has also been increasing the availability of electric vehicle charging infrastructure on campus for public, workforce, and fleet vehicle use. The campus currently has 28 charging units with 53 charging ports dispersed at eleven locations.

Alternative Vehicle Types



Alternative Vehicles by Department



Engagement

Campus Engagement

The University of Colorado Boulder shares sustainability information with the campus community through a variety of outreach and communication conduits.

The Chancellor's Call to Climate Action, issued in April 2021, brought attention to several aspects of sustainability, including updating the campus greenhouse gas (GHG) emission reduction goals (50% by 2030 and carbon neutrality by no later than 2050), the need for an in-depth analysis of what the campus will need to do to reach STARS Platinum and the formation of a campus-wide sustainability governance structure.

There is a cross-campus sustainability communications group that strategizes and coordinates all aspects of communications related to sustainability. In addition to a host of university websites that address sustainability, the Environmental Center (E-Center) sends a monthly newsletter that compiles updates on campus initiatives, engagement opportunities, events, and student projects reaching nearly 10,000 campus and community subscribers. The E-Center is the first student-led of any university in the country and was established at the University of Colorado Boulder 52 years ago. The E-Center has 17 full-time staff and employs over 140 students each semester who work on a wide range of sustainability initiatives. The E-Center also has an active social media presence, reaching over 6,000 followers across its channels. Several other on-campus units and organizations amplify E-Center's messaging, resulting in significant increases in online engagement.

The University of Colorado Boulder campus hosts a variety of governance groups that engage in sustainability conversations:

- The campus-wide Sustainability Council had its inaugural meeting in October 2021 and is charged with recommending policies, programs, and investments to campus leadership to advance the campus reality and reputation in sustainability.
- CU Student Government (CUSG) has an appointed Sustainability Director and examines and acts on sustainability matters consistent with its mission.
- The Boulder Faculty Alliance has established the Climate Science and Education Committee (CSEC), which also examines and acts on sustainability matters.
- The Zero Waste Board of Directors (ZWBOD) is governed by an MOU amongst the program's (operational) partners.

There are many campuswide initiatives that not only inform University of Colorado Boulder affiliates of sustainability policies, but actively engage them:

- Can parity project: Facilities Management teams identified areas where stand-alone trash cans could be paired with recycling cans (and, in many cases, compost bins). The goal of this project is to make it easier for CU affiliates to sort their discards quickly and properly, helping the campus get closer to the goal of Zero Waste.
- Sustainable dining initiative: Dining Services reaches students where they dine. A Zero Waste policy aims to achieve a 90% reduction of landfilled material coming from dining halls by 2025. Pre-consumer food waste from commissary preparation

operations is redirected from compost collection and given to a local farm to be used as animal feed.
- Student outreach: Students are regularly active on campus to inform CU affiliates about campus efforts towards Zero Waste and climate action through tabling, giveaways, and recycling roundups in residence halls.
- Green office program: This campuswide program focuses on staff engagement in sustainability with a certification program, as well as a monthly lunch and learn series.
- Greenhouse gas emission (GHG) reduction goals: Reduction goals include 50% by 2030 and carbon neutrality by no later than 2050, as updated from the original 2007 American College and Presidents' Climate Commitment. These goals will be core to the updating of the campus Climate Action Plan.

There is a wide range of student clubs on the University of Colorado Boulder campus, many of which encompass a focus on the environment and sustainability. Examples include the University of Colorado Boulder chapters of the American Conservation Coalition, the Colorado-based Inland Ocean Coalition, the American Water Resources Association, the Citizens' Climate Lobby, the American Society of Landscape Architects, and the Boulder Zero Emissions Network (ZEN) of the American Solar Energy Society. Additional student-led clubs include the Biomimicry Club, the CU Birding Club, the CU Energy Club, the CU in the Farm Club, the CU Wildlife Club, the Environmental Product Design Club, the Environmental Studies Club, the Society of Environmental Engineers, and the University of Colorado Bee Club.

Student internships are associated with several academic departments. As one key example, the Masters of the Environment (MENV) program partners with a broad range of external partners in the public, private and non-profit sectors to provide MENV students with hands-on jobs or internships that provide "real-life" experience and produce applied results, as well as exceptional learning opportunities for students.

The sustainability division within the office of the Vice Chancellor for Infrastructure and Sustainability (I&S) operates at the campus level to advance sustainability. Currently, staff within I&S advance sustainable transportation, oversee LEED certification for all eligible CU buildings, partner with CU's nationally recognized Green Labs program, enact strategic engagement with internal and external partners, and serve as co-chairs for the upcoming Right Here, Right Now Global Climate Summit that University of Colorado Boulder will be co-hosting with United Nations Human Rights.

Community Engagement

The University of Colorado Boulder frequently collaborates with local partners. Among many examples: an announcement in April 2022 about the formation of a Climate Collaboratory between University of Colorado Boulder's Leeds School and Deloitte, whose mission is to accelerate action on the climate crisis. There is also a collaboration with the City of Boulder, Xcel, Boulder Valley School District (BVSD), and several other organizations that are working to build a sustainable transportation economy in the Boulder region. This group is advancing a proposal for a shared electric fleet charging, repair, maintenance, and workforce training facility. University of Colorado Boulder also has representation on the Xcel Energy Partnership Advisory Panel created by Xcel Energy and the City of Boulder.

Academic and Research Efforts

The classroom is a frequent vehicle through which sustainability is taught, learned, and discussed through faculty lectures, student presentations, and guest lecturers. During the fall of 2021, there were 52 undergraduate and 29 graduate sustainability-focused courses offered. This is 14% of total course offerings across 53 academic departments.

CU Boulder is one of the top research universities in the world for geoscience and climate science and is a worldwide hub for climate-related research and innovation. Our faculty, our array of research institutes, including INSTAAR, CIRES and RASEI, and our partnerships with the federal labs are all part of our leadership in this extraordinarily important arena. One quarter of the University of Colorado Boulder's 12 institutes conduct research related to sustainability, which are highlighted below.

- The Cooperative Institute of Research and Environmental Science (CIRES) is comprised of more than 800 scientists who work to understand the dynamic Earth system, including people's relationship with the planet. CIRES' areas of expertise include weather and climate, specifically impacts on wildfire and water, changes at the Earth's poles, air quality and atmospheric chemistry, water resources, solid Earth sciences, and more.
- The Institute of Arctic and Alpine Research (INSTARR) aims to understand the biological, chemical, and physical processes operating in continental and ocean environments.
- The Renewable and Sustainable Energy Institute (RASEI) addresses important complex problems in energy that require a multidisciplinary approach to advancing renewable energy science, engineering, and analysis.
- There are also several centers that focus on research in the sustainability realm including Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE), the International Research Center for Energy and Economic Development, National Snow and Ice Data Center, and the Sustainability Innovation Laboratory at Colorado (SILC).

Some research developments from these institutes, centers, and students in 2021 and 2022:

- CU Boulder won first place in the 2021 U.S. Department of Energy Solar Decathlon Build Challenge, the third time CU Boulder has placed first in the highly competitive event.
- CU Boulder receives $1.1 million in EPA grants to reduce public exposure to wildland fire smoke
- Increased winter snowmelt threatens western water resources
- Campus teams present innovative solutions to fight climate change, win funding
- How cattle ranchers in Brazil could help reduce carbon emissions

Some recent University of Colorado Boulder awards pertaining to sustainability are:

- 2021 Pac-12 Innovation Award given to Ralphie's Green Stampede
- Buffs Earn Most Innovative Award In Pac-12 Zero Waste Challenge
- For 25 years, University of Colorado Boulder has maintained a campus sustainability awards program. The awards program recognizes outstanding individuals and departments who demonstrate a sincere commitment to continuing the University of Colorado Boulder tradition of leadership and student participation in campus sustainability. Awardees exhibit innovation that directly reduces the university's ecological footprint, enhances social cohesion and equity in the campus community, and/or integrates sustainability into the culture of Boulder and our local communities.

What's Next?

For more than half a century, the University of Colorado Boulder has been a leader in climate and energy research, interdisciplinary environmental studies programs, and engaging in sustainability practices both on campus and beyond. The University of Colorado Boulder is one of 23 members in the University Climate Change Coalition (UC3) demonstrating our commitment to accelerating climate action on campus, in communities and on a global scale. Chancellor Phil DiStefano's Call to Climate Action articulates the upcoming following endeavors for the Boulder campus:

1. Updating the campus Climate Action Plan with an enhanced goal of carbon neutrality by no later than 2050. One of the first steps toward that effort will be to increase energy efficiency in our buildings by 30% by 2035.
2. Conducting a detailed gap analysis to move the campus from STARS Gold to STARS Platinum status.
3. Continuing to advance campus as a living-learning laboratory for innovations in sustainability.
4. Continuing to work with the CU System to advance sustainability and climate solutions.
5. Holding all constituencies accountable for the progress we seek through periodic meetings between the chancellor and student leaders, as well as publishing and publicizing regular reports that track progress toward our greenhouse gas emission reductions.

The Climate Action Plan (CAP) update will address Scopes 1 and 2 greenhouse gas (GHG) emissions and will determine both the extent to which and in what manner Scope 3 can be addressed. Scope 1 emissions are direct greenhouse emissions that occur from sources that are controlled or owned by CU (e.g., emissions associated with fuel combustion in boilers, furnaces, and vehicles). Scope 2 emissions are indirect GHG emissions associated with the purchase of electricity, steam, heat, or cooling. Scope 3 emissions are the result of activities from assets not owned or controlled by the University of Colorado Boulder, but that we indirectly impact in our value chain, such as daily commute, business travel, purchased goods and services, and capital equipment. Sustainable procurement can help address these greenhouse gas emissions and support the University of Colorado Boulder efforts to positively influence climate change on a larger scale. The CAP will also incorporate climate justice as part of the evaluation of all recommended strategies.

Over the next year, the University of Colorado Boulder is taking steps to initiate some of the actionable items from the *Energy Master Plan* (EMP). One of the first execution strategies of the EMP is to embark on a campus-wide Energy Performance Contract (EPC), which was solicited in the first quarter of 2022 through the Colorado Energy Office's EPC program. The scope of this contract is to provide a preliminary assessment of 19 buildings for energy and water efficiency upgrades and renewable energy systems and narrow down the list for more extensive building audits to develop the project scope for an EPC. This is a first step that could lead to a multi-year, multi-phase program of Energy Performance Contracting.