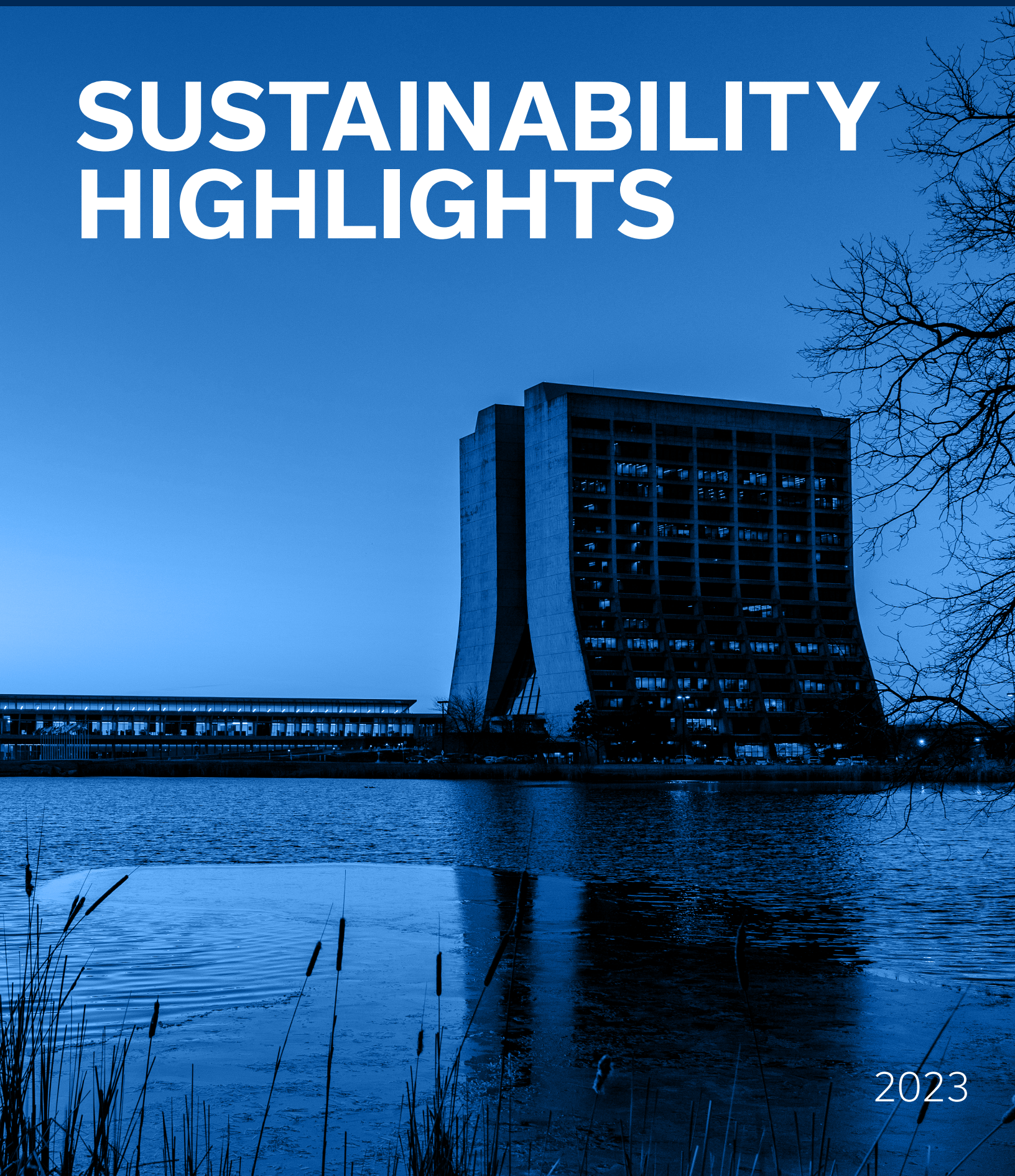
Fermilab

SUSTAINABILITY HIGHLIGHTS



2023

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INTRODUCTION

Fermi National Accelerator Laboratory is America's particle and accelerator physics laboratory, bringing the world together to solve the mysteries of matter, energy, space and time. As a Department of Energy National Laboratory, Fermilab is working on the world's most advanced particle accelerators and seeking out the nature of dark matter and dark energy. Ensuring that our activities in science and operations are executed in a sustainable manner and providing a model for sustainability to the high energy physics community is integral to delivering on Fermilab's mission.

Protecting, restoring and improving the natural environment are priorities. Fermilab is committed to long-term sustainability and resilience of its operations, which was demonstrated during the past year when we took big strides to build and improve our sustainability program.

This Fermilab Sustainability Highlights brochure summarizes our achievements from 2023.

SUSTAINABILITY VISION

Fermilab's vision is to be a global leader for sustainability in particle and accelerator physics and technology innovation. As a large user of energy, water and other resources, Fermilab has the responsibility to incorporate sustainability into the execution of our mission. We join the global concern over the threat of climate change and environmental issues.

Fermilab broadly defines sustainability as creating and maintaining conditions under which humans and nature can exist in productive harmony, permitting the fulfillment of social, economic, and other requirements of present and future generations.

Sustainability at Fermilab is advanced through:

- taking actions that seek to minimize or eliminate emissions of greenhouse gases and other pollutants;
- reducing energy and water use;
- increasing adaptation and resilience to the impacts of climate change;
- protecting public and worker health;
- minimizing waste;
- addressing anticipated harm from emerging contaminants of concern;
- conserving and restoring ecosystems and preserving native landscapes, watersheds, and biodiversity;
- and delivering environmental justice.

Fermilab strives to be a global leader in performing science sustainably. We are committed to setting sustainability goals as an integral part of new scientific infrastructure projects. We are also incorporating sustainability into all our operations so we can further establish Fermilab as a beacon of sustainability and progress. Many technologies developed and advanced in pursuit of discoveries in particle physics will contribute to a more sustainable future. Our discoveries demonstrate the ability of humanity to more fully understand the basic building blocks of energy and matter and with it, the inspiration to solve the intractable problems of our time.

Lia

Lia Merminga, Director of Fermilab

HISTORICAL LEADERSHIP

Fermilab has a long history of environmental stewardship with an early focus on ecological land management and prairie restoration dating back to the 1970's. Over the last 15 years, Fermilab has increased efforts to address site sustainability in support of DOE's sustainability goals and requirements. The Fermilab Sustainability Management Team — chartered as a working group under the Chief Operations Officer — leads the laboratory's sustainability program.

The team leverages a matrix group of designated employees to help establish policies and develop and implement programs that support energy and water efficiency, waste minimization and recycling, and green transportation, among other areas. Through our sustainability program we seek to build upon our legacy of ecological land management and environmental stewardship to lead by example with sustainability and climate action.

SUSTAINABILITY STRATEGY AND KEY GOALS

Fermilab's sustainability program focuses on the following four key strategies to achieve our vision and meet DOE's sustainability goals:

- **Making sustainability part of our culture:** We incorporate sustainability into how we meet our mission.
- **Applying best practices for sustainable operations:** We implement proven and impactful sustainability approaches into how we manage our campus infrastructure and execute our operational activities.
- **Driving discovery to achieve sustainability in science:** We discover new ways to integrate sustainability into our science strategy and execution of our mission.
- **Leveraging partnerships to drive impact:** We partner and collaborate with cross-division teams and external partners to increase the impact of our actions.

Fermilab operates under a Site Sustainability Plan that is released annually. The plan outlines the lab's recent progress and goals for meeting DOE's sustainability standards for energy management, water management, waste management, fleet management, sustainable buildings, and acquisition and procurement practices. Fermilab reports performance data through the DOE Sustainability Dashboard which measures the lab's progress towards these goals. The Site Sustainability Plan requirements are integrated into the sustainability program strategy.

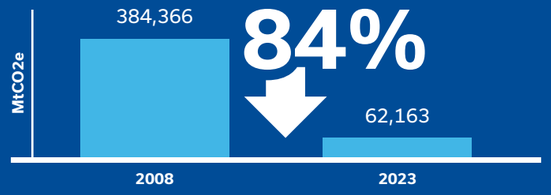
Working toward net zero carbon emissions is a key priority of the Federal Sustainability Plan and the DOE. Fermilab has incorporated these priorities into our fiscal year 2024 Site Sustainability Plan which include the following:

1. Conversion of energy to 100% carbon-pollution free
2. Conversion and construction of net-zero sustainable buildings
3. Conversion of laboratory fleet to net-zero electric vehicles

We are taking an all-laboratory approach to realize our sustainability vision and achieve our sustainability goals. In 2023 we established a strategic plan to address near-term actions and set a path for long-term success.

KEY SUSTAINABILITY METRICS

Carbon emissions



GOAL: Net-zero by 2050

Resource conservation

12X
Cooling water is reused 12 times before being discharged from the site

52%
of waste diverted (municipal solid waste)

81%
of construction and demolition debris diverted from landfill

Electrification

35%
carbon pollution-free electricity (FY23)

GOAL: 100% by 2030

42%
166/394 of Fermilab's buildings are electric (FY23)

GOAL: 100% by 2045

52%
zero emission vehicle acquisition

87 total vehicles ordered, 45 are mix of plug-in hybrid electric vehicles and battery-electric vehicles

GOAL: 100% acquisitions by 2035

Education and planning

16 staff trained on energy

121 staff trained on climate AND energy (Earth Day and training)

45 Sustainability Management Team members

SUCCESS STORIES AND ACCOMPLISHMENTS

Success stories from the last year highlight our progress in addressing DOE's sustainability goals and serving as a model for sustainability in a high energy physics laboratory.

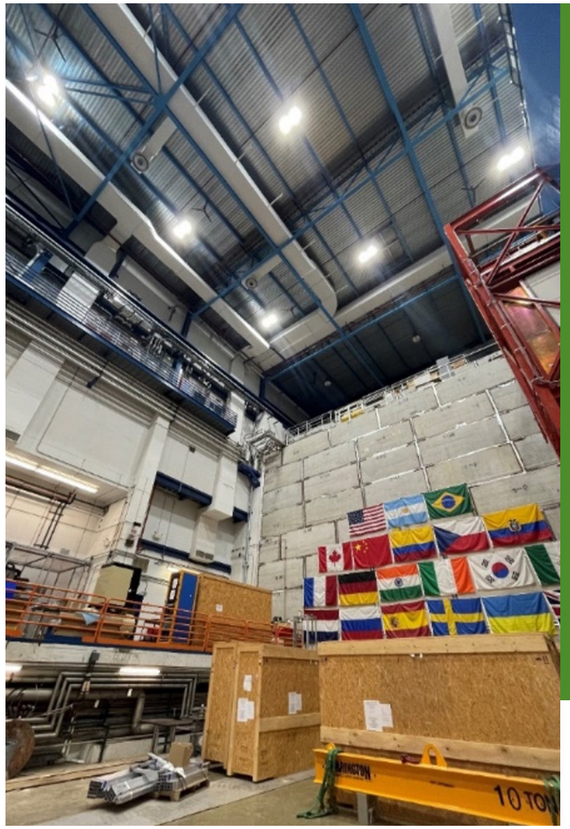
Sustainability team expansion

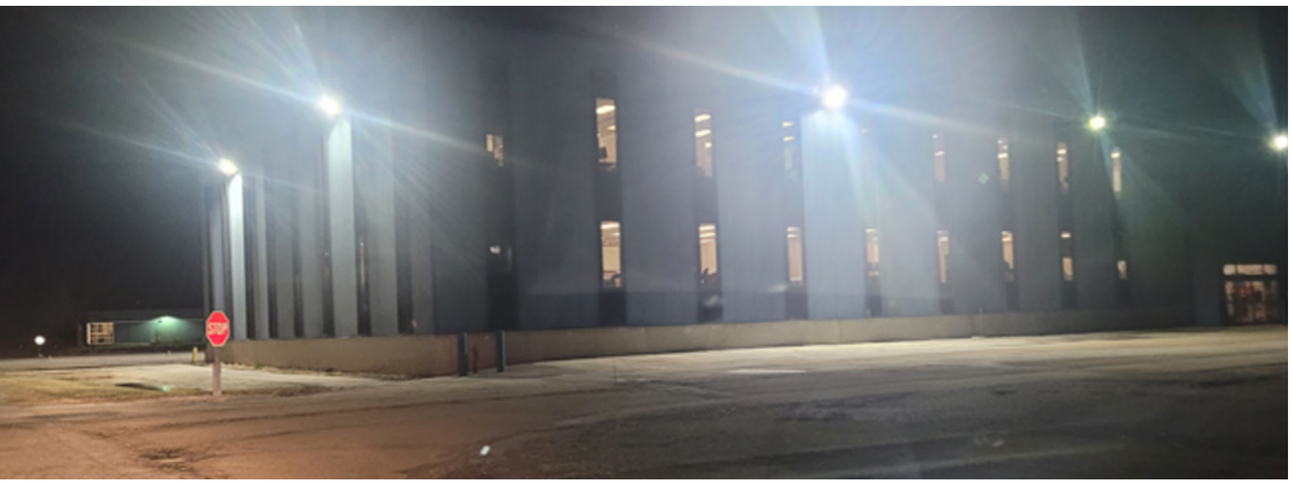
Fermilab demonstrated its commitment to sustainability by adding four full-time dedicated staff members. Their focus has been to develop and implement a strategy and lead the laboratory's expanded sustainability efforts. Dedicated staffing allowed Fermilab to expand matrixed Sustainability Management Team membership from approximately 12 individuals to 45 people who focus on strategy implementation. The expanded team had great success building valuable partnerships and recruiting many subject matter experts this past year. New synergies are being identified, fresh ideas are surfacing and momentum is growing across Fermilab toward a greener, more resilient future.

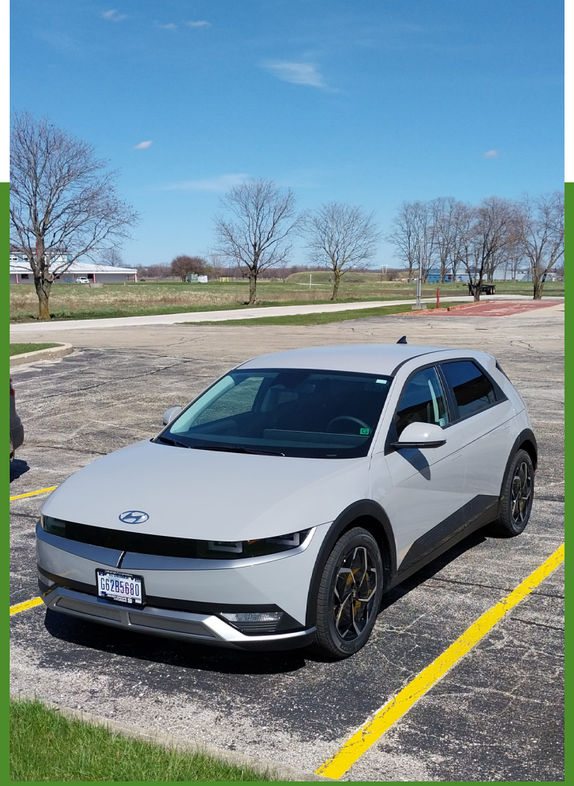
Sustainable buildings

Fermilab continued to install energy efficient lighting across the laboratory to support safe and efficient workspaces. A highlight was a lighting upgrade which replaced 36 bulbs in a high bay above a 70-foot pit. The area had been declared a “No Maintenance Zone” because of the extreme height of the ceiling. A special lift with over a 75-foot reach was used in the high bay area to reach the light fixtures. Fermilab replaced 1,080W bulbs with 320W bulbs for a total reduction of 26,000 watts. The project also received a $30,000 rebate from ComEd.

Additionally, Fermilab took strides to plan and implement sustainable building features across the laboratory. Gas furnaces at 22 residential units in the Village were replaced with electric heat pumps. A master plan was completed for renovating Wilson Hall, which involves a strategy of performing end-of-life replacement on two floors of Wilson Hall every year. Fermilab also completed preliminary design for the central utility building as a part of the Utilities Infrastructure Project, which includes replacement of natural gas fired boilers with electric boilers and other facility upgrades. Eleven buildings on Fermilab’s campus are now Guiding Principle compliant and ten more buildings are in design or construction that will be compliant upon commissioning.





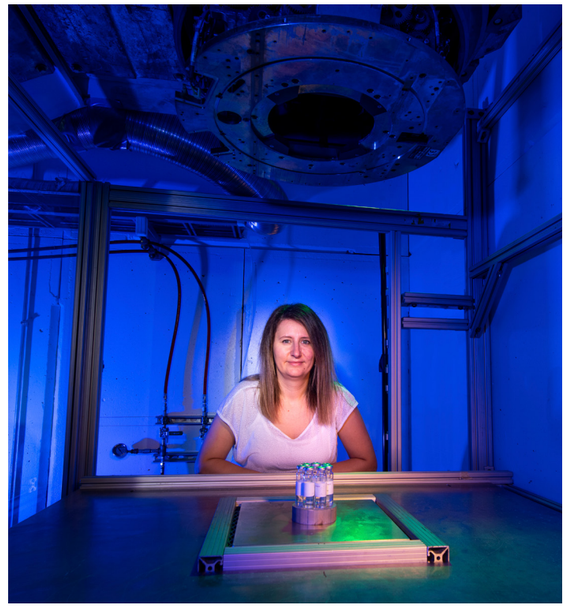


Zero emission vehicles

A plan is being established to convert the Fermilab fleet to zero-emission electric vehicles and to create a charging station infrastructure to support the transformation. Thus far, approximately 48 alternative fuel vehicles have been requested through the General Services Administration, a mix of battery electric vehicles and plug-in hybrid electric vehicles. A major part of the roadmap was the development and planning of electric vehicle charging station infrastructure across the Fermilab site. Phase 1 of this deployment is in planning stages currently to support the forthcoming electric fleet vehicles.

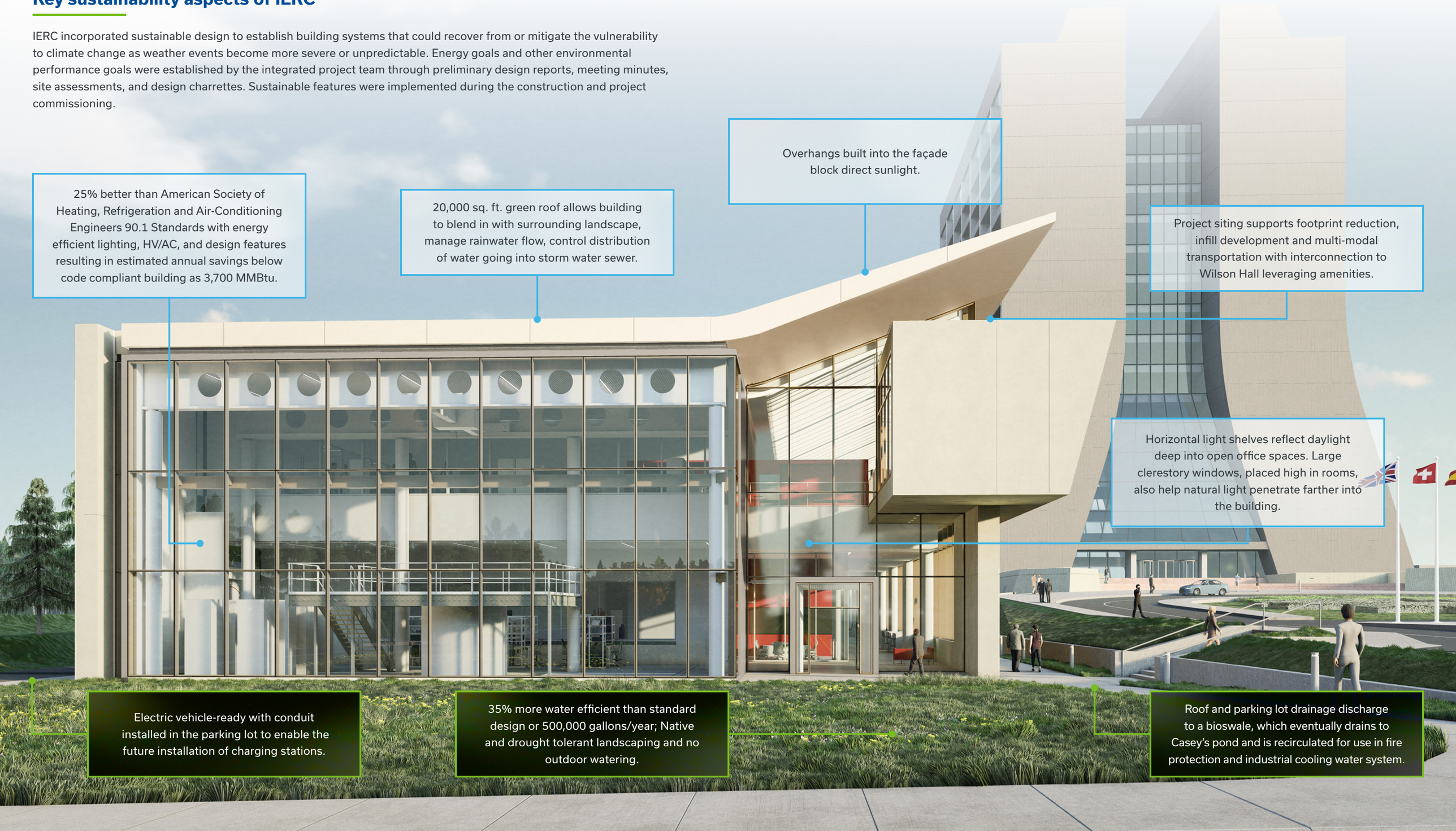
Sustainability in science: high-energy electron beams for water treatment

Researchers at Fermilab are using electron beams to eradicate forever chemicals in water. High-energy electron beams are excellent candidates for destroying PFAS in the environment. Perfluoroalkyl and polyfluoroalkyl substances — commonly known as PFAS and often called forever chemicals — accumulate in the environment and body, and are not broken down with natural processes. This year researchers at the Fermilab, in collaboration with 3M, have successfully demonstrated that an electron beam can destroy the two most common types of PFAS in water — PFOA and PFOS. This success is one great example of how Fermilab is pursuing opportunities to integrate sustainability into science and leverage our technologies to solve sustainability and environmental challenges for the benefit of the world.



Key sustainability aspects of IERC

IERC incorporated sustainable design to establish building systems that could recover from or mitigate the vulnerability to climate change as weather events become more severe or unpredictable. Energy goals and other environmental performance goals were established by the integrated project team through preliminary design reports, meeting minutes, site assessments, and design charrettes. Sustainable features were implemented during the construction and project commissioning.



Department of Energy awards

Fermilab was recognized for excellence in sustainability performance with two awards by the Department of Energy Sustainability Performance Office.

Eric Mieland recognized as Sustainability Champion
Eric Mieland was recognized by DOE as a "Sustainability Champion" for his decades long effort to improve the laboratory's environmental performance. Eric was a key leader of early grassroots sustainability efforts at Fermilab more than 14 years ago and still is today. He was the founder and volunteer chair of the first sustainability committee and recruited others to help. Over the years Eric led many sustainability projects, such as waste diversion programs, incorporating sustainability into food service and custodial contracts, and education and outreach efforts. Last year Eric developed Fermilab's climate vulnerability and resilience plan, working with numerous stakeholders across the lab.

Fermilab and Fermilab Natural Areas recognized for strategic partnerships for sustainability
The long-standing partnership between Fermilab and Fermilab Natural Areas, a 501(c)3 non-profit, was awarded a DOE Sustainability Award for the successful ecological management of our campus. For nearly 20 years, this partnership has worked to maintain and enhance over 4 thousand acres of natural areas including 1,200 acres of restored prairie. Together, the laboratory and Fermilab Natural Areas have maintained our iconic National Environmental Research Park, created invaluable site access opportunities for the public, preserved countless species, and carried on the original prairie restoration mission of ecologist, Dr. Robert Betz. This partnership has resulted in thousands of volunteer hours each year to help maintain a healthy ecosystem. Weekly workdays allow for the public to visit the lab and work hands-on with our current ecology stewards. This opportunity establishes a sense of pride and fosters a healthy relationship with surrounding communities.

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FOR MORE INFORMATION:

Please email the Sustainability Program at **sustainability@fnal.gov**.