MathWorks®

MathWorks 2022 Climate Action Report

Contents

Report Summary

MathWorks is committed to protecting and restoring Earth's resources. In 2022, we made significant advancements in our environmental efforts throughout our operations, partnerships, and products.

Operations	
Reporting	• Published inaugural report following Global Reporting Initiative (GRI) standards and committed to annual reporting moving forward. • Calculated 2022 environmental footprint including Scope 1, 2, and 3 greenhouse gas (GHG) emissions, as well as energy, water, and waste. • Began developing an Environmental Management System.
Carbon	• Offset 100% of emissions from our worldwide Scope 1 and Scope 2 carbon footprint and a portion of our Scope 3 emissions. • Conducted an electrification audit and maximized all viable opportunities for onsite solar generation at the Natick, Massachusetts campuses (Apple Hill and Lakeside). Generated 2,100+ megawatt hours (MWh) of renewable energy in 2022. • Invested in 12-year virtual power purchase agreement (VPPA) with Enel North America, generating 50,000 MWh annually, and retained associated renewable energy credits (RECs). • Purchased carbon removal offsets from GreenTrees' Mississippi Alluvial Valley reforestation project through the Arbor Day Foundation.
Energy and Water	• Attained campus energy usage intensities (EUIs) of 44.87 and 38.25 and data center power usage effectiveness (PUE) values of 1.42 and 1.22 at our Apple Hill and Lakeside campuses, respectively. • Implemented HVAC control strategies at both Natick campuses and completed conversion to 100% LED lighting at the Lakeside campus. • Reduced water consumption by installing low-flow fixtures, improving cooling tower chemistry, and reducing chilled- and condenser-water loop flow rates. • Implemented fault detection and diagnostics as well as an ongoing recommissioning plan at the Natick campuses.
Waste	• Diverted 66% of Natick office waste from landfills and incinerators through recycling, composting, and electronics collection programs. • Initiated a back-of-house cafeteria composting program.

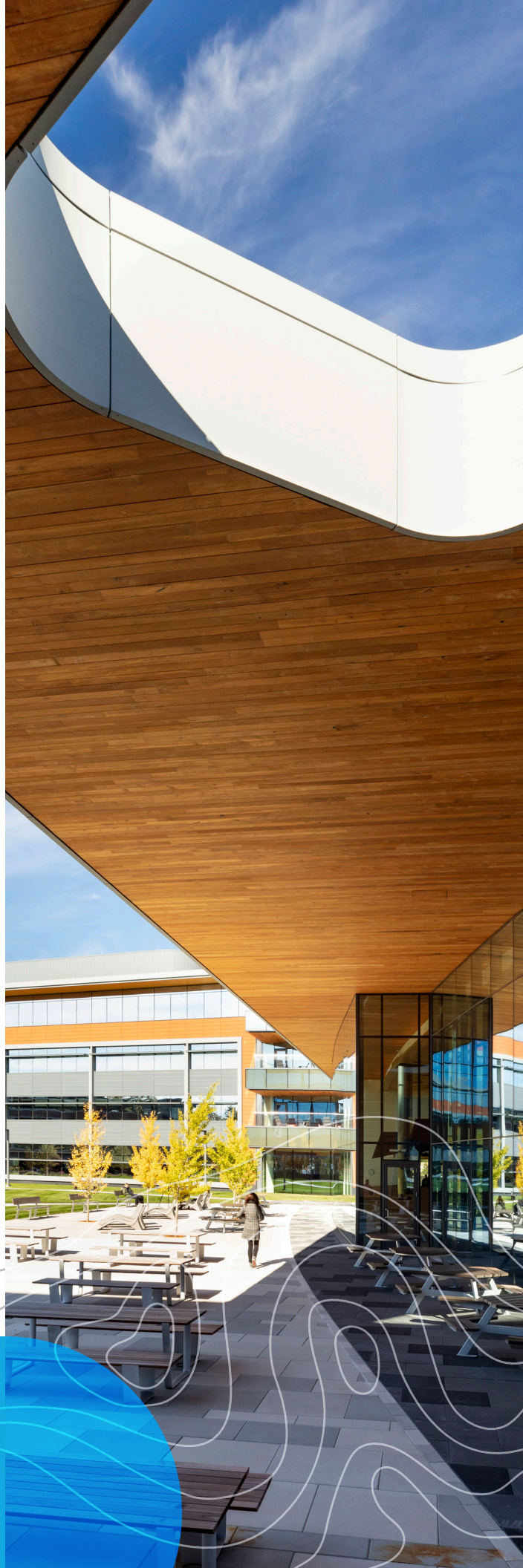
Partnerships	
Environmental Organizations	• Partnered with Mass Audubon through the MathWorks Foundation, donating $2.5 million to support large-scale conservation and restoration of land in Massachusetts.
Accelerators	• Pledged $1.5 million in climate-related research funding, hosted engineering competitions, and worked with Greentown Labs to support development of climate technologies. • Supported 160 climate-focused technology startups around the world through strategic partnerships with leading accelerators.
Academia and Industry Associations	• Engaged with the MIT Climate & Sustainability Consortium to help drive large-scale industry collaboration. • Joined the EcoCAR EV Challenge as a headline sponsor, supporting students engineering a next-generation battery electric vehicle. • Collaborated with Chalmers University of Technology and Delft University of Technology to develop courseware for electric and hybrid vehicle design and solar energy engineering.
Products	
Electrification	• Expanded product support for electrification by adding capabilities for the design and simulation of battery and energy storage systems.
Climate Science	• Released the Climate Data Visualization and Analysis curriculum module, enabling instructors to design courses that inspire the next generation of climate research.

ABOUT MATHWORKS

MathWorks at a Glance

MathWorks Offices

Our Products and Services



About MathWorks

MathWorks is the leading developer of mathematical computing software. Our purpose is to change the world by accelerating the pace of discovery, innovation, development, and learning in engineering and science. We achieve this through four components of our mission:

- **Technology**. We work to provide the ultimate computing environment for technical computation, visualization, design, simulation, and implementation. We use this environment to provide innovative solutions in a wide range of application areas.
- **Business**. We strive to be the leading worldwide developer and supplier of technical computing software. Our business activities are characterized by quality, innovation, and timeliness; competitive awareness; ethical business practices; and outstanding service to our customers.
- **Human**. We cultivate an enjoyable, vibrant, participatory, and rational work environment that nurtures individual growth, empowerment, and responsibility; appreciates diversity; encourages initiative and creativity; values teamwork; shares success; and rewards excellence.
- **Social**. We actively support our local and professional communities through initiatives that advance STEM education, foster staff volunteerism, build environmental sustainability, and aid global relief efforts.

MATHWORKS AT A GLANCE

Founded in 1984

Revenue of $1.25 billion

Headquartered in Natick, Massachusetts

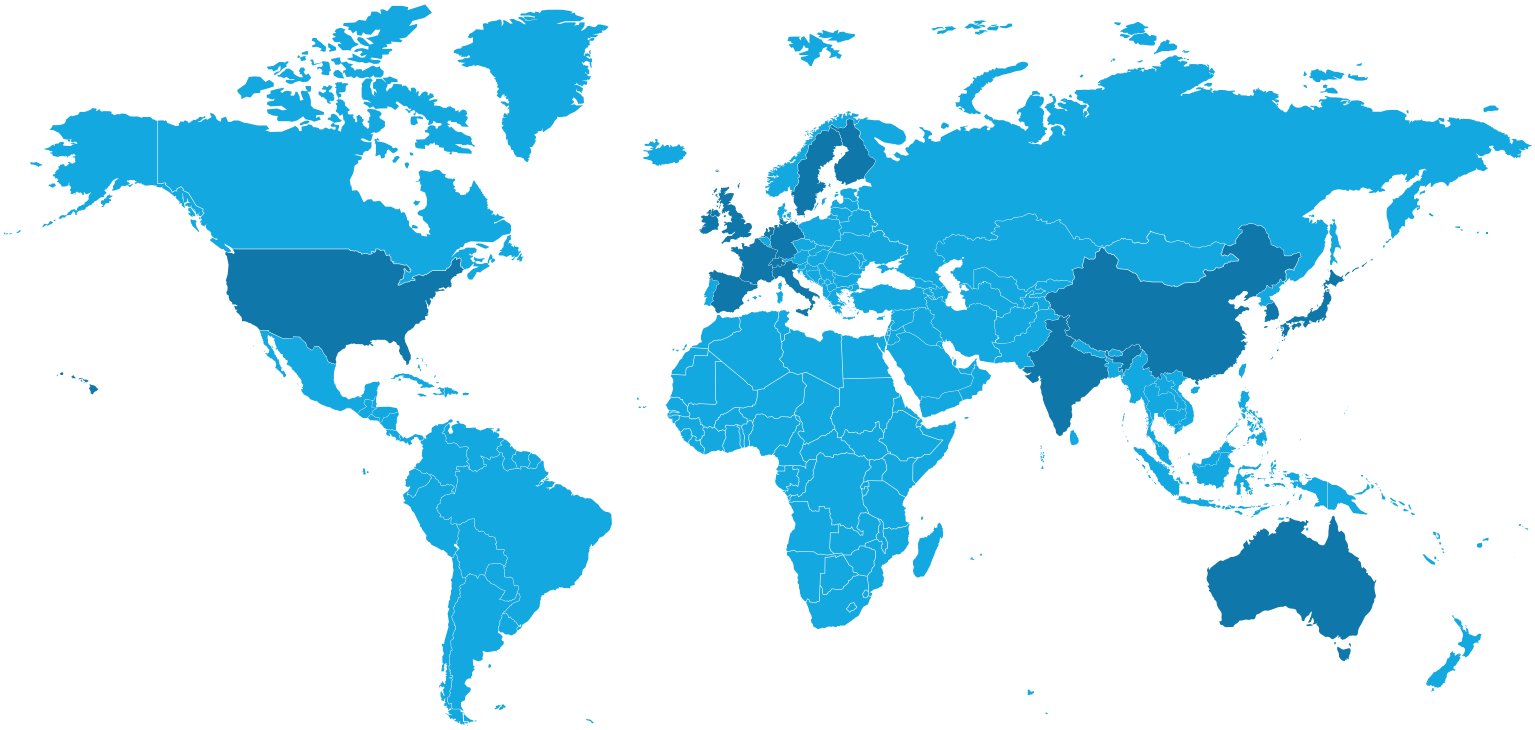
6,000+ staff members across 34 global locations

120+ MATLAB® and Simulink® products with 5 million+ users

Customers in 180+ countries

Installations at 100,000+ businesses, universities, and government organizations

MathWorks Offices: 34 Locations in 16 Countries



AUSTRALIA | Chatswood

CHINA | Beijing and Shanghai

FINLAND | Espoo

FRANCE | Meudon and Montbonnot

GERMANY | Aachen, Munich, Paderborn, and Stuttgart

INDIA | Bangalore, Hyderabad, New Delhi, and Pune

IRELAND | Galway

ITALY | Torino

JAPAN | Nagoya, Osaka, and Tokyo

KOREA | Seoul

NETHERLANDS | Eindhoven

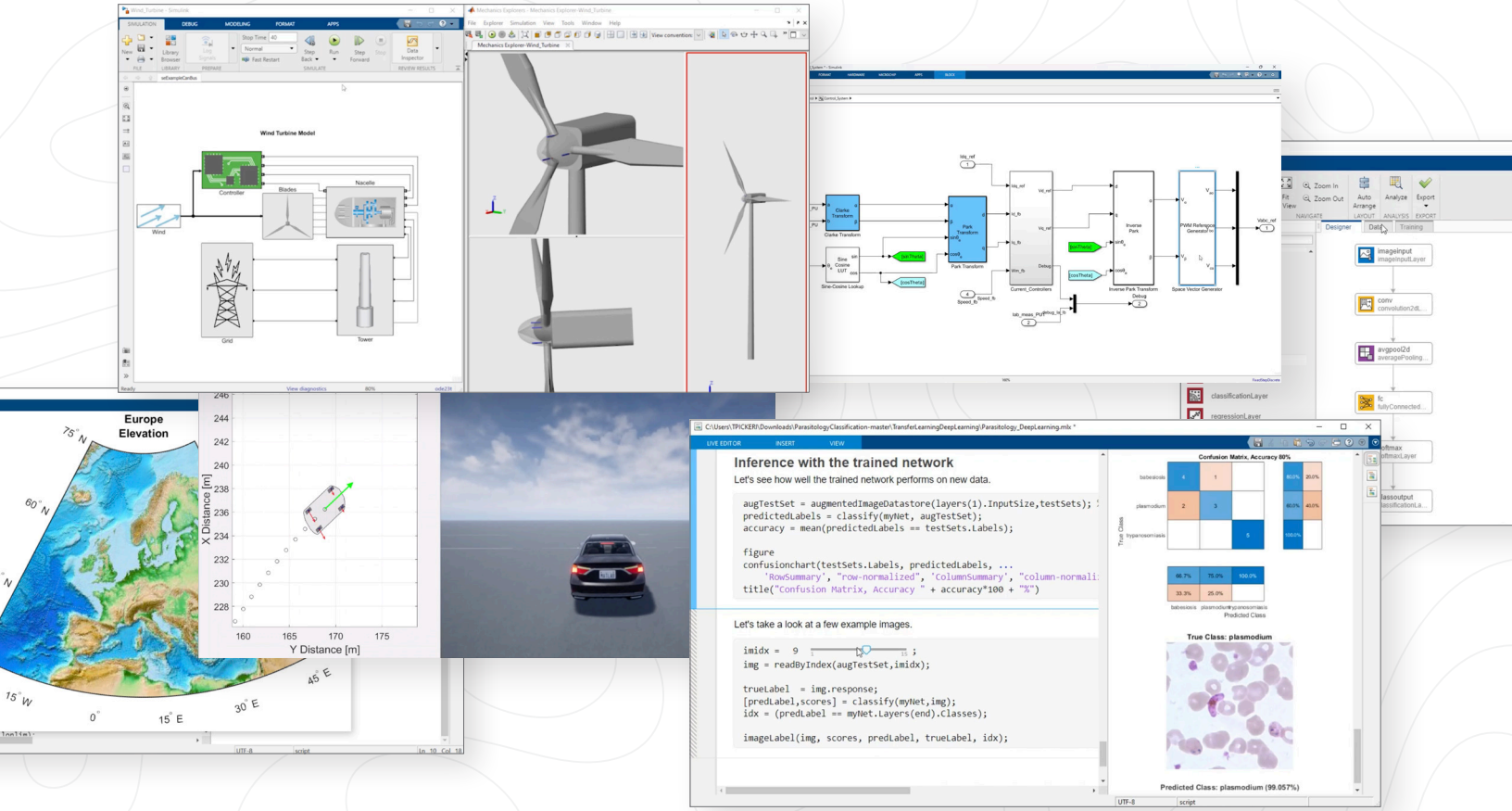
SPAIN | Madrid

SWEDEN | Gothenburg and Kista

SWITZERLAND | Bern

UNITED KINGDOM | Cambridge, England, and Glasgow, Scotland

UNITED STATES | Carlsbad, Santa Clara, and Torrance, California; Chevy Chase, Maryland; Natick, Massachusetts; Novi, Michigan; and Plano, Texas



Our Products and Services

At MathWorks, we believe in the importance of engineers and scientists to increase human knowledge and profoundly improve our standard of living. We help them do their best work through two product families:

- **MATLAB**, a programming and numeric computing platform for analyzing data, developing algorithms, and creating models
- **Simulink**, a block diagram environment used to design systems with multidomain models, simulate before moving to hardware, and deploy without writing code

Engineers and scientists worldwide use MATLAB and Simulink across many industries:

- Academia
- Aerospace and defense
- Automotive
- Biotech and pharmaceutical
- Communications
- Electronics and semiconductors
- Energy
- Financial services
- Industrial automation and machinery
- Medical devices
- Software and internet

Learn more about MathWorks products and services.

ENVIRONMENTAL GOVERNANCE AND ENGAGEMENT

Environmental Management

Environmental Governance and Engagement

MathWorks has long pursued sustainability as part of our mission. We formed an environmental leadership team to focus on the company's environmental performance, investments, and progress toward goals.

Beyond the leadership team, the staff-run GreenWorkers group promotes environmentally friendly practices at work, at home, and in the community. As of 2022, they have spearheaded the following company initiatives:

- Earth Day celebration, including a speaker series and film screening
- Lunch-and-learn events throughout the year on sustainability issues such as climate change and civic engagement
- Regular meetings to discuss company initiatives and improvement opportunities

Environmental Management

Our environmental management approach is focused on compliance and mitigation of MathWorks environmental footprint. We own or lease 34 offices globally, taking a decentralized approach that considers the unique circumstances and capabilities of each location, including:

- Local laws and regulations
- Footprint size
- Options available given lease or ownership status

We strategically invest in environmental initiatives, focusing on owned locations and those with the largest footprint, such as the two locations in Natick: Apple Hill and Lakeside. We regularly audit our buildings to identify improvement opportunities.

In 2022, we began developing a formal Environmental Management System (EMS) for the Natick locations. The EMS references recognized standards and best practices such as ISO 14001 environmental management standards.

OPERATIONS

Commitment to Reporting and Transparency

Addressing Our Carbon Footprint

Managing Energy and Water

Diverting Waste

Operations

MathWorks organizes our operational efforts into four pillars:

Reporting	Carbon	Energy and Water	Waste
• Annual environmental reporting • GRI alignment • External assurance	• Emission reduction • Renewable energy generation • Carbon removal and offsets	• Energy and operational efficiency • Water efficiency	• Waste minimization • Recycling • Composting

Commitment to Reporting and Transparency

We know that making things visible through data and reporting is critical to identifying problems or opportunities for innovation. This applies to environmental reporting, and we will provide annual updates regarding our environmental performance. This report is prepared following internationally recognized standards including GRI and the Greenhouse Gas (GHG) Protocol. For further assurance regarding the integrity of this report, we have completed **third-party verification** of our environmental data.

Addressing Our Carbon Footprint

MathWorks calculates our total global carbon footprint across Scope 1, 2, and relevant Scope 3 emissions sources. Our current Scope 3 emissions categories include purchased goods and services (PG&S), capital goods, fuel- and energy-related activities (FERA), waste, commuting, remote work, business travel, and downstream leased assets.

Our first step in reducing our footprint is to avoid emitting GHGs in the first place. We do this through constant improvement of our built spaces to drive efficiency, reducing our Scope 1 and 2 emissions. We also maximize **onsite energy generation** and continue to expand our waste management practices, thus **diverting waste** from landfills and incinerators. More details on how we accomplish these objectives are provided later in this report.

However, as efficient as MathWorks has become, we must accept the reality that we will continue to emit some GHGs in our current global infrastructure. Because of this, MathWorks offset 100% of our emissions for our worldwide Scope 1 and 2 energy use in 2022.

MathWorks is in the beginning stages of reducing our Scope 3 emissions, over which we have limited direct control. These efforts include engaging our supply chain in a carbon-conscious way and continuing to improve the quality of available data to inform our actions.

MathWorks has started offsetting some categories of our Scope 3 footprint, including 100% of emissions from our commuting, waste, and business travel, as well as portions of our remote work and downstream leased assets.

Formalizing Our Climate Strategy

While 2022 marked the first year of MathWorks reporting, our efforts to formalize our GHG inventory and address emissions date back to 2009. Milestones from the last several years include:

- **2009:** Added 139 kW DC solar array at Apple Hill Building 2.
- **2016:** Added 271 kW DC and 715 kW DC solar arrays at Apple Hill Building 3 and the Lakeside garage, respectively.
- **2017:** Added 315 kW DC combined solar arrays at Apple Hill Buildings 1 and 4.
- **2018:** Added 294 kW DC combined solar arrays at the Lakeside Math and Science buildings.
- **2020:** Calculated Scope 1 and 2 emissions at our locations in Natick, Massachusetts, as well as Scope 3 business travel (air travel only). Committed to offsetting these emissions each year moving forward.
- **2021:** Extended GHG inventory companywide and expanded Scope boundaries to include additional material emissions sources.
- **2022:** Calculated MathWorks total Scope 1, 2, and 3 emissions footprint across global operations. Initiated efforts to address emissions at a greater scale, including investing in internal reduction measures, RECs, and offsets.

Through these efforts, we have a comprehensive view of our global carbon footprint and have formalized a robust strategy for addressing our emissions. We have organized our operational climate strategy around the following actions:

- Calculate and report our carbon footprint.
- Prioritize direct emission reductions through our operations.
- For emissions we cannot eliminate, support clean energy through renewable energy projects and enable carbon removal and sequestration by investing in nature-based carbon removal offsets.

Our Greenhouse Gas Inventory

To calculate our GHG footprint, we reference guidance from the **GHG Protocol**, consult with industry experts, and verify our approach through internal and external audits. **Read more** about our environmental data calculation and methodology.

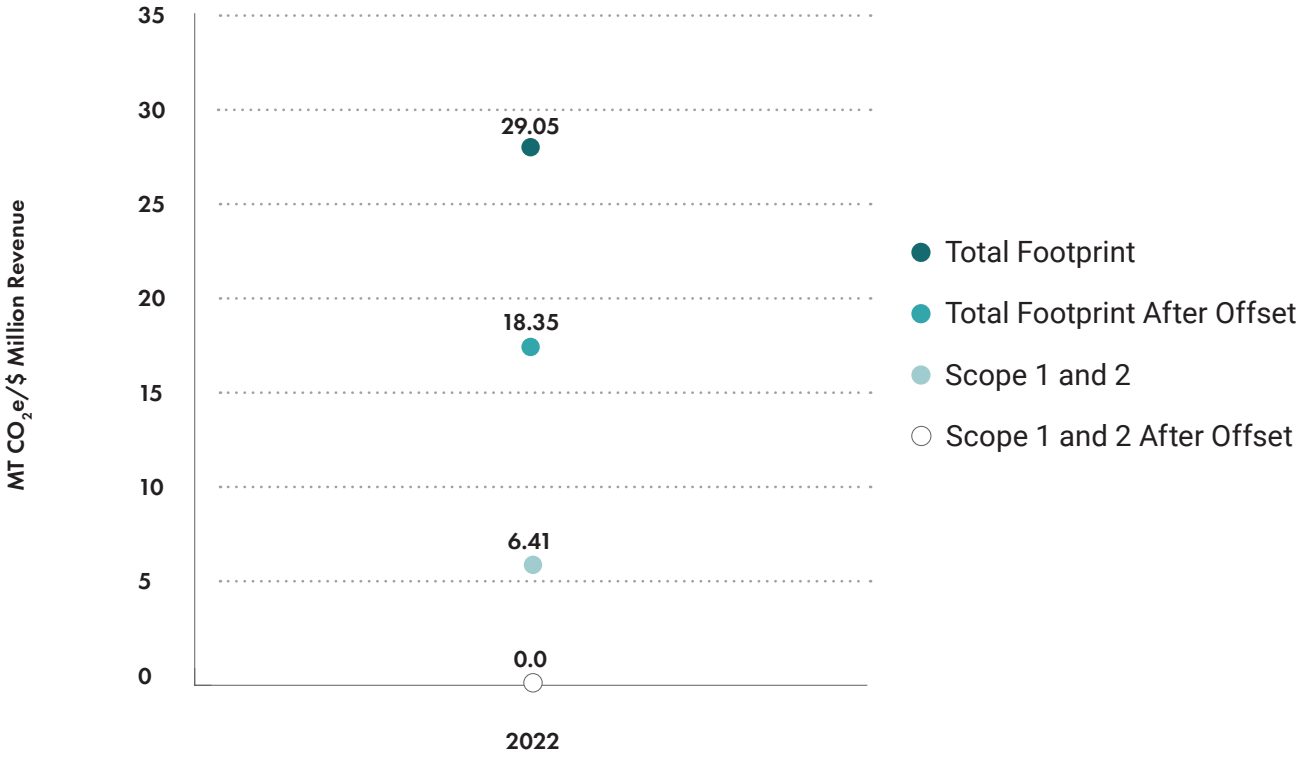
Scope 1, 2 and 3 Definitions and Sources

	GHG Protocol Definition	MathWorks Key Sources
Scope 1	Direct GHG emissions from sources owned and controlled by MathWorks	Primarily natural gas used to heat buildings, provide hot water, and operate campus cafeterias across our global footprint
Scope 2	Indirect GHG emissions from purchased grid-sourced electricity, steam, heat, or cooling	Global building operations and data centers
Scope 3	All other indirect GHG emissions that are a consequence of MathWorks activities but occur from sources not owned or controlled by the company	Purchased and capital goods and services, fuel- and energy-related activities (FERA), waste, business travel, staff commuting, remote work, and downstream leased assets

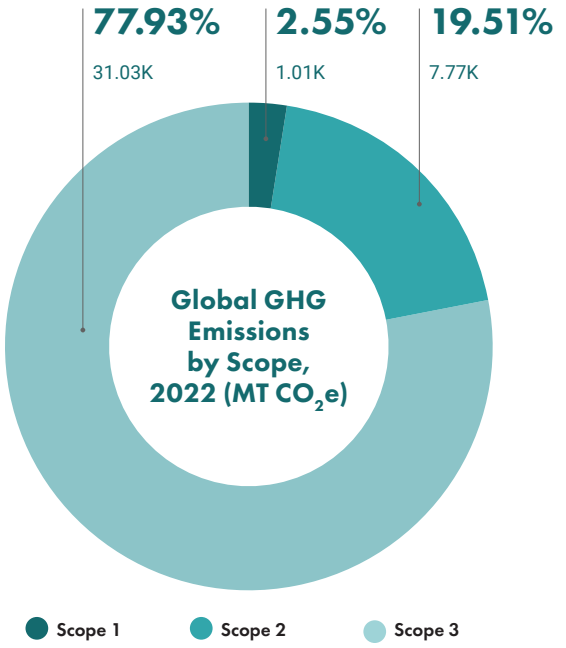
Addressing Key Sources of Global 2022 GHG Emissions (MT CO_2e)

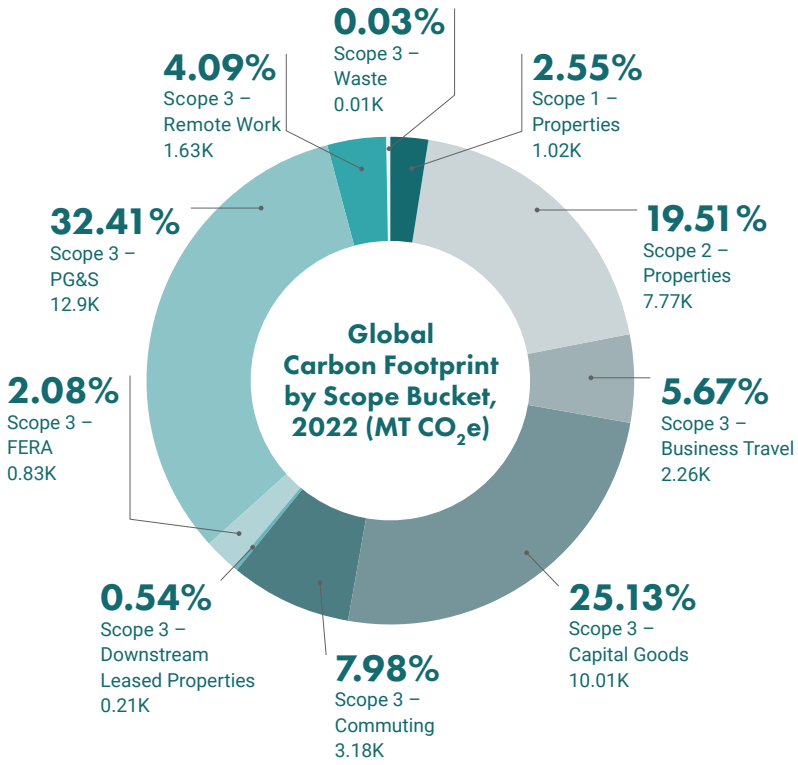
Total GHG emissions (Scopes 1, 2, and 3) associated with MathWorks operations	39,813
GHG emissions addressed	
Addressed by renewable energy procurement (RECs from VPPA and unbundled purchases)	4,838
Addressed by carbon offsets	9,825
TOTAL	**14,664**
Percentage emissions addressed	36.8%

Global GHG Emissions Intensity, 2022



MathWorks has grown every year since inception, and we expect to sustain continued growth in the future. To take that growth into account, MathWorks will track progress in metric tons of CO_2e per million dollars of revenue. This will be shown in terms of both our Scope 1 and 2 progress and our total carbon footprint. We will also factor in the investments we are making through offsetting our unavoidable emissions.





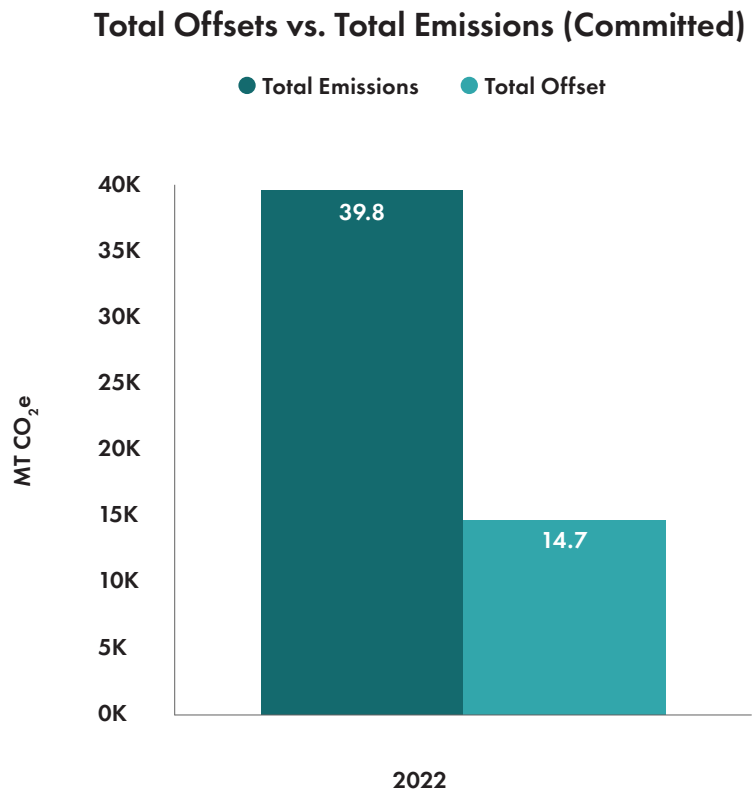
Global GHG Emissions, 2022 (MT CO_2e)

	Emissions	Offset
Scope 1	1,017	1,017
Scope 2	7,769	7,769
Scope 3		
Category 1: Purchased Goods and Services	12,905	0
Category 2: Capital Goods	10,005	0
Category 3: FERA	828	0
Category 5: Waste*	11	11
Category 6: Business Travel	2,256	2,256
Category 7: Staff Commuting	3,178	3,178
Category 7: Remote Work	1,630	315
Category 13: Downstream Leased Properties	215	119
TOTAL	**39,813**	**14,664**

* Represents ~69% of global office square footage.

Note: For additional information on carbon offsets and RECs, **see the appendix**.

Global Emissions and Offsets by Scope, 2022



Supporting Renewable Energy

Renewable energy is instrumental to our carbon reduction strategy. We installed our first solar array in 2009 and have steadily expanded our renewable energy generation since then.

Direct Renewable Generation: As of December 31, 2022, seven solar array installations throughout our Natick campuses total roughly 2 megawatts (MW) of onsite generation. MathWorks participates in state incentive programs, which sell the environmental attributes (RECs) to local providers. Therefore, MathWorks will not claim the reduced carbon of these installations until our participation in the programs ends, which will occur over the next several years.

Expanding Renewable Energy: In addition to direct generation, we support renewable energy infrastructure in communities by purchasing RECs and investing in a VPPA with **Enel North America**. Since 2020, MathWorks has purchased a total of 50,000 RECs (15,500 in both 2020 and 2021, and 19,000 in 2022), predominantly from the Prairie Breeze Wind Energy II Project. This project provides Nebraska with approximately 73 MW of renewable energy from 20 wind turbines. We strategically purchased RECs in Nebraska, a state with a relatively high use of coal, to help expand renewable infrastructure in this region and make a measurable impact.

INITIATING A 12-YEAR VPPA WITH ENEL NORTH AMERICA

In 2022, MathWorks identified, negotiated, and signed a VPPA with Enel North America to purchase approximately 50,000 MWh of wind-powered electricity and associated RECs annually, fully addressing our GHG emissions related to US electric consumption. The agreement runs for 12 years and begins January 2023.

Through the VPPA, MathWorks funds an 11 MW portion of Enel's 25 Mile Creek Wind Project in Ellis County, Oklahoma, helping expand renewable infrastructure and enable other benefits in the community. Over its lifetime, the project is estimated to create over $24 million in new local tax revenue for schools and public services and more than $56 million in landowner payments.

Enabling Carbon Removal Projects

MathWorks remains focused on driving direct emission reductions whenever feasible. However, for our unavoidable emissions, we seek projects that maximize the impact we can have through our participation while retaining offsets from those projects. If those projects don't meet our criteria, we strategically purchase carbon offsets from trusted sources that are already having a positive impact.

Our climate investments help support reforestation and carbon sequestration, climate resilience, and renewable energy expansion, thus funding renewable energy and carbon removal at a large scale.

We carefully select partners for carbon removal to ensure the validity of our offsets. We prioritize investing in voluntary emission reductions. We have vetted the projects we invest in to ensure they will remove the emissions projected and provide sequestration for at least 40 years. We collaborate with widely recognized organizations such as the Arbor Day Foundation, the largest nonprofit organization dedicated to planting trees.

INVESTING IN QUALITY CARBON REMOVAL PROJECTS

We are committed to investing in high-quality projects that generate extensive reductions and co-benefits. To date, our focus has been on identifying projects that either add renewable energy to the grid or remove carbon from the atmosphere. We reference guidance from **The Oxford Principles for Net Zero Aligned Carbon Offsetting**. Criteria we carefully consider include:

- **Certification:** Our offset projects are certified by a recognized third-party standard or certification body.
- **Additionality:** We carefully assess offset projects to ensure the GHG emissions reductions or removals would not have occurred without our offset purchase.
- **Permanence:** We collaborate with organizations when we can trust that GHG emissions reductions or removals from offset projects we invest in are permanent and will not be reversed in the future.
- **Verifiability:** We invest in offset projects that are transparent and can demonstrate that the claimed GHG emissions reductions or removals have actually taken place.
- **Avoidance of Double-Counting:** We trust the offset project to ensure that the GHG emissions reductions or removals claimed by the offset provider are not claimed by any other party.
- **Co-benefits:** We look for projects that generate additional social, economic, or environmental benefits beyond reducing GHG emissions.

Since 2020, we have purchased carbon credits from the **Arbor Day Foundation** in support of the **GreenTrees ACRE (Advanced Carbon Restored Ecosystem)** project located in the Mississippi Alluvial Valley. The Arbor Day Foundation partners with GreenTrees to restore degraded agricultural lands to their original and highly beneficial forest ecosystem in the lower Mississippi River Valley. Through the purchase of 57,800 metric tons of carbon credits, MathWorks has supported the current pool of 600+ landowners, 134,000+ acres, 60+ million trees planted and grown, and 6.3+ million metric tons of carbon sequestered.

The GreenTrees reforestation project has a powerful impact on the environment as well as the surrounding communities, plants, and animals. To date, MathWorks carbon credit purchases from the project have resulted in an estimated 31 million liters of water stored, 1,156 acres of terrestrial habitat restored, and over $8.7 million of economic impact.*

Carbon credits issued from the American Carbon Registry for our investments in this project offset our unabated Scope 1, select Scope 2, and a portion of Scope 3 GHG emissions in 2022. **Learn more** about 2022 retirements.

*Estimates were calculated using **GreenTrees' co-benefits tool** (co-benefits per metric ton).

Managing Energy and Water

Effective energy and water management is a fundamental pillar of our operational strategy, minimizing our environmental impact and optimizing resource efficiency.

We rely on energy to operate our facilities, power our data centers, and provide our workforce with comfort and safety. We own and co-lease data centers on and near our locations to manage, process, and store data. Our water use primarily results from operating our buildings, including bathrooms, cafeterias, and equipment (i.e., cooling towers supporting our data centers and HVAC systems).

We work diligently to optimize our consumption and conserve when possible. We closely monitor energy and water using energy usage intensity (EUI), water usage intensity (WUI), and power usage effectiveness (PUE) metrics that measure building performance, water efficiency, and data center sustainability.

Our initiatives focus on areas of our operations where we can generate the greatest reductions. This includes rolling out projects in our Natick headquarters—the largest contributor to our environmental footprint—and our other locations when possible.

Global Energy Consumption, 2022

Source	Consumption
Electricity (MWh)	24,630
Natural gas (therms)	190,745
Diesel fuel (Gal)	2,079
District heating (MMBTU)	1,018

Optimizing Our Natick Facilities

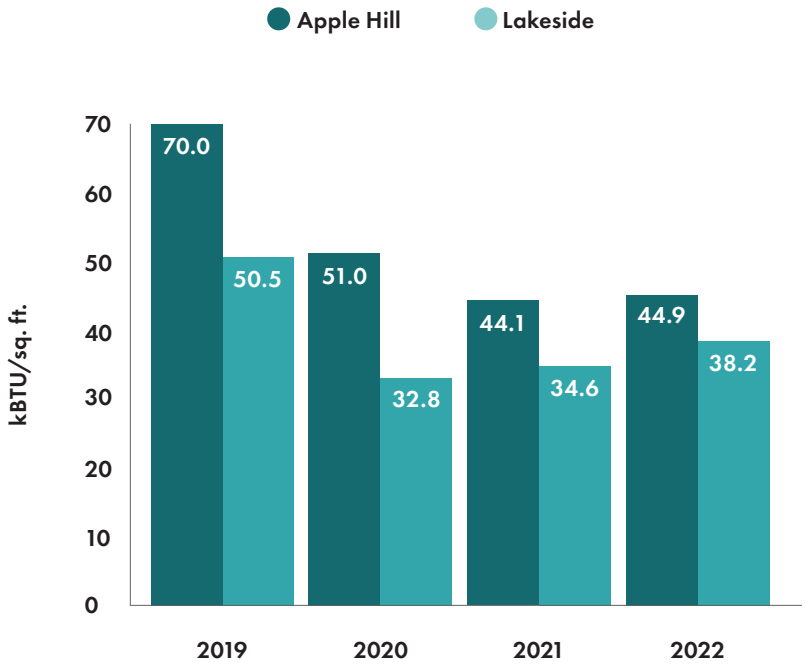
Our ability to optimize operations varies across locations and facilities. We have greater influence in spaces we own and operate, such as our Natick campuses, Apple Hill and Lakeside, than in locations where we simply lease space. Accounting for over 65% of MathWorks square footage worldwide, our Natick campuses represent the largest opportunity to viably increase our efficiency. In addition to the larger projects detailed in this report, we have built energy efficiency considerations into materials and equipment purchase decisions for our facilities:

- Met and exceeded Massachusetts energy Stretch Code during new construction and renovation projects
- Implemented highly efficient building technologies such as chilled beams, triple-pane glass, and a full campus building management system with advanced control strategies
- Installed automated LED lighting with occupancy sensors, dimmers, and photocells throughout our offices
- Deployed a free-cooling system that satisfies data center and all campus demands during cooler months in New England
- Tracked WUI, audited our equipment, and installed water-saving technology such as lower-flow faucets and showerheads, rooftop rainwater harvesting systems, and rainwater irrigation tanks
- Assessed electrifying our campuses and developed a long-term plan for replacing fossil fuel use
- Implemented smart landscaping techniques such as using drought- and disease-resistant grass, which reduces water consumption and the need for herbicides, pesticides, and fertilizer
- Installed green roofs, which enhance roof insulation, rainwater retention, and air quality
- Equipped 3% of our staff parking with free electric vehicle charging stations

We have also implemented ongoing programs and processes to monitor and limit energy use, including:

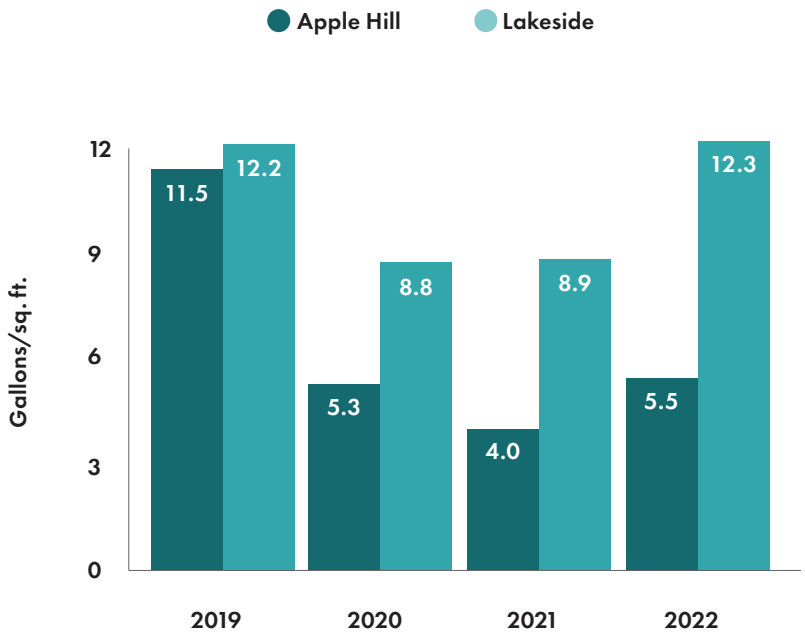
- Leveraging smart technology such as fault detection and diagnostics software, which uses MATLAB, extensive metering, and controls automation to understand how our facilities are operating and where we have opportunities to improve
- Conducting routine audits of the building envelope to identify and correct air and water leakage
- Offering staff commuter solutions by collaborating with local public transport agencies to enhance the efficiency and accessibility of staff routes, providing complimentary bikes and bike storage across Natick campuses, and conducting commuter surveys

Natick Campus Energy Use Intensity, Excluding Data Centers, 2019–2022



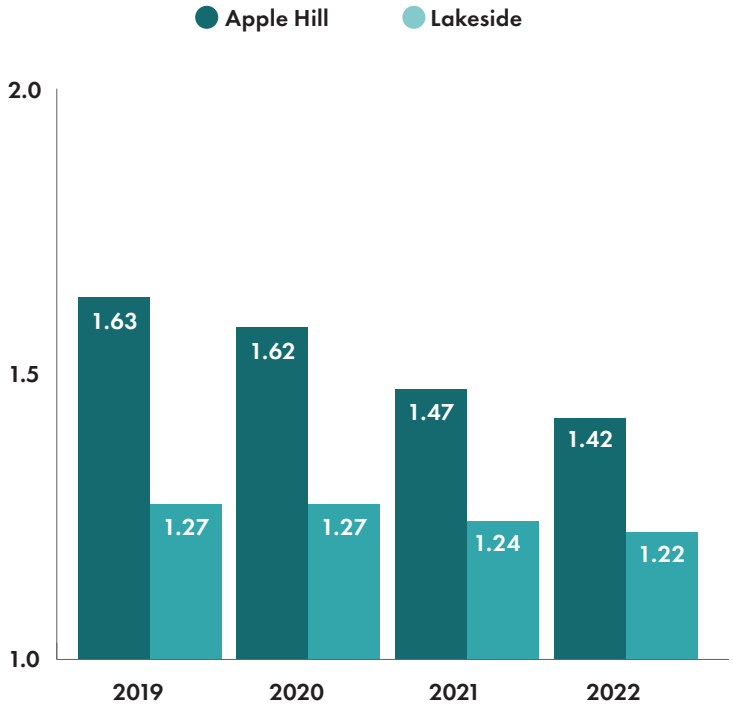
MathWorks measures office space efficiency in terms of energy use intensity (EUI), which reflects facility energy consumption per square foot, excluding data center energy consumption. MathWorks has decreased EUI through various measures, most notably the shutdown of our tri-generation plant (CCHP), implementation of fault detection and diagnostics (FDD), and adjustments to our cooling controls at Apple Hill. MathWorks was shut down in early 2020 due to the pandemic, soft-opened offices in 2021, and instated a hybrid work model in early 2022, resulting in an increase in EUI over this time. MathWorks also began free fitness center and cafeteria operations for staff as we returned to the office, increasing consumption.

Natick Campus Water Use Intensity, 2019–2022



MathWorks measures water consumption in water use intensity (WUI), which reflects the total water consumed, in gallons per square foot. Natick water consumption decreased significantly during the pandemic and has been on the rise as we returned to office, now with expanded cafeteria and fitness center services. The Lakeside data center expansion has increased cooling demand, which requires more water as well. Increasing the cycles of concentration of cooling tower water through improved chemistry and filtering has been a significant water savings measure. We have also installed new lower-flow fixtures throughout both campuses.

Natick Campus Data Center Power Use Effectiveness, 2019–2022



Power use effectiveness (PUE), a way of measuring data center efficiency by looking at the supporting energy required to operate the data center (e.g., cooling, lighting), was relatively unaffected by the pandemic. The Lakeside campus opened in 2019, and we have been able to maintain and slightly improve its efficiency since construction. Apple Hill data center PUE has decreased mainly because of a revised cooling control strategy put in place to reduce the amount of water being pumped through the system.

The energy required to support our IT load has decreased by 33% in the last three years to a 2022 PUE of 1.42 for Apple Hill and 1.22 for Lakeside, well below the industry average of 1.55.

Industry averages for 2022 sourced from Uptime Institute's **Global Data Center Survey 2022** (page 6).

Diverting Waste

As a software company that does not manufacture tangible products, waste doesn't represent a substantial part of our environmental footprint compared with other industries. However, we still prioritize diverting waste by recycling and composting and through resource management.

In 2022, we diverted 66% of waste at our Natick locations away from landfills and incinerators.

Managing Key Sources of Waste

Source	Mitigation and Diversion Strategies
Office and cafeteria supplies (such as paper and cardboard)	• Recycling (paper, printer cartridges, plastic, and aluminum) • Working with suppliers who use reclaimed or recycled materials as well as eliminating packaging waste when viable
E-waste (such as batteries, computers and other machinery, and data center waste)	• Recycling e-waste with a third-party vendor and holding electronic recycling events where both personal and business equipment are donated for recycling and reuse • Repairing and refurbishing technology when possible • Reclaiming, reusing, or repurposing parts and machinery when feasible • Reselling goods or returning them to the seller when possible
Food waste	• Composting • Working with our food vendor to optimize the amount of food ordered and prepared, preventing spoilage and overstock

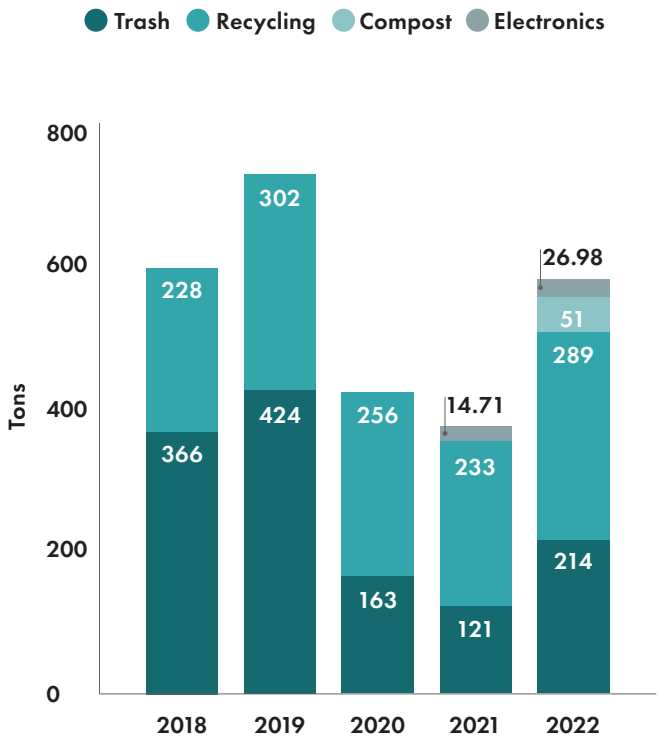
COMPOSTING IN OUR CAFETERIAS

In 2022, we initiated a kitchen composting program at our Apple Hill and Lakeside campuses to mitigate food waste. Since the program's launch, we have diverted an estimated **100,000 pounds** of food waste.

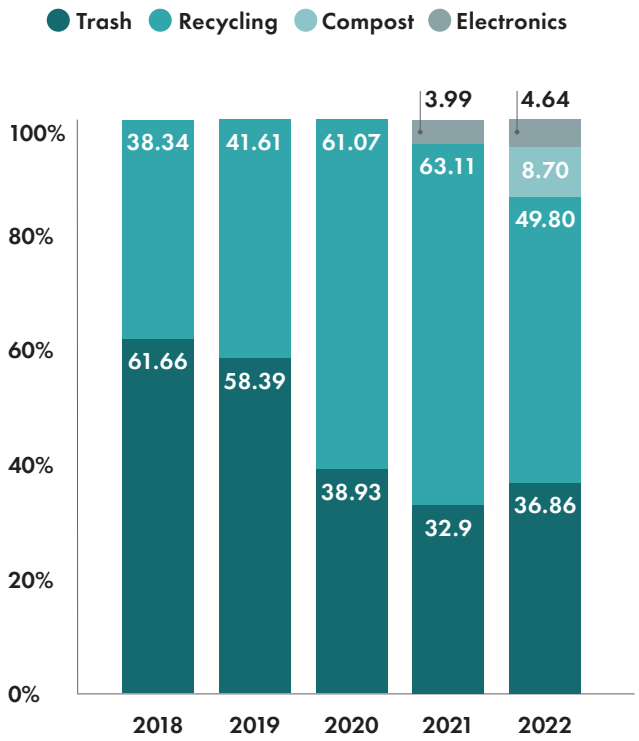
Natick Waste Management, 2022 (Tons)

Total recycled (includes paper and plastic)	289
E-waste recycled	27
Composted	51
Landfilled or incinerated	215
TOTAL	**582**

Natick Physical Waste Generated by Type, 2018–2022 (Tons)



Share of Natick Physical Waste Generated by Type, 2018–2022



MathWorks has tracked waste output through our vendors for several years. Before 2020, MathWorks followed a standard, five-day in-office work week. 2020 saw our campuses shut down due to the COVID-19 outbreak, leading to reduced waste generated in 2020 and 2021. Staff returned to the office in our new hybrid work model in 2022, which increased the total waste we were generating.

PARTNERSHIPS

Protecting Climate Resiliant Lands and Biodiversity with Mass Audubon

Accelerating Large-Scale Solutions

Supporting the Startup Community

Making Sustainable Progress in Academia

Partnerships

MathWorks invests in targeted partnerships that create opportunities for leveraged, scalable solutions to tackle climate change.

Protecting Climate-Resilient Lands and Biodiversity with Mass Audubon

In 2022, the MathWorks Foundation began working with the **Massachusetts Audubon Society** (Mass Audubon), the largest nature-based conservation organization in New England, to support the protection and care of climate-resilient lands across Massachusetts.

Through this partnership, Mass Audubon identified four high-risk and high-impact properties where MathWorks could provide critical funding for protection—Minery in Sandisfield and Otis, Long Pond in Brewster, Laughing Brook in Hampden, and Porcupine Woods in Princeton—all of which are connected to expanses of existing protected land. In addition to that connectivity, the state has designated each property as a Critical Natural Landscape, and three are also designated as important habitats for rare species. MathWorks has donated $2.5 million to Mass Audubon to preserve these properties for many years to come and will continue working with Mass Audubon to protect Massachusetts' precious ecosystems.

Accelerating Large-Scale Solutions

MathWorks is an inaugural member of the **MIT Climate & Sustainability Consortium** (MCSC), created in 2021. MCSC is an academia-industry collaboration that brings companies together to accelerate the implementation of large-scale, real-world solutions across sectors to address global climate and sustainability challenges. The consortium, which aims to inspire transformative change, also includes Apple, Boeing, Dow, IBM, Liberty Mutual, PepsiCo, Verizon, and several other leading companies. Our lead research scientist and director of the Advanced Research & Technology Office serves on the MCSC's Industry Advisory Board.

In 2022, our participation and investment in MCSC resulted in the launch of the Interactive Geospatial Mapping Tool, which helps member companies visualize and understand critical data for addressing decarbonization and resilience planning. Developed by MCSC Postdoctoral Impact Fellow Sydney Sroka, the tool integrates data sets on carbon capture and sequestration (CCS) infrastructure, electric grid carbon intensity, natural hazard risk, vegetation, transportation routes, and population. Combining information from disparate sources with new data layers from member companies into one tool enables them to identify opportunities to strategically deploy carbon capture throughout their supply chain.

Supporting the Startup Community

Our MathWorks Accelerator Program provides incubators and accelerators with free access to our software, engineering support from our experts, and the MATLAB Central™ user community.

MathWorks is also a Terawatt-level partner of **Greentown Labs**, North America's largest climate tech startup incubator, providing its 400-plus members with access to MATLAB and Simulink to model and test solutions for energy generation and storage, transportation, mobility, and wastewater management in a simulated environment.

Furthermore, the MathWorks Startup Program provides low-cost access to MATLAB and Simulink as well as training, engineering support, and co-marketing. Through this program, MathWorks has supported more than 500 startups geared toward tackling climate change.

Making Sustainable Progress in Academia

We support and engage with academic institutions and students to accelerate learning and progress on climate change. In 2022, we pledged $1.5 million in funding for ongoing climate-related research activities at universities across the US, UK, and India.

Since 2013, the MathWorks Accelerator Program has developed partnerships with leading accelerators, supporting 160 climate focused technology startups around the world.

The types of projects we helped fund in 2022 include:

- **Academia and industry collaboration events**, such as MCSC
- **University centers and departments focused on sustainability initiatives**, such as the University of Cambridge's Agriforwards Centre for Doctoral Training
- **Innovations** in renewable energy, electric vehicles, battery technologies, and autonomous transport

MATLAB and Simulink are installed in more than 6,500 universities worldwide, helping students prepare for careers in engineering, science, economics, and finance. Students use MATLAB for their capstone or thesis projects, including project ideas focused on sustainability and renewable energy.

Examples of these projects include:

- **A smart plant watering system** using the Internet of Things and low-cost hardware to minimize the negative impacts of water overuse in farming and preserve water resources
- **A motor control application** with enhanced performance and product quality to accelerate the global transition to smart manufacturing and electrification
- **A portable charger for EVs** to make them more reliable for general use
- **A model of a reversible fuel cell** integrated into a renewable energy microgrid structure to produce hydrogen from clean sources
- **A predictive maintenance model** with machine learning to enhance wind turbine reliability and provide reliable green energy

Through the **MOOC Support Program**, MathWorks collaborates with online course teams to incorporate MATLAB and Simulink into open online courses. As part of this program, MathWorks supports institutions developing online course content on green technology. Examples of courses on edX include:

- Chalmers University of Technology's emerging automotive technology courses, which equip learners with the necessary skills for a career in the automotive industry and provide a broad perspective of emerging automotive technologies. Topics include electric and hybrid vehicles and autonomous driving systems.
- Delft University of Technology's solar energy engineering courses, which teach the skills needed to pursue a career in the solar energy field. Learners explore the wide range of solar energy applications and design a grid connecting the photovoltaic (PV) system in the city of Delft.

In 2022, MathWorks joined the **US Department of Energy** and **G**eneral Motors as a headline sponsor of the EcoCAR EV Challenge. This four-year competition, which concludes in 2026, challenges students across 15 North American universities to engineer a next-generation battery electric vehicle that uses automation and vehicle-to-everything connectivity to implement energy-efficient and customer-pleasing features while meeting the automotive industry's decarbonization needs.

As part of our MATLAB and Simulink Challenge Projects, MathWorks also created the Sustainability and Renewable Energy Challenge. This set of 16 projects seeks solutions to environmental issues including carbon neutrality, green hydrogen production, heating and cooling systems, electric vehicles, and more.

INVESTING IN TOMORROW'S TALENTS

MathWorks is dedicated to helping address the global talent demand for EV and battery engineers. We partnered with Robert Bosch Engineering and Business Solutions India Private Limited (RBEI) and the National Institute of Technology Calicut in 2017 to create an undergraduate course called Electric Vehicle System Engineering. This course covers EV fundamentals such as regenerative braking, energy storage systems, and EV systems modeling and simulation using Simulink and Simscape™. Top students earn internships at RBEI, where they work on real-world EV projects. This project was renewed in 2021 for an additional five years, enabling more students to participate in this rapidly expanding area.

PRODUCTS

Supporting Electrification

Enabling the Energy Transition with Climate Science and Green Technology

Integrating Climate Factors in Financial Services

Optimizing Product Performance and Efficiency

Products

MathWorks was founded in 1984 because engineers and scientists needed more powerful, productive computation environments beyond those provided by existing programming languages such as Fortran and C. Today, MATLAB and Simulink serve more than 5 million users in over 100,000 businesses, universities, and government organizations across more than 180 countries.

Due to the general-purpose nature of MATLAB and Simulink, our customers are using these products in a variety of ways to combat climate change. The products are used in the development of applications that advance sustainability, and we continuously expand capabilities to enable innovations that contribute to carbon reduction.

In 2021, we established a team of cross-functional leaders and experts to determine and formalize our corporate strategy on enabling customers to develop solutions that mitigate climate change. This resulted in three focus areas: electrification, climate science, and climate finance.

Supporting Electrification

The company's focus on electrification as a megatrend supports our customers' development of electrical innovations that help increase power generation reliability, improve equipment efficiency, and mitigate climate change by reducing GHG emissions. These solutions range from motor control and battery management for EVs to the integration of renewable energy into power grids.

MathWorks provides software that enables our customers to use system-level simulation to:

- Perform trade studies and size and specify components
- Determine power requirements for consumer, commercial, and industrial products
- Design, validate, and implement embedded software conforming to industry standards

Solving for Renewable Energy Systems

Renewable energy systems, such as wind and solar farms, account for an increasing share of total electricity generation. However, designing and testing them can be complex due to variables in renewable electricity supply and the need to balance generation and demand. Engineers rely on MATLAB, Simulink, and Simscape to model renewable energy system architectures, perform grid-scale integration studies, and develop controls for renewable energy and energy storage systems.

For example, energy storage systems provider EVLO used MATLAB and Simulink to model and simulate an energy storage system using lithium iron phosphate batteries, a battery chemistry offering the advantages of efficiency, stability, and capacity, as well as having less impact on the environment compared to alternatives. EVLO's Simulink models helped it predict energy storage capacity, develop the control system to maximize power output, and generate the software needed to operate the energy storage system.

Enabling the Energy Transition with Climate Science and Green Technology

Climate science is essential to enabling the energy transition. Third parties leverage MATLAB capabilities to help geoscientists better understand dynamics, preconditions, and trends related to the Earth, ocean, and atmosphere.

Their efforts include:

- Climate Data Toolbox for MATLAB, which contains a standard set of MATLAB functions for analyzing and displaying climate data. It also includes guidance on interpreting results in the context of Earth science processes
- Climate Data Store Toolbox for MATLAB, which makes it easy for climate scientists to efficiently access data from the European Centre for Medium-Range Weather Forecasts
- The Climate Data Visualization and Analysis curriculum module, which helps university professors design a course on the basics of importing, visualizing, and analyzing climate data with MATLAB

With data collected from the field or facilities, scientists use MATLAB and Simulink to:

- Analyze and understand complex geological trends
- Visualize and handle data easily with fewer manual coding requirements
- Build and simulate models of past and future environmental events
- Access and synthesize data sources from peer research and government- and university-funded data facilities for collaboration across large-scale analyses and simulations
- Publish code artifacts related to innovative scientific findings

DRIVING INNOVATION IN CARBON CAPTURE

Approximately 2 million semitrailer trucks are on US roads annually, producing about 340 million tons of CO_2, or 5% of the nation's total carbon output. Remora, a carbon capture startup, developed hardware that can consume CO_2 directly from the trucks' tailpipes to be offloaded every 500 miles at truck stops or gas stations. The CO_2 can then be sold to companies that need it for concrete or wastewater treatment.

To make this solution work, Remora needed to develop control algorithms and acquire data from many of the truck's modules. It created a software simulation in Simulink, which is informed by data from 26 customers' engines, and paired it with an engine simulation built in Gamma Technologies' GT-POWER software. Remora is working on its first iteration and plans to use machine learning to optimize control parameters once it has enough data to train the algorithm.

Remora will continue to use MATLAB as it refines its product and to collaborate between different systems and teams to drive this innovative solution.

Facilitating Critical Research on Extreme Heat Trends

Heat is the deadliest form of extreme weather, responsible for more human fatalities than floods, tornadoes, or hurricanes, according to National Weather Service **statistics**. To better comprehend the global implications of extreme heat, researchers are using MATLAB and Simulink to improve data quality and perform data analysis.

In a **recent study** by the Chinese Academy of Meteorological Sciences and the University of Edinburgh, researchers analyzed climate data in MATLAB to explore different temperature events.

This analysis yielded invaluable insights, identifying a rise in compound extreme heat events. Key findings include:

- From 1960 to today, the number of exceptionally hot days in the Northern Hemisphere has increased by about five times, and these days are approximately 2.7 degrees Fahrenheit (1.5 degrees Celsius) warmer.
- If humans cannot curb GHGs, many places in the Northern Hemisphere can expect around 69 days with brutal daytime and nighttime heat by 2100—over eight times more than in 2012.

Using MATLAB for Climate Data Visualization and Analysis

MATLAB users can conduct climate research via visualization and data analysis features. Software research applications include the ability to:

- Analyze global temperature and CO_2 data
- Visualize changes in Arctic Sea ice
- Characterize drought in regions such as Northern California

A **learning module** helps users get started with climate research.

Integrating Climate Factors in Financial Services

Financial services organizations increasingly need to incorporate climate factors into their risk, lending, and portfolio construction processes. To effectively respond to these evolving needs, MathWorks has developed a suite of capabilities for computational finance that facilitate the integration of physical climate factors, transition risks, and environmental, social, and governance (ESG) considerations into risk management and investment procedures.

With MATLAB, financial services organizations can:

- Analyze, visualize, and simulate climate data sets, providing valuable insights into potential climate risks and their impact on financial markets
- Perform climate transition risk assessments, which arise from the global shift toward a more sustainable economy
- Assess, model, and manage the risks associated with climate-related natural disasters
- Incorporate ESG factors into investment decision-making and risk management processes, develop ESG scoring models based on climate and other ESG factors, and incorporate climate data into portfolio optimization models
- Perform climate stress testing and align with regulatory requirements from institutions such as the Bank of England, the European Central Bank, and the Federal Reserve

These tools and capabilities have enabled users to assess the potential impacts of climate risk on various aspects of their operations. This includes mapping scenario transitions to financial shocks, modeling the impacts of climate risk on mortgages, and performing Monte Carlo simulations for price, rate, and economic forecasting.

Incorporating climate factors into financial processes is not only about risk management but also about aligning financial practices with sustainability objectives. Accurate pricing of climate risk allows financial institutions to steer marginal financing away from polluting activities and into investments that advance the transition to a low-carbon economy.

ADDRESSING AIR QUALITY WITH DATA ANALYTICS

Research and analytics have proven critical to understanding and addressing pollution and air quality issues. Researchers can leverage MATLAB to analyze air quality data collected by an air quality sensor on the analytics platform **ThingSpeak** to aggregate, visualize, and analyze live data streams in the cloud.

The air quality sensors measure the presence of pollution while ThingSpeak enables storage, visualization, and understanding of the sensor data collected. A MATLAB script can then be used to analyze the collected air quality data. This script is available on the MathWorks **File Exchange** and simplifies air quality data analysis for researchers by:

- Preprocessing sensor data
- Providing data classification
- Offering visualization tools integrated into ThingSpeak channel dashboards for real-time air quality monitoring
- Calculating the air quality index per US Environmental Protection Agency definitions

These tools can be used across many applications. For example, MathWorks installed a **PurpleAir sensor at our Apple Hill campus** in Natick, Massachusetts, to assess air quality in our local community. Researchers can also use air quality data to understand the effects of forest fires and other pollutants.

Optimizing Product Performance and Efficiency

Conducting research and testing with real systems—such as energy generators, storage devices, wind turbines, batteries, and solar panels—can be costly and unsafe as miscalculations can result in battery fires or broken turbine blades. That is why engineers and scientists use MATLAB and Simulink to computationally model and run simulations that can replicate real-world behaviors to identify effectiveness and potential risks.

However, running models and simulations takes extensive bandwidth, requiring high energy consumption. We strive to improve product performance and usability to make it easier and faster for users to achieve their goals. To reduce energy use, we optimize efficiency by:

- **Improving performance speed** through algorithm efficiency, enabling users to get precise answers faster
- **Providing template models** customizable to unique situational needs, such as Simscape vehicle templates with configurable vehicle models
- **Providing the Code Analyzer app**, which identifies potential errors and improvement opportunities within users' code, enabling them to quickly fix mistakes
- **Providing code generation capabilities**, which automatically create readable and portable production code, removing the need for engineers to manually write thousands of lines of code
- **Sharing thought leadership**, technical, and training content, making it easier to use our software and learn from other programs
- **Developing fit-for-purpose simulations and models**, making them smaller and easier to run in low-resource environments, delivering the required performance without energy overuse

We continuously find ways to improve product performance. From 2015 to 2022, we increased performance speed by 2.25 times based on nearly 100 application-level benchmarks we monitor. This increase enables a simulation to complete within two weeks instead of five weeks. The decrease in run time also translates to lower energy usage and emissions.

Appendix

About This Report

This MathWorks Climate Action Report serves as an informational resource for our stakeholders and all who may be interested in learning about our approach to environmental stewardship. This report includes quantitative and qualitative information prepared following Global Reporting Initiative (GRI) standards from January 1, 2022, to December 31, 2022, unless otherwise noted. Data in this report has been externally verified; **see the assurance report**. Going forward, we plan to report annually. For more information or with questions, email **sustainability@mathworks.com**.

GRI Index

The following table includes a subset of disclosures from the GRI Standards 2021 that correspond to the content and environmental boundaries of our report. Report content and responses were prepared following the GRI standards for the period of January 1, 2022, to December 31, 2022.

General Disclosures		
Disclosure	**Description**	**2022 Location/Response**
2-1	Organizational details	**About MathWorks**
2-2	Entities included in the organization's sustainability reporting	**About MathWorks**
2-3	Reporting period, frequency, and contact point	About This Report
2-4	Restatements of information	About This Report
2-5	External assurance	Data in this report has been externally verified by LRQA using ISO 14064 - Part 3. **See the assurance report**
2-6	Activities, value chain, and other business relationships	**About MathWorks** **Company Fact Sheet**
2-7	Employees	**About MathWorks**
2-12	Role of the highest governance body in overseeing the management of impacts	**Environmental Governance and Engagement**
2-13	Delegation of responsibility for managing impacts	**Environmental Governance and Engagement**
2-14	Role of the highest governance body in sustainability reporting	**Environmental Governance and Engagement**
2-23	Policy commitments	**Policies and Statements** We are in the process of developing an environmental policy.
2-25	Processes to remediate negative impacts	**Operations**

2-27	Compliance with laws and regulations	**Environmental Management**
2-28	Membership associations	• The Business Software Alliance • Massachusetts Institute of Technology (MIT) Climate & Sustainability Consortium
Economic Performance		
201-2	Financial implications and other risks and opportunities due to climate change	**Addressing Our Carbon Footprint**
Energy		
302-1	Energy consumption within the organization	**Managing Energy and Water**
302-3	Energy intensity	**Managing Energy and Water**
302-4	Reduction of energy consumption	**Managing Energy and Water**
Water and Effluents		
303-1	Interactions with water as a shared resource	**Managing Energy and Water**
303-5	Water consumption	**Managing Energy and Water**
Biodiversity		
304-3	Habitats protected or restored	**Protecting Climate-Resilient Lands and Biodiversity with Mass Audubon**
Emissions		
305-1	Direct (Scope 1) GHG emissions	**Our Greenhouse Gas Inventory**
305-2	Energy indirect (Scope 2) GHG emissions	**Our Greenhouse Gas Inventory**
305-3	Other indirect (Scope 3) GHG emissions	**Our Greenhouse Gas Inventory**
305-4	GHG emissions intensity	**Our Greenhouse Gas Inventory**
305-5	Reduction of GHG emissions	**Our Greenhouse Gas Inventory**

Waste		
306-1	Waste generation and significant waste-related impacts	**Diverting Waste**
306-2	Management of significant waste-related impacts	**Diverting Waste**
306-3	Waste generated	**Diverting Waste**
306-4	Waste diverted from disposal	**Diverting Waste**
306-5	Waste directed to disposal	**Diverting Waste**

Environmental Data Notes and Methodology

GHG emissions data has been reported for MathWorks global operations of owned and leased locations, including administrative and office spaces, which included 34 total properties in 2022.

Our emissions data was calculated following GHG Protocol methodology (**Version 1.0**), and we follow the guidelines provided by the GHG Protocol for Scopes and associated emissions. Notes are provided where a judgment call has been made after internal review and third-party consultation. We also review our Scopes and categories annually for materiality and keep track of updates in the GHG Protocol guidelines.

Scope 1 GHG emissions are direct emissions from sources that are owned or controlled by MathWorks. This includes natural gas consumption at Apple Hill, Lakeside, and leased properties around the world. For properties less than 20,000 square feet, where fuels categorized as Scope 1 are associated with the space we lease, we estimate consumption using CBECS data.

Scope 2 GHG emissions are indirect emissions from sources that are owned or controlled by MathWorks, including grid electricity consumption at Apple Hill and Lakeside in Natick, Massachusetts, and leased properties in the Americas, Asia/Pacific, and Europe. We also consider emissions from offsetting RECs sold, which represent 1 MWh of electricity generated by our onsite solar arrays. For properties less than 20,000 square feet, we estimate electric consumption using CBECS data.

Scope 3 GHG emissions are from sources not owned or directly controlled by MathWorks but caused by our activity and operation. We primarily include emissions from purchased/capital goods and services, fuel- and energy-related activities, waste, business travel, employee commuting, remote work, and downstream leased assets. Leased properties in the Americas, Asia/Pacific, and Europe are excluded from waste emissions until data can be collected.

We do not calculate emissions for certain Scope 3 categories, such as upstream/downstream transportation and distribution, processing, use, end of life for sold products, franchises, and investments as these are not material or relevant to MathWorks.

The categories for which we do calculate emissions are:

- **Category 1: Purchased goods and services.** This category is calculated based on MathWorks annual global spending, categorized and converted to US dollars. Total category spending is aligned with the categories in the CEDA data set to convert to MT CO_2e.
- **Category 2: Capital goods.** This category is calculated based on MathWorks annual global spending, categorized and converted to US dollars. Total category spending is aligned with the categories in the CEDA data set to convert to MT CO_2e.
- **Category 3: Fuel- and energy-related activities (FERA).** FERA data for our utility consumption comes from our Scope 1 and Scope 2 calculations, regardless of whether they are from utility bills or estimated. For 2022, only electric transmission and distribution losses and fossil fuel well-to-tank (WTT) were calculated utilizing EPA, IEA, and DEFRA data. Electric WTT and WTT transmission and distribution were not calculated as reliable emission factors were not available at the time of this report.
- **Category 5: Waste.** MathWorks only calculates waste where removal and processing data is available, which in this case is our Natick campuses. This accounts for 69% of our total square footage. Emission factors come from DEFRA.
- **Category 6: Business travel.** Data for business travel comes from our travel booking and management software and our expense system. Emission factors are based on DEFRA or spending data leveraging the CEDA data set.
- **Category 7: Employee commuting.** Data for calculation comes from the MathWorks HR system, MathWorks security system, MathWorks commuting survey, and a MATLAB program built internally to determine commute distance. Emissions per mile data comes from the EPA and DEFRA.
- **Category 7: Remote work.** The GHG protocol only briefly mentioned remote work within the commuting section but offered no formal approach or calculation methodology. On the guidance of our consultant, calculations were based off of the **EcoAct Homeworking Emissions white paper**. Data for remote work comes from the MathWorks HR system and MathWorks security system.
- **Category 13: Downstream leased assets.** This category follows the same methodology as calculating our Scope 1 and 2 emissions for our Natick campuses.

As part of our ongoing commitment to transparency and continuous improvement, we will keep refining our data collection and calculation methodologies, ensuring accurate reporting of our environmental performance.

Climate Project Index

In 2022, we retired the following carbon offsets and RECs to address GHG emissions.

Project	Credit Type	Volume of Retirement (Unit)
GreenTrees ACRE (Advanced Carbon Restored Ecosystem) project	Offsets	51,800 MT CO_2e
Prairie Breeze Wind Energy II Project	RECs	19,000 MWh

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MathWorks®

Accelerating the pace of engineering and science