



SUSTAINABILITY

3-YEARS OF ACCOMPLISHMENTS
2020-2022



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During 2020-2021, a global pandemic challenged the Colorado School of Mines' (Mines') commitment to sustainability. Mines had to quickly transition to online learning platforms and remote work for staff. When classes resumed in person in 2021, despite the lingering impacts of the pandemic, students and faculty came back to campus eager to learn. Health and safety were still top priority. Facilities staff reduced the spread of COVID-19 by conducting full building air flushes (periodically replacing indoor air with fresh air at set intervals), which increased energy consumption. Plastic waste increased due to a higher demand for personal protective equipment (PPE) like disposable masks and gloves. Many dining areas switched to disposable plates, cups, and utensils during the pandemic to prevent spread of COVID-19. Energy costs have also increased due to inflation. Despite all the challenges, Mines reduced greenhouse gas emissions from buildings and transportation, two of the largest sources of emissions, when campus returned to normal occupancy and operations. Mines also continues to make progress in campus water and waste reduction. Academia expanded sustainability educational opportunities. While our sustainability related research received national attention.

Go Mines!

Lauren Poole, Colorado School of Mines, Sustainability Coordinator
| February 2023

ACKNOWLEDGMENTS

We sincerely thank the students, faculty, and staff at Mines who support campus sustainability efforts and programs. The entire Mines community has played a role in reaching the goals outlined in this report.

ABOUT THE REPORT

This report provides data and information about sustainability activities at Mines between 2020 and 2022. At the end of the report is a link to a status report update on the 2019-2024 Sustainability Plan.

PHOTOS TOP TO BOTTOM Mines' Graduation, Students working in lab; President Johnson getting COVID-19 vaccine in 2021; Mines student playing volleyball during pandemic.

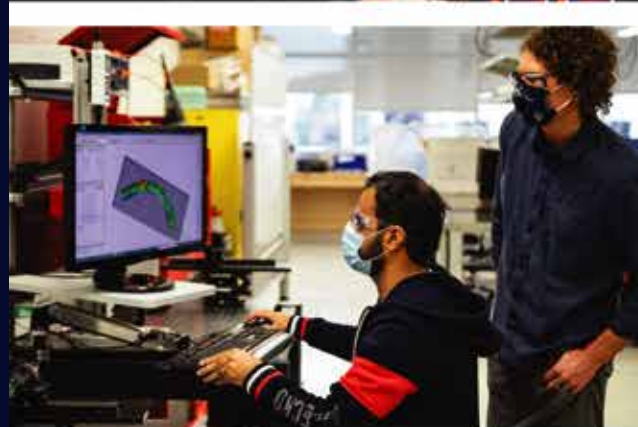


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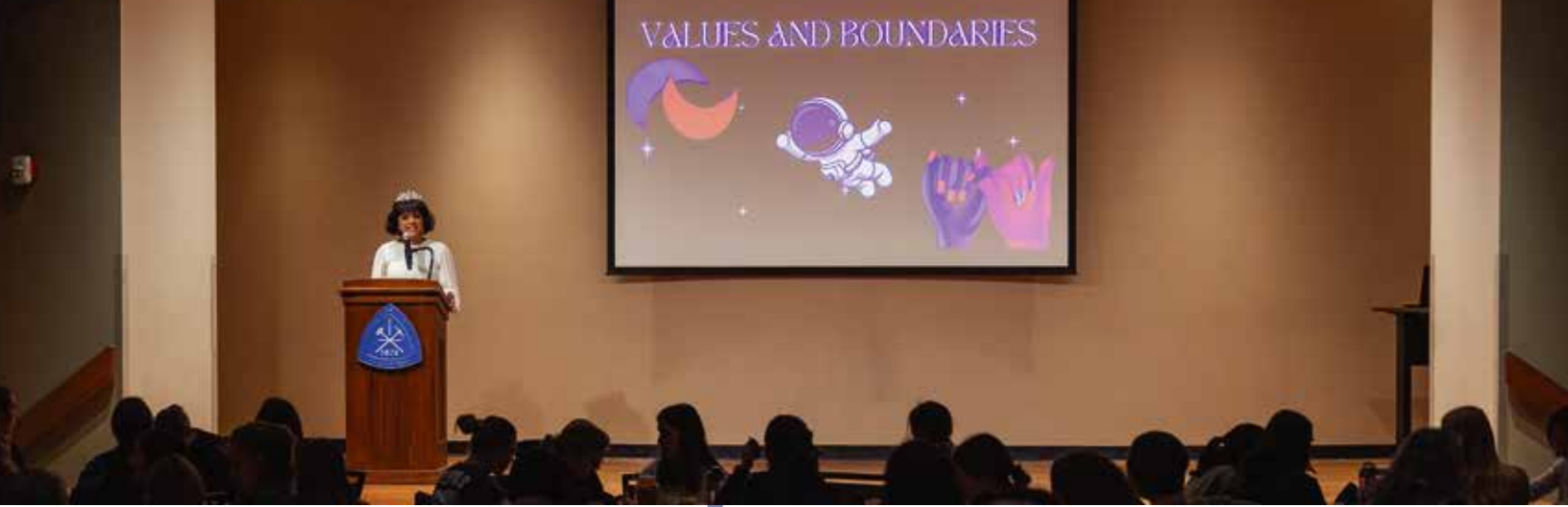


PHOTO ABOVE Arjumand Alvi, a Mines alumna, speaks at a Mines event. Alvi now works for NASA and dreams of becoming the first woman on the moon. She was crowned Miss Pakistan International in 2022.

DIVERSITY PROGRAM

A high score for Diversity and Inclusion contributed to achieving the AASHE STARS Silver rating for the Colorado School of Mines (Mines). In 2022, Mines received the Higher Education Excellence in Diversity (HEED) Award from INSIGHT Into Diversity magazine, the oldest and largest diversity-focused publication in higher education. As a recipient of the annual HEED Award — a national honor recognizing U.S. colleges and universities that demonstrate an outstanding commitment to diversity and inclusion — Mines was featured, along with 102 other recipients in the November 2022 issue of INSIGHT Into Diversity magazine.

Our students come from every state in the nation and from more than 90 countries around the world, and we continue to make progress in the areas of diversity and inclusion by providing programs and services to support these efforts. In addition to advocating for programs that ensure the campus has a diverse faculty and student body, the Mines Diversity & Inclusion program also supports programs that reach out to elementary, middle, and high-school students from low-income and underrepresented groups to help them continue their studies or get interested in STEM.

For more information about the Mines Diversity & Inclusion Program, visit mines.edu/diversity.





PHOTO Parking lot solar array near the athletic complex at Mines.

CLIMATE ACTION

According to the EPA, the two largest sources of greenhouse gas emissions are electricity used to power buildings and transportation¹.

Since 2020, Mines has reduced its campus carbon footprint through building energy conservation and energy efficiency, renewable energy, and adding more electric vehicle charging stations to campus.

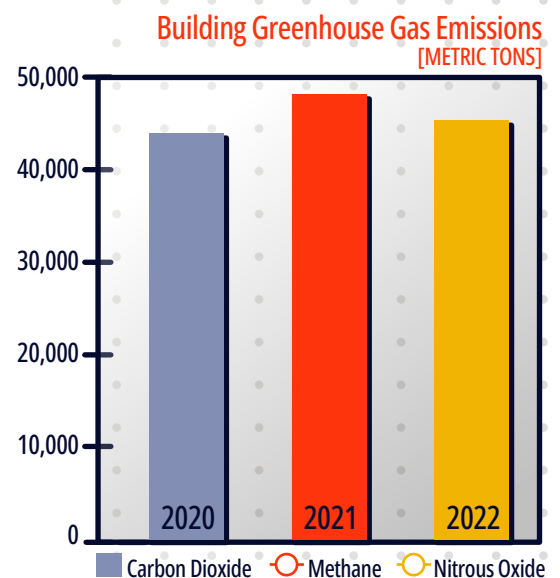
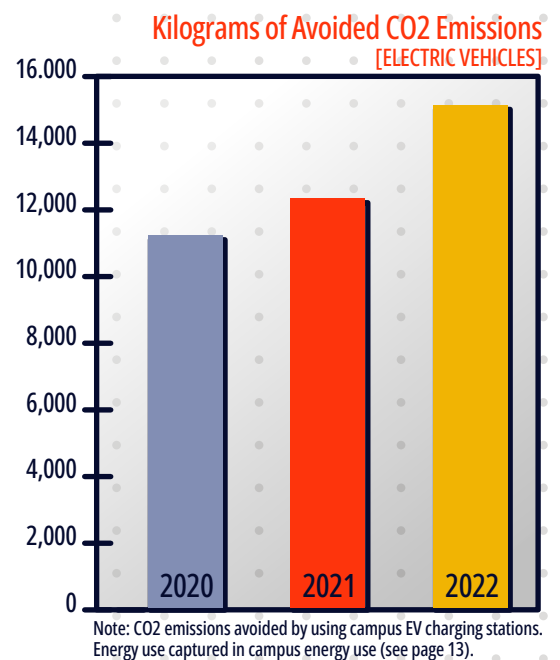
Mines Parking Services replaced some older gas-powered vehicles used for parking monitoring with newer electric vehicles. EHS has purchased electric bikes for departments looking for alternative transportation without parking concerns.

In 2022, Mines further reduced its carbon footprint with projects that continued to focus on building automation, lighting upgrades, heating and cooling system optimization, and alternative energy including solar and novel heat pump systems. We added new educational and research programs focused on reduction of greenhouse gas emissions.

¹EPA Inventory of Greenhouse Gas Emissions and Sinks, April 2022.

In 2022, Mines reduced its greenhouse gas emissions from buildings despite adding more than 500,000 square feet of new building space and more students.

Source: EnergyCap Carbon Emissions, 2023



AASHE STARS SILVER RATING

In 2022, Mines achieved a Silver rating from the Association for the Advancement of Sustainability in Higher Education (AASHE). Their Sustainability Tracking, Assessment & Rating System (STARS) is a comprehensive rating system created by universities for university sustainability tracking. It is used by most colleges and universities in the U.S. and Canada and addresses the environmental, social and economic dimensions of sustainability specific to academia and research universities. Mines also made the Princeton Review's Green Schools List.

Notable STARS accomplishments:

- Two LEED Platinum residence halls certified by the U.S. Green Building Council
- Establishment of a new Humanitarian Engineering program for socially responsible engineering solutions
- Implementation of an environmentally friendly campus operations program called People.Power.Planet
- Installation of two solar arrays and completion of a solar feasibility study
- Launch of a new Sustainable Capstone program
- Expansion of composting activities and electric vehicle charging stations on campus
- Completion of a electric self-driving shuttle pilot program
- Diversity, inclusion, and access awards program
- Launch of Sustainable Energy@Mines, a customization scholars program
- Partnership with the National Renewable Energy Laboratory on an Advanced Energy Systems graduate program.



BY THE NUMBERS

23,724 METRIC TONS OF CO2 REDUCED FROM ENERGY CONSERVATION SINCE 2018

14,500 KILOGRAMS OF CO2 SAVED FROM TRANSPORTATION 2022

207 METRIC TONS OF CO2 AVOIDED FROM RENEWABLE ENERGY AS OF 2021

10 LEED PLATINUM BUILDINGS AS OF 2022

10 ELECTRIC VEHICLE CHARGING STATIONS INSTALLED AS OF 2022

1.5 MEGAWATTS SOLAR INSTALLED AS OF 2022 (SYSTEMS GO ONLINE IN 2023)

53% RECYCLING RATE AS OF 2022

PHOTO 1750 Jackson Street residence hall apartments. Jackson street is the first LEED Platinum building in City of Golden. See page 12 for more details.





PHOTO Mines Sustainability engages with students at large events on campus sustainability, including recycling, composting, and ways to save energy and water on campus.

EDUCATION & ENGAGEMENT

Mines offers nearly 45 undergraduate and graduate courses that are sustainability related, 10 undergraduate and 7 graduate courses that focus specifically on sustainability.

In 2020, the COVID-19 pandemic shut down campus indoor engineering design maker space studios. Mines moved engineering design outdoors by creating a Sustainable Environments Design Studio that met the growing demand for sustainability related engineering design capstone projects while allowing students to use the campus as a living lab.

Among the projects accepted by the Capstone Program in 2020, 2021, and 2022 were

- A campus electric vehicle charging station plan
- A solar feasibility study for Mines Park and solar system design for buildings
- Installation of a student-designed greenhouse and outdoor garden at Mines Park
- Efficient lithium batteries and routes for campus electric AV shuttles.

Mines Sustainability held Solar Challenges over the last several years that invited students to design a solar electric system for a campus building or area. Winning solar designs received \$500, \$300, and \$250 for 1st, 2nd, and 3rd place. McKinstry engineers, along with Mines faculty and staff, reviewed the project proposals and awarded certificates to winners during our annual Earth Day Fairs.



PHOTOS LEFT TO RIGHT Students in a senior design capstone program conduct a solar feasibility study at Mines Park; Student in the Cornerstone program designed a carbon cube using origami as inspiration; Students in the Sustainable Energy Distinction Program attend a building tour to learn about energy efficiency.

New Sustainable Academic Programs

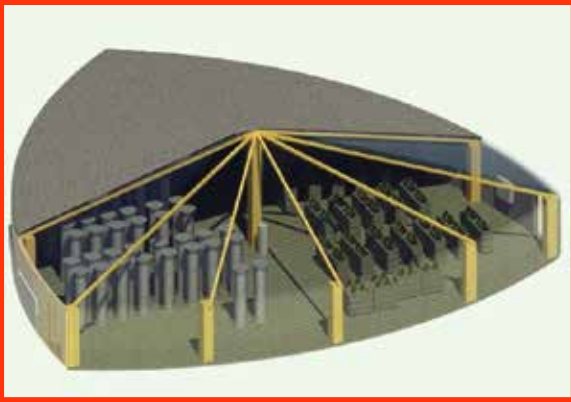
Mines launched the following sustainability related programs

- 1. Sustainable Energy Distinction Program**
Focuses on sustainable energy: affordable buildings/ communities, renewable energy, storage, policy, and energy equity.
- 2. Sustainable Environments Design Studio (SEDS)**
Capstone senior design program that solves a technical design problem for clients through the combined efforts of students in civil, electrical, mechanical, and environmental engineering degree programs.
- 3. Environmental Justice Themed Learning Community**
Focuses on environmental justice and sustainability issues.
- 4. Environmental Leadership Lab**
A free camping retreat at the Rocky Mountain Land Library where students participate in a variety of hands-on sustainability related workshops.
- 5. Environmental Scholars Program**
Supports students in sustainability leadership roles in their junior and senior years.

SENIOR DESIGN CAPSTONE PROJECTS

The Mines Sustainability Office partners with the Capstone and Cornerstone program on sustainability related student projects. Some project examples include

- *an app for finding parking spaces on campus that uses a solar-powered camera*
- *an EV charging station plan*
- *efficient batteries and routing for the Mines Rover, an autonomous electric shuttle pilot*
- *a greenhouse for Mines Parks*
- *a solar feasibility study for Mines Park*
- *a sustainable building for Solar Decathlon.*



PHOTOS TOP TO BOTTOM Mines' Rover; Mines' Greenhouse; Sustainable building design for Solar Decathlon.



Engagement

Engaging the Mines community to create a culture of sustainability begins at new student, faculty, and staff orientation with a quick introduction to the Sustainability Office and some basic sustainability principles. The Mines Sustainability Office continues to integrate sustainability practices into academia, research, and operations by partnering with the Mines Green Team, faculty, and staff on projects.

In 2022, we launched a Green Office program to educate offices about sustainable operations. We partner with Residence Life on Energy Challenges where residence halls compete against each other to see which buildings can reduce the most energy and water consumption. Residence hall energy challenges educate students about how their behavior impacts campus energy and water use and the environment. Winners receive prizes and recognition.

In our labs, we host annual “*Shut the Sash*” campaigns to educate our lab researchers about how labs consume energy and how to reduce their carbon footprint by lowering laboratory hood sashes.

We partner annually with the Mines Green Team to host annual Earth Day Fairs and related events. The annual fair includes a popular plant giveaway, guest speakers on sustainability related topics, and education about recycling and composting.

PHOTOS TOP TO BOTTOM Mines’ Earth Day Fair, Members of the Green Team giving away reusable lunch containers and recycling educational materials; staff members Brad Avenia and Robert Thompson posing with their Green Office Certificate for the Student Recreation Center.



SUSTAINABLE RESEARCH

In 2022, Mines was recognized as an R1 research university; only 146 universities in the U.S. are classified as R1 by the Carnegie Classification of Institutions of Higher Education. Mines research includes 12 sustainability related centers and groups dedicated to exploration and analysis of renewable energy materials and fuel cells, sustainable mining methods, novel sustainable water treatment, and reducing the cost of high-efficiency solar cells used in space. Among our many research partners are the Colorado Renewable Energy Collaboratory and the National Renewable Energy Laboratory.

The following are examples of some of Mines' sustainability related research

1. High-efficiency solar cell research featured in *Advanced Energy Materials* magazine in Issue 29, August 4, 2022
2. Development of reversible fuel-cell energy storage systems
3. Energy equity and environmental justice related to energy efficiency and renewable energy
4. Sustainable mining and metals separation
5. Soil nutrients, bioproducts, and the bioeconomy
6. Environmental geophysics that looks at groundwater contamination, the effects of climate change on glaciers and deep inside the earth's interior
7. Sustainable space mining
8. Sustainable urban water infrastructure development.



PHOTO main research page: <https://research.mines.edu/>



GREEN LABS PROGRAM

Laboratories are the largest consumer of power, heat resources, and materials for most universities. At Mines, the top 5 energy-consuming buildings, which contain most of the labs on campus, use as much power as the bottom 21 buildings (mostly administrative, athletics, and residence halls). By implementing sustainable lab practices, Mines saves thousands of dollars annually while reducing tons of waste and carbon emissions.

In 2022, Mines expanded its green labs efforts to include a new Green Labs Certification Program. The Green Labs Certification Program seeks to make research laboratories on campus more sustainable by offering incentives for saving energy and water and reducing waste.

Green Labs focus areas

1. Energy and water conservation
2. Lab recycling and waste reduction
3. Green chemistry and chemical waste
4. Freezer management
5. Equipment and space sharing
6. Lab equity principles

PHOTO LEFT Melissa Cano, Biochemist, participating in our *Shut the Sash* and labrecycling programs.



PHOTO Artist rendition of the new Venture Center at Mines.

GREEN BUILDINGS

The Mines sustainable buildings strategy starts with sustainable design considerations for new construction and building renovation. In 2022, the U.S. Green Building Council awarded two new buildings on campus which are a LEED Platinum rating. A LEED (Leadership in Energy and Environmental Design) rating for building design and construction is the highest rating for sustainable buildings. Mines now has 10 LEED certified buildings on campus: 2 Platinum, 4 Gold, and 4 Silver.

In 2022, the U.S. Green Building Council awarded two new buildings on campus a LEED Platinum rating: 1750 Jackson Street Residence Hall and Spruce Hall. Mines began construction of two new buildings designed to foster innovation in STEM that will be rated LEED Gold: The Labriola Innovation Hub and the Venture Center. The Venture Center, shown in the artist rendition above, aims to have a zero-carbon footprint, with all electric mechanical systems, and a novel ground source heat pump system designed to capitalize on the stable temperature of the Earth's subsurface to heat and cool the buildings.

CAMPUS GREEN BUILDING TOUR

mines.edu/sustainability/campus-buildings-green-tour/

MINES SOLAR EXPANSION TOUR

mines.edu/sustainability/initiatives/solar/

MAKING PROGRESS

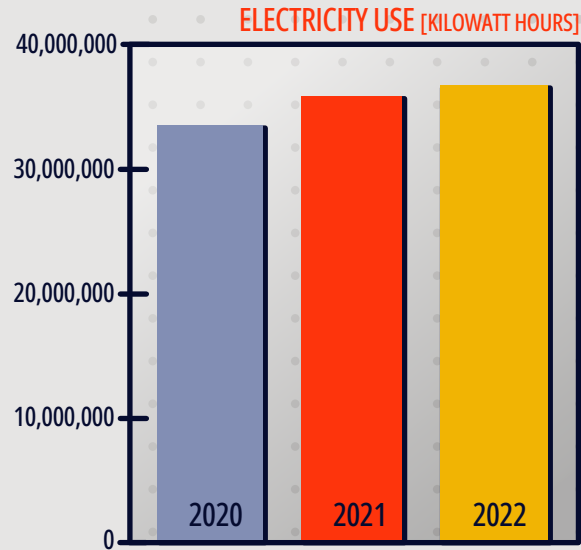
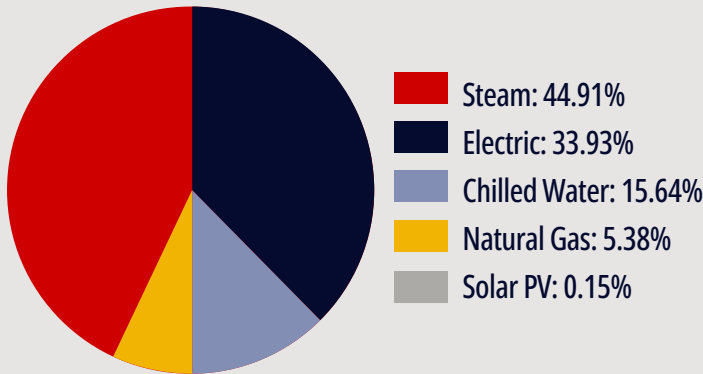
To ensure Mines buildings are also operating sustainably, Mines focuses on energy and water efficiency in existing buildings and grounds and renewable energy use. In 2021 and 2022, Mines began an energy program that added more than 1.5 megawatts of solar to campus buildings and a parking lot canopy.

Through ambitious energy conservation initiatives, Mines has achieved significant improvements in energy efficiency, including implementing an Energy Savings Performance Contract with McKinstry in 2010-2012 and again in 2017 through 2024. For just the McKinstry contract combined verified savings from 2010-2020 (not annual) savings are 18,974,217 kWh and \$4,334,997 and the equivalent of 10,690 MTCO₂ abated.

CAMPUS ENERGY USE

BELOW Mines energy use breakdown January 2022 through December 2022.

RIGHT Electricity use increased in 2022 as shown in the chart at right (normalized data). However, square footage increased by more than 500,000 square feet of new buildings and the number of students also increased by 1000. *Source: EnergyCap.*



Measuring Energy Savings & Growth

Energy Use Intensity (EUI) has been called the “miles per gallon” energy use rating of a building. It is a building’s annual energy consumption relative to its gross square-footage. For Mines, we use EUI to adjust for campus building growth by analyzing campus energy use converted into MMBtus for consistent measurement divided by the campus gross square footage. Mines EUI decreased from 6.81 MMBtu/SqFt in 2020 to 6.10 MMBtu/SqFt in 2022. Mines increased total building square footage by more than 500,000 square feet and its student population by more than 1,000. Total main campus building square footage at the end of 2022 is 2,871,170.

Campus Energy Use Intensity

Source: EnergyCap Sustainability Manager Report, January 2023

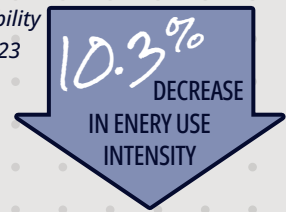


PHOTO ABOVE Mines is located in the foothills of the mountains and gets snow 4 or 5 months out of the year. For heating improvements, Mines renovated an old steam plant built in 1948 that provides steam to many older buildings on campus through underground steam tunnels. The old heating plant used coal to heat boilers. The new plant uses natural gas.



PHOTOS LEFT TO RIGHT Mines composts for large events such as the summer BBQs and offers a compost drop site to graduate student residents living in family housing.

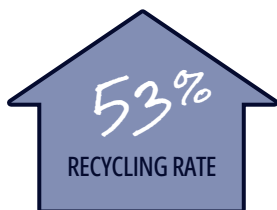
WASTE REDUCTION

The total campus waste diversion rate for single-stream recycling was 53% in 2022. That means that more than half our waste is recycled. In addition, we recycled 11 tons of electronic waste. Lab waste recycling included 165 pounds of nitrile gloves and 112 lbs of plastic pipette boxes. During move-in week, we recycled 10 boxes of plastic film and 10 supersacs of block Styrofoam. During Move-Out, we recycled more than 500 lbs of donated clothes.

We composted an estimated 11,500 lbs or more of food waste and serviceware from our kitchens and during large events. Construction waste recycled included asphalt from roads and concrete and other building materials.

A significant portion of the campus waste comes from daily operations, including lab waste and residence hall waste. The pandemic years caused an increase in waste going to landfill. All meals shifted to carry-out or disposal single-use containers in campus dining halls for health and safety reasons due to COVID-19. Solid waste increased from disposable gloves, masks, and signage, and other materials. On the bright side, we did expand campus composting by adding composting service to more large events and a weekly pickup service to our Student Center Kitchens. We also added a compost drop site to our Mines Park apartments for graduate student family housing.

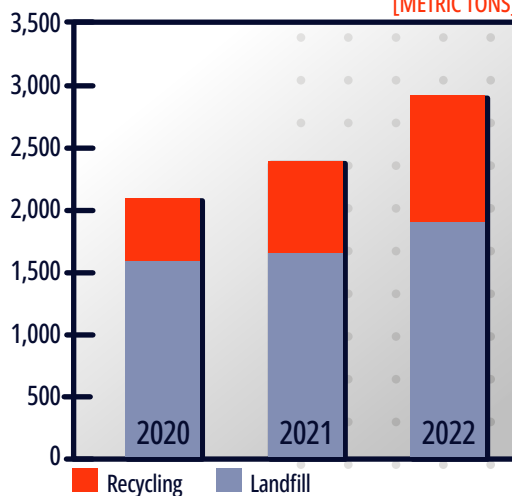
To reduce waste in our main dining facility, the Mines Green Team introduced several "Sustainability Days," where volunteers helped to compost serviceware from the dining facility and the chef featured special vegetarian meals. At this time, supply shortages prevent composting services on a daily basis



MAKING PROGRESS

Despite adding more buildings to campus and an increase in student population, Mines has seen an increase in its recycling rate. The percentage of waste diverted from landfill through recycling at Mines was 43% in 2020, 45% in 2021, and increased to a 53% waste diversion rate in 2022. The progress made was due to educational campaigns as well as the Green Team assisting with move-in recycling.

Single-Stream Landfill & Recycling
[METRIC TONS]





PHOTOS LEFT TO RIGHT Many students ride bikes to campus; an autonomous electric mini shuttle on campus called the Mines Rover.

SUSTAINABLE TRANSPORTATION

Mines is a mid-sized college with a student population of more than 7,000 students and more than 1,000 faculty and staff. Some 50% of students and more than 80% of faculty and staff commute by car, which significantly impacts our Scope 3 carbon emissions. Mines encourages campus commuters to walk, bike, carpool, or use alternative transportation when possible. Students/staff/faculty receive free ECO-passes for public transportation. Mines does allow hybrid and full-remotely work schedules for some staff.

Electric Vehicles

Mines continues to improve access to electric vehicles by adding EV infrastructure to campus and by adding electric vehicles to its campus fleet. Mines has installed 10 dual port charging stations on campus.

Electric Bikes

Electric bikes are becoming popular because they are easier to park than vehicles. Mines Sustainability subsidizes e-bike purchases for campus departments. So far, EHS, Public Safety, IT, Residence Life, and Electric Shop staff have e-bike transportation to get around campus.

Mines Rover

The Mines Rover was launched in Fall 2021 as the first phase of the largest deployment of low-speed autonomous electric shuttles in the U.S. This pilot program ended in December 2021 after four months of testing and service. In a message to the Mines community in January 2022, Mines officials thanked project partners EasyMile and the Colorado Smart Cities Alliance for bringing AV technology to the Mines campus.

Key barrier to long-term implementation of Mine's Rover were the steep slopes and narrow streets with parking on both sides found around the Mines campus.

Students in the Mines Capstone program studied the shuttles to determine if battery efficiency for autonomous electric shuttles could be improved.

Campus EV Charging Data [2020-2022]

YEAR	SESSIONS	UNIQUE DRIVER	KWh
2020	140	5	1,756
2021	1,410	193	18,744
2022	1,998	359	21,348

Note: charger energy use captured in campus energy use on page 13.



PHOTO Mines campus with Table Mesa in background.

WATER & GROUNDS

Mines promotes water conservation behavior change for the campus community through its People.Power.Planet campaign and Green Labs Programs. Among the water improvements made to buildings are water use and infrastructure audits, installing more water efficient appliances and fixtures, and more sustainable landscape management practices including natural landscaping along walkways and on the plaza area. In 2022, Mines started an electric leaf blower pilot. Mines continues to integrate sustainability practices into water and landscape management.

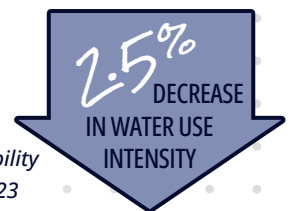


Campus Water Use Intensity

2020 : 94,172 Kgal

2022 : 91,863 Kgal

Source: EnergyCap Sustainability Manager Report, January 2023



PHOTOS Mines ground staff manage the campus grounds. A grounds staff member uses an electric leaf blower on campus.

SUSTAINABILITY REPORT

PROGRESS REPORT TRACKING
2019-2024

COLORADO SCHOOL OF MINES PUBLISHED A FIVE-YEAR STRATEGIC SUSTAINABILITY PLAN IN LATE 2019 JUST PRIOR TO THE PANDEMIC IN 2020.

FOR A SUMMARY OF PROGRESS TOWARDS THE SUSTAINABILITY TARGETS AND OBJECTIVES OUTLINED IN THE PLAN ACROSS SUSTAINABILITY PROGRAM AREAS ***READ THE FULL REPORT HERE >***
[MINES.EDU/SUSTAINABILITY/SUSTAINABILITY-REPORT-ARCHIVES/]



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2020-2022

COLLABORATION • INCLUSION • EXCELLENCE • ENGAGEMENT • LEADERSHIP • INNOVATION

WE, THE COLORADO SCHOOL OF MINES COMMUNITY, ARE UNITED BY OUR COMMITMENT TO OUR TIMELESS MISSION OF EDUCATING AND INSPIRING STUDENTS FROM ALL BACKGROUNDS AND ADVANCING KNOWLEDGE AND INNOVATIONS, WITH THE ASPIRATION THAT OUR GRADUATES, IDEAS, ACTIONS AND INNOVATIONS WILL HAVE A TRANSFORMATIVE IMPACT ON INDIVIDUALS AND SOCIETY, LEADING TO SHARED PROSPERITY AND SUSTAINABLE USE OF THE EARTH'S RESOURCES.



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