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# Our environmental strategy

The environmental challenges we face today are significant, and we're responding with urgency and innovation. We approach our work by focusing on fundamental questions. What matters most? And where can we make the greatest impact? These questions — and the data underlying their answers — guide our work across our strategic pillars of climate change, resources, and smarter chemistry. We know we're not alone in working to reduce our environmental footprint. So we're engaging with others to support our efforts and find opportunities to move our industries forward.

## CLIMATE CHANGE

We're already carbon neutral for our corporate operations, and we've set a goal to become carbon neutral for our entire product footprint by 2030. We plan to get there by reducing our emissions by 75 percent compared with 2015, then investing in high-quality carbon removal solutions for the remaining emissions.

LOW-CARBON DESIGN

ENERGY EFFICIENCY

CLEAN ELECTRICITY<sup>4</sup>

DIRECT EMISSIONS ABATEMENT

CARBON REMOVAL

## RESOURCES

We aim to make durable, long-lasting products and packaging using only recycled or renewable materials, as well as enhance material recovery. At the same time, we're committed to stewarding water resources and sending zero waste to landfill.

MATERIALS

WATER

ZERO WASTE

## SMARTER CHEMISTRY

Through chemistry innovation and rigorous controls, we design our products to be safe for anyone who assembles, uses, or recycles them — and to be better for the environment.

MAPPING AND ENGAGEMENT

ASSESSMENT AND MANAGEMENT

INNOVATION

## ENGAGEMENT AND ADVOCACY →

Engaging with others — from industry partnerships to policy advocacy — is integral to advancing our environmental work and to achieving an even greater impact that considers communities around the world. We learn from feedback, and we work with partners to influence change in our industries. And we're transparent about our challenges and achievements to inspire others to take their own action.

# Goals

We create products and services to enrich the lives of our customers. And we strive to do so in a way that sustains the ecosystems and resources that we all depend on. Setting ambitious goals is essential to this — to drive the innovation and collaboration that make change possible and to be transparent about and accountable for our progress.

## HIGHLIGHT

We've reduced the emissions across our value chain by **OVER 45 PERCENT** since 2015.

### CLIMATE CHANGE

Achieve carbon neutrality for our entire carbon footprint by 2030, and reach our emissions reduction target<sup>5</sup>

Create all products with net-zero carbon impact by 2030

Transition our entire product value chain, including manufacturing and product use, to 100 percent clean electricity by 2030

### RESOURCES

Use only recycled and renewable materials in our products and packaging, and enhance material recovery

Eliminate plastics in our packaging by 2025<sup>6</sup>

Reduce water impacts in the manufacturing of our products, use of our services, and operation of our facilities

Eliminate waste sent to landfill from our corporate facilities and our suppliers

### SMARTER CHEMISTRY

Drive comprehensive reporting of the chemicals used in our supply chain to make our products

Integrate smarter chemistry innovation into the way we design and build our products

Avoid exposure to chemicals that could be harmful to human health or the environment

## HIGHLIGHT

**20 PERCENT** of all materials shipped in products in 2022 came from **RECYCLED** sources.

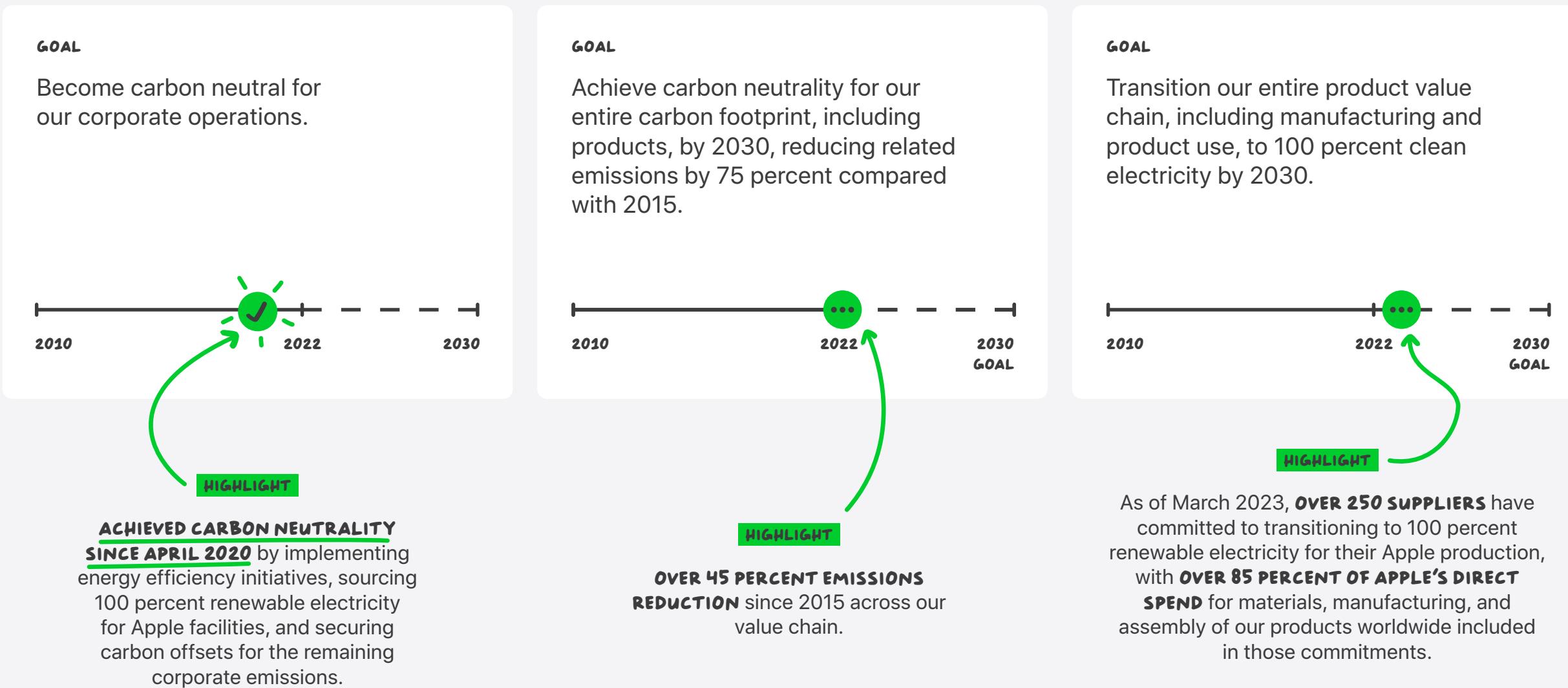
## HIGHLIGHT

We've made new commitments to **PHASE OUT PFAS** from our products and manufacturing processes.

# Climate Change



# Goals and progress



# Our approach

Climate change continues to define the world around us in ways that impact our daily lives. Shifting weather patterns threaten the food we eat. Widespread wildfires and flooding devastate the communities we live in and the ecosystems we depend on. These dangers are felt around the globe and are developing at an unprecedented pace. The stakes are fundamental: Human rights like life, health, food, and an adequate standard of living face grave risks, disproportionately affecting low-income and historically marginalized communities. The worst, and potentially irreversible, impacts of climate change can be prevented with global, comprehensive, and immediate action.

As a large global company, we believe it's our responsibility to take strong, decisive, and inclusive steps to mitigate our impact on the climate. We've committed to achieving carbon neutrality across our entire value chain by 2030 — reducing emissions by 75 percent compared with 2015 and balancing the residual emissions with high-quality carbon removal.<sup>7</sup> This means that our goal to be carbon neutral also extends to all our products. This goal is more aggressive than the Intergovernmental Panel on Climate Change's recommendation for global carbon neutrality within 20 years.<sup>8</sup>

Apple is also committed to working toward reaching a 90 percent reduction in emissions from our 2015 baseline by 2050. Attaining this deep decarbonization target will require a different focus and a collective, global effort. Entire industries and economies must decarbonize. And while reaching a 90 percent reduction in emissions is outside Apple's or any one company's control, Apple is committed to supporting action as part of this global shift: to push for better policies, invest in new technological innovations, and engage in new and expanded partnerships, both public and private.

Our goals are ambitious — and they come with many challenges. But we've already made progress by cutting emissions across our value chain by over 45 percent since 2015.

We began by making the transition to sourcing 100 percent renewable electricity at our offices, retail stores, and data centers, which we achieved in 2018. And in 2020, we achieved carbon neutrality for our corporate emissions.<sup>9</sup>

Our philosophy for achieving carbon neutrality follows these principles:

**Calculate our footprint across our value chain:** Our responsibility extends beyond our direct operations to our product-related emissions. That's why we model our emissions across the entire life cycle of our products — including the sourcing of raw materials, manufacturing, shipping, product use, and end-of-life processing.<sup>10</sup> We use the results of our detailed carbon accounting to adjust our 2030 Climate Roadmap, which lays out our plan to become carbon neutral.

**Set ambitious targets:** Our plan to reach carbon neutrality by 2030 centers around our strategy to reduce emissions by 75 percent, relative to our 2015 carbon footprint. This reduction aligns with what current climate science shows is necessary to limit warming to 1.5° C.<sup>11</sup> We plan to invest in high-quality carbon removal projects to address the remaining emissions, prioritizing nature-based solutions. And by focusing on emissions reduction, we're tackling the transformative work of making low-carbon products.

**Match solutions to sources:** For each activity within our value chain, we seek out decarbonization actions that tie to the source of those emissions. For example, we'll look to reduce emissions from electricity by using renewable or low-carbon electricity and decrease emissions from transportation by using alternative fuels and lower-carbon modes of transport. By matching solutions to carbon sources, we'll do our part to help decarbonize the economy.

**Make environmental progress good for our business:** We're proving every day that there doesn't need to be a trade-off between what's good for the planet and what's good for business. This means that we seek out climate solutions that are cost competitive, offer a financial return, benefit our customers, or achieve more than one of these outcomes. For example, we're working with investment managers who are creating investment funds for clean energy and nature-based carbon removal solutions, which aim to deliver both environmental benefits and financial returns. And when we design products to be energy efficient and use recycled content, we view these as product features that add value for our customers. By underpinning our climate strategy with strong business principles and innovation, we aim to harness the power of markets to replicate our solutions at scale, creating the impact necessary to meet global reduction targets.

**\$4.7B**

We've issued \$4.7 billion in green bonds to model how businesses can drive investments to reduce global emissions. In our latest Annual Green Bond Impact Report, we share progress on the projects funded in 2022. Read our latest Annual Green Bond Impact Report (PDF).

**Our 10-year Climate Roadmap addresses Apple's carbon footprint through five pillars:**



### LOW-CARBON DESIGN

Design products and manufacturing processes to be less carbon-intensive through thoughtful material selection, increased material efficiency, and greater product energy efficiency.



### ENERGY EFFICIENCY

Increase energy efficiency at our facilities and in our supply chain by finding opportunities to reduce energy use, such as retrofitting outdated or inefficient equipment and systems.



### CLEAN ELECTRICITY

Transition our entire product value chain — including manufacturing and our customers' use of our products — to 100 percent clean electricity by 2030.



### DIRECT EMISSIONS ABATEMENT

Reduce direct greenhouse gas emissions in our facilities and our supply chain through process innovation, emissions abatement, and moving away from fossil fuels.



### CARBON REMOVAL

In parallel with our emissions reduction efforts, scale up investments in carbon removal projects, including nature-based solutions that protect and restore ecosystems around the world.

>75 PERCENT EMISSIONS REDUCTION

<25 PERCENT OF FOOTPRINT

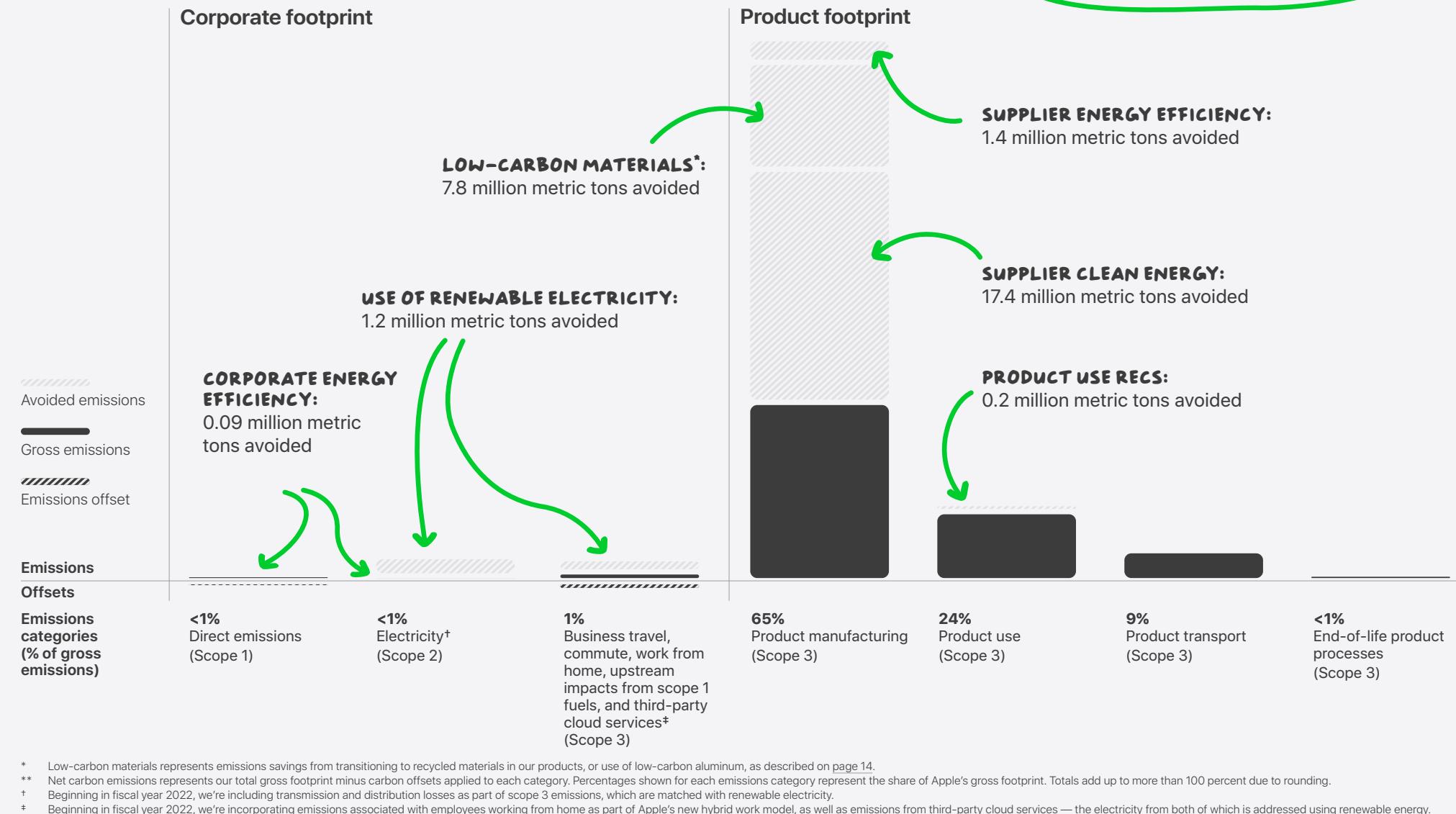
**Explore all solutions:** Reaching our 2030 carbon goal will require scaling proven solutions that are available today, as well as exploring the solutions of the future. This includes facilitating the development of new technologies, like direct carbon-free aluminum smelting, adopting novel financial approaches such as the Apple Restore Fund, advancing policies that support a low-carbon economy, and continuing to invest in research and development to enable decarbonizing our products by 2030.

**Be open:** We're committed to disclosing our carbon footprint as well as our climate strategy and progress. By sharing our approach, we aim to send clear signals to others and invite them to work with us. We also hope to empower our peers in their pursuit of carbon neutrality and engage investors through financing options, such as green bonds. This means sharing both challenges and successes. Our annual Environmental Progress Reports, as well as our response to the global disclosure nonprofit CDP, provide details on our progress.

**Support underrepresented communities:** Low-income and historically marginalized communities too often bear the brunt of the effects of climate change. So we're pursuing ways to directly support these communities in our climate program — like with the Apple Impact Accelerator, which aims to bolster equity and foster opportunity for Black-, Hispanic/Latinx-, and Indigenous-owned businesses in the environmental sector. We're advocating for greater access to clean energy, and we're investing in renewable energy projects in emerging markets. And our carbon removal projects often benefit the livelihoods of local and Indigenous communities.

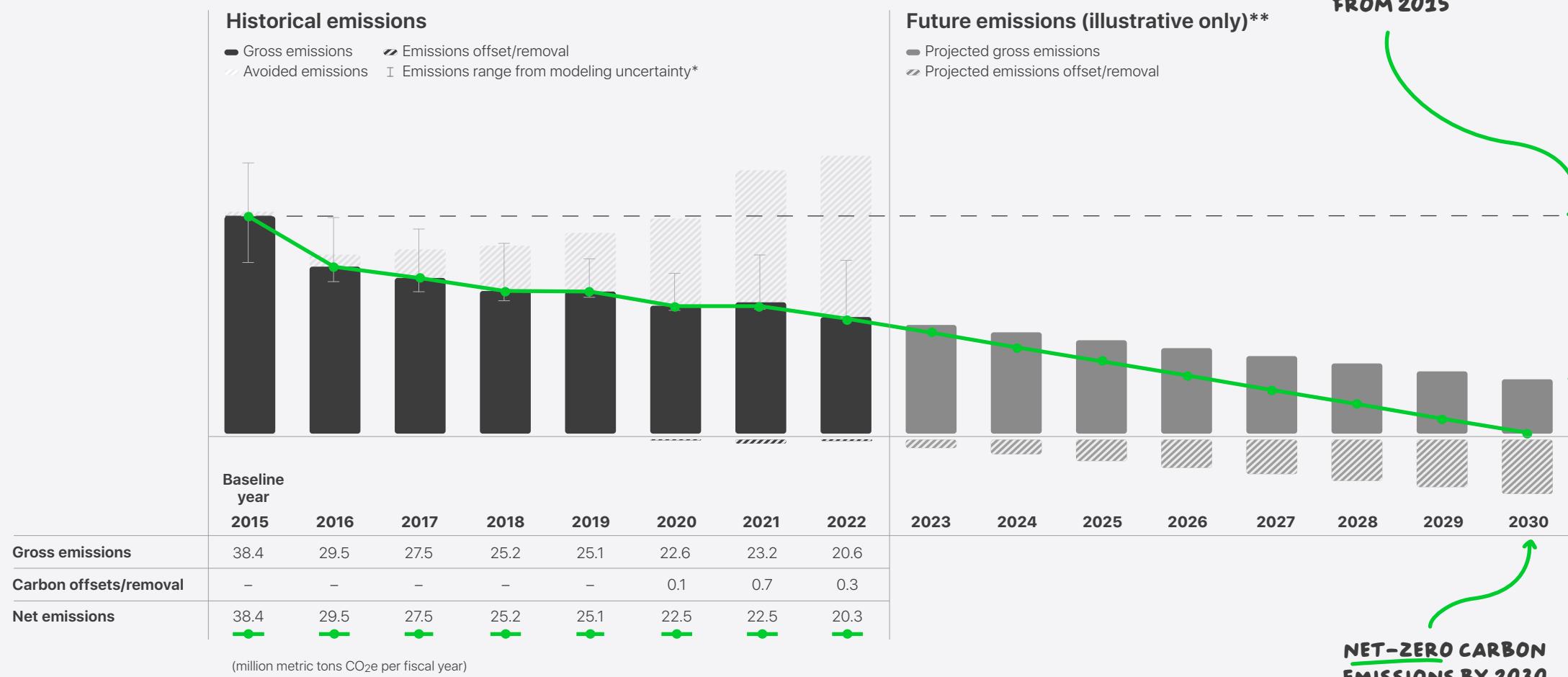
# Apple's comprehensive carbon footprint

This past year, we've continued our efforts to reduce Apple's emissions. In 2022, our environmental programs avoided over 28 million metric tons of emissions across all scopes. Initiatives that we've been growing for years — like sourcing 100 percent renewable electricity for our facilities, transitioning suppliers to renewable energy, and using low-carbon materials in products — have yielded clear results. Thanks to this work, we're decoupling business growth from emissions: While our revenue has grown by over 68 percent since 2015, our gross emissions have decreased by over 45 percent.



# Progress toward net-zero emissions

Our plan to become carbon neutral by 2030 centers around a 75 percent emissions reduction target compared with our 2015 footprint. We've already reduced our gross carbon footprint<sup>12</sup> by over 45 percent since 2015. And we plan to address residual emissions through high-quality carbon removals.



\* Error bars: We're continuously refining our methodology to improve our carbon footprint estimate. But there's uncertainty inherent to modeling product-related carbon emissions, which we've illustrated through error bars in this graphic.

\*\* Future emissions: Future emissions, including offsets and removals, are displayed as a linear trend to reach net-zero carbon emissions by 2030. Actual future emissions will likely not be linear.

## Carbon neutrality for our corporate emissions

Since April 2020, we've been carbon neutral for our corporate operations, including direct emissions (scope 1); indirect emissions from purchased electricity, steam, heat, or cooling (scope 2); and emissions from business travel and employee commute (scope 3). In 2022, we expanded the scope 3 emissions we include in our corporate footprint and are now also carbon neutral for work from home, third-party cloud services, electricity transmission and distribution losses, and upstream impacts from scope 1 fuels. To reach neutrality, we focused on driving energy efficiency improvements and transitioning our facilities to 100 percent renewable electricity, which we achieved in 2018. These programs have reduced our scope 1 and scope 2 emissions by 67 percent since 2011, when we first began procuring renewable electricity, even as our business grew. We've addressed the remaining

scope 1, 2, and 3 emissions (for a total of 324,100 metric tons) by securing high-quality carbon credits from projects that protect and restore forests, wetlands, and grasslands.

### Measuring our footprint

We account for our carbon footprint by following internationally recognized standards, like the World Resources Institute (WRI) Greenhouse Gas Protocol and ISO 14040/14044. For our corporate footprint, we calculate emissions based on consumption data when available; when it's not available, we rely on reasonable assumptions and methodologies to estimate emissions, which we revisit and improve on regularly. For our product hardware carbon footprint, we use a life cycle-based approach. Apple-specific data drives many of our most critical calculations; in cases where that data isn't available, we rely on secondary sources, including industry

averages. We continually refine our model to include new sources of product life cycle data — and offer a more accurate and transparent assessment of our footprint. Our comprehensive carbon footprint and our methodology are assessed by a third party each year to confirm accuracy and transparency (see Appendix D). Improving the accuracy of our carbon footprint is an ongoing process — as we learn more, we refine our carbon models and adjust our climate road map. We also regularly revisit the boundary of our footprint to best reflect our impact. For example, in 2022, we expanded our corporate footprint to include work from home emissions, third-party cloud services, electricity transmission and distribution losses, and upstream impacts from scope 1 fuels.

### Evaluating climate risks

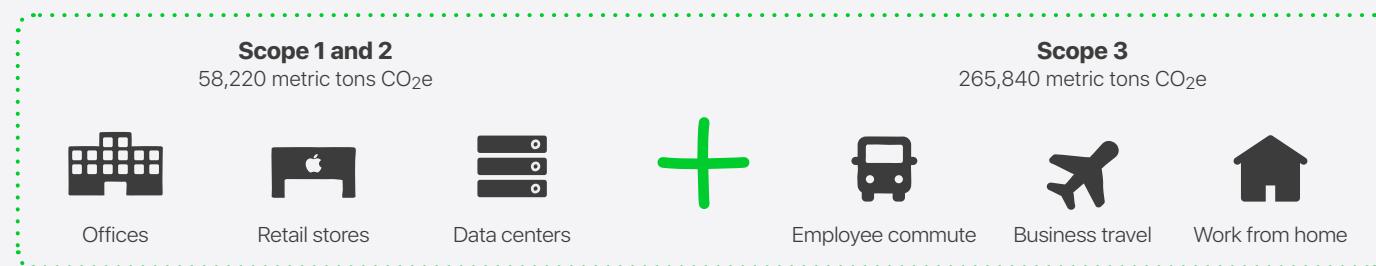
In 2020, we conducted a climate scenario analysis to help us better understand the potential physical and

transition effects of climate change. To align with the Task Force on Climate-related Financial Disclosures (TCFD) recommendations, we considered a range of future scenarios, including a scenario below 2° C. Our assessment had a global scope to capture all our corporate facilities — including offices, retail locations, and data centers — as well as 200 supplier facilities, based on spend. The analysis highlighted how our renewable energy program and carbon neutrality goals could contribute to our corporate resilience. It also provided environmental data that we considered when developing business strategies, including around supply chain diversification, and when safeguarding our global assets. The results of the scenario analysis contributed to a larger body of internal assessments on the physical and transition impacts of climate change on our business.



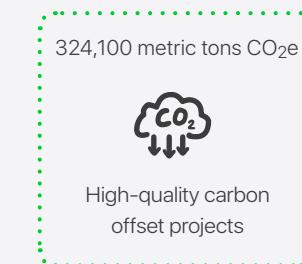
We're committed to managing regulatory, reputational, and market risks related to climate change. For more information on these climate-related risks and Apple's governance of these risks, read our [CDP Climate Change 2022 submission \(PDF\)](#).

## CORPORATE EMISSIONS (HAVING ALREADY REDUCED SCOPE 1 AND 2 EMISSIONS BY 67% SINCE 2011\*)



\* We've reduced corporate emissions through energy efficiency, renewable electricity, and low-carbon fuels, and we're applying carbon offsets to the remaining emissions.

## CARBON REMOVALS



## CARBON NEUTRAL FOR OUR CORPORATE OPERATIONS

# Low-carbon design

Each Apple product represents an opportunity to reduce our carbon footprint — even small changes can yield significant results. Our carbon footprint helps us identify opportunities to reduce the carbon intensity of our product designs. We prioritize the materials and components that account for significant portions of our carbon emissions. This means that the choices we make product by product can scale toward reducing our overall footprint. These priorities inform our work to design for material efficiency and increased use of recycled and renewable materials.

## Improving material and manufacturing efficiency

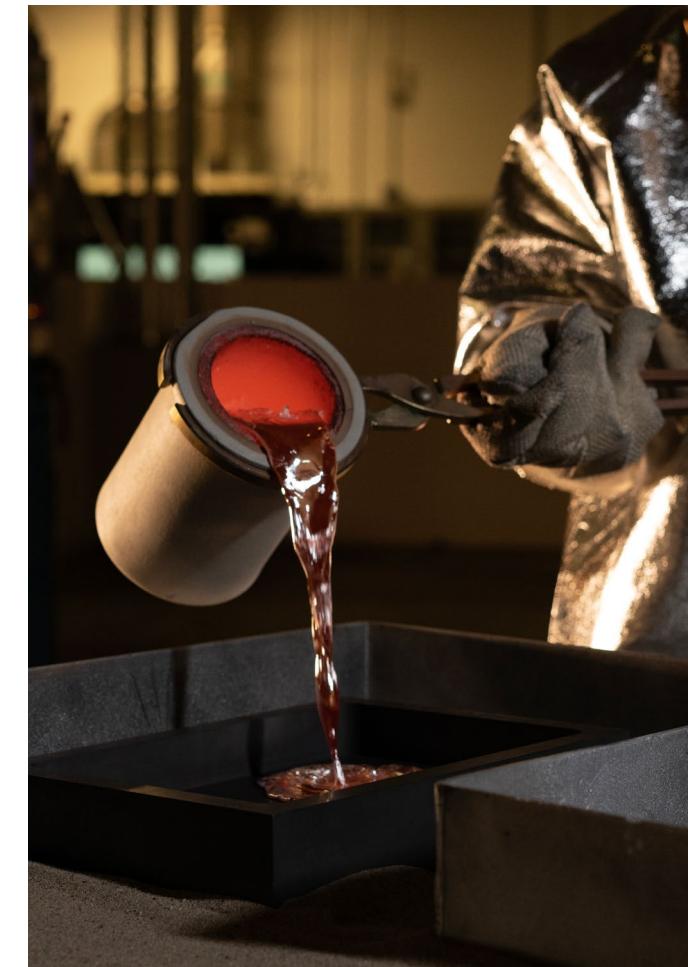
Less means more when it comes to our approach to materials and how we process them. Making our manufacturing processes more efficient creates less waste and helps us make the most of the materials we source. We're also working to design our products so that they require less material in the first place. Combined, these efforts help reduce emissions from transporting and processing materials. And as we progress toward our 2030 carbon neutrality goal, we continue to investigate new materials and new ways to manufacture efficiently.

We've continued to improve the carbon efficiency of the integrated circuits that we use in our products — components we've prioritized because they're carbon-intensive. Integrated circuits perform vital functions in electronic devices but require significant energy to manufacture. We also continued our work with the sustainable semiconductor technologies and systems research program of imec, a world-leading research and innovation hub in nanoelectronics and digital technologies, of which we were the first public company to join in October 2021. Our goal in collaborating is twofold: to improve the data associated with integrated circuit production, from end to end, and to use improved data and shared expertise to identify carbon reduction opportunities for the entire integrated circuits industry.

And we keep investigating new opportunities for improved efficiency across our product manufacturing processes. In 2022, we continued to invest in research and development projects aimed at: creating less waste in processing materials, reducing machining time and associated energy use, more efficiently transforming material into the shapes we need, and maximizing recovery and reprocessing of manufacturing scrap. Once these improved processes are successfully developed, we plan to work with our suppliers as they deploy them at scale at our supplier facilities.

## Using recycled materials to lower our product carbon footprint

Materials selection is another way to reduce the carbon footprint of our products. Our strategy is to transition to materials manufactured using low-carbon energy and recycled content. We've prioritized the materials and components that make up a large part of our product carbon footprint to move us closer to our goal of product carbon neutrality. And to accelerate collective efforts, we signed on to the First Movers Coalition's near-zero emissions primary aluminum commitment for 2030 (see more on page 26).



Undertaking a comprehensive life cycle analysis for the materials and components in our products led us to prioritizing low-carbon aluminum. In 2018, Apple created an aluminum alloy made of 100 percent recycled aluminum and a reduced carbon footprint.

## Low-carbon design addresses emissions from:



**PRODUCT  
MANUFACTURING  
(SCOPE 3)**



**PRODUCT USE  
(SCOPE 3)**



**PRODUCT  
TRANSPORT  
(SCOPE 3)**



Aluminum is a great example of Apple's comprehensive approach: We're transitioning to recycled content, and where we haven't yet, we're moving to low-carbon suppliers and technology innovations to further decarbonize. In 2015, aluminum represented over a quarter of our product manufacturing footprint. Since then, we've continued to introduce 100 percent recycled aluminum in the enclosures of Apple products: All iPad models in our lineup use 100 percent recycled aluminum in their enclosures — joining Apple Watch Series 8, Apple Watch SE, MacBook Air, Mac mini, and the 14-inch and 16-inch MacBook Pro computers. In addition, the new Studio Display contains a 100 percent recycled aluminum stand, and the Mac Studio enclosure and Apple TV thermal module both contain 80 percent recycled aluminum. And with iPhone 14, we've increased recycled content by using recycled CNC chips with Apple's strongest aluminum alloy for the first time.

For products shipped in 2022 that had enclosures made with primary aluminum, we prioritized the use of aluminum smelted using low-carbon sources of electricity rather than fossil fuels, for a lower carbon impact. We also shipped iPhone SE enclosures that contained ELYSIS aluminum, which was smelted without generating greenhouse gas emissions (see page 26 for more information).

We also continue to make progress in how we source recycled aluminum. Our first priority is to recover any of our own scrap at high quality. Then, to augment this, we look to other postindustrial and postconsumer sources for high-quality recycled aluminum, which emits less carbon than newly mined materials. And we're expanding our sourcing to include postconsumer recycled aluminum from building and construction scrap that meets the high standards that our products require. These emissions reduction efforts have reduced our aluminum-related emissions by 71 percent since 2015 and now represent less than 8 percent of our product manufacturing footprint, compared with 27 percent in 2015.

In 2022, we began shipping products with certified recycled steel and expanded our use of certified recycled gold — two materials that typically have significant carbon footprints. We introduced certified recycled steel for the first time in the MacBook Air with M2 chip, which has 90 percent recycled steel in the battery tray. And we significantly expanded the use of certified recycled gold in our products — from the gold plating on the main logic board on iPhone to other product main logic boards and flexible printed circuit boards — increasing recycled gold content from 1 percent in 2021 to approximately 4 percent across all product lines in 2022.

**71%**

Switching to recycled and low-carbon aluminum has decreased our carbon emissions associated with aluminum by 71 percent since 2015. Read more about how we plan to address emissions from our customers' use of Apple products on page 24.

## Driving product energy efficiency

Product energy use accounts for 24 percent of our gross carbon footprint — and it has an impact on the individual energy use of each of our customers. This is why we've set aggressive targets to reduce our products' energy usage. We approach this challenge in the earliest phases of design, taking a holistic view of each product — from how efficiently the software operates to the power requirements of individual components.

With each generation of products, we strive to improve energy efficiency. For example, the transition to Apple silicon on Mac devices continues to drive these improvements. The latest generation of our Pro chips is enabling more Mac devices to run with improved energy efficiency. For example, MacBook Pro with M2 Pro and M2 Max made significant progress in reducing energy use in 2022, and the new Apple TV 4K is designed to minimize its impact on the environment, using nearly 30 percent less power than the previous generation

while achieving more powerful performance.<sup>13</sup> The efficiency gains of the A15 Bionic chip eliminate the need for an internal fan, resulting in a more compact design and contributing to a 25 percent reduction in carbon footprint over the previous generation. Through our energy efficiency improvements, we've cut overall product energy use across all major product lines by more than 70 percent since 2008.<sup>14</sup> And Apple products are consistently rated by ENERGY STAR, which sets specifications that reflect the 25 percent most energy-efficient devices on the market. In 2022, all eligible Apple products received an ENERGY STAR rating for superior energy efficiency.<sup>15</sup> They also met the requirements for EPEAT registration,<sup>16</sup> another environmental rating system for electronic products, which considers energy efficiency and a number of other environmental topics.

## Product energy efficiency



Apple TV 4K is designed to use nearly **30 PERCENT LESS POWER** than the previous generation while achieving more powerful performance.<sup>17</sup>

Over the course of a year, Mac Studio uses up to **1000 KILOWATT-HOURS LESS ENERGY** than a high-end PC desktop.<sup>18</sup>



iPhone 14 uses **57 PERCENT LESS ENERGY** than the U.S. Department of Energy's requirements for battery charger systems.<sup>19</sup>

# Energy efficiency

Our energy efficiency goals extend well beyond our products. We're focused on using less energy across our operations, beginning with how we design, operate, and maintain our facilities. And we continue these same efforts into our supply chain. Energy efficiency is also essential to meeting our 2030 carbon neutrality goal. So we track and monitor energy use across our operations and supply chain, conducting audits to find opportunities to work more efficiently. And we view our energy use holistically, from the point of design to the point of manufacture.

## Operating Apple facilities efficiently

While our data centers, retail stores, and offices all use 100 percent renewable electricity, we are focused on reducing the energy we use in the first place. We consider natural gas and electricity usage at each of these types of sites — as well as research and development facilities — auditing how we perform and, when needed, using best practices for energy management to reduce our loads. And we tailor the design of new buildings to our occupants' and lab users' specific needs. This approach helps us use our facilities efficiently and productively.

**Existing buildings:** There are significant opportunities to save energy in retrocommissioning buildings that Apple already occupies or operates, including energy-intensive facilities like data centers. We audit the performance of buildings around the world, and then deploy identified reduction measures. Retrocommissioning focuses on building controls to emphasize energy use reduction and operational efficiency. We are prioritizing reducing natural gas usage and replacing natural gas equipment with electrical equipment. While we've already transitioned to renewable electricity for our facilities, minimizing natural gas is also an important element of working toward decarbonization. We are focused on reviewing and benchmarking our most natural gas-intensive buildings to look for reduction and fuel switching opportunities.

**Data centers:** Data centers are traditionally energy-intensive, requiring significant resources to cool the heat-generating equipment. That's why we're continuously monitoring and improving upon the controls for our

cooling systems. This retrospective view often enables us to increase cooling capacity of our existing facility, thereby maximizing the amount of servers within our data center footprint.

In 2022, we further improved energy efficiency at data centers by deploying our own server design, developed with a focus on energy and computing efficiency, resulting in over 56.7 million kilowatt-hours per year in energy savings. This work builds on previous efficiency efforts in our data centers, including developing a specification requiring our servers to be powered by high-efficiency power supplies — exceeding even the efficiency requirements for ENERGY STAR certification — which was deployed to hundreds of thousands of servers in 2021, resulting in over 4 million kilowatt-hours per year in energy savings.

**New facilities:** When designing new facilities, we incorporate energy efficiency principles early in the process. We look at each location's conditions, planning for local temperature, humidity, and light. As each site becomes operational, we monitor how well we're performing and make needed adjustments. For example, in designing our new campus in Austin, we put in a water-cooled air-conditioning system, rather than air-cooled, because of its increased energy efficiency. At the same time, it was critical to consider the water stress of the area, therefore the cooling system will be supplied with recycled water, which will also be used for toilet flushing. The first phase of our work on the Austin campus is saving 5.7 million kilowatt-hours per year.



Apple's Reno data center, opened in 2012, takes advantage of the mild climate by cooling its servers with outside air whenever possible.

Energy efficiency addresses emissions from:



**DIRECT EMISSIONS (SCOPE 1)**



**INDIRECT EMISSIONS (SCOPE 2)**



**PRODUCT MANUFACTURING (SCOPE 3)**

**Retail stores:** In 2022, we were especially focused on our efficiency measures in European retail stores as the region navigated energy shortages. Beyond aligning with all mandates in place, we established a task force to exceed them, identifying and rolling out additional measures — related to LED lighting, temperature, and even keeping doors closed — in retail stores across the continent.

**Measurement and accountability:** Measurement is critical to maintaining building energy performance. We continue to develop our system of energy tracking and benchmarking, which includes data from utility meters that continuously monitor 15-minute electricity and daily natural gas energy consumption. This method helps us identify performance issues at our sites early. We can then take corrective action to restore building system efficiencies and actively manage our energy footprint.

Finally, across Apple, “energy champions” play an important role in achieving our efficiency outcomes. These employees sit in facilities roles across the company, proactively identifying opportunities for efficiencies and bringing their teams and colleagues along to put them in action.

In 2022, our energy efficiency program avoided 69.4 million kilowatt-hours of electricity, which includes savings from the efficient servers, and 161,000 therms of natural gas per year through adjustments made to 9.3 million square feet of new and existing buildings. Together, these new initiatives reduced total energy use by 4 percent in the targeted buildings (including data centers with high loads) and will avoid an additional 27,500 metric tons of CO<sub>2</sub>e per year. Combined with ongoing energy savings from past years, we saved over 89,000 metric tons of CO<sub>2</sub>e in 2022.

## Improving energy efficiency in our supply chain

The manufacturing of Apple products accounts for 65 percent of Apple’s gross carbon footprint. To address this impact, we’re collaborating closely with our suppliers to prioritize energy reductions as an important element of our strategy. Together, we work to use clean energy as efficiently as possible at every point in our supply chain, creating leaner, more efficient factories all over the world. The Supplier Energy Efficiency Program, launched in 2015, exists to help our suppliers optimize their energy use. Implementing energy efficiencies reduces the energy intensity of manufacturing, which translates to reduced carbon emissions.

Energy efficiency gains and subsequent carbon savings are often found at the facility level — for example, by replacing outdated and inefficient lighting and equipment or capturing waste heat for reuse. Honing manufacturing processes using smart controls and monitoring can also offer opportunities to complete the same work with less electricity.

We support our suppliers’ energy efficiency projects by helping to identify optimization opportunities and design solutions through assessments, and providing extensive education and training opportunities that include technical assistance and connections to external funding for energy efficiency projects, which can be an obstacle to making improvements. As suppliers become more knowledgeable in this space, they become more able to tackle deeper decarbonization challenges.

We continue to expand the support we provide to suppliers as they build more energy-efficient systems, through new training and educational materials, and increased access to funding opportunities — like the Asia Green Fund, which Apple launched in 2019 to help provide energy efficiency expertise and finance capital-intensive energy efficiency projects. In 2022, \$8.9 million of investments have been made in supplier efficiency projects using the Asia Green Fund.

In 2022, more than 100 supplier facilities participated in our energy efficiency program, achieving over 1.6 billion kilowatt-hours of electricity savings and about 2,039,000 MMBtu in additional energy savings, which together avoided over 1.3 million metric tons of CO<sub>2</sub>e, representing a 17 percent increase since 2021.

**69.4M** 

We reduced Apple’s facilities energy use by 69.4 million kilowatt-hours through efficiency efforts implemented in 2022.

**1.3M** 

Suppliers in our Supplier Energy Efficiency Program avoided more than 1.3 million annualized metric tons of supply chain carbon emissions in 2022.

**FEATURE**

# Apple calls on global supply chain to decarbonize by 2030

Reducing energy use begins with measuring and understanding the carbon footprint of a business. Since 2019, as part of Apple's Supplier Code of Conduct, we've required our suppliers to regularly identify sources of emissions, measure their scope 1 and scope 2 carbon emissions, and make this information available to Apple as needed. By understanding a supplier's carbon emission sources and quantity, we can provide resources that help the supplier create an action plan to decarbonize and maximize energy efficiency opportunities. Further, we empower our suppliers to utilize the trainings, resources, and tools provided through our programs to extend their efforts beyond Apple to their own supply chains and customers.

Apple has made significant progress in reducing emissions in our supply chain through work on energy efficiency and renewable energy (see [page 22](#)). At the same time, we've set — and continue to advance — clear expectations for our suppliers on the decarbonization required to meet our 2030 goal in the years to come.

In October 2022, we urged our materials, manufacturing, and assembly partners to decarbonize their entire Apple footprint by 2030, including all their scope 1 and 2 emissions associated with Apple production. We'll evaluate our suppliers' work to decarbonize their Apple-related operations — including running on 100 percent renewable electricity — and we'll track yearly progress. Progress toward these goals will be a crucial part of the criteria we consider when awarding future business.

Additionally, we encourage suppliers to address the greenhouse gas emissions beyond their Apple production, prioritizing clean energy. To help suppliers meet their commitments and go even further, we offer a suite of free learning resources and trainings, and we work closely with our suppliers and local partners to identify effective solutions for renewable energy and carbon removal.



Over 250 suppliers have committed to 100 percent renewable electricity for Apple production, as part of Apple's Clean Energy Program. Holmen Iggesund in Sweden (pictured) joined the program in 2023.

# Clean electricity

We're at a pivotal moment in addressing climate change. Renewable energy is poised to replace fossil fuels as the future of electricity. Its adoption means cleaner air and lower carbon emissions.

Apple has generated or sourced 100 percent renewable electricity for its corporate operations since 2018,<sup>20</sup> and we're swiftly progressing toward transitioning our entire manufacturing supply chain and product use to 100 percent clean electricity, too.

As we grow, we continue to bring new renewable electricity projects online around the world. In the long term, we believe that these projects provide more cost-effective energy with less price volatility. Renewable electricity can offer a competitive advantage by providing power to our operations, as well as to those of our suppliers, with greater control over energy supply and reduced exposure to cost fluctuations. And supporting our suppliers to adopt renewable energy technologies helps put them in a unique position to drive environmental action in their respective regions and significant progress toward our goal of carbon neutrality by 2030.

Ultimately, we find ways to optimize energy use, and we seek renewable sources to supply that energy in support of our goal of 100 percent clean electricity across our operations, manufacturing supply chain, and charging of Apple products. With the renewable energy that we source, we aim to achieve positive impacts. Before we engage in an energy project, we consider its potential environmental and social impacts. When possible, we focus on creating new renewable electricity projects, going above and beyond what might be available on the local grid. We also follow stringent assurance standards<sup>21</sup> to verify our clean energy projects.

## Maintaining 100 percent renewable electricity for Apple facilities

Our retail stores, data centers, and offices around the world currently source 100 percent renewable electricity. We're proud of this accomplishment — and as we grow, we're working diligently to maintain this benchmark. We've focused our efforts to source renewables around several key pillars: creating new renewable energy projects, undertaking projects that deliver clear benefits to local communities, and supporting renewable energy innovations.

### Creating new projects

New renewable electricity projects require investment — whether in the form of direct ownership, equity investments, or long-term power purchase agreements. In total, Apple-created renewable sources account for about 90 percent of the renewable electricity that our facilities use — currently around 1.5 gigawatts.

Apple-created projects include:

- **Direct ownership**  
(~9 percent of Apple-created projects)  
We build our own projects — including solar, biogas fuel cells, and low-impact hydro projects — to provide renewable electricity, where feasible.
- **Equity investment**  
(~3 percent of Apple-created projects)  
We invest capital in new solar PV or wind projects in some markets, matching the renewable energy generated with our energy use.
- **Long-term renewable energy contracts**  
(~88 percent of Apple-created projects)  
Through long-term power purchase agreements, virtual power purchase agreements, and other forms of long-term commitments, we help support new, local, and primarily solar PV and wind projects in line with our renewable energy-sourcing standards.



At 200-megawatts, the Montague Wind Power Facility in Oregon is one of Apple's largest renewable projects to date.

Clean electricity addresses emissions from:



**INDIRECT EMISSIONS (SCOPE 2)**



**PRODUCT MANUFACTURING (SCOPE 3)**



**PRODUCT USE (SCOPE 3)**

To address gaps in our renewable energy needs beyond what's provided by



Apple has invested in the California Flats energy storage project, which retains generated clean energy from intermittent renewable sources, including the adjacent 130-megawatt California Flats Solar Project (pictured).

Apple-created projects, we directly purchase renewable electricity through available utility green energy programs (about 5 percent of our total corporate load in 2022). Colocation and distribution facility vendors supply about 3.2 percent of our total load of renewable energy. And in certain situations, we purchase Renewable Energy Certificates (RECs).<sup>22</sup> These RECs, which account for about 3.5 percent of our total load, share the same power grid as the Apple facility that they support, where available. These purchases are subject to the same standards as our Apple-created renewable energy projects. [Appendix B](#) provides additional details on Apple's renewable energy solutions.

#### Supporting social impact

We launched our Power for Impact program in 2019 to help provide local communities with needed energy resources. With funding from Apple, local communities and organizations gain access to cost-effective energy. At the same time, Apple retains the projects' environmental attributes, benefiting the community, our company, and the environment. Apple is currently supporting 20 renewable electricity projects around the world, including in the Philippines, Thailand, and South Africa. Read more about Power for Impact on page 25.

#### Advancing renewable electricity through innovation

We've continued to pursue innovations in how we create and use renewable electricity, including through investments in energy storage.

To help address the intermittency in renewable electricity production, we've invested in utility-scale storage in California and in research on new energy storage technologies. The California Flats storage project — an industry-leading grid-scale battery energy storage system capable of storing 240 megawatt-hours of electricity — became operational in 2021. This project supports the 130-megawatt California Flats solar farm, which provides most of our renewable energy in California, by storing excess energy generated during the day and deploying it when it's most needed.

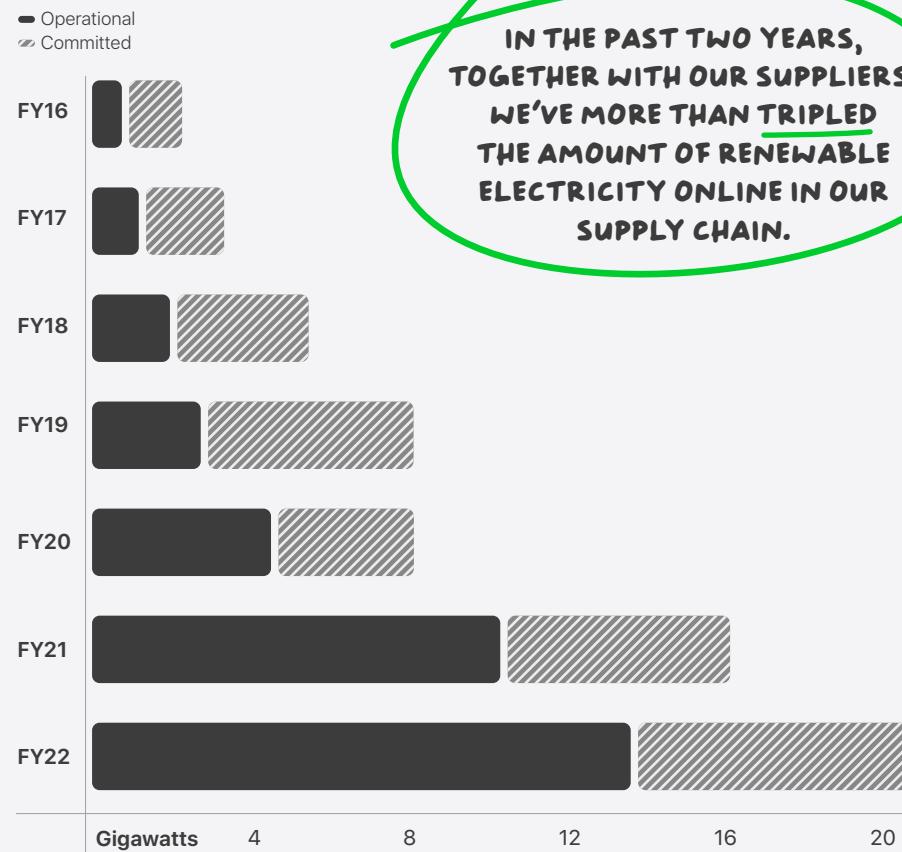
We're also continuing to support biological methanation research at Aarhus University, Denmark, which explores the production of synthetic methane for storage in the existing gas grid. In this process, bacteria consumes both hydrogen produced from excess renewable energy and captured carbon dioxide to produce methane, the principal component of natural gas. Methane produced from renewables is a versatile energy carrier that can be used as a fuel source in households, industry, and transportation.

**90%**

Apple-created renewable sources account for about 90 percent of the renewable electricity that our facilities use.

## Supply chain clean energy progress

Renewable electricity operational and committed in gigawatts (GW)



## Transitioning our suppliers to renewable electricity

The electricity that our manufacturing suppliers use represents the largest single source of carbon emissions throughout our manufacturing supply chain. That's why our efforts to facilitate the transition of our entire supply chain to 100 percent renewable electricity are essential to reaching our 2030 goal of carbon neutrality. And the benefits extend beyond Apple. Suppliers are able to implement best practices in advocating for and procuring renewable energy across all their operations and to share them with their own partners. At the same time, transitioning to 100 percent renewable electricity presents challenges: technical and regulatory barriers, need for capital investment, and lack of awareness about where to find and access high-quality and cost-effective solutions.

Our Supplier Clean Energy Program helps enable suppliers' transition to clean, renewable electricity through policy advocacy, providing information and access to renewable energy procurement options, and creating engagement opportunities with renewable energy experts. To cover emissions from suppliers that we don't contract with directly, we plan on investing in additional renewable electricity projects. To date, we've directly invested in nearly 500 megawatts of solar and wind projects in China and Japan.

As of March 2023, over 250 suppliers making up over 85 percent of Apple's direct spend for materials, manufacturing, and assembly of our products worldwide have committed to using renewable electricity for their Apple production. In total, the Supplier Clean Energy Program now has over 20 gigawatts of clean energy commitments, of which nearly two-thirds are already operational.

In 2022, the 13.7 gigawatts of renewable energy procured by suppliers and online in Apple's supply chain generated 23.7 million megawatt-hours of clean energy, avoiding 17.4 million metric tons of carbon emissions — a 23 percent increase over 2021.<sup>23</sup> Appendix C includes more information about which suppliers have joined Apple in transitioning to 100 percent renewable electricity.

In many cases, our suppliers are leading the way with the efforts they're undertaking. We work closely with our suppliers to identify innovative methods of creating and accessing cost-effective renewable energy. And we work together to break down barriers by advocating for clean energy-friendly policies.

## How suppliers are responding

Long-standing energy policies and infrastructure that incentivize the use of fuels like coal can make it difficult to bring new renewable energy online in some regions, prompting some of our suppliers to rely on less impactful solutions, like one-time purchases of energy attribute certificates from existing renewable energy projects. These options represent an annual cost for buyers and offer no opportunity for cost savings or a return on investment. To overcome these challenges, suppliers are leveraging new purchasing methods, creating renewable energy businesses, and even participating in some of the world's largest and most innovative renewable energy deals. Suppliers are also adapting to changing renewable energy markets by finding new solutions, including first-of-their-kind procurement structures in specific regions that include more corporate procurement options.

In China, this includes the Green Power Trading Platform and cross-provincial power purchasing agreements that have provided suppliers with more options. South Korea has expanded its options for green power, including power purchase agreements and the ability to purchase renewable energy credits. Japan has also introduced new renewable energy options, including power purchase agreements and price-competitive nonfossil credits that have the potential to scale access to renewable energy across the market. While we've seen progress in key markets, we continue to advocate for policies that enable renewable energy to compete fairly with fossil fuels, opening more avenues for our suppliers to make the transition (see page 29).

## How we support our suppliers

### Galvanizing internal champions

We've been able to quickly scale the Supplier Clean Energy Program by involving supplier-facing Apple employees. Apple employees are passionate about the environment and are driven to help meet our 2030 carbon neutrality goal. We empower supplier-facing Apple employees — those who often travel to supplier sites or have direct, consistent cadence with suppliers — with the tools they need to help speed a supplier's transition to 100 percent renewable electricity. This starts with data and transparency. We track the electricity use and renewable procurement of our suppliers, including those just beginning to learn about renewable electricity and others that are well on their way to using 100 percent renewable electricity, and we help them measure progress and gain access to solutions. We've also created internal trainings and crafted a simple engagement process, backed by resources for both Apple employees and suppliers. By connecting our suppliers with resources and providing transparency on supplier progress, our teams are scaling impact across our supply chain.

### Supporting supplier capacity

We share the experience gained through our transition to 100 percent renewable electricity with our suppliers because knowledge empowers them to identify and pursue opportunities to decarbonize as their businesses evolve. For this reason, we invest heavily in providing education and training across our supply chain through platforms such as our Clean Energy Academy.

More than 170 supplier participants in China, Korea, Japan, and Vietnam participated in our Clean Energy Academies in 2022. The academies offer updates on available energy procurement options in suppliers' markets, help suppliers prepare to participate in upcoming renewable energy pilots, and provide guidance from local experts on implementation. This program supplements our Clean Energy Portal, which is available to all suppliers and provides training materials, resources, and country-specific information to guide suppliers in their transition to 100 percent renewable electricity. In 2022, we announced plans to donate these resources to create a first-of-its-kind public training platform that will be available to businesses across many different industries. This platform will give companies of all sizes — in Apple's supply chain and beyond — access to the resources and advocacy networks we've cultivated for nearly a decade.

We also educate suppliers through advanced and customized trainings with leading experts. And we support the creation and growth of renewable energy industry associations that our suppliers can join to learn about local opportunities.

### Expanding access to renewable electricity

To support our suppliers' transition to renewable electricity, we help them find high-quality solutions so they can decide how best to address their specific needs. When we face barriers to accessing cost-effective clean electricity, we innovate. One such innovation, the China Clean Energy Fund, enables Apple and our suppliers to invest in clean energy. As of March 2023, the fund has invested in over 650 megawatts of renewable electricity projects, with nearly 100 percent of those investments online. We also connect suppliers with opportunities to buy renewable energy directly from project developers and utilities as those models emerge around the globe.

### Advocating for policy change

Our collective ability to procure and enable high-quality renewable energy is often influenced by local policies. Effective government policies and rules can remove significant barriers to low-carbon solutions and enable solutions to rapidly scale. We recognize that to transition to renewable energy effectively, clean energy investments need to make financial sense. But carbon-intensive energy sources, like coal and gas, often have an unfair price advantage because of explicit subsidies and the

ignored costs of externalities, such as air pollution and carbon emissions. We're encouraging governments not to subsidize or expand carbon-intensive infrastructure that will inhibit competition and discourage the development of new technologies, like renewable energy and advanced energy storage technologies. We also encourage governments to keep pace with the speed of technological innovation, consider life cycle emissions of energy solutions, and support new energy solutions that effectively reduce global emissions.

We lend our voice and stand with other companies and NGOs to break down policy barriers to achieve thriving clean energy markets. Across regions where our suppliers operate, we engage with policy makers to support renewable energy that's cost-effective, accessible to companies, and sourced from high-quality projects with a material impact on local markets. For example, with RE100, an initiative that brings together the world's most influential businesses through commitments to use 100 percent renewable electricity, we've identified country-level policy barriers to procuring renewable electricity. RE100 collates the challenges that member companies face and advocates for changes on our behalf. We also cofounded the Asia Clean Energy Coalition, which convenes a diverse coalition of leading renewables private sector actors to enact critical policy shifts in Asia that will enable a variety of corporate procurement options for renewable energy.



Apple is investing in renewable energy worldwide — including this large-scale solar project in Brown County, Texas — to help address the electricity customers use to charge their Apple devices.

## Product use

The electricity that our customers use to charge their Apple devices represents 24 percent of Apple's gross carbon footprint. Increasing the energy efficiency of our products helps drive down emissions from product use, and we're taking steps to address the emissions that remain.

When Apple committed to running our business on 100 percent renewable electricity in 2013 — a goal we met for our facilities in 2018 — we were early leaders in this transition. As we address emissions tied to the electricity that our products use globally, our guiding principles focus on three areas: exploring innovative solutions to minimize carbon emissions from product use, including energy efficiency (see page 14); building clean electricity projects aimed at maximizing carbon reductions and social impact; and engaging with our customers to educate and provide opportunities to support decarbonizing the grid.

## Clean energy projects

As we expand on our strategy to cover product use with clean electricity, we're considering a number of factors in selecting projects. In accordance with global greenhouse gas accounting standards, we'll match the electricity consumption of our products with 100 percent clean electricity on an annual basis. While we'll source the majority of our clean electricity from the region, we're maintaining geographic flexibility for a portion of the emissions so that we can target grids with higher carbon intensity. This approach allows us to balance focusing on areas where our customers use our products and maximizing the social and environmental benefits of additional renewable energy. For example, while California is a large market for Apple, we might build new renewable energy projects in other locations with lower clean energy percentages on their grids, where the same renewable energy capacity can have a more significant impact.

As a first phase of this work, we're working toward developing large-scale solar and wind projects in the U.S. and Europe. In the U.S., we've invested in the 320-megawatt 2300-acre IP Radian solar project in Brown County, Texas, and plans for additional projects in the U.S. are underway. In Europe, we plan to engage in projects that range between 30 and 300 megawatts, with an initial request for proposals issued in 2022.

## Engaging with our customers

In many places, electricity comes from clean sources like the sun or wind at certain times of the day. Customers play an important role in deciding when to pull electricity from the grid. We're building programs to make those decisions easier for customers. Clean Energy Charging, which became available in the United States in fall 2022 through iOS 16, enables customers to help decrease the carbon footprint of iPhone. The new feature looks at the sources of electricity during expected charge times, and it optimizes to reduce carbon by charging when the grid is using cleaner energy sources ([learn more here](#)).

Beyond the work that we do on our products, we collaborate with others to continue advancing climate-smart decision-making for customers across their household energy usage, as well as for our employees and partners. As an example, Apple has joined the CoolClimate Network, a research partnership of the University of California, Berkeley, that motivates and empowers individuals and organizations to make low-carbon choices.

**FEATURE**

# Increasing access to clean energy around the world

Power for Impact is driven by the idea that access to clean energy creates opportunities within communities while benefiting our climate. Apple launched the initiative in 2019 to provide underresourced communities with renewable power while supporting economic growth and social impact.

The program funds clean energy projects that are mutually beneficial — local communities and organizations get access to cost-effective energy, and Apple retains the environmental attributes of each project. We currently support 20 renewable projects around the world, including:

**Colombia:** Apple helps bring a rooftop solar power system online at the Hospital Infantil Santa Ana. The money saved on energy bills will allow the hospital to purchase more equipment and medications. A rooftop solar installation at Ciudad Don Bosco, a nonprofit that provides educational and social services for underresourced youth, helps the group advance its sustainable development goals.

**Democratic Republic of the Congo:** Apple provides access to renewable energy for the Malaika School, which empowers Congolese girls and their communities through education, agriculture, water projects, health outreach, sports, and vocational training. To support Malaika students and teachers, this solar initiative builds on other Apple collaborations, including virtual Today at Apple sessions on coding with Swift, photography, filmmaking, and design, as well as other events with Apple Retail teams and Diversity Network Associations.

**Israel:** Apple supports the Nitzana Educational Eco-Village, a community for at-risk youth, with a 260-kilowatt solar system to help lower electricity costs. The savings help enhance educational experiences for youth from various backgrounds.

**Nigeria:** A remote mini-grid project is under development to provide energy access to community members and replace fossil fuels for some businesses. Apple will also continue to support the development of a solar power system to serve primary healthcare centers in the state of Ondo, as well as 200 households in the surrounding region.

**Philippines:** Apple helps fund an educational institution that provides scholarships to high-achieving, underresourced students by offsetting electricity expenses through a new rooftop solar installation in Bataan.

**South Africa:** Apple will fund new rooftop solar installations at a vocational school and at a home for senior citizens. Along with the four operational projects, these installations will reduce electricity costs, and the savings will help fund operating costs and expand programs to support underserved groups. Apple will continue to bring electricity to over 3500 households that previously lacked access with local street lighting.

**Thailand:** Apple helped establish a solar energy system to replace the use of polluting diesel fuel for a remote fishing village that relies on refrigerators to maintain the quality of its fish products. We increased local renewable energy production and battery storage to improve reliable access to electricity.

**Vietnam:** Apple helps provide solar electricity for 20 schools around the country, and helps teach thousands of children about sustainable development and STEM.

**Zambia:** A microgrid supported by Apple will provide power to hundreds of households that are currently without electricity. The project will reduce reliance and costs associated with imported diesel and gasoline for generators, and it will increase the amount of power available to community organizations and businesses.

Power for Impact is expanding access to clean, affordable power in different parts of the world. Apple will continue to focus on uplifting communities as it pursues its environmental goals.



With access to electricity in their homes through one of the South Africa projects, kids can now do homework at night and families can cook meals indoors.

# Direct emissions abatement

Some materials that are integral to our products result in significant emissions. The same is true for certain manufacturing processes and the transportation of our products. To address these emissions, we seek technological solutions and emissions abatement, and we're moving away from fossil fuels.

## Rethinking how aluminum is made

As part of Apple's commitment to reduce our products' environmental impact through innovation, we've partnered with aluminum companies and the governments of Canada and Quebec to invest in ELYSIS — a joint venture to commercialize patented technology that eliminates direct greenhouse gas emissions from the traditional smelting process. This is a revolutionary advancement in the manufacturing of one of the world's most widely used metals. Since our collaboration began in 2018, we've helped accelerate the development of this technology by facilitating the joint partnership and providing initial funding and ongoing technical support.

In 2022, Apple shipped iPhone SE devices using ELYSIS aluminum, building on our 2019 purchase from the first-ever commercial batch of aluminum resulting from the joint venture, used in the production of the 16-inch MacBook Pro.<sup>24</sup> The commercial-purity aluminum used in these products is the first to be manufactured without creating any direct carbon emissions during the smelting process. Throughout the past year, ELYSIS has also

continued to make progress within its industrial research and development center in Quebec — enabling the venture to begin producing commercial-purity primary aluminum at industrial scale — and continued construction of its larger commercial-scale prototype cells.

## Addressing fluorinated greenhouse gas emissions

One of the largest contributors of direct emissions in our supply chain is the use of fluorinated greenhouse gases (F-GHGs). F-GHGs are used in the electronics manufacturing of semiconductors and flat-panel displays, and they have global warming potentials that are thousands of times more than those of CO<sub>2</sub>. We're partnering closely with key manufacturers as they work to prevent these gases from being released into the atmosphere. So while the use of F-GHGs in certain manufacturing processes today is difficult to avoid, emissions can be abated by switching to alternative input gases, by optimizing production processes to use and emit fewer F-GHGs, and by installing gas abatement tools.

## Transporting products

To transport our products from our manufacturers to our customers, we're shifting to shipping modes that are less carbon-intensive than air transport, such as by ocean, whenever possible. In 2022, we launched three new products — Mac Studio, Studio Display, and AirPods (3rd generation) — that leveraged ocean shipping by enabling an ocean supply chain from our manufacturers. On average, shipping an item by ocean instead of on an airplane reduces transportation-related emissions by 95 percent.<sup>25</sup>

We're also seeking out technical innovations for transport, including working with our suppliers to use alternative fuels and electric vehicles. For example, in Europe we piloted a heavy-duty truck fueled by hydrogen, an emerging low-carbon fuel for trucks that travel long distances. And we're continuing to evaluate carriers that offer carbon-neutral deliveries using electric vehicles, including e-bikes and e-cars. These innovations help reduce our impact in the communities where our customers purchase our products. And by preferring vendors that offer low-carbon options, we signal the value of these options to us and reward those driving decarbonization in their industry. We are also combining multiple products into one delivery when possible, reducing packaging and reducing emissions through efficiency on the last leg of the journey. At the same time, Apple is working to spur entirely new solutions, for example by supporting analyses by Carbon Direct identifying pathways for developing sustainable aviation fuels.

## Improving employee travel and commute

And we're exploring ways to reduce our carbon footprint from employees commuting to work. For example, we're helping our employees transition away from single-occupancy vehicles through mass transit, coach services, and campus bicycles. To incentivize the use of electric vehicles, we offer more than 1670 EV charging stations and 3200 ports across our U.S.-based campuses. For the commute-related emissions that remain, we're applying high-quality offsets.



Aluminum is one of the world's most widely used metals, and ELYSIS' innovative direct carbon-free smelting process has the potential to reduce the climate impact of the production process.

**Direct emissions abatement addresses emissions from:**



# Carbon removal

Our 2030 Climate Roadmap aims to reduce our emissions by 75 percent compared with 2015 levels, as well as scale up carbon removal strategies to address the remaining emissions that we can't yet avoid. We're exploring a range of carbon removal solutions to do so, which is consistent with the Intergovernmental Panel on Climate Change's position that all pathways limiting warming to 1.5° C require carbon removal for unavoidable emissions.<sup>26</sup>

Carbon removal projects take carbon dioxide out of the atmosphere and store it in long-term carbon sinks, whether nature-based — like forests, wetlands, and grasslands — or geologically, in formations such as saline aquifers or other suitable geological sites. In addition to removing carbon, nature-based carbon removal projects also offer important ecological and social benefits, such as preserving biodiversity and enhancing the resilience of ecosystems while often providing economic development opportunities for local communities.

## Investing in nature

The earth's trees, plants, and soils provide some of the greatest capabilities to remove and store carbon from the atmosphere. Carbon credits provide an opportunity to invest in these solutions, but carbon markets haven't yet scaled to remove the carbon needed to limit global warming to 1.5° C. That's why we're expanding nature-based investments to support our goal of achieving carbon neutrality across our full product life cycle by 2030.

In 2021, we partnered with Conservation International and Goldman Sachs to launch the Restore Fund, which has closed over \$100 million in projects that forecast to remove over one million metric tons of carbon starting in 2025. This fund is unique because it aims to change carbon removal from a cost to a potentially profitable investment. By creating a fund that generates both a financial return as well as real and measurable carbon impact, we aim to drive broader change — encouraging capital investment in carbon removal around the globe.



Through the first phase of the Restore Fund, we're working with forestry managers to create sustainably managed forests that are optimized for both carbon and wood production, creating revenue from timber and generating high-quality carbon credits. Photo credit: Arbaro Advisors.

**Carbon removal projects to address nonelectricity emissions — up to 25 percent of 2015 emissions (all scopes)**



The first phase of our innovative fund has focused on blending responsible forestry practices with carbon removal. We're working with forestry managers to create sustainably managed forests that are optimized for both carbon and wood production in order to create revenue from timber and generate high-quality carbon credits. The projects also seek to maximize environmental impact, including carbon, hydrology, and habitat restoration. In October 2022, Apple announced three new projects through the Restore Fund. In partnership with Conservation International and Goldman Sachs, Apple has invested with three high-quality forestry managers in Brazil and Paraguay with the goal of restoring 150,000 acres of certified sustainable working forests and protecting around 100,000 acres of native forests, grasslands, and wetlands. Together, these initial forestry projects are forecast to remove one million metric tons of carbon dioxide from the atmosphere starting in 2025.

To improve the accuracy of monitoring, reporting, and verification of the projects' carbon removal impact, Apple is deploying innovative remote sensing technologies using Space Intelligence's Carbon and Habitat Mapper and Upstream Tech's Lens. Using high-resolution satellite imagery from Maxar and other providers, this initiative enables us to view detailed habitat and forest carbon maps for our Restore Fund projects. Through our engagement with the MIT Climate & Sustainability Consortium, Apple is jointly funding research with PepsiCo and Cargill on improving the measurement of soil carbon in nature-based carbon removal projects. And Apple is separately exploring the use of LiDAR data using iPhone to improve field measurements of forest carbon.

Based on our learnings with these projects and the growing global need for more nature-based solutions, Apple announced an expansion of the Restore Fund in 2023. Apple has committed additional funds — up to \$200 million — that will be managed by Climate Asset Management, a joint venture between HSBC Asset Management and Pollination. The commitment will support a broader portfolio of high-quality nature-based projects that scale up carbon removal while seeking to achieve a financial return on investment.

The expanded fund will target two types of investments: sustainable agriculture and other ecosystem assets, and a pipeline of landscape restoration projects that aim to remove carbon from the atmosphere. Together, this unique blended fund structure will continue to demonstrate that we can invest in high-quality nature-based projects to achieve both financial and carbon returns.

Integrity and a rigorous approach are central to how we designed the Restore Fund with our partners. The projects aim to become certified to international standards developed by organizations such as Verra, Gold Standard, the Climate, Community & Biodiversity Alliance (CCBA), and the Forest Stewardship Council (FSC). Use of these international standards helps confirm that the carbon stored in forests is measured and reported to the highest standards and that projects have the most up-to-date safeguards in place. The projects we choose will also seek to have a positive impact on the livelihoods of local communities by bringing economic opportunities to often underserved rural economies. And we'll continue to focus on projects that protect lands with high conservation values.

## High-quality carbon offsets as an interim solution

We plan to reach our goal of becoming carbon neutral across our entire value chain by 2030, using a wide range of solutions at our disposal, prioritizing significant emissions reductions and long-term carbon removal initiatives like the Restore Fund. But as the projects in the Restore Fund come online, we're also working to address difficult-to-avoid emissions in the short term.

We've been carbon neutral for our corporate emissions since April 2020. We started by reducing our corporate emissions through the use of 100 percent renewable electricity and energy efficiency efforts at our facilities. But emissions remain difficult to avoid in some activities — including the natural gas used in some of our buildings and emissions from business air travel and employee commute.

For the emissions we can't avoid, we use high-quality offsets as an interim solution. We're intentional about identifying avoided deforestation and removal projects that are of the highest standard and that achieve meaningful impact. We often originate our own projects working with a reputable partner, like Conservation International, or we carefully select projects from third-party certified registries. For more details about our purchases of carbon offsets, see Appendix A.

**\$200M**

Apple committed up to \$200 million in additional funds to expand the Restore Fund.

**FEATURE**

# Advocating for strong climate policies

The scientific community has laid out a clear rationale for mitigating the impacts of climate change by reducing emissions — and they've provided stark warnings for the consequences of inaction. In addition to strong actions by businesses and individuals, we need strong government policies that support a just climate transition. That's why Apple believes that advocating for strong climate policies is a core part of our climate strategy.

Apple has a long history of advocating for strong climate policies. And in 2022 Apple, joined by other companies, submitted an Amicus Brief, urging the Supreme Court to uphold the U.S. EPA's authority to regulate greenhouse gases from power plants.

Our climate policy advocacy centers on the following principles:

## **Setting strong science-based targets**

Policy makers need to set strong science-based targets to reduce emissions in line with the Paris Agreement and limit warming to 1.5° C.

## **Rapidly decarbonizing through economy-wide and sectoral policies**

Rapid decarbonization requires every sector of the economy to adopt new zero-carbon technologies as fossil fuels phase out. We not only support economy-wide policies but also acknowledge that each sector responds to different signals and the maturity of technologies to decarbonize them isn't equal. Apple's advocacy for sectoral approaches includes these principles:

- Promote economy-wide carbon pricing programs with strong interim and long-term targets and accountability mechanisms.
- Advocate for policies that make it easier and more cost-effective to deploy renewable energy.
- Support policies that promote energy efficiency across all sectors, including for manufactured goods.
- Invest in mature and new zero-emission technologies to cut emissions, particularly in hard-to-decarbonize sectors.

## **Encouraging and enabling high-quality measurement and disclosure of emissions**

Governments should require that companies measure their emissions along the entire value chain and disclose those emissions publicly. Developing clear rules for disclosure across all scopes of emissions will create best practices, enhance the transparency and integrity of claims, and promote competitive innovation. Governments should align to have the same high-quality standards.

## **Ensuring high-quality solutions**

Governments should establish or oversee systems to track and verify renewable energy credits and carbon credits to avoid double-counting, to incentivize participation, and to ensure environmental integrity. These credits should be transparent and verified to provide confidence to the public, and they promote energy solutions that significantly reduce emissions, including consideration of the full value chain impact.

## **Centering equity and justice in climate solutions**

Climate policies should support the development of the new green economy, with new job opportunities focused on advancing clean innovation. Equity should be a guiding principle of policies supporting this economy. Communities that have been disproportionately impacted by climate change should benefit from the economic opportunities of potential solutions.

**“[We] believe that both corporate and regulatory action are necessary to prevent the worst impacts of climate change and have a strong interest in the implementation of sound public policies to reduce greenhouse gas emissions.”**

**Brief Amici Curiae of Apple et al.,**  
West Virginia vs EPA (2022).

## Key milestones in our climate policy advocacy

**2015 (U.S.):** Apple joined the White House's American Business Act on Climate Pledge, in which participating companies voiced support for a strong outcome at the COP21 in Paris and demonstrated an ongoing commitment to climate action.

**2016 (U.S.):** Apple joined Google, Microsoft, and Amazon to sign an Amicus Brief in support of the U.S. EPA's Clean Power Plan.

**2016 (World):** Apple addressed 700 senior government, business, and community leaders at the seventh Clean Energy Ministerial, where we called for governments across the world to put a price on carbon to address climate change.

**2017 (U.S.):** Apple urged the White House to remain in the Paris Agreement and take meaningful action on climate change.

**2018 (U.S.):** Apple filed individual comments to the U.S. EPA, urging it not to repeal the Clean Power Plan because of its importance in reducing emissions.

**2018 (Japan):** Apple filed comments with the Japanese government, calling for the development of a robust and verifiable renewable energy trading system.

**2018 (U.S.):** Apple filed comments to the Federal Energy Regulatory Commission, urging it not to finalize a rule that would subsidize fossil fuels, which would limit the ability of renewables to compete in the electricity market. FERC chose not to finalize that rule.

**2017 (Vietnam):** Apple joined other companies urging the government of Vietnam to make regulatory changes allowing businesses to procure renewable energy through direct power purchase agreements.

**2017 (China):** Apple hosted a roundtable with the Green Electricity Consumption Cooperative Organization (GECCO) to create a platform for buyers in China where they can discuss renewable energy procurement challenges and opportunities and inform future policy.

**2018 (China):** Apple submitted formal comments to China's National Development and Reform Commission about the implications of draft policy on corporate clean energy procurement.

**2018 (South Korea):** Apple met with government officials in Korea to discuss the need for increased renewable generation and retail choice, whereby consumers can select their power source.

**2018 (Japan):** Apple was among the first multinational companies to join the Japan Climate Leaders' Partnership, a coalition of companies that align business objectives with environmental goals.

**2019 (Vietnam):** Apple urged the government to reform the electricity market, allowing businesses to purchase power directly from renewable power plants.

**2019 (World):** Apple participated in the UN Environment Assembly and conducted bilateral discussions with a number of countries to advocate for policies that enable a circular economy and bold action on climate.

**2022 (South Korea):** Apple spoke at the carbon neutrality conference calling for Korea's 2030 energy plan to set a higher target for renewable energy, a more fair competitive market for renewables, and improved transparency for renewable energy solutions.

**2021 (U.S.):** Apple became the first company to voice support for the enactment of the Clean Energy Standard (CES) that would decarbonize the power grid by 2035.

**2021 (Vietnam):** Apple and other companies vocalized our support to the government of Vietnam for the ambitious Power Development Plan prioritizing clean energy.

**2021 (U.S.):** Apple was one of the first large, public U.S. companies calling on the SEC to require disclosures of global greenhouse gases across all emissions scopes.

**2020 (EU):** Apple called on European leaders to increase their climate ambition to achieve targets of at least 55 percent greenhouse gas emissions reductions by 2030 and carbon neutrality by 2050. The EU adopted these targets.

**2022 (Japan):** Apple joined a letter calling for a level of carbon pricing that provides an incentive for emissions reduction.

**2022 (U.S.):** Apple filed comments to encourage more rapid integration of renewable energy to the transmission grid, a key bottleneck to renewable energy deployment.

**2022 (U.S.):** Apple led an Amicus Brief supporting the U.S. EPA's authority to regulate greenhouse gases from power plants.

**2022 (U.S.):** Apple, along with Meta and Google, advocated for greatly expanded renewable generation to achieve a 70 percent reduction in emissions in the state through intervention in the North Carolina Carbon Plan proceeding.

**TO REACH OUR GLOBAL CLIMATE GOALS, GOVERNMENTS MUST CREATE POLICIES THAT SUPPORT A JUST CLIMATE TRANSITION. WE'VE BEEN ACTIVELY ADVOCATING FOR STRONG CLIMATE POLICIES FOR MANY YEARS.**

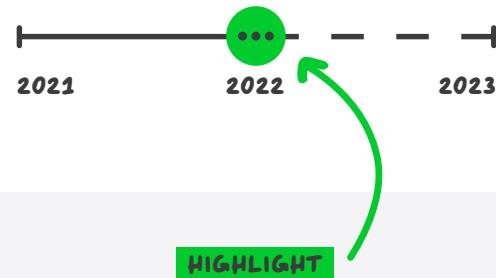
# Resources



# Goals and progress

GOAL

Use only recycled and renewable materials in our products and packaging, and enhance material recovery.

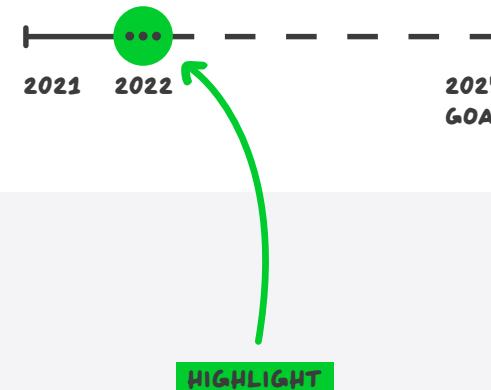


In 2022, **20 PERCENT** of the material we shipped in our products came from **RECYCLED OR RENEWABLE SOURCES.**<sup>27</sup>

We've accelerated our work through new commitments to transition to 100 percent recycled cobalt, tin, gold, and rare earth elements in select components by 2025.<sup>28</sup>

GOAL

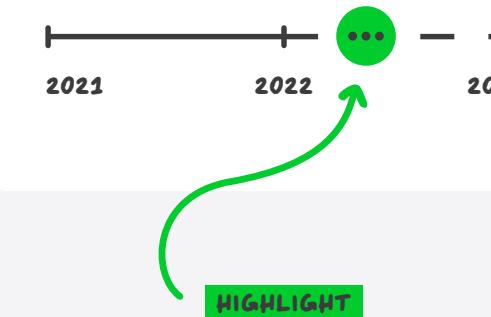
Eliminate plastics in our packaging by 2025.<sup>29</sup>



Our product packaging contains  
only **4 PERCENT PLASTIC** —  
down from 21 percent in 2015.

GO

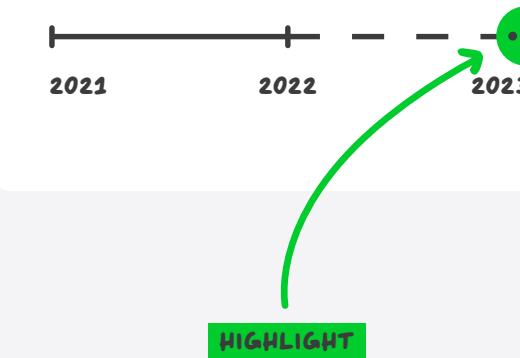
Reduce water impacts in the manufacturing of our products, use of our service and our facility operations.



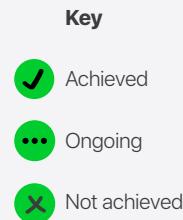
Our **PRINEVILLE, RENO, AND MESA**  
**DATA CENTERS** and **17 SUPPLIERS**  
**FACILITIES** have been certified to  
the Alliance for Water Stewardship  
standard for leading water  
management practices.

GO

Eliminate waste sent to landfill from our corporate facilities and our suppliers



Our corporate facilities waste diversion rate increased to **71 PERCENT**, driven by progress at our data centers.



# Our approach

Each of our products and services is made possible by natural resources. We're committed to sourcing, using, and recycling the materials that we rely on in a way that meets our high standards for labor, human rights, and environmental stewardship.

This commitment extends across our operations and supply chain, so we use materials in a manner consistent with our values, we responsibly manage freshwater usage so that these resources will be available and safe for others in the community, and we work to eliminate waste at our facilities and those of our suppliers. This serves our objective to minimize the overall resource footprint supporting our products. And we know that we can't do this alone — it requires collaborative stewardship of shared resources.

In the future we envision, our products are made solely from responsibly sourced recycled and renewable materials — to our same rigorous standards of quality and durability. We aim to build durable, long-lasting products that make the best use of the resources required to make them. And recycling approaches and innovations make this achievable, helping us recover and use the materials that we rely on in our products to their full potential. We're working with leading recyclers and academic institutions to realize this future through researching new technologies and identifying the challenges and opportunities to achieve positive change across industries.

Water is one of the most critical resources we need to build our products. It provides vital services at our offices, data centers, and stores — and it's essential to our manufacturing processes. Water is also a community resource. For this reason, we prioritize our stewardship efforts — working toward the most efficient use of freshwater, using alternatives where possible, and managing our discharge responsibly. We also look beyond our facilities to the water basins where we operate. Through collaborations with local partners — including companies, NGOs, and government agencies — we're working together to improve the quality of the water that our communities rely on.

Another approach to conserving resources is by eliminating waste. We work to reuse and recycle across our operations and throughout our supply chain. We strive to eliminate waste where we and our suppliers operate. These efforts go beyond reducing the amount of waste that we generate. We're innovating approaches to reuse and working with local businesses to create new recycling opportunities.

We can move ahead only by working with others. When we collaborate with suppliers, NGOs, recyclers, community stakeholders, and innovation leaders, we can do more while relying on less — and reduce our overall carbon and material footprint.

**Within resources, we focus on three main areas of impact:**



## MATERIALS

Transition to only recycled or renewable materials in our products and packaging, and maximize material efficiency, product longevity, and recovery.



## WATER

Reduce water impacts in the manufacturing of our products, use of our services, and our facility operations. At the same time, transition to alternative solutions, improve the quality of water that we discharge, and protect shared water resources.



## ZERO WASTE

Minimize overall waste generated and eliminate waste sent to landfill from our manufacturing supply chain as well as corporate offices, data centers, and retail stores.

# Materials

We're working toward a world where we create our products from, and where we contribute to, circular supply chains. This starts by building products that are circular by design and made from responsibly sourced recycled and renewable materials. This work will help us end reliance on mining, which is often both carbon-intensive and detrimental to the communities and ecosystems where it takes place.

We aim to create products that make greater use of circular supply chains that don't rely on mined resources. They do so while meeting our rigorous requirements for quality, durability, and performance. Part of what makes this possible are the recycling innovations we're developing to enhance material recovery. While these innovations support circular supply chains for Apple, we also hope our actions are inspiring others to follow.

This progress can impact those who buy our products, can influence the markets where we work, and can create change for broader global communities. These are the opportunities that drive us through the challenging work of creating circular supply chains.

## The following three pillars define our approach to achieving circularity:

### Sourcing and efficiency

We source recycled and renewable materials for our products and packaging, and we use these materials more efficiently. We also source the materials responsibly, whether from primary, recycled, or renewable sources.

### Product longevity

We make the most of the materials we use by designing long-lasting products. We design durable hardware, leverage software updates to extend functionality, provide convenient access to safe and high-quality repair services, and direct devices and parts to be refurbished and reused.

### Collection and recovery

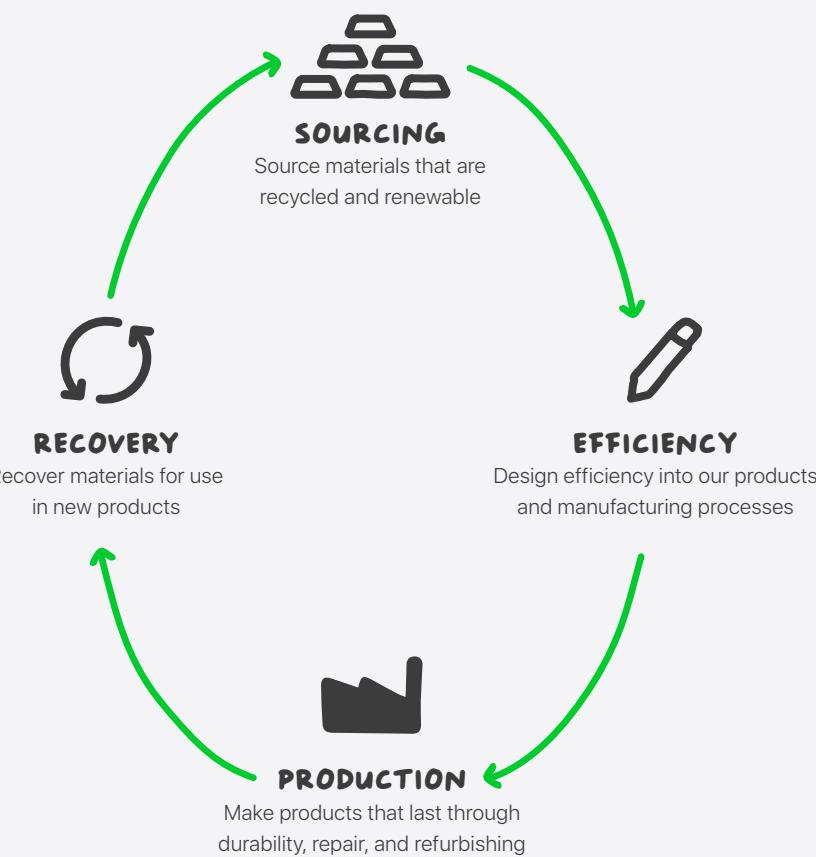
We improve how we collect end-of-life products and develop recycling innovations so that we and others can use old devices as raw material sources for the future.

### Sourcing and efficiency

We continue to progress toward our goal of relying solely on responsibly sourced recycled or renewable materials for our products and packaging.

The source of the materials we rely on matters to us. We place a clear value on materials that don't deplete the earth's resources. As we move toward recycled and renewable content, we're joined in our efforts by many partners. We look forward to engaging with many others as part of a broader global transition. As we design new products, we continue to source materials responsibly and continue to use materials efficiently and safely.

## How we pursue circularity for our products



## Expanding our use of recycled content

Our progress on materials continued in 2022 as we've moved closer to creating a circular supply chain for several materials. With tin, we first proved in 2017 that we could use 100 percent recycled tin for the solder on the main logic board (where the majority of tin is found) of iPhone 6s and in 2022, we're now using 100 percent recycled tin on many flexible printed circuit boards used across almost all newly launched products. This resulted in the total shipped recycled tin increasing to 38 percent across all product lines in 2022 — up from 30 percent in 2021. We took a similar approach with gold. Across all products, we expanded our use of certified recycled gold — from the gold plating on the main logic board on iPhone to other product main logic boards and flexible printed circuit boards — increasing certified recycled gold content to approximately 4 percent across all products that shipped in 2022 — up from just 1 percent in 2021.<sup>30</sup> These and other innovations helped us increase our use of recycled and renewable content to 20 percent of all the material shipped in products in 2022.<sup>31</sup>

We've also achieved several milestones with copper and zinc. For iPad models introduced in October 2022, we're using 100 percent recycled copper foil in the main logic board. For Mac Studio and Studio Display, we've developed a brass alloy using 100 percent recycled copper and zinc for use in the AC inlet and cable prongs. Finally, since last year, we've nearly doubled our use of recycled cobalt in batteries to 27 percent across iPhone, iPad, and Mac devices year over year, bringing the total recycled cobalt shipped in 2022 to 25 percent.<sup>32</sup>

## Prioritizing our efforts

Our recycled and renewable efforts continue to focus on 14 materials that we've prioritized based on a broad range of environmental, social, and supply chain impacts. (These are outlined in detail in our [Material Impact Profiles](#) white paper.<sup>33</sup>) Some of the materials prioritized through this process include lower-mass but higher-impact materials. Our priority materials include aluminum, cobalt, copper, glass, gold, lithium, paper, plastics, rare earth elements, steel, tantalum, tin, tungsten, and zinc, and they account for 87 percent of the total product mass shipped to our customers in 2022.<sup>34</sup>

Our teams are overcoming many obstacles to creating closed loop supply chains, including material performance and traceability. This is possible through our work with a diverse group of partners. We've been able to design a new, 100 percent recycled aluminum alloy that meets our rigorous performance standards. And we've improved our ability to track key materials like batteries within our supply chain, end-to-end.

Barriers to our progress remain — including challenges within our control and those outside Apple's direct influence. Addressing these requires a collective response. But through collaboration within the material space, we can achieve impact felt beyond our business. The supply chains we're helping create serve more than just our needs — they help promote the availability of competitively priced, quality recycled and renewable materials across geographies.

Maintaining high standards for materials is an essential element of this work. Our recycled and renewable material specifications follow standards established by the international community.<sup>35</sup> Through this process, we're able to confirm that a material has been recycled or comes from a renewable source — one that can continually produce without depleting the earth's resources.<sup>36</sup> We approach materials from new sources with the same rigor, evaluating each for the safety of the materials' chemistry. This process allows us to scale our use of materials that are better for the environment and safe for use in our products.

## Responsible sourcing of materials

This diligence carries over to sourcing. We obtain our resources responsibly, regardless of whether we're using primary or recycled materials. This approach is a necessary complement to our environmental efforts — and it draws from the same reliance on international standards. Our [standards for Responsible Sourcing of Materials](#) are based on leading international guidance, including the United Nations' Guiding Principles on Business and Human Rights and the Organisation for Economic Co-operation and Development (OECD) Due Diligence Guidance. In 2022, 100 percent of the identified tin, tantalum, tungsten, gold (3TG), cobalt, and lithium smelters and refiners in Apple's supply chain completed assessments to verify compliance with our standards, and to aid in identifying social, environmental, human rights, and governance risks. We also map other materials in our products such as mica, copper, graphite, and nickel, and, before production, evaluate suppliers of new materials for compliance with our requirements. We also continue to map, conduct additional due diligence, and facilitate

independent third-party audits on other materials used in our products, such as graphite, nickel, and copper. As we build supply chains for recycled materials, we're also partnering with the smelters and refiners identified through this process.

## Industry collaboration

As we focus on responsible sourcing and the use of recycled content, we continue to engage with multiple industry initiatives. These include our role on the steering committee of the Responsible Minerals Initiative (RMI). This coalition is one of the most commonly used resources for companies — from a range of industries — that are working to address mineral sourcing issues in their supply chains. We are also a board member of the Platform for Accelerating the Circular Economy (PACE) and co-lead the electronics program. PACE is a global collaboration platform for public and private decision makers to share a vision, best practices, and innovations toward a circular economy. Apple is a co-champion of the First Movers Coalition for Aluminum, whose focus is to aggregate demand signals for ultra low carbon technologies and materials. We also collaborate with other industry organizations, including the Aluminum Stewardship Initiative, to promote transparency across supply chains and implement additional commodity-specific auditing and due diligence systems.

Using recycled and renewable materials helps lower our carbon footprint, moving us closer to our climate goals. To fulfill the transition to these materials, we're working with policy makers to support international standards that enable the use of these materials globally.

Apple is committed to setting the highest standards for responsible sourcing of the materials used in our products. For more information, read our "People and Environment in Our Supply Chain" progress report and our "Conflict Minerals Report" at [apple.com/supplier-responsibility](http://apple.com/supplier-responsibility).

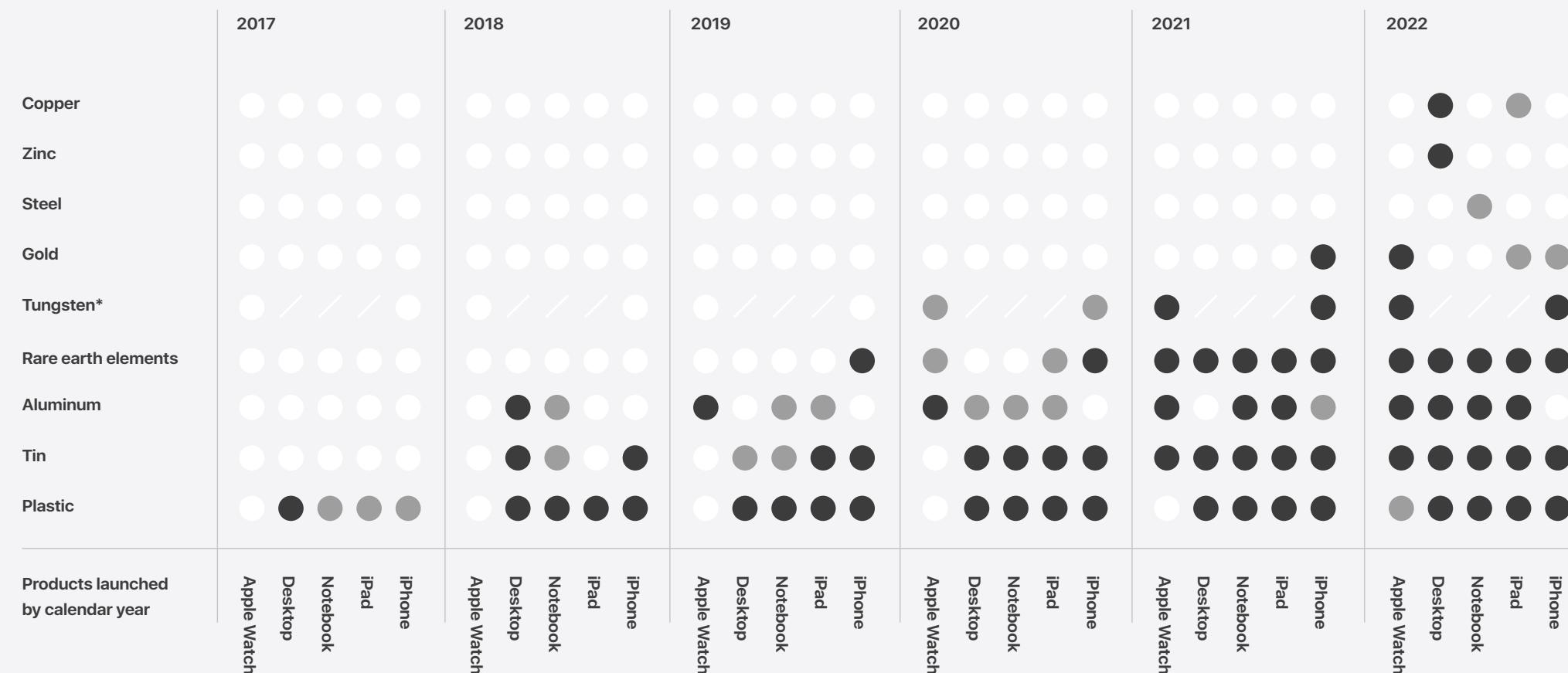
**FEATURE**

# Our transition to certified recycled materials by product line

**WE'RE USING MORE RECYCLED MATERIALS THAN EVER**



In 2022, the average recycled content shipped in Apple products increased to 20 percent. We've approached the work material by material, component by component, starting by introducing recycled content in one product and then expanding across Apple's product lines.



- All products launched in the calendar year include certified recycled content
- Some products launched in the calendar year include certified recycled content
- No products launched in the calendar year include certified recycled content
- / Recycled content not applicable\*

\* Material is considered "not applicable" if it's found only in small quantities dispersed across modules.

## FEATURE

# Progress across our priority materials

We're making progress toward our goal of sourcing only recycled or renewable materials in our products: in 2022, 20 percent of the material we shipped in products came from recycled or renewable sources.<sup>37</sup>

We're also accelerating our ambition: We recently announced that by 2025, we plan to use 100 percent recycled cobalt in all Apple-designed batteries;<sup>38</sup> 100 percent recycled tin soldering and 100 percent recycled gold plating of all Apple-designed rigid and flexible printed circuit boards;<sup>39</sup> and 100 percent recycled rare earth elements in all magnets across all products.<sup>40</sup>

Below is an overview of our progress across the 14 materials that we're prioritizing for recycled or renewable sourcing. As we work toward our goals, we'll continue to be open about the challenges that we encounter.

## Key challenges to developing circular supply chains include:

### Technical properties

The properties of a recycled or renewable material may differ from the primary material. This needs to be accounted for during product design and manufacturing. For example, select recycled plastics differ in properties from other plastics. The composition of other recycled materials can also be impacted by some level of contamination during the recycling process.

### Availability and access

Supply of recycled and renewable materials can be constrained by the limited availability of scrap sources or production of renewable content. When supply exists in some locations around the world, new suppliers need to be incorporated into supply chains for the material to be accessed.

### Supply chains

Recycled or renewable content may not be easily accessible on the market, requiring the development of new supply chains.

## Traceability

Information about the source of materials — whether mined, recycled, or renewable — might not be readily available.

### Scale

Materials for a single component can come from hundreds of different material suppliers, representing an exponential increase in effort as we scale the use of high-quality recycled or renewable materials across components and products.

### Regulatory barriers

Transboundary movement regulations — created to establish critically important community and environmental protections — can have the unintended consequence of inhibiting the ability to recover and move materials to best-in-class recyclers or refiners for use in new products. Read about our support of policies in our [feature on circular economy policy](#) that enable circular supply chains while improving social and environmental protections.

| Material        | Key challenges   | Progress   |
|-----------------|--|--|
| <b>Aluminum</b> | Regulatory barriers<br>Technical properties<br>Scale     | We're continuing to scale our new, 100 percent recycled aluminum alloy — which incorporates recycled content without compromising performance — across all products. Overall, in 2022, 67 percent of the aluminum we shipped came from recycled sources — up from 59 percent in 2021. <sup>41</sup> Of the products introduced during this period, iPad Air (5th generation), Apple Watch Series 8, Apple Watch SE (2nd generation), and MacBook Air with M2 all contain 100 percent recycled aluminum in their enclosures. Apple Studio Display contains 100 percent recycled aluminum in the stand, and Apple TV 4K (3rd generation) contains 80 percent recycled aluminum in the thermal module. Because recycled aluminum can have 1/40th the carbon footprint of aluminum from primary sources, this supports our pursuit of low-carbon design. <sup>42</sup> Our recycled material comes from several sources, including scrap from the manufacture of Apple products and other postindustrial sources. And our product claims are supported by suppliers who have taken the additional step of getting their recycled content certified by an independent, third party. |
| <b>Cobalt</b>   | Regulatory barriers<br>Availability and access<br>Scale  | In 2022, 25 percent of the cobalt shipped in our products — nearly double the amount shipped in 2021 — came from certified recycled sources on a mass-balance basis, including both postindustrial scrap and post consumer scrap from end-of-life batteries. The cobalt from iPhone batteries disassembled by Daisy is being returned to the market, making the material available to others. And in 2023, Apple committed to using 100 percent recycled cobalt in all Apple-designed batteries by 2025. <sup>43</sup>   |
| <b>Copper</b>   | Technical properties<br>Supply chains<br>Scale           | Electronics applications require the use of high-performance copper. Yet even as challenges remain in identifying quality scrap sources, we're making progress. In March 2022, we introduced 100 percent recycled copper for the first time in any Apple product: Apple Studio Display and Mac Studio both use 100 percent recycled copper in the brass prongs of the power cord plug and AC inlet. We also continue testing 100 percent recycled copper in other applications to evaluate its technical properties and performance across product lines. Copper is also a key material in printed circuit boards. For iPad (10th generation), introduced in October 2022, we're using 100 percent recycled copper foil in the main logic board — Apple's first use of standalone recycled copper.   |
| <b>Glass</b>    | Technical properties<br>Availability and access<br>Scale | Recycled sources are scarce for the quality of glass that we use in our products — and performance of this material is key to the durability of our final products. We're working hard to identify recycled content and incorporate it into the material that we use to produce glass parts. The cover glass and back glass of all iPhone and iPad devices contain recycled glass. By incorporating quality scrap in our applications, we also help keep glass at its highest-purity use for future recovery.  |

| Material                   | Key challenges   | Progress  |
|----------------------------|--|---|
| <b>Gold</b>                | Regulatory barriers<br>Transparency<br>Scale             | In 2021, iPhone 13 models were the first Apple devices to contain 100 percent certified recycled gold, used in the plating of the main logic board and wire of the front and rear cameras. In 2022, we expanded our use to the wire of every camera of iPhone 14 and to the plating of the printed circuit boards of all newly released Apple Watch models, to iPad Pro 11-inch (4th generation), and to AirPods Pro (2nd generation), increasing our use of recycled gold to about 4 percent in 2022 across all product lines — up from 1 percent in 2021. Because primary and secondary sources of gold are often commingled, to certify 100 percent recycled sources required pioneering industry-leading levels of traceability: we identified suppliers who were able to source and segregate recycled gold sources while meeting our due diligence requirements; then we elevated these suppliers as preferred vendors. This level of traceability helped us to build out a supply chain of exclusively certified recycled content. And in 2023, we committed to using 100 percent recycled gold plating in all Apple-designed rigid and flexible printed circuit boards by 2025. <sup>44</sup> All gold in Apple products is responsibly sourced, whether it's primary or recycled. For more information, see our <a href="#">Conflict Minerals Report</a> . |
| <b>Lithium</b>             | Regulatory barriers<br>Availability and access<br>Scale  | We're shifting toward recycled materials recovered from batteries as they become more viable and economical. We've worked to identify sources of recycled content and test the performance of the recycled material to see if it meets our requirements — both at the material level and in its application in batteries. This rigorous evaluation is key to maintaining our products' performance as we transition to recycled content over the long term. In January 2023, Apple began using recycled lithium for the first time in some of our batteries for some products, and we're in the process of getting this material third-party certified. <sup>45</sup>   |
| <b>Paper</b>               |  | For information about our progress on paper, see our <a href="#">feature on packaging</a> .   |
| <b>Plastics</b>            | Technical properties<br>Availability and access<br>Scale | We use a broad range of plastics in hundreds of product components, from speakers to keycaps. Each plastic material has different performance requirements that we must maintain as we switch to recycled or renewable sources. And we continue to diligently pursue this effort. In 2022, we introduced more than 100 parts with an average of over 40 percent recycled plastic. These include the Apple Watch Ultra antenna lines on the housing, which use plastic from bottles that have been transformed into a stronger, higher-performance material.   |
| <b>Rare earth elements</b> | Regulatory barriers<br>Availability and access<br>Scale  | More than 73 percent of the total rare earth elements that Apple shipped in products in 2022 came from certified recycled sources, a significant increase from 45 percent used in 2021. To reach this progress, we've focused on rare earth elements used in magnet manufacturing — praseodymium, neodymium, terbium, and dysprosium — and worked with our supply chain to build circular supply paths for the rare earth elements. And we're featuring greater percentages of recycled rare earth element content across our latest devices: 100 percent in iPhone 14 and Apple Watch Series 8, 99 percent in iPhone 14 Pro Max and Apple Watch Ultra, and 98 percent in MacBook Air with M2. We're also committed to using 100 percent recycled rare earth elements in all magnets across all products by 2025. <sup>46</sup>   |

| Material        | Key challenges  | Progress  |
|-----------------|---|---|
| <b>Steel</b>    | Regulatory barriers<br>Technical properties<br>Scale            | Since steel is a highly recycled material, we focus on keeping it in the highest-quality form possible, working to recover high-purity steel from our manufacturing scrap and our products at end of life. We're collaborating with our supply chain partners on opportunities to expand the use of recycled content into components of our products. Scaling the use of recycled steel is a key challenge because there are multiple layers in the supply chain between the raw material and the many components that ultimately become part of our products. We're making progress in realigning these supply chains to use more recycled material. In June 2022, we introduced 90 percent recycled steel in the battery tray of MacBook Air with M2 — a first for Apple. |
| <b>Tantalum</b> | Regulatory barriers<br>Availability and access<br>Supply chains | We continue to address the challenge of sourcing 100 percent recycled content at the quality we need for capacitors. We're actively investigating recovery approaches from end-of-life electronics to develop further use of this recycled material. Based on material recovery rates, our products may already contain some recycled tantalum. But, to reach our goal, we have to move beyond existing tantalum supply chains that mix primary and secondary content. This requires starting from the beginning by identifying new sources of quality tantalum scrap, then building traceable supply chains around exclusively recycled material so that we can verify its use in high quantities in our products.   |
| <b>Tin</b>      | Scale   | With tin, we began our efforts to use recycled material on the main logic board for iPhone 6s in 2017, and last year we expanded to many flexible printed circuit boards across many products. This resulted in our recycled tin use increasing to 38 percent on average across all product lines in 2022 — up from 30 percent in 2021. In 2023, we committed to using 100 percent recycled tin soldering in all Apple-designed rigid and flexible printed circuit boards by 2025. <sup>47</sup> As we continue to scale use across even more components, we seek to engage an exponentially increasing number of suppliers in this effort.   |
| <b>Tungsten</b> | Regulatory barriers<br>Technical properties                     | More than 95 percent of the tungsten used in 2022 came from recycled sources, a significant milestone from prior years. In 2022, all released iPhone models feature 99 percent recycled tungsten across the entire device, and all released Apple Watch models feature 100 percent recycled tungsten across the entire device. And with the help of our disassembly robots, Daisy and Dave, and our recycling machine, Taz, the tungsten from our Taptic Engine can be recovered and recycled.  |
| <b>Zinc</b>     | Technical properties<br>Supply chains                           | We continue to work to identify high-quality sources of recycled zinc. This is a challenge because the material is prone to accumulating impurities during the recycling process. Each source that we identify is rigorously tested so that recycled materials meet our high performance standards. In March 2022, we introduced 100 percent recycled zinc for the first time in Studio Display and Mac Studio, which use it in the brass prongs of the power cord plug and AC inlet.   |

**How we source materials:****Recycled content**

Certified recycled content is sourced from recycled materials that have been independently verified by third parties to a standard that conforms with ISO 14021. We also account for recycled content that has been confirmed by suppliers but hasn't received third-party verification.

**Responsible sourcing**

Apple's Responsible Sourcing of Materials Standard covers all primary and recycled materials. Our standard aligns with leading international standards, including the UN's Guiding Principles on Business and Human Rights and OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas.

**FEATURE**

# Reducing plastic and waste through packaging innovation

We're closing in on our goal to eliminate plastics from our packaging by 2025.<sup>48</sup> To get this far, we've addressed many packaging components that typically rely on plastic, including large product trays, screen films, wraps, and foam cushioning, replacing each with fiber alternatives. We're now focusing on implementing innovative alternatives to the small uses of plastics across our packaging — like labels and lamination — which will help us address the remaining 4 percent of plastic in Apple's packaging footprint. At the same time, we're taking steps so that our packaging is recyclable and that the fiber we source comes from recycled sources or responsibly managed forests.

Improving the recyclability of our packaging helps reduce our overall environmental footprint. In 2022, we released a number of products with over 95 percent fiber-based packaging, including iPhone 14 Pro, MacBook Air with M2, and iPad Air (5th generation).<sup>49</sup> And this year, we've continued this work with packaging innovations for iPhone, iMac, iPad, and Apple Watch to address the remaining plastic in the smaller parts of our packaging — labels and lamination.

To eliminate the need for labels on the latest iPhone models — iPhone 14 and iPhone 14 Pro — we introduced digital printing directly on the back of boxes.<sup>50</sup> We developed a custom high-resolution ultraviolet inkjet printer that can print on demand at the manufacturing facilities where iPhone is packaged. We estimate that eliminating the labels will avoid over 300 metric tons of plastic, over 150 metric tons of paper, and over 3700 metric tons of carbon emissions.<sup>51</sup>

We're also working to eliminate plastic lamination from our packaging. In 2022, iPad Air (5th generation), iPad Pro, and Apple Watch Series 8 replaced the polypropylene plastic lamination used on boxes and packaging components with an overprint varnish. This varnish, which we developed with rigorous qualification over three years, makes packaging more recyclable while retaining the design and feel that our customers expect when first opening their product. It's also more efficient; the overprint varnish process requires a single step rather than the multiple steps needed previously. In 2022, this helped us avoid over 1100 metric tons of plastic and over 2400 metric tons of CO<sub>2</sub>e.<sup>52</sup>



We carefully developed our new overprint varnish to replace the polypropylene lamination while meeting rigorous quality standards for our packaging recyclability and aesthetic.

Each of these innovations has applications for our other products — and potential to eliminate plastics. We intend to implement these across our products to reach our goal of eliminating plastics in our packaging. For example, overprint varnish replaces the plastic lamination that accounts for approximately half the plastics remaining in our packaging.

We're also working to improve the recyclability of our packaging. Apple's packaging design guidelines factor in packaging recyclability, requiring the use of fiber-based materials that can break back down to pulp as part of mixed-paper recycling streams, alongside materials like cereal boxes.<sup>53</sup> These guidelines are supported by third-party assessments from firms — including Western Michigan University's Paper Pilot Plant and the U.S. Forest

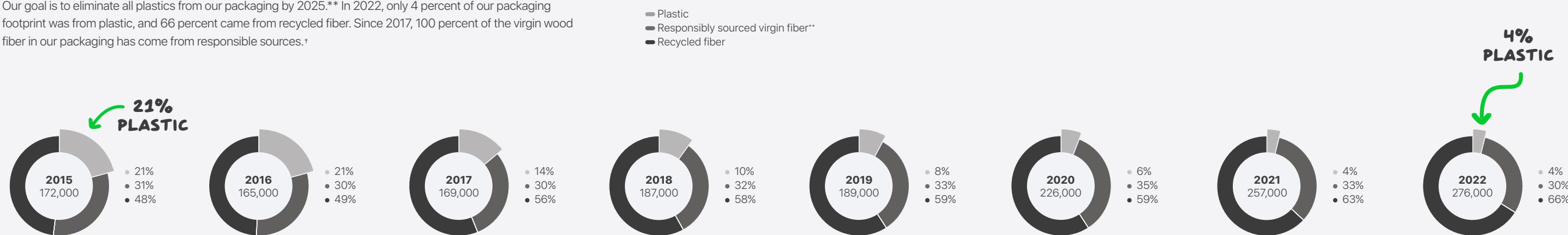
Service's Forest Products Laboratory — and we continue to monitor evolving international packaging standards.

As we eliminate plastic in our packaging, we continue to make sure that the wood fiber comes from responsible sources. Since 2017, all the wood fiber we use for our packaging comes from either recycled sources or responsibly managed forests. Through partnerships with

The Conservation Fund and World Wildlife Fund, we've protected and improved forest management practices on more than one million acres of working forests in the U.S. and China. In 2022, these forests generated enough responsibly sourced fiber to balance all the virgin fiber in our packaging, while contributing to the global supply of responsibly sourced fiber.<sup>54</sup>

## Packaging fiber and plastic footprint\* (metric tons)

Our goal is to eliminate all plastics from our packaging by 2025.\*\* In 2022, only 4 percent of our packaging footprint was from plastic, and 66 percent came from recycled fiber. Since 2017, 100 percent of the virgin wood fiber in our packaging has come from responsible sources.<sup>†</sup>



\* Beginning in fiscal year 2022, we expanded our packaging goal boundary to better reflect our impact, resulting in an increase of about 36 percent of our total packaging mass, as reported here. We're now including retail bags, all finished goods boxes (including plastic content in labels and in-box documentation), packaging sent to our customers as part of Apple Trade In, AppleCare packaging for whole units and service modules (with the exception of plastics needed to protect items from electrostatic discharge), and secondary packaging of Apple products and accessories sold by Apple. Our goal boundary does not include the inks, coatings, or adhesives used in our packaging in addition to our packaging footprint. We also calculate the fiber used at our corporate facilities. In fiscal year 2022, this number was 632 metric tons.

\*\* Beginning in fiscal year 2025, we plan to eliminate plastic from packaging. The boundary of Apple's packaging footprint reflects the boundary of our plastic elimination goal. It includes retail bags, all finished goods boxes (including plastic content in labels and in-box documentation), packaging sent to our customers as part of Apple Trade In, AppleCare packaging for whole units and service modules (with the exception of plastics needed to protect items from electrostatic discharge), and secondary packaging of Apple products and accessories sold by Apple. Our goal does not include the inks, coatings, or adhesives used in our packaging. We plan to eliminate plastic from the packaging of refurbished products by 2027, once old product packaging designs are phased out.

† Responsible sourcing of fiber is defined in [Apple's Sustainable Fiber Specification \(PDF\)](#).

## Product longevity

Our products are designed to last. Product longevity not only makes for a better customer experience but also is an important aspect of conserving Earth's finite resources and meeting our 2030 carbon neutrality goal. Our approach combines hardware designed to endure the rigors of everyday use, regular software updates that unlock new features and functionality, and — when needed — high-quality repair services.

Apple Trade In plays an important role in product longevity. Longer-lasting devices provide our customers with options to access the value of their current device through Apple Trade In or third-party programs. Customers can upgrade to the latest products using a credit according to their device's trade-in value. This also helps keep products in use for as long as possible so that new customers can experience Apple products and services with refurbished devices. Making more products and services available to more people is good for our business, and making those products last longer is better for the planet.

Products that are designed to last hold their value longer. iPhone, for example, has the slowest depreciation rate among the six leading smartphone manufacturers. And compared with flagship Android devices, iPhone holds an average of 30 percent more value over a four-year buy-back period.<sup>55</sup> As of January 2023, iPhone 7, which was introduced in 2016, still had monetary value for Apple Trade In in the United States.<sup>56</sup>

We're committed to building long-lasting devices, and part of achieving that is designing durable hardware. To minimize products' need for repair, we refine features that improve durability, like water resistance and Ceramic Shield, which protects the display on iPhone. And we provide regular software support, so customers can update their devices to the most recent operating systems and unlock the latest features and functionality years after purchase.

We've also expanded access to safe, reliable, and secure repair services to meet our customers' needs. When products require repair, customers can more easily find repair options that work for them, such as Apple Authorized Service Providers, the Independent Repair Provider program, and, starting in 2022, Apple's Self Service Repair.

### Building products to last

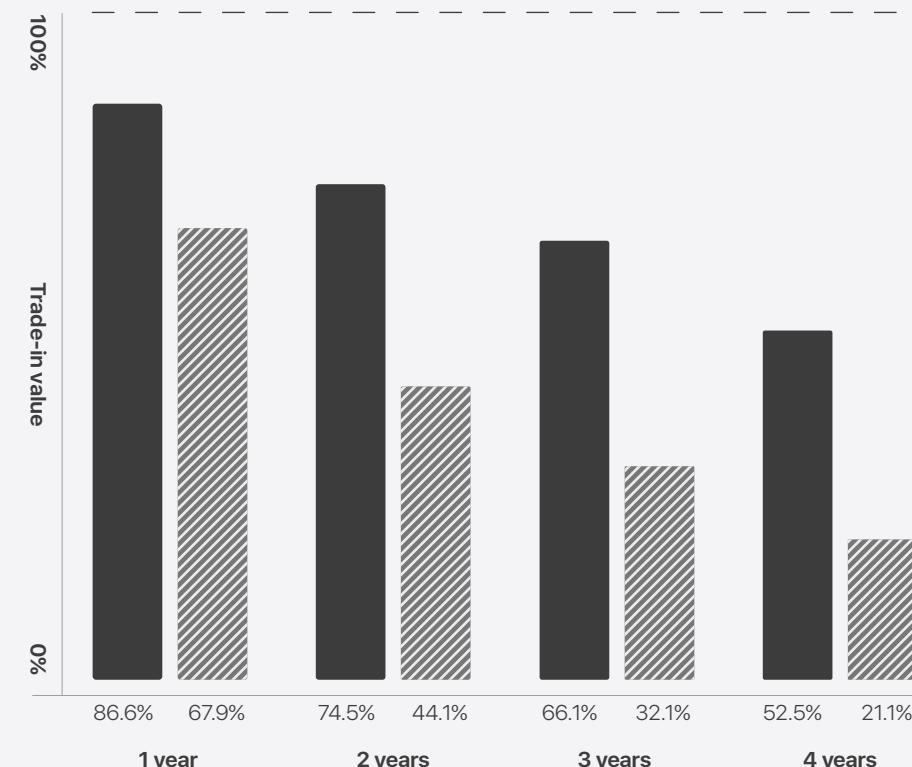
Our customers use our products every day. Which is why we design our devices with the rigors of continuous use in mind — and to minimize the interruptions of maintenance and repair.

Durable hardware is central to our products. Engineers in our Reliability Testing Lab assess our designs against our strict durability standards that measure the performance of materials, components, and fully assembled products. They use testing methods that mimic realistic conditions in which our customers use their products, assessing many aspects of each device. In-depth user studies to understand how our customers use, and misuse, their products inform the durability standards that we've established.

During product development, we test numerous units of a product, relying on the results to inform each successive round of design. In 2022, Apple introduced Apple Watch Ultra, with a design developed for the highest level of durability to support the needs of our most adventurous and explorative customers. Apple Watch Ultra was designed for demanding conditions that required a series of new environmental and impact tests to maintain the device's high level of reliability. Tests that our engineering team developed included a random impact test to simulate bike falls, a gravel impact test to evaluate durability in rugged stone terrain, and additional environmental tests to support compliance with MIL-STD-810H — a standard used for military equipment that's also popular among rugged device manufacturers.<sup>57</sup> This also included low-pressure testing to simulate a range of environmental conditions, from high altitude to extreme temperatures, temperature shock, chemical exposure, freezing and thawing, shock, vibration, submersion, and other assessments to emulate operations in rugged settings. Our engineers performed these tests in addition to other trusted reliability procedures developed through iteration across several generations of the Apple Watch product line.

## iPhone retains its value over time\*

— iPhone  
▨ Average flagship Android



\* According to the "2021–2022's Phone Depreciation Report," published by BankMyCell, a website that tracks trade-in and sale value of technology products.

### Improving access to repairs

We design our products to be used daily with minimal need for repair. But if a repair is needed, customers should have easy access to convenient, quality repair services to get their product back up and running as quickly as possible.

We've expanded our repair footprint in the past three years — nearly doubling the number of professional service locations that have access to genuine Apple parts, tools, and training. Repair options include Apple Store locations, Apple Authorized Service Providers, participating Independent Repair Providers, mail-in repair centers, onsite service, and Self Service Repair. This also includes more than 4000 Independent Repair Providers and a global network of more than 5000 Apple Authorized Service Providers, with more than 100,000 service technicians, that offer support for customers to get repairs.

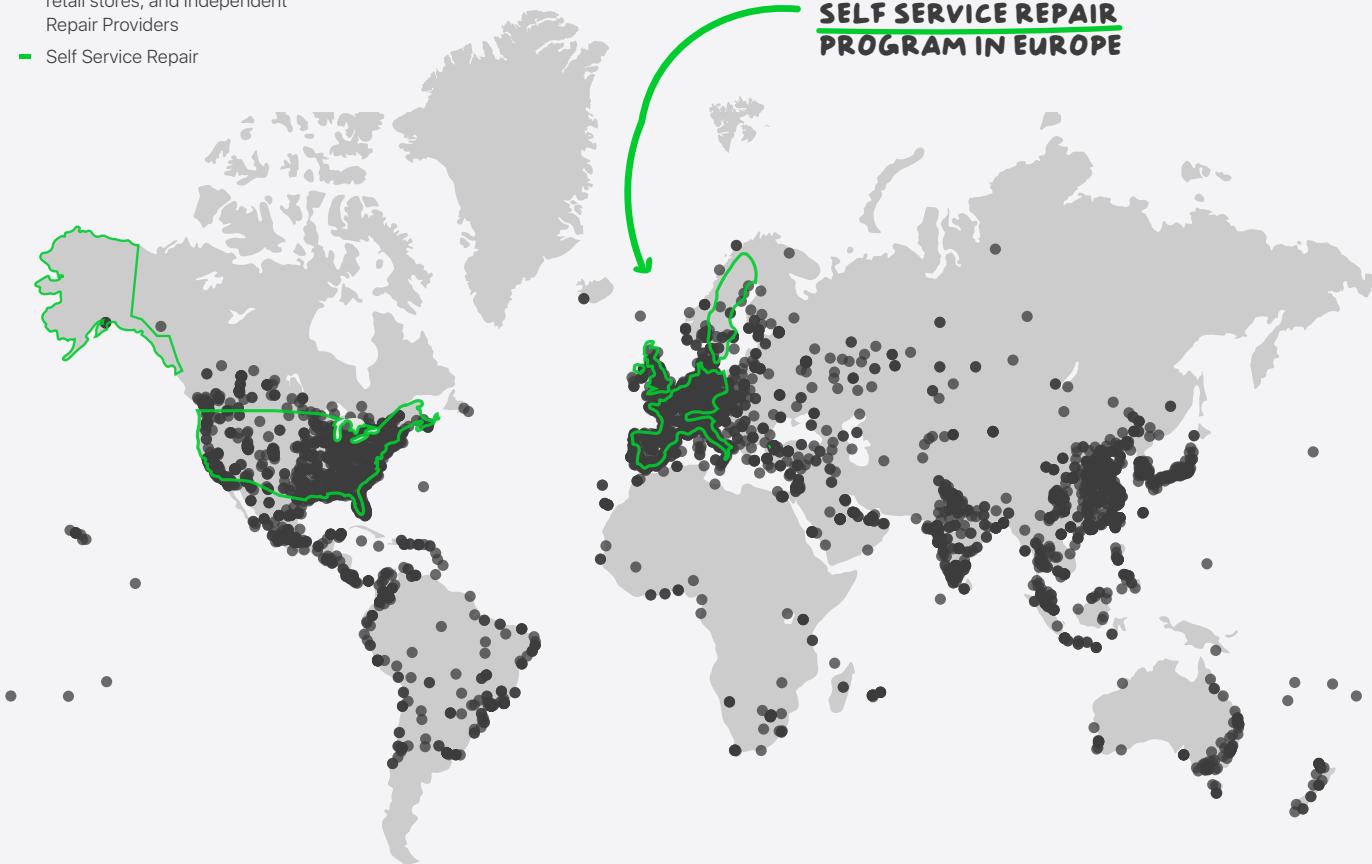
Since 2019, our Independent Repair Provider program has enabled independent repair businesses of all sizes to access genuine Apple parts, tools, diagnostics, and training. This program expanded from the U.S., Europe,

and Canada to more than 200 countries worldwide. We also continue to expand coverage by offering repair service at our customers' homes and offices in select cities across the United States, providing greater convenience to our customers. We train and certify service personnel to repair Apple products. This helps them correctly diagnose the issue, leading to successful service and repair and preventing damage to the device so that it works as it should.

In 2022 we introduced Self Service Repair, providing individuals with access to repair manuals and genuine Apple parts and tools through the Apple Self Service Repair Store. Self Service Repair is available in the U.S. and Europe — including in Belgium, France, Germany, Italy, Poland, Spain, Sweden, and the UK. The new online store offers more than 45 types of device repairs, intended to enable customers who are experienced with the complexities of repairing electronics to service certain iPhone models, MacBook and Mac computers, and displays themselves.

### Global repair locations

- Apple Authorized Service Providers, retail stores, and Independent Repair Providers
- Self Service Repair



## Designing products with repairability in mind

We continue to make progress designing more durable products and offering customers more repair options. At the same time, we're working to make repairs more accessible and affordable. iPhone, for example, has even more repairable modules than before, in addition to enhanced durability features and water resistance. iPhone 14 and iPhone 14 Plus introduced an updated internal design that improved the repairability of the back glass and ease of access to internal components, making fixes easier. In the new internal design, the aluminum housing and back glass are no longer one enclosure, so repairs to the back glass don't require replacing the housing. The 13-inch MacBook Air with Retina display (2018) and later models also allow for battery replacement with a stretch-release adhesive, facilitating component access. And iPad mini (6th generation) and iPad Air (5th generation) now support the same unit battery replacement in select locations. We've also expanded availability of repair parts in countries around the world to support vintage products for up to seven years. For example, a program for Mac notebooks makes battery repair available for up to 10 years after the product was last distributed. For more information, refer to the [support page](#) about availability of service parts past warranty.

## Keeping products current with software updates

Free software updates also support our product longevity goals. We provide these to enhance our customers' experience by allowing them to access the latest features available to their device for as long as possible. This includes important security and privacy updates. As we continually improve the operating systems that power our products, we also make sure that each software release runs seamlessly on all supported devices. Customers can benefit from the latest software updates whether they're using a brand-new device or one that's several generations older.

iOS 16, our most recent release, extends support back to iPhone 8 (2017). iPadOS 16 compatibility goes back to the fifth-generation iPad (2017), and macOS Ventura supports MacBook models from 2017 and later. The updates in each operating system make the latest capabilities — from Messages and the Lock Screen to Continuity features — available to a broad user base. These updates also provide more customers with access to the newest security and privacy features.

Software updates are popular with our customers. By February 2023, more than 80 percent of all iPhone devices introduced in the last four years had updated to iOS 16, and iPadOS 16 was being used on 50 percent

of devices introduced in the last four years. These continually high rates of adoption make it clear that our customers see value in software updates. We also offered customers using iOS 15 and iPadOS 15 the option to update only the security features on their device for a while — giving them more time, if they wanted it, to update the entire operating system.

## Extending the life of products and parts through refurbishment and reuse

Products that last longer make the best use of the resources that go into them. Refurbishing and reusing products helps lower the impact that each device has on the environment — including carbon intensity per year of life. We extend the life of our products by building them to serve more than one owner — enabling customers to exchange devices for an upgrade.

We collect devices for refurbishing and reuse through several programs, including Apple Trade In, the iPhone Upgrade Program, AppleCare, and our corporate Hardware Reuse Program. In 2022, we sent more than 12.1 million devices and accessories to new owners for reuse. The Apple Trade In program, available in 25 countries, provides customers with product end-of-life options — they can access the value of their current device if they upgrade to a newer model, or they can trade in their device for free.

Our customers drive the success of our trade-in programs and those of third parties. Customers who use these options help realize the long-term value that we've designed and built into our products — whether through trading or passing down their devices or by purchasing refurbished products. Each product that's refurbished and reused contributes to reducing our overall environmental footprint.

Some device parts can also be reused. We're finding new ways to access these valuable components within our devices. After recovery, these parts can be used to replace existing components or repurposed in new creative applications. We continue to expand the number of parts that can be recovered and refurbished to our high quality and performance standards, and reused as replacements. This enables us to reduce the need to create spare parts as we repair devices. We also remain focused on innovation opportunities to reuse accessories sent for recycling. For example, we send collected power cables and adapters that still function to our final assembly sites, where they power products used on production lines.

## Product end of life

Even after a product reaches the end of its life, the materials within it can serve the next generation of products. Each time that we effectively recover materials from end-of-life products, we enable circular supply chains—and make the best use of finite resources. This takes collaboration—with customers who trade in their products when they're done using them and with recyclers capable of recovering materials effectively from devices. This helps to reduce the need to mine new materials. It also saves the considerable energy expended in extracting and refining materials, driving down emissions and conserving resources.

## Optimizing recycling through partnerships and innovation

Our recycling strategy is a key part of our efforts to create circular supply chains. We're working to make it easier for customers to recycle our products. We provide or participate in product take-back and recycling collection programs in 99 percent of the countries where we sell products. Our customers can trade in devices they're no longer using for reuse or recycling at retail locations and through recycling programs offered by local operators. They also have the option to do so online through platforms like Apple Trade In. In 2022, we directed more than 40,000 metric tons of electronic scrap globally to recycling with the help of customer and employee programs. Our customers play an important role in continuing the growth of these programs, and we encourage them to engage in these programs by returning devices after use.

We work with best-in-class recyclers to make sure we can maximize the potential of the recycling materials stream, as well as drive our efforts to close the loop on key materials. We define best-in-class recyclers as those capable of recovering materials at high rates, and doing so with the best environmental and safety performance. We verify recyclers' compliance with our Code and Standards through independent third-party assessments. In addition, we look for our recyclers to maintain regional leading certifications such as WeeeLabex, e-Stewards®, or R2.

As we expand our partnerships with recyclers across the globe, we're maintaining the rigorous standards that we require of all suppliers. We assess our recyclers regularly for compliance with labor and human rights, security, and environment, health, and safety (EHS) standards, regulations, and best practices. In 2022, we conducted 61 recycler assessments. We've increasingly sought out specialty providers capable of handling specific material streams to increase the quantity and quality of materials, and we've seen volumes handled by these suppliers grow by over 70 percent in 2022. This global footprint of recyclers also helps us build a more resilient recycling supply chain and innovate with more suppliers around the world.

Education and training can help us improve recovery rates from our products. We've invested deeply in this because it provides recyclers with the information to improve efficiency, quality, and capacity. We work with recyclers

to continue devising new recycling solutions that can be shared through training and ongoing support. We help these partners develop the ability to disassemble our products and recover as much material as possible while minimizing waste.

In 2022, we expanded our Apple Recycler Guides to include certain models of iPhone and the new Studio Display. These guides are developed by our engineering teams to help recyclers optimize recovery and make sure that the processes can be completed using tools and procedures available to a wide range of professional recyclers. The guides provide valuable insight into the recycling process, including recommendations for directing disassembled parts to the best downstream facilities for resource recovery. As we continue to improve material recovery through collaboration, we're increasing the availability of high-quality recycled content on the market for all.

Through the Apple Education Hub, part of our Supplier Employee Development Fund, we've also supported efforts to improve recycling capacity, quality, and efficiency with our U.S.-based recycling suppliers with a lean manufacturing educational program. Embracing lean methodologies and management systems can bolster employee engagement, mitigate safety issues, and improve recycling economics.



We work with best-in-class recyclers to drive our efforts to close the loop on key materials used in our products.

Beyond our programs around the world, we continue to explore ways to make e-scrap recycling even more convenient for our customers. Through our membership with Corporate Eco Forum (CEF), we've collaborated with Amazon, Dell Technologies, Google, and Microsoft on a doorstep electronics waste recycling pilot program in the U.S. Launched in February 2022, it offers residents in the city of Denver, Colorado, direct pickup of e-waste from their homes upon request. This pilot will enable us to learn more about consumer behavior, with an ultimate goal of making recycling more convenient for users.

We're also continuing our partnership with Atea — a leading provider of IT infrastructure solutions in the Nordic and Baltic region — to collect end-of-life iPhone devices for recycling with our Daisy robot in the Netherlands. We encourage more of our customers around the world to engage with Apple to return end-of-life devices to us so that materials are returned to the circular economy. To learn more about our recycling programs, visit the [Apple Recycling Programs web page](#).

### **Developing new approaches to disassembly and recovery**

Innovation plays a key role in realizing the potential of recycling — not just for Apple products but throughout our industry. We continue to develop better, more efficient means of disassembling products that maximize material recovery while minimizing waste. Our Material Recovery Lab (MRL), an R2-certified facility in Austin, Texas, focuses on assessing the recyclability of our products, helping inform design decisions that support disassembly and recovery. The MRL's work has led the way in automated approaches to material recovery with our robots Daisy, Dave, and Taz.

Daisy, our disassembly robot, is capable of quickly and skillfully taking apart 23 models of iPhone — including various models between iPhone 5 and iPhone 12 — into discrete components. This vital step helps improve material recovery and recycling and yields clear results. From just one metric ton of iPhone main logic boards, flexes, and camera modules recovered by Daisy, our recycling partner is capable of recovering the same amount of gold and copper as more than 2000 metric tons of mined rock.<sup>58</sup> We hope other innovators follow suit. The U.S. Patent and Trademark Office issued Apple five patents related to Daisy, and we're willing to license these to researchers and other electronics manufacturers that are developing their own disassembly processes.<sup>59</sup>

Dave, a robot specializing in disassembling the Taptic Engine, enables the recovery of rare earth magnets as well as tungsten and steel. Taz, which helps recycle modules by separating magnets containing rare earth elements from audio modules, is designed as an alternative to the conventional shredder that many recyclers rely on. While rare earth elements are typically lost in conventional shredders, Taz is designed to access these valuable materials, improving our overall recovery rate.

We're also developing new technologies at our Santa Clara Valley, California, asset recovery center that leverage automation and machine learning to facilitate recycling processes that typically require manual sorting, which can be time-intensive and error-prone. This work aims to create low-cost solutions that our suppliers can deploy to recover more materials, freeing up their employees for more complex tasks that can't be easily automated.

The benefits we're trying to achieve aren't strictly resource based. We're also working to improve the material handling efforts of demanufacturing. In 2022, we began deploying overhead projector-based augmented reality systems to recyclers. This system projects instructions for demanufacturing processes onto the work surface. This innovation is designed to further improve safety, productivity, and efficiency.

### **Designing for the next generation of recycling**

The greatest opportunities for recycling are yet to come. We're committed to a long-term approach to recycling innovation, relying on and continually improving current approaches while nurturing new and emerging technologies. By fostering research and development, we can identify opportunities for transformative changes. We invest with this in mind. And we continue to support initiatives that set out to redefine disassembly and material recovery.

We're investing in recycling innovations that can have industry-wide impacts. For several years, we've worked with Carnegie Mellon University's Biorobotics Lab in the School of Computer Science's Robotics Institute to identify and disassemble e-scrap. This innovation has the potential to enable recyclers to recover the materials at a higher quality. The software from this project will be open source and available to others in the industry that are working to maximize the recovery of recyclable materials. We've also worked with the lab to improve the accuracy of disassembly and the recovery of materials through X-ray imaging with RGB imaging. And we're optimizing our robots' abilities to handle objects and adjust to contact, enabling them to "feel" by using high-frequency force feedback and machine learning. Through this work, we're driving toward developing truly intelligent disassembly technology.



Learn more about Apple's research with Carnegie Mellon University in our [white paper](#).

**FEATURE**

# Our position on circular economy policy

The responsible use of natural resources is a critical part of Apple's environmental objectives. Extracting the materials that make up our products comes with significant environmental costs. We work to minimize these by using materials efficiently so that we can one day build all our products out of recycled or renewable materials. This circularity ambition is an integral part of our strategy to meet our goal of being fully carbon neutral in 2030, including across the lifetime use of our products.

Global demand for electronics is increasing, and with it, so is the demand for the materials that make up those products. Awareness is growing of the finite nature of some of these resources, such as critical minerals or rare earth elements — as well as of the complex, globally interrelated nature of the supply chains that electronics rely on. Circularity plays an important role in helping realize environmental benefits while building supply chain resilience. Policy can be part of the solution, helping transition from the older "take-make-dispose" linear model to circular supply chains. This reflects changing technologies as well as current and future demands, making circular supply chains competitive with traditional, extractive ones.

Over the last year, Apple has reached new milestones in our products and our efforts to demonstrate what's possible in circularity. We're aiming for even greater use of recycled content in our products. Our commitments include using 100 percent recycled cobalt — a critical mineral — in Apple-designed batteries and using 100 percent recycled rare earth elements in all magnets, both by 2025.<sup>60</sup> And advancements in recycling technology help make this possible. For example, cobalt recovered from iPhone batteries disassembled by Daisy is returned to the market. And Taz — which we developed as an alternative to traditional shredders for breaking down electronics — enables us to recover even greater amounts of rare earth elements. This more efficient and economical approach makes these materials available to others beyond our supply chain.

We've also expanded our Self Service Repair program from iPhone 12 and iPhone 13 to include MacBook Air and MacBook Pro notebooks with the M1 family of chips. This makes repair manuals and genuine Apple parts and tools available to customers through the Apple Self Service Repair Store. We continue to build, support, and participate in circular supply chains. But challenges remain to achieve fully circular electronics supply chains.

Policy can help accelerate progress. A thriving, responsible, circular economy supports critically important health, safety, and environmental protections. It can also enable closed loop supply chains to be cost and operationally competitive with linear models. Harmonized policies can remove barriers and drive the transition to circularity by meeting the following high-level objectives:

**Sourcing and recycling materials responsibly:**

- Policies should seek to improve strict labor, human rights, and environmental standards throughout recycled and primary materials supply chains.
- Circularity should be a priority for policies that aim to address sources of supply over new ways or locations for resource extraction. Recycling electronics will help unlock the valuable materials in those devices for reuse, reducing reliance on newly mined resources.

**Designing for longevity:**

- Policies should strive to maximize product longevity while minimizing environmental impact, by enabling the optimal balance between designing for reliability and ease of repair.
- Ecodesign policies are most effective in delivering environmental benefits when they're product-specific and globally aligned.

**Improving material recovery:**

- Support the development of efficient collection programs that engage customers, protect environmental and human health, and capture high volumes of electronics for reuse, repair, refurbishment, and recycling.
- Waste regulations should be consistent and harmonized across geographies, enabling efficient, commercially viable movement of materials. Such policies can drive maximum materials recovery, prevent downcycling, and help enable parity with newly mined resources while maintaining critical environmental and social protections.

**Improving recycling:**

- Incentivize the inclusion of recycled content in products by supporting the generation of increased, high-quality material supply, including improving waste collection and recycling infrastructure, the development of global waste treatment standards, and recycled content quality standards.
- Support the development of advanced electronics recycling facilities that can recover more types of resources, including materials that are difficult to recover or of lower value.

Apple is working to realize a circular economy through policy engagement and advocacy.

Apple supports the ratification of the Basel Convention by the United States. This would help enable circular supply chains and address some current barriers to efficient materials recovery and reuse. The Basel Convention is the global regulatory framework guiding how some waste — including electronics and e-scrap — can be moved for recovery, recycling, and disposal. The convention provides critical environmental and social protections, especially against moving hazardous waste to geographies that lack the resources to manage it in an environmentally sound manner. Countries that have ratified the convention can move materials covered by the agreement among themselves, following the agreement's regulatory requirements.

The U.S. is one of a very small number of countries not party to the Basel Convention. This imposes restrictions on the movement of Basel-controlled wastes for recycling or resource recovery into or from the U.S. to nearly all other countries in the world, requiring specific trade agreements with another country. The U.S. ratifying the convention would unlock more efficient movement of material to high-quality electronics recycling facilities, helping scale circularity and the available supply of recycled material. It would also allow the U.S. to participate in the global conversation around how to protect communities and environmental health and create more efficient and effective circular supply chains.

# Water

Water is among the planet's most precious resources. We consider the full life cycle of water as we bring our products and services to life. And we know that to protect this resource, we must go beyond our corporate footprint, across our supply chain and into the communities and watersheds where we operate.

Climate change continues to impact global water resources — making freshwater increasingly scarce, flooding more frequent, and access more vulnerable. These effects can be felt in the communities where we and our suppliers operate, which is why we're committed to managing these resources responsibly. We can do so by reducing our freshwater withdrawals and returning clean water to the watershed. We can limit the use of freshwater. And, where appropriate, we can rely on alternative sources such as recycled water for functions like irrigation and cooling so that freshwater is available for people and ecosystems.

Water quality is another challenge. We've made it a priority to maintain the quality of the water that we use and discharge so that it will be suitable for its next use, contributing to the overall health of local watersheds.

Water is a community resource, and it demands equitable distribution and access, which requires a collective approach to challenges and local solutions. This is why we're committed to engaging watershed stakeholders through supporting Alliance for Water Stewardship certifications for our suppliers and key corporate facilities, as well as by participating in local watershed management projects.

We aspire to advance water security in the places where we operate through actions that deliver on our guiding principles of improving availability, quality, and access. We've aligned our approach across five strategic pillars: low-water design, site efficiency and conservation, site water stewardship, replenishment and nature-based solutions, and leadership and advocacy.

This strategy is informed by geographically specific insights. Resources like the World Resources Institute (WRI) Aqueduct Water Risk Atlas provide detailed insights on local watershed health, such as baseline water stress. Understanding that 37 percent of our corporate and supply chain water use is located in areas of high or extreme basin stress helps inform the prioritization of our efforts.<sup>61</sup>

We continue to monitor and manage water use in our owned-and-operated facilities, and we go beyond the typical practice in our industry by further engaging with our suppliers across our manufacturing supply chain sites to better understand their water use. Only by considering impacts throughout the value chain can we achieve the water management goals that we've set for ourselves.

## Our water strategy



### LOW-WATER DESIGN

Minimize water impacts in the design of products, services, and sites.



### SITE EFFICIENCY AND CONSERVATION

Improve the performance of existing sites and processes.



### SITE WATER STEWARDSHIP

Demonstrate responsibility beyond our facilities through watershed level management.



### REPLENISHMENT AND NATURE-BASED SOLUTIONS

Improve water availability, quality, and access through regenerative approaches.



### LEADERSHIP AND ADVOCACY

Advance water management through policy, advocacy, and technology innovation.

## Low-water design

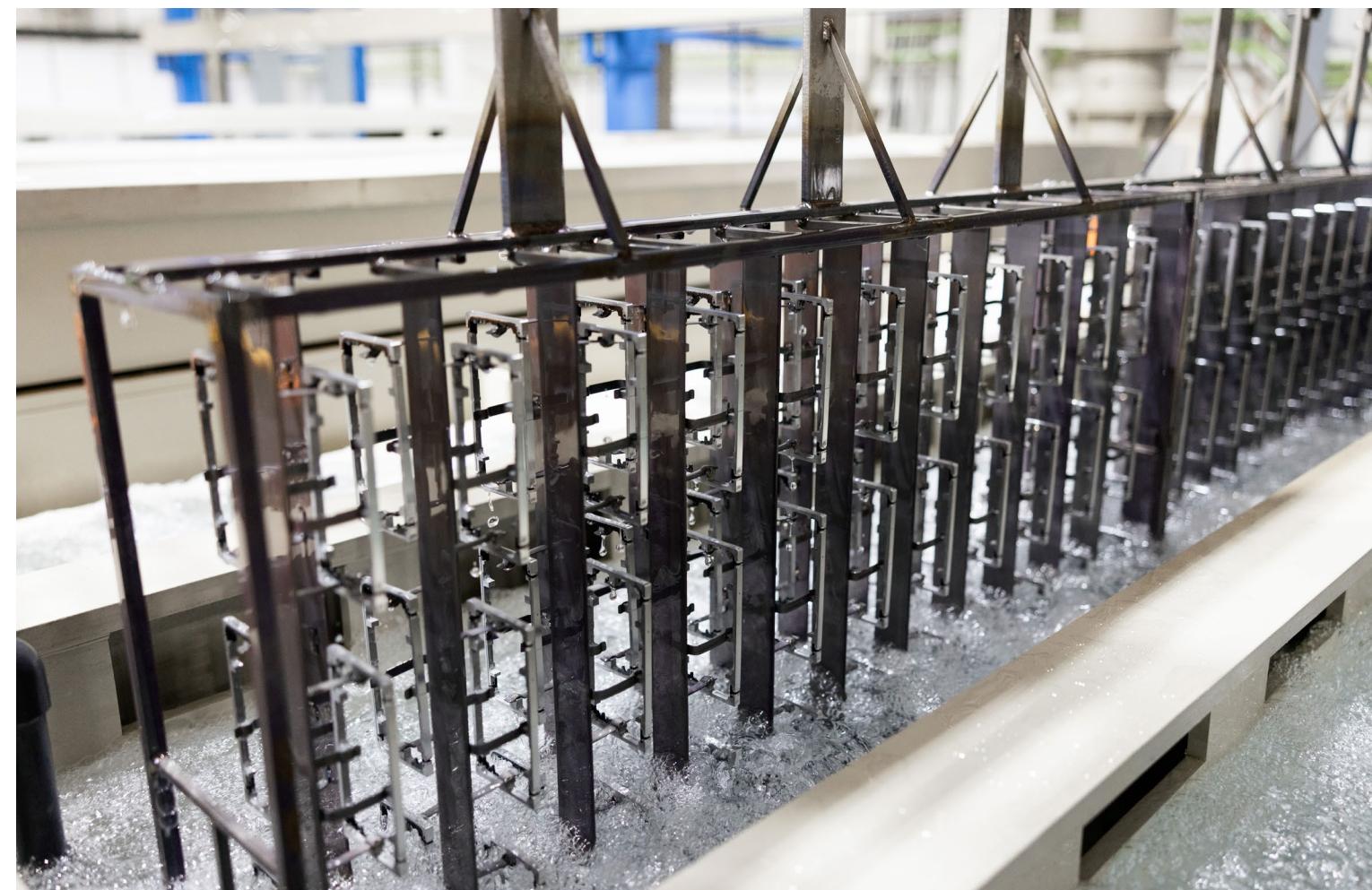
We approach low-water design by first focusing on site selection, conducting a water risk evaluation to determine whether a potential site is in a water-stressed area or not. We aim to avoid locating water-intensive processes in water-stressed locations, so we either use the results to select a more appropriate site where possible, or to mitigate the impact of our expected water use.

Then, we look to systems and processes that use less water or reuse water, so that we can limit excess water consumption and, where possible, eliminate waste. We also design solutions to manage the quality of the water that we return to the watershed.

In our corporate operations, we discharge the majority of our wastewater to the sanitary sewer. Up to 44 percent of the water that we use at our corporate locations is discharged back into the local water system rather than consumed.<sup>62</sup> We monitor the water quality from sites where we have an industrial wastewater discharge so that each location meets or exceeds local discharge requirements.

One example is our new Capstone campus in Austin, Texas, where we aim to achieve net-zero water use. To accomplish this, the campus will rely on an onsite wastewater reuse system, as well as condensate recovery and stormwater capture, limiting potable water use to potable purposes only. This effort will avoid 60 million gallons of freshwater use, relying instead on nonpotable water for cooling and toilet flushing.<sup>63</sup> This cooling approach will also allow us to achieve 28 million kWh in energy savings annually at the location.

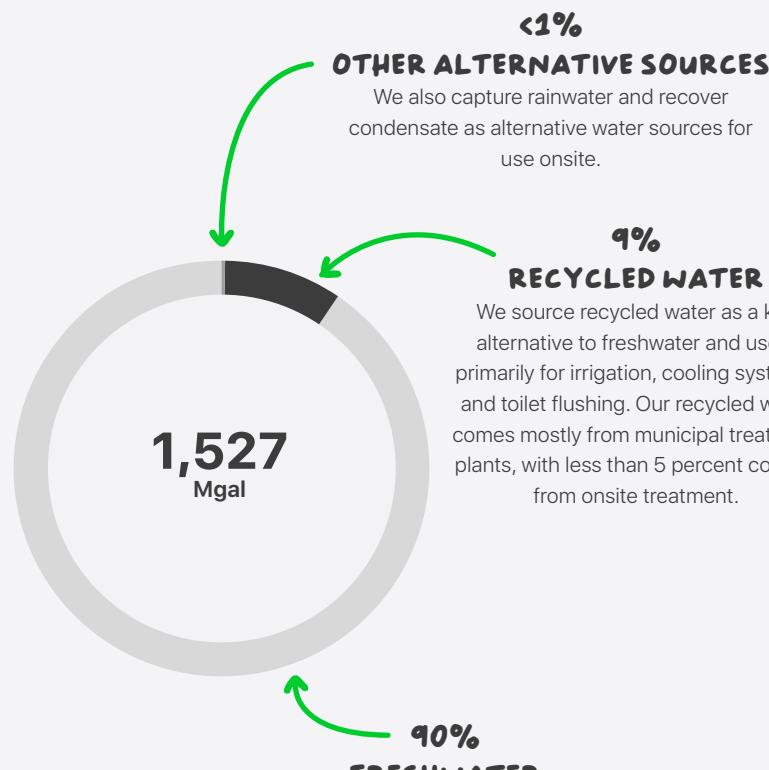
In our supply chain, a majority of water is used during manufacturing. For example, in 2019 we launched a pilot program at a manufacturing location in China as part of our anodizing improvement program with the aim of reducing, and eventually eliminating, potentially hazardous discharge as well as reducing water and chemical use. Anodizing is the most water-intensive process in the metal-finishing process of enclosures. As part of the pilot, we employed several water efficiency approaches, including using cascade and counterflow rinsing processes, which helped retain 75 to 85 percent of the water used during metal finishing. This process improvement has the potential to save millions of gallons of freshwater annually when applied at scale.



The aluminum anodizing process is typically water-intensive. In 2019, we launched a pilot to seek to eliminate hazardous discharge and increase water efficiency from anodizing. The cascade and counterflow rinsing processes, which helped retain 75 to 85 percent of the water used during metal finishing, could save millions of gallons of freshwater annually when applied at scale.

## Water use at corporate facilities

We track our corporate water use for our data centers, retail stores, distribution centers, and corporate offices.



We define freshwater as drinking-water quality, the majority of which comes from municipal sources and less than 5 percent of which comes from groundwater.

## Site efficiency and conservation

Next, we focus on identifying steps to use less freshwater in our existing operations. In particular, we prioritize regions where our efforts can immediately reduce stress on local watersheds. Our corporate and supplier sites rely on water for everything from sanitation and climate control to maintaining green spaces and manufacturing. At each point, we seek out efficiencies and approaches to reduce our freshwater use.

One challenge we've committed to addressing is reducing water use, even as we grow in our corporate facilities. Separating growth from water use requires dedicated focus. In 2022, our facilities used about 1.5 billion gallons of water in our direct operations, a 9 percent increase from 2021. Some of this growth reflects the return to office from the COVID pandemic, but most of the increase was driven by corresponding growth in our data center cooling loads. We expect currently implemented improvements in water use effectiveness (WUE) and new dry cooling designs at our data centers to decouple water use from electricity use.

Last year, alternative water sources accounted for about 10 percent of our total corporate water usage — primarily from municipal recycled water sources. At Apple locations in Texas, North Carolina, Ireland, Taiwan, and Japan, we used rainwater capture systems to source 3 million gallons of water; from our newly installed condensate recovery systems in Santa Clara Valley, Austin, and North Carolina, we captured 1.5 million gallons of condensate in 2022. Through our low-water design and site efficiency and conservation efforts, we saved 152 million gallons of freshwater in 2022 from projects implemented since 2017.<sup>64</sup>

These efforts start at the local level. In Santa Clara Valley, California, where our corporate headquarters are located, we've pursued water conservation across our landscaping efforts. This includes six new projects in 2022, saving 1.2 million gallons of water. We intend to expand this work to an additional 16 conservation projects in 2023.

At our data centers, we've upgraded and replaced servers to reduce our cooling water usage by 60 million gallons annually. We've also piloted a resin water treatment system that resulted in a 30 percent reduction in makeup water use and up to 60 percent reduction in discharge.<sup>65</sup> Based on this success, we are implementing this technology at our data centers in Prineville, Oregon, and Mesa, Arizona. Additionally, we piloted a plant-based water treatment using sustainably harvested sphagnum moss at several data centers, helping eliminate the need for biocides and corrosion inhibitors. This system, which uses compostable, natural sphagnum moss to improve water quality, can further improve water savings. We implemented this at our Reno, Nevada, data center and have begun permanent installations in Maiden, North Carolina, and Mesa, Arizona.

We're also expanding our efforts to recover water that's otherwise wasted. Six new condensate recovery installations — including four in Santa Clara Valley and installations at our new Capstone campus in Austin, Texas, and at our Maiden, North Carolina, data center — harvest excess water from cooling systems to be redirected to cooling towers and for landscaping use that would otherwise be discharged.

We also require our suppliers to maintain the high standards for water discharge outlined in the Apple Supplier Code of Conduct. Through Apple's Clean Water Program, we help suppliers minimize process water impacts and adopt best practices in wastewater treatment. We make our expectations clear to our suppliers and help define operational approaches so that they have the support needed to achieve their optimal level of water efficiency and conservation. There's a clear business imperative to develop these practices, particularly in manufacturing and production where water is critical for power generation, cleaning, and cooling processes. Water scarcity around the world requires that we focus on shifting this program away from voluntary engagement. We're working to incorporate water requirements into our procurement decision-making so that supplier engagement scales faster.

Our supply chain accounts for 99 percent of our total water footprint, based on our detailed water inventory. That's why we partner closely with our suppliers through our Clean Water Program. Since the program's launch in 2013, more than 234 participating supplier sites increased their average reuse rate to 42 percent and saved our suppliers 13 billion gallons of freshwater in 2022, for a total of over 63 billion gallons of water savings.<sup>66</sup> These savings come from a range of initiatives, such as reuse of reclaimed water, upgrades to water-efficient equipment, and countercurrent rinse methods.

## Site water stewardship

We look beyond our operations and those of our suppliers to address shared water challenges. This involves engaging with the communities around our facilities for the protection of local watersheds. Since 2018, we've partnered with the Alliance for Water Stewardship (AWS) to advance the AWS Standard, the first global framework to measure responsible water stewardship across social, cultural, environmental, and economic criteria. In 2020, Apple joined the AWS board of trustees with the objective of highlighting water stewardship opportunities to our suppliers and promoting collective action on shared water challenges with the Information and Communications Technology sector.

Through AWS, we've been able to certify facilities that meet the AWS Standard, considering benefits and recognizing impacts to local water catchments, communities, and ecosystems. Our Prineville, Oregon, data center was the first facility of its kind to receive AWS certification in 2021. In January 2023, our Reno, Nevada, and Mesa, Arizona, data centers also achieved certification. We are on track to certify all of our owned and operated data centers by 2025.

Since 2018, 17 of our supplier sites have achieved certification for the AWS Standard, 15 of which achieved a Platinum rating — the highest score achievable within the AWS framework. In January 2022, Suzhou Industrial Park — with the help of Apple and other partners — became the first industrial park in the world to earn the AWS certification.

We're also active in the communities where our facilities are located. In Prineville, we supported the Deschutes Land Trust in the protection of the Ochoco Preserve, which is situated at the confluence of the Ochoco and McKay creeks — a major salmon and steelhead trout habitat in the Crooked River basin. In Reno, Nevada, and the surrounding areas, we continue to partner with The Nature Conservancy for restoration and clean-up efforts of natural habitats along the Truckee River.

## Replenishment and nature-based solutions

A key element to addressing water availability, quality, and access is replenishment efforts and nature-based approaches to restoring watersheds. Our goal is to replenish our corporate freshwater withdrawals in high stress locations. This work is underway with some key projects.

In partnership with the Bonneville Environmental Foundation, we're funding the removal of the invasive *Arundo donax* cane species in the San Fernando Valley area of the Los Angeles River watershed. This plant species monopolizes space, sunlight, and water, displacing wildlife and stressing local watersheds. This removal effort addresses water availability in the watershed that feeds the greater Los Angeles area and will deliver 55 million gallons of replenished water annually.

In 2018, we partnered with the City of Prineville to develop an aquifer storage and recovery (ASR) system. The ASR system pumps water during the winter off-peak months

from the large aquifer that underlies Prineville, treats the water, and then conveys it uphill to a smaller local aquifer. In the summer, this stored water is pumped to meet our cooling needs so that our water usage doesn't affect city water supplies. This response to seasonal variability helps provide water security and drought resilience for the region.

We're also engaged with the Uptime Catalyst Facility in India, one of our key corporate locations with water, sanitation, and hygiene (WASH) challenges, to introduce an innovative performance-based program that allows clean, cold water to be more widely distributed and maintained. This will generate a volumetric water benefit annually, equivalent to our direct operations freshwater withdrawal in India.<sup>67</sup>

## Leadership and advocacy

Our work on water affords us another opportunity: to lead with others and push for change across industries. We collaborate with groups, including AWS and the Responsible Business Alliance (RBA), and speak to audiences that are in a position to impact their communities and industries. In May 2022, we addressed the AWS Global Water Stewardship Forum in Edinburgh to discuss our stewardship strategy supply chain. In October 2022, we addressed the RBA's annual conference in Santa Clara, California, with AWS to promote collective action on key catchment identification in the ICT sector in order to further accelerate supplier participation in water stewardship efforts, including supplier hubs in priority water basins.

In 2022, we partnered with Frank Water in India to develop and implement a water resource management plan through a community-based WASH grant that focuses on increasing water stewardship through improving decision making around water and climate resilience. Frank Water works alongside local partners so that safe water, sanitation, and hygiene are within reach for communities experiencing challenges in accessing water resources. And in 2023, we joined the UN Water Conference to speak to the importance of corporate leadership on water, emphasizing the importance of supply chain actions.

We also take positions on issues that matter to us and where we can try to make a difference. We're engaging with the development of the next phase of Volumetric Water Benefit Accounting methodology with the WRI and others to further the replenishment and nature-based solutions industry.

# Zero waste

All waste that gets sent to landfill comes with costs. These can be measured in the resources and emissions that go into discarded materials. And, too often, the most vulnerable communities around the world carry a disproportionate burden of these costs and others associated with waste disposal. We're working to change this by prioritizing waste-free operations at our own facilities as well as those of our manufacturing suppliers.

At our offices, retail locations, data centers, and construction sites, we're implementing systems and approaches to avoid sending waste to landfill. We're asking our manufacturing suppliers to do the same. Our focus is on eliminating waste generated during manufacturing and engaging with local specialty recyclers and composters to redirect materials from landfills. This requires innovation and collaboration with local partners to make the best use of our resources. We measure our progress in the amount of waste that we divert at the source and by our ability to protect the communities where we and our suppliers operate.

## Reducing waste at our corporate facilities

We're reducing the amount of waste generated in our corporate operations and directing more to recycling programs — an effort that has continued since launching our Zero Waste Program in 2018. Initially we focused on U.S. campuses and retail locations. Since then, we've grown in the U.S. and around the world while remaining committed to sending zero waste to landfill.

In 2022, recycling and composting efforts allowed us to achieve a waste diversion rate of 71 percent — up from 68 percent in 2021 — limiting landfill waste from our global operations to about 16,000 metric tons.<sup>68</sup> Despite occupancy increases during our transition from COVID-related temporary closures, our overall waste generated remained low.

We haven't interrupted our efforts to make progress on waste diversion since achieving our first zero-waste certification, UL's Zero Waste to Landfill validation, in 2015 for our campus in Cork, Ireland. In 2023, our Taiwan Technology Center became the second Apple facility to receive the UL Solutions Zero Waste to Landfill validation.<sup>69</sup> And our data center in Viborg, Denmark, became the third facility to receive TRUE certification in 2023, joining our data centers in Mesa, Arizona, and Prineville, Oregon.<sup>70</sup> These facilities achieved TRUE Platinum, the highest certification level. TRUE recognizes facilities that divert more than 90 percent of waste for recycling, compost, or reuse. To accomplish this, we improved waste separation through infrastructure upgrades and moved away from single-use materials

to reusable alternatives. These certifications also reflect efforts working and coordinating with local partners, from composters to specialty recyclers capable of handling specific waste streams, like plastic wraps and foams. By partnering with these providers, we're able to support the local economies engaging in recycling and composting as an alternative to municipal waste disposal programs.

## Promoting material reuse, composting, and waste diversion across our corporate and retail locations

As our company grows and changes, we've prioritized finding opportunities to recycle construction and demolition waste. In 2022, we achieved a waste diversion rate of 83 percent — approximately 23,500 metric tons — from corporate office and data center construction and demolition projects through recycling and source separation efforts. We expanded source separation efforts for our corporate office and data center construction projects — from 7.2 percent participation in 2021 to 36 percent across projects in 2022. The locations using this approach saw a 10 percent higher overall diversion rate. An example of the effectiveness of source separation is our new office in Battersea Power Station in London, United Kingdom. Our team there achieved a 98 percent diversion rate of construction waste, including 300 tons of drywall, one-fifth of which was directed to agricultural uses such as mushroom cultivation and farming. The project reused timber onsite and donated key construction materials, including plasterboard, for local uses. The location also recycled personal protective equipment used during construction and build-out.



In 2023, our Viborg, Denmark, facility became the third to receive TRUE Platinum certification, which requires more than 90 percent of waste from a facility to be recycled, composted, or redirected for reuse.

We also focus on using less so that we reduce the waste to be recycled or sent to landfill. By identifying significant sources of waste — like packaging materials and commonly used equipment — and then working with our suppliers, we've found bulk packaging solutions and recyclable and reusable alternatives. Across our data center sites, we're switching to reusable air filters. Previously, there were no off-the-shelf reusable air filters available for our application. In 2019, we partnered with an industry-leading automotive filtration and technology company to design a sustainable solution that met very specific design criteria for our design centers. And more than 38,000 reusable high-performance air filters — which are available for other companies to use — have been placed in Apple-managed facilities worldwide to date. By replacing disposable air filters with reusable ones, we avoid landfilling 25 tons of dirty filters each year. Further, the reusable air filters are more energy efficient, leading to 35 percent savings in fan energy use. And we intend to rely exclusively on reusable filters at data centers from here on out.

We're working to keep waste that's unavoidable out of landfills. This requires sorting items correctly to redirect waste to recycling and composting where possible. To enable this, we make clearly labeled containers available throughout our locations. For example, we're working to reduce contamination and increase recycling rates by continuing to roll out consolidated bins for recycling, composting, and landfill and by improving signage. We recycle paper, plastic, aluminum, and cardboard materials at most of our corporate and retail sites worldwide. And more than 450 of our corporate offices, retail stores,

and data centers are participating in composting. We're also using technology to improve our diversion rates at corporate locations. At our offices in Santa Clara Valley and Culver City, California, we piloted waste sensor technology, a system that employs cameras and data collection within dumpsters to monitor contamination and increase diversion efficiency. The data provides collectors with accurate information on volume to inform scheduling of pickups and the use of appropriately sized hauling containers.

We remain committed to the safe and responsible management of hazardous waste. So that wastes are treated, recycled, or incinerated according to safety and environmental standards in the U.S., Apple performs audits of treatment, storage, and disposal facilities (TSDFs), with 12 performed in 2022. We continually reevaluate the facilities used for disposal and management of hazardous and regulated wastes, working to assess disposal method, availability, economics, and sustainability.

### Driving solutions internally through communication, reporting, and education

Our employees are one of our best resources in achieving our zero-waste goals. They play a critical role in reporting on waste and facilitating waste audits at our locations. We support these efforts with training, education, and access to resources. In 2022, we standardized waste reporting requirements across all our data centers and corporate offices and implemented a centralized dashboard system. Our retail auditing program examined 13 locations in North America, documenting the material characteristics

of our waste. This data will allow for better assessment of our waste practices and opportunities to improve our approaches. We also launched site-specific zero-waste training for all Apple data centers. All new data center employees are now required to complete the site-specific zero-waste training and receive manager approval of completion. Finally, we've standardized signage at our data centers with contextual signs for logistics and operations, as well as for office and administrative sites.

### Taking a zero-waste approach with our suppliers

We're committed to leaving no waste behind in the communities where we build our products. Our suppliers, recyclers, and waste solution providers are central to achieving this goal. We're working with them to eliminate waste from our manufacturing processes. Since we launched the Zero Waste Program for our manufacturing partners in 2015, we've continued to make considerable progress. And this program has expanded to include more than 300 supplier facilities across 14 countries and regions.

In 2022, we shifted our Zero Waste Program from an opt-in effort for suppliers to a requirement as part of our Supplier Code of Conduct. This means that suppliers are now required to implement a systematic approach to identifying all sources of waste and characterizing each stream in the waste inventory, developing a program or solution to quantify and monitor their waste-to-landfill diversion rate, setting waste-minimization goals, and maintaining progress toward achieving zero waste to

landfill. Our Zero Waste Program provides training and tools to help suppliers track their waste, set waste-minimization goals, and create improvement plans toward achieving zero waste for their operations.

We make available to all facilities participating in the program resources and guidance on how to reduce waste and then reuse, recycle, or compost the waste they do create. Suppliers at these locations can also access tools to improve waste management and, in some cases, onsite support. The program is making an impact: In 2022, suppliers redirected 523,000 metric tons of waste from landfills (up from 491,000 metric tons the previous year), bringing the total to 2.5 million metric tons since the program's inception — the equivalent of eliminating 3.1 million square meters of landfill space. Throughout 2022, 100 percent of established final assembly sites — including for iPhone, iPad, Mac, Apple Watch, AirPods, HomePod, Apple TV, and Beats — maintained zero-waste-to-landfill operations.<sup>71</sup>

And we're working on the next challenge in achieving zero waste, which is a level deeper into the subassembly module suppliers who assemble the individual components that make up Apple products. The waste stream at this level is often more complex than final assembly sites, but we're making progress. This year, module suppliers — including core technology suppliers — that are participating in the Zero Waste Program increased by 50 percent. Eliminating landfill waste across these sites marks both a significant effort and an achievement, diverting more than 357,000 metric tons of waste from landfills.



**150**

Over 150 Apple supplier facilities are zero-waste verified.



**2.5M**

2.5 million metric tons of waste were redirected from landfill by supplier facilities as part of Apple's Zero Waste Program.

## Getting to zero through innovation

Innovation plays a significant role in advancing progress toward zero waste within our supply chain. We use novel recycling strategies and approaches to divert greater quantities of waste from landfill in our supplier facilities at even greater rates. But we also pursue material solutions to impact the waste streams coming into these facilities to simplify and maximize the recyclable content that our suppliers work with.

We've partnered with our suppliers and local businesses to create new recycling options and develop opportunities for material reuse. Recycling and reuse provide environmental benefits and can help our suppliers increase material efficiency while reducing the costs associated with material waste. At final assembly supplier sites, more of our suppliers use the recyclable and reusable alternatives that we helped develop for key sources of waste. In particular, our Recyclable Protective Films (RPFs) that protect products during manufacturing and the reusable trays used to deliver modules safely through assembly sites have helped our suppliers reduce waste.

We've also achieved reductions by developing thinner stretch wrapping film used on pallets for final product packaging. This wrapping film is a significant portion of the virgin plastic usage in our supply chain. The thinner film reduces the amount of plastic needed by up to 50 percent. We've shared the formula for our proprietary thinner stretch film with our suppliers' current wrapping film vendors to help accelerate its adoption while producing stronger wrapping films for product packaging.

Another opportunity for waste reduction is to decrease the amount of plastic tape used on our production lines — and to develop a stronger paper tape that can act as an alternative. An audit of our production processes showed that the plastic tape used to secure parts before assembly is often mixed with paper tape, making it difficult to sort and divert from landfill to a recycling process. And in many cases, the plastic tape wasn't needed. We found that for 75 percent of the parts secured with plastic tape, paper tape could perform equally well. We then worked with an industry-leading tape producer with the technology to produce a strong, lower-cost paper alternative. This new paper tape alternative was put to use for 200 parts, eliminating 1200 metric tons of virgin plastic from our waste streams.

## Engaging with suppliers to reduce waste

We work closely with our suppliers to realize our zero-waste goals. This work faces a range of challenges, including a lack of access to recycling technologies, the absence of local infrastructure, and the lower value of recyclable material that impacts the economics of recycling. We engage with our suppliers to address these challenges through knowledge sharing. The Waste to Resource database that we designed provides access to available technologies and local recyclers that we've collected from the suppliers that we work with. The database provides information on more than 1000 resources across more than 177 cities in China, Thailand, and Vietnam — a number that grows as we and our suppliers share valuable resources through the database. As more of our suppliers achieve their zero-waste goals, we're able to learn and share more information. We plan to make this resource public for the benefit of the entire electronics industry.

Reducing waste is an ongoing collaboration between us and our suppliers and recycling vendors. We're actively sharing best practices and innovative approaches to reduce waste; and we're matching our suppliers with capable recycling technologies that help eliminate waste throughout the process of manufacturing our products.

One example of this is a tool developed by Apple and UL Solutions, our partner that validates zero-waste efforts. The tool provides the first-ever supply chain zero-waste management system assurance program,

which allows for third-party zero-waste verification at a systems level rather than at a site level. The assurance procedure has allowed us to accelerate the verification process significantly and establishes a new model that companies across industries can employ to verify zero-waste programs at scale. This streamlined approach has brought even more suppliers into our program, with more than 150 validated in 2022 — a 50 percent increase from the previous year.<sup>72</sup>

We also provide support for our suppliers in verifying their zero-waste efforts. The foundation of our Zero Waste Program since launch has been following the UL 2799 Zero Waste to Landfill Environmental Claim Validation Procedure (ECVP), which requires at least 90 percent diversion through methods other than waste-to-energy. Through this standard, our supplier facilities can certify against clear benchmarks for waste diversion, including Platinum, Gold, and Silver levels of verification. We've spent the last seven years expanding this program throughout our supply chain, with suppliers in China, India, and Vietnam becoming UL validated. In 2022, Thailand joined that list when a local Apple supplier became the first in the country to receive UL 2799 ZWTL Gold validation. Since we switched from individual site verification to system-level verification, suppliers participating in the assurance program can easily apply their verification statements from UL. Following the switch, many suppliers maintained their individual certification for their own purposes.

**FEATURE**

# Green buildings

Each space that we build presents an opportunity to realize the type of world we'd like to live in — one that's inclusive and accessible, reflects the value we place on creativity and innovation, and furthers our environmental goals. Whether we're constructing a data center or corporate office or restoring a historic site to house a retail outlet, we have an opportunity to advance our vision.

Our environmental approach to design and construction adheres to industry-recognized best practices for green buildings that promote renewable energy, water conservation, energy efficiency, and responsible material sourcing. As of 2022, 100 of our corporate offices and data centers across the world are LEED (Leadership in Energy and Environmental Design) or BREEAM (Building Research Establishment Environmental Assessment Method) certified. That number grows each year as we develop more than 17 million square feet of green building space globally.

Our global footprint requires that we adapt to the needs of different locations and climates while pursuing our overall objectives. In 2022, four Apple sites in the U.S. and China earned LEED Gold certification. One example is for the construction of a corporate facility in California, where we achieved an 80 percent diversion rate for construction materials — 15 percent more than the average diversion rate typically observed in this region — by separating the majority of recovered materials and sending them to local specialty recyclers. We sourced FSC-certified wood for 98 percent of the wood used in this project. And 50 percent of its structural materials were sourced from regional manufacturers, less than 500 miles away, minimizing material transport by using local suppliers.

We bring a similar environmental approach to our retail store development. In Vancouver, Canada, we reopened Apple Pacific Centre, nearly doubling the previous store's size while reimagining features and elements to incorporate the location as a creative hub for the community. The design drew from the local landscape and ecosystem, including a facade surrounded by 10 magnolia trees sourced from the Pacific Northwest. The store's exterior is framed by a living wall spanning more than 40 feet and featuring 144 species of locally sourced plants. Designed to stay lush throughout the year, the living wall promotes bee and insect habitats and naturally absorbs heat and traffic noise. Our new store in London, United Kingdom, Apple Brompton Road features a unique curved ceiling and 12 towering Sicilian ficus trees. Both spaces, like all Apple facilities, source 100 percent renewable electricity.

Each Apple building needs to coexist with its environment while meeting our standards for human-centric design. We work hard to strike this balance and harness the creativity and innovation that these challenges demand.



**100**

100 Apple buildings worldwide are LEED or BREEAM certified for environmental performance as of 2022.

In 2022, we opened Apple Brompton Road which sources 100 percent renewable electricity, like all Apple facilities.

# Smarter Chemistry



PROTECTING THOSE WHO  
MAKE, USE, AND RECYCLE  
OUR PRODUCTS BY USING  
SAFER MATERIALS



# Goals and progress

**GOAL**

Avoid exposure to chemicals that could be harmful to human health or the environment.



We performed toxicological assessments on **OVER 1300 MATERIALS** in 2022 to proactively evaluate and eliminate potentially harmful substances from our products.

**GOAL**

Integrate smarter chemistry innovation into the way that we design and build our products.



Apple led the IPC task group that helped develop and publish a **NEW IPC INDUSTRY STANDARD** on the use of safer cleaners in 2022.

**GOAL**

Drive comprehensive reporting of chemicals used in our supply chain to make our products.



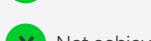
We've included **OVER 47,000 MATERIALS** in our comprehensive material library.

**Key**

Achieved



Ongoing



Not achieved

# Our approach

We carefully consider the chemicals that we use in our products and manufacturing processes. These choices directly impact the safety, recyclability, and reuse of our products, which are key to truly circular supply chains.

Smarter chemistry is our approach to identifying chemicals that best serve all our priorities, including safety, performance, and environmental impact. This supports our circular supply chain efforts by minimizing the recirculation of potentially harmful substances. Our efforts to remove potentially harmful chemicals from our products help create safer and healthier workplaces for our employees and suppliers, and safe products for people and the environment.

Our approach to limiting potential chemical exposure in product manufacturing leverages the hierarchy of controls. The hierarchy of controls is a concept used to control hazard exposure and consists of five actions in order of preference: elimination, substitution, engineering controls, administrative controls, and personal protective equipment (PPE). Elimination and substitution are the most preferred forms of control. When no alternative is available to eliminate or substitute potential exposure, we rely on engineering and administrative controls to safeguard against it. As we focus on this for our manufacturing processes, we push our industry to do the same.

We've taken the important initial step of accounting for the materials that we use, both in our products and in the processes to create them. This information helps us better protect the people who design, make, use, and recycle our devices. It also informs our efforts to

protect the environment. We're working side by side with leading members of the scientific community, NGOs, and industry organizations to move forward, and we continue to push for the development and broad adoption of safer alternatives.

Our approach involves proactively promoting the use of smarter materials and chemicals. This involves establishing safety requirements that often exceed local industry standards and empowering our suppliers to meet our guidelines. We also help suppliers source materials that are safer alternatives, which provide the necessary level of performance and are also better for people and the environment. We have created standards and programs to support these efforts, including the rigorous requirements defined in our Regulated Substances Specification (RSS) and the deep supply chain engagement through our Full Material Disclosure (FMD) and Chemical Safety Disclosure (CSD) programs. We also share what we've learned in creating these systems with others in the industry — and we push for change that can transform product manufacturing.

Advocacy and leadership are needed to make this happen. We're committed to providing both this role, pushing to broaden the use of safer and more sustainable materials based on smarter chemistry — and working with our suppliers and material manufacturers to create alternatives that can help move our industry forward.

## Our smarter chemistry strategy



### MAPPING AND ENGAGEMENT

Engage our supply chain partners to comprehensively identify the chemicals in the materials used to make our products and the processes used to make them, allowing us to drive change that goes beyond what's required for regulatory compliance.



### ASSESSMENT AND MANAGEMENT

Assess the potential human health and environmental risks of chemicals to evaluate compliance with our requirements and inform product design.



### INNOVATION

Drive the development and use of innovative materials that enable the creation of groundbreaking products and support industry-wide change.

# Mapping and engagement

We're committed to creating products of the highest quality — and that commitment extends to the health and environmental impacts of everything we make. This begins with a clear understanding of the chemistries of the materials that go into our products. Through collaboration, we can build a comprehensive view of the chemicals in the materials that we use and drive improvements in how we make our products.

Several Apple programs support these efforts. Our FMD program maps the materials and their chemistries in our products, while our CSD program tracks the materials used to manufacture our products. We drive our supply chain partners to collect in-depth information on the chemicals they use, including the purpose for their use, the amount consumed, and how the chemicals are being applied, stored, and handled. We also work closely with our partners to review the steps being taken to protect their employees.

We have criteria for the performance needs, environmental impact, and safety of the materials that we use. Our goal is to identify material chemistries that meet these standards. We examine the effects of material chemistries across a product's life — from design and manufacturing to the customer experience and, ultimately, recycling and recovery. Through early engagement and effective data collection, we're able to develop a comprehensive view of each material, and its chemistry, in support of our health and environmental goals.

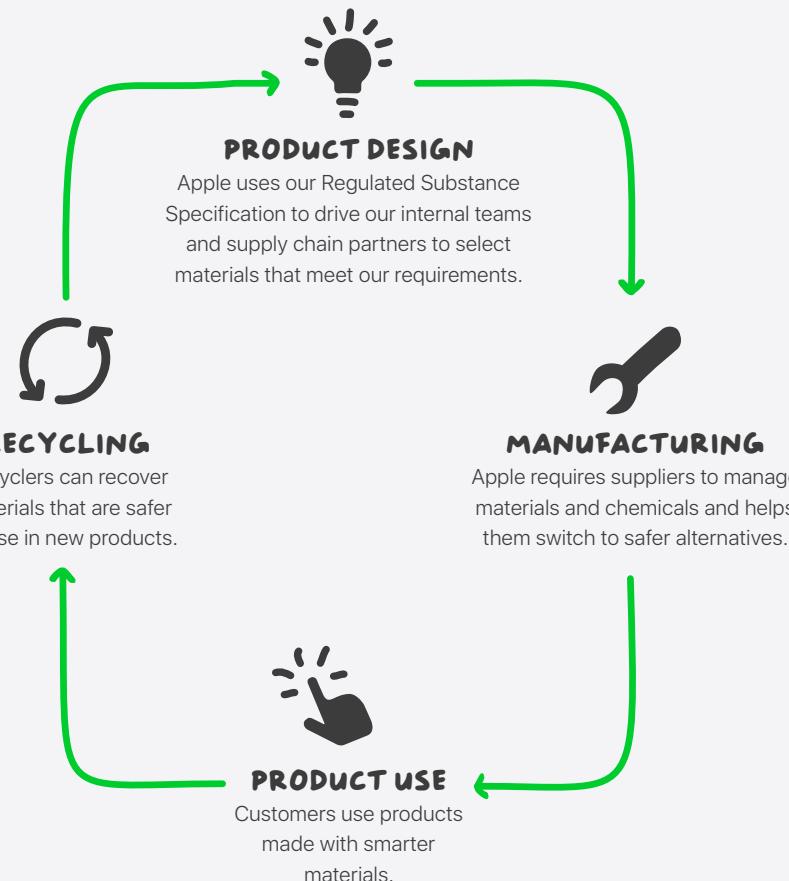
We're leading in these efforts. With our partners, we're engaged in the work required to understand the chemical composition of the materials in our products, as well as the chemicals and materials used during manufacturing. Close collaboration with our partners allows us to account for the materials used across our supply chain. This information informs our decisions when it comes to health and environmental risks. The way that we effectively collaborate with our partners can help others in our industry take their own steps toward eliminating potentially harmful chemicals in their products and manufacturing processes. This progress across our industry supports our effort to build responsible circular economies at scale.

## Building a comprehensive view of the materials in our products

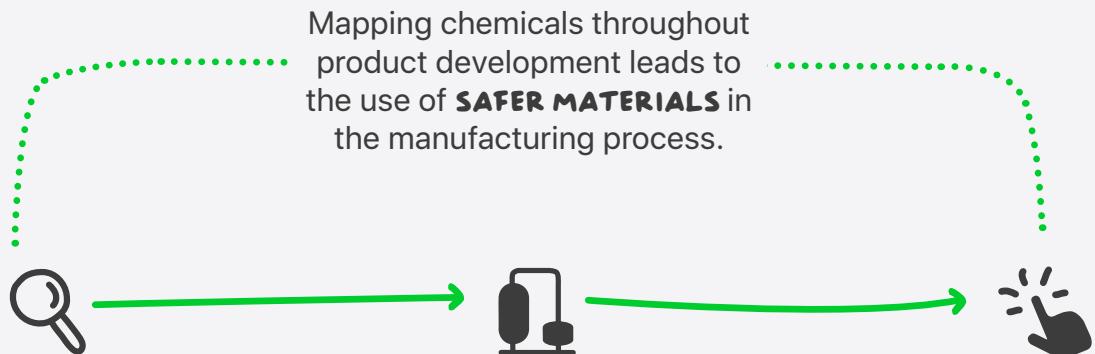
Good data is fundamental to delivering safer products. We rely on detailed and comprehensive information to inform our decision-making on material chemistries. The FMD program, launched six years ago, is integral to this process. It aims to catalog and map each chemical in the materials used in our products. Material manufacturers are at the center of these efforts. They provide thorough reporting on material compositions from deep within our supply chain — proprietary data that's shared through our innovative and secure data collection system. This system enables us to make informed choices about the materials that are used. For iPhone, iPad, and Mac products released in 2022, we collected detailed chemical information of 91 percent of each product by mass, on average. For the Apple Studio Display, we collected information on more than 93 percent of the product by mass.

Our suppliers are required to participate in the program. Collectively, they share information on thousands of materials used to manufacture our products. To make this process easier, we've implemented an advanced collection system for suppliers with access to a library of more than 47,000 materials, which have been researched and validated by Apple. Our suppliers use this materials library to select the materials they use in our products. If a material that our supplier uses isn't yet listed in our library, we authenticate the new material with documentation from the manufacturer that provides it.

## Smarter chemistry matters at **EVERY STAGE** in the product life cycle



## Comprehensive chemical mapping



## UNDERSTANDING CHEMICAL INGREDIENTS leads to better materials for Apple products.

Through the FMD program, Apple manufacturing partners share the materials used to manufacture Apple products.

Apple works with material manufacturers to understand the chemistries of the materials to enable evaluation.

Data helps Apple suppliers **MANAGE CHEMICALS AND MATERIALS** when making Apple products.

Information on how chemicals are used, how they're stored, and how employees are protected is shared with Apple by suppliers through our CSD program.

CSD data informs and prioritizes supplier engagement, encouraging rigorous chemical management practices and adoption of safer alternatives.

Apple **CUSTOMERS BENEFIT** from using products made with safer materials and chemicals.

The FMD and CSD programs help support the creation of best-in-class products in a responsible manner for our customers.

## Creating an inventory of chemicals used in manufacturing

We prioritize the health and safety of the people in our supply chain. The Apple Supplier Code of Conduct and Supplier Responsibility Standards outline our requirements for our suppliers in the areas of health and safety, labor and human rights, environment, ethics, and management systems. We also account for how chemicals are selected and managed within our supply chain — and the impact this can have on people working in our supply chain.

Detailed and accurate information drives this process, including which chemicals our suppliers use as they make our products and how they store, handle, and consume each one. Through the CSD program, suppliers are required to provide this data as part of a rigorous disclosure process. With a detailed chemical inventory from our suppliers, we can support our supply chain partners in identifying risks and opportunities to implement safer alternatives.

In 2022, more than 1000 supplier facilities shared their chemical inventories as well as their storage and control information through the CSD program, including suppliers representing the majority of Apple's direct spend. This extensive reporting provides direct insights into how our suppliers manage their chemical inventories and practices. And through this program, we've identified more than 19,000 unique materials and chemicals used in manufacturing process. All these efforts contribute to a safer work environment for people across our supply chain.



We evaluate materials for substances restricted in our Regulated Substances Specification — including VOCs — using equipment like this gas chromatography/mass spectrometry (GC/MS) system.

## Working with suppliers to meet global requirements

We're supporting our suppliers in their efforts to meet our requirements. And we've created systems for our suppliers to learn about our material specifications, track and assess the materials they use, and regularly communicate material usage. This also helps our suppliers meet global standards and regulations governing their operations. The FMD and CSD programs require suppliers to gather, understand, and share information on materials they're using — a requirement beyond regulatory requirements.

We support supplier engagement with these programs — and the RSS — through ongoing training. This continued engagement is central to our partnership and to our shared efforts to promote smarter chemistry in our products and processes. Since 2020, our suppliers in China worked under the new regulations governing the use of materials containing volatile organic compounds (VOCs). And we went even further to support compliance

by assessing and qualifying over 3500 low-VOC materials for use, helping our suppliers transition to these alternatives. In 2022, we continued to provide additional support for suppliers through trainings on the new regulations, which were attended by more than 800 participants. By deploying a VOC specification worldwide, we're also helping drive adoption of low-VOC alternatives around the world. And we're working with our suppliers to identify and develop materials that meet the current and upcoming complex per- and polyfluoroalkyl substances (PFAS) regulatory requirements.

These programs, along with the RSS, allow us to engage with suppliers through ongoing training. This fosters our partnerships and shared efforts to promote smarter chemistry in our products and processes.

**47K**

47,000 validated materials are stored in our comprehensive materials library.

**93%**

We collected detailed chemical information of 93 percent of Mac Studio computers by mass and over 91 percent on average for all iPhone, iPad, and Mac products released in 2022.

# Assessment and management

We base key decisions on our product designs, manufacturing processes, and approaches to recycling and reuse on the data that we collect on chemicals and materials. This information enables us to establish requirements for our suppliers, including those set in our Regulated Substances Specification and our Restricted Chemicals for Prolonged Skin Contact Materials specification.

Our requirements provide clear restrictions on potentially harmful materials and chemicals, including those that are restricted. Through our assessment system, we work so that only materials that meet our stringent requirements are used in Apple products. The data that we gather on chemicals and our rigorous assessments allow us to make informed decisions for chemical management, for the safety of those who use, make, and recycle our products. These decisions also help make the materials recovered from our products at end of life safer for reuse in new products, enabling circular supply chains.

## Setting and maintaining rigorous chemical safety requirements

Over 20 years ago, we first published the [Regulated Substances Specification](#), setting requirements for the use of chemicals or materials in our products, accessories, manufacturing processes, and packaging. The specification builds on our history of advancements in material safety — and it reflects our dedication to the collection of necessary data to uphold these requirements.

We continue to evolve the RSS with new chemicals and restrictions based on the latest scientific research and standards, drawing from regulations, international standards, and voluntary requirements. Many of the specification's restrictions exceed the most stringent local regulatory requirements in order to protect human health and the environment. The specification designates restricted substances and requires reporting on additional substances. We've updated and expanded chemical restrictions that, in many instances, surpass current regulatory restrictions. Most recently, we've added perfluorohexanesulfonic acid (PFHxA) — which is a subset of the larger group of PFAS — phenol, isopropylated, phosphate (3:1) (PIP 3:1), and several skin-sensitizing substances well ahead of regulatory restrictions.

Our Green Chemistry Advisory Board provides feedback on key initiatives, including potential updates to the RSS. The advisory board is an independent group of leading researchers and academics. Their diverse experience and perspectives help us lead the way to protect our customers and those who make or recycle our products.

We remain focused on materials that will be in prolonged skin contact. We apply rigorous controls defined in our [Restricted Chemicals for Prolonged Skin Contact Materials](#) list. The restrictions focus on substances that are potential skin sensitizers to minimize the potential for reactions commonly reported across wearable products, like jewelry. These restrictions are derived from leading standards, recommendations from toxicologists and dermatologists, international laws and directives, and Apple policies. We mandate that our suppliers analyze each material that comes into prolonged contact with skin according to Apple's requirements, and we review compliance with these requirements. Our specifications are incorporated into contractual obligations for our suppliers, and each one helps us maintain our stringent requirements.



We test all our products, and place special attention on materials that come into prolonged skin contact. In this nickel leach test, we place Apple Watch bands in jars of artificial sweat to ensure the nickel, a potential allergen, stays where it belongs — in the product.



We've proactively provided our suppliers a list of cleaners and degreasers that are safe to use, and since 2018, all of our final assembly sites have used only safer alternative cleaners and degreasers.

## Verifying and developing in the Environmental Testing Lab

We evaluate the safety of our products and materials through chemical analyses at our Environmental Testing Lab. Our chemists test materials to monitor compliance with our specifications. And the lab continues to grow in its mission and capacity as we expand our testing facilities with new technologies to conduct chemical analysis while expanding our FMD and CSD programs. Our teams also review test reports from suppliers to evaluate substances against the Regulated Substances Specification and Restricted Chemicals for Prolonged Skin Contact Materials specification. In 2022, we performed toxicological assessments on over 1300 new materials to proactively evaluate and eliminate potentially harmful substances from our products.

The data that we collect from our disclosure programs drives our assessments. We're able to generate comprehensive assessments like GreenScreen®, a methodology that we use to gauge the impact of chemicals on individual health and the environment based on 18 criteria. We develop toxicological profiles on new chemicals, using both scientific literature and internal assessments. These profiles detail the impacts of each chemical, providing data that allows us to evaluate

the safety of the use of a substance in a particular product. In 2022, we continued to expand the scope of biocompatibility testing beyond individual materials to include modules and whole products. Through this work, we have an even more comprehensive view of each material and the impact that assembly has on safety. We perform toxicological analysis of the materials in our products to help guide our material safety guidelines. The information that we share through material specifications benefits our suppliers and those that we collaborate with in the industry.

## Creating a list of safer cleaners

We're making an immediate impact in our efforts to protect human health and the environment through our approach to the application of cleaners and degreasers. These substances account for some of the highest-use materials at final assembly sites. Regulators and environmental health and safety organizations have focused considerable attention on the chemistries of cleaners and degreasers. We're investing in the due diligence required to identify preferred alternatives for use by suppliers and others in the industry.

We now proactively provide our suppliers with a list of cleaners and degreasers that are safer to use. In 2022, we approved 58 safer cleaners for use in our supply chain, bringing the total number of safer cleaners we've approved over the past three years to 133. Each of these cleaners has gone through a rigorous independent assessment against a comprehensive set of criteria.

Our efforts have had a direct impact on health and safety — and they have the potential to change how our industry operates. We're promoting the use of safer alternatives for process chemicals in our supply chain by making it easier for suppliers to select preferred substitutions from the start. All our final assembly sites have used only safer alternative cleaners and degreasers, as defined by Apple, since 2018. We've since expanded this work to the component manufacturers who create modules used in final assembly, helping them identify and implement opportunities to use safer alternatives in their operations. In 2020 and 2021, we received the EPA Safer Choice Partner of the Year Award for our work to scale the use of safer process chemicals and protect those working in our supply chain.

We're also looking outside our own supply chain to promote a broader transition to safer chemicals. See page 66 for more about how we're advocating for safer cleaners and degreasers across our industry.

# Innovation

We're continually developing our knowledge of material properties to improve the chemical safety, performance, and environmental impact of materials. These three factors drive our assessments of substances and help us pursue innovations that align with our values.

The foundation of these innovations is our work in mapping, assessing, and managing the chemicals used in our products and supply chain. We also look at how these materials are used in a product life cycle, from design and manufacturing to end of life. With this knowledge, we can seek out and support the development of safer chemistries that have an impact, and we can contribute to continually improving the overall safety of our products and processes.

## Innovating the designs and processes used to make our products

By focusing on materials early in product development, we create opportunities to innovate improvements throughout the process of creating a product. We assess materials for performance, safety, and environmental impact. These represent our holistic approach to smarter chemistry, allowing us to design for our customers' needs while creating products that exceed expectations and are safer for use, reuse, and recycling.

To achieve these goals, we focus on the process of material selection. This involves choosing the substances incorporated into our product designs and those that our suppliers use to manufacture our products. Our comprehensive chemical profiles of each material provide the basis for each decision. The FMD program documents material information — like composition — for review by our experts so that a substance's suitability meets our standards before it enters our supply chain. This includes toxicological assessments of each chemical within a material, focusing on those that come into prolonged contact with skin. Each design choice determines the materials included in our product and the chemicals required to make them. Through the CSD

program, we look at the conditions in which a material is used so that we can make recommendations that reflect the existing controls around a substance. And we work proactively with our suppliers so that their employees are protected through proper storage, handling, and material application controls.

Our work considers the impact of materials when our products reach their end of life. We take steps to prevent potential releases into the environment during the recycling process and to protect those involved in recycling our products. This involves monitoring chemistries that may be harmless in small quantities but become more concentrated through recycling processes. And it also entails assessing how potentially harmful substances impact the recyclability of a material to avoid downcycling — use of the material in lower-quality applications — or substances that could make the material unsafe for any use.

We also pursue innovation projects that lead to better products. In 2019, we launched a pilot program at a manufacturing location in China as part of our anodizing improvement program with the aim of reducing, and eventually eliminating, potentially hazardous discharge, as well as reducing water and chemical use. As part of the pilot, we employed several water efficiency

approaches, including using cascade and counterflow rinsing processes, which helped retain 75 to 85 percent of the water used during metal finishing. This process improvement has the potential to save millions of gallons of freshwater annually when applied at scale.

In addition, we advanced our ability to recover acids used in chemical polishing and anodizing. These acids are typically discarded after one use, but we were able to purify and recycle them back into the manufacturing process, reducing consumption by more than 90 percent. This approach has enabled us to reduce the largest source of solid waste from the anodizing process, and at scale could potentially eliminate 4000 tons of waste.

The material and process innovations that we develop result from all these efforts. Our work to share information across our supply chain, perform detailed process and chemical assessments, and partner with suppliers on chemical management lays the foundation for improvements. We're able to better protect those who make and use our products and enable the reuse of key materials. And by keeping harmful chemicals out of our supply chain at the outset, we make it possible for us and others to recover materials for the next generation of products.

## Creating new, safer chemistries to move the industry forward

Our strict requirements that govern potentially harmful substances in our products and processes encourage the suppliers we work with to also prioritize safer materials, helping create a market for better alternatives. We're lending our expertise on safer chemistries to help our suppliers meet the growing demand for safer materials. Prioritizing these materials also means phasing out chemistries that don't meet our specifications. We've approached this across our company and products while investing in safer alternatives to drive change across our industry. The use of safer cleaners today supports the circular supply chains of the future.

Using our research and analysis of materials, we've collaborated with suppliers to find safer alternatives — including for substances where none currently exist. In those cases, we lend our technical capabilities in material science to work with suppliers to develop entirely new chemistries. We maintain the same high safety, performance, and environmental standards for new alternative materials, submitting them through rigorous testing and evaluation to avoid regrettable substitutions.

This work isn't new to Apple; we've been leading in the identification and successful removal of potentially harmful substances since the late 1990s. This process has involved the rigorous assessment of chemicals and the removal of those that don't align with our goals — in some cases, before removal becomes a requirement and industry standard. We're committed to phasing out our use of PFAS and engaging with all our supply chain partners to restrict PFAS from our products and manufacturing processes. While our analysis indicates that PFAS used in our products are safe during product

use, we felt it was important to broaden our scope to consider manufacturing along the supply chain. We're prioritizing our phaseout activities in applications that result in the highest volumes of PFAS reductions and the most meaningful environmental impact. We're pursuing our phaseout in three steps: compiling a comprehensive catalog of PFAS uses in our products, identifying and developing non-PFAS alternatives that can meet our performance needs, and confirming that non-PFAS alternatives align with our human health and environmental goals.



Read our [white paper](#) about our commitment to phasing out per- and polyfluoroalkyl substances.

## Substances that we keep out of our products\*



### PVC AND PHTHALATES

We've replaced these with safer thermoplastic elastomers. Both are still used by other companies in power cords and headphone cables.



### BROMINATED FLAME RETARDANTS (BFRs)

In 2008, we eliminated BFRs from thousands of parts, such as enclosures, cables, circuit boards, and connectors. We use safer metal hydroxides and phosphorus compounds in their place.



### MERCURY

We eliminated mercury from displays in 2009. We use energy-efficient, mercury-free LEDs and OLEDs instead of mercury-based fluorescent lamps in all our displays.



### LEAD

Apple phased lead out of display glass and solder in 2006.



### ARSENIC

Arsenic, traditionally used in glass, has been eliminated from Apple display glass since 2008.



### BERYLLIUM

Eliminated from all new product designs, beryllium is found in copper alloys used to make connectors and springs.



### PFAS (PFOA AND PFOS)

We eliminated PFOA and PFOS from our products, with RSS restrictions added in 2010 and 2013, respectively. These types of chemicals are commonly used in manufacturing water-resistant materials. We're committed to eliminating PFAS entirely from our products.

\* Apple's Regulated Substances Specification describes Apple's restrictions on the use of certain chemical substances in materials in Apple products, accessories, manufacturing processes, and packaging used for shipping products to Apple's end customers. Restrictions are derived from international laws or directives, regulatory agencies, ecolabel requirements, environmental standards, and Apple policies. Apple products are free of PVC and phthalates with the exception of AC power cords in India, Thailand (for two-prong AC power cords), and South Korea, where we continue to seek government approval for our PVC and phthalates replacement. Apple products comply with the European Union Directive 2011/65/EU and its amendments, including exemptions for the use of lead. Apple is working to phase out the use of these exempted substances where technically possible.

## Advocating for safer alternatives across our industry

Our work around smarter chemistry helps facilitate the transition to safer alternatives that are accessible to others in our industry. The criteria we set for chemicals—and how our suppliers use them—help establish even more stringent standards around health and safety across the electronics industry. We collaborate with standard-setting bodies, trade associations, and NGOs to achieve this—developing tools, standards, and mechanisms to drive the identification and adoption of smarter chemicals throughout our supply chain.

We've focused on cleaners and degreasers—building out a safer cleaners innovation ecosystem through multiple efforts. In 2022, we continued our role as a founding signatory of the Toward Zero Exposure program from the Clean Electronics Production Network (CEPN). Led by the NGO Green America, CEPN is a multi-stakeholder initiative to accelerate companies' efforts to eliminate workers' exposure to hazardous chemicals and to raise awareness of the need to improve chemical management practices across the global electronics manufacturing industry.

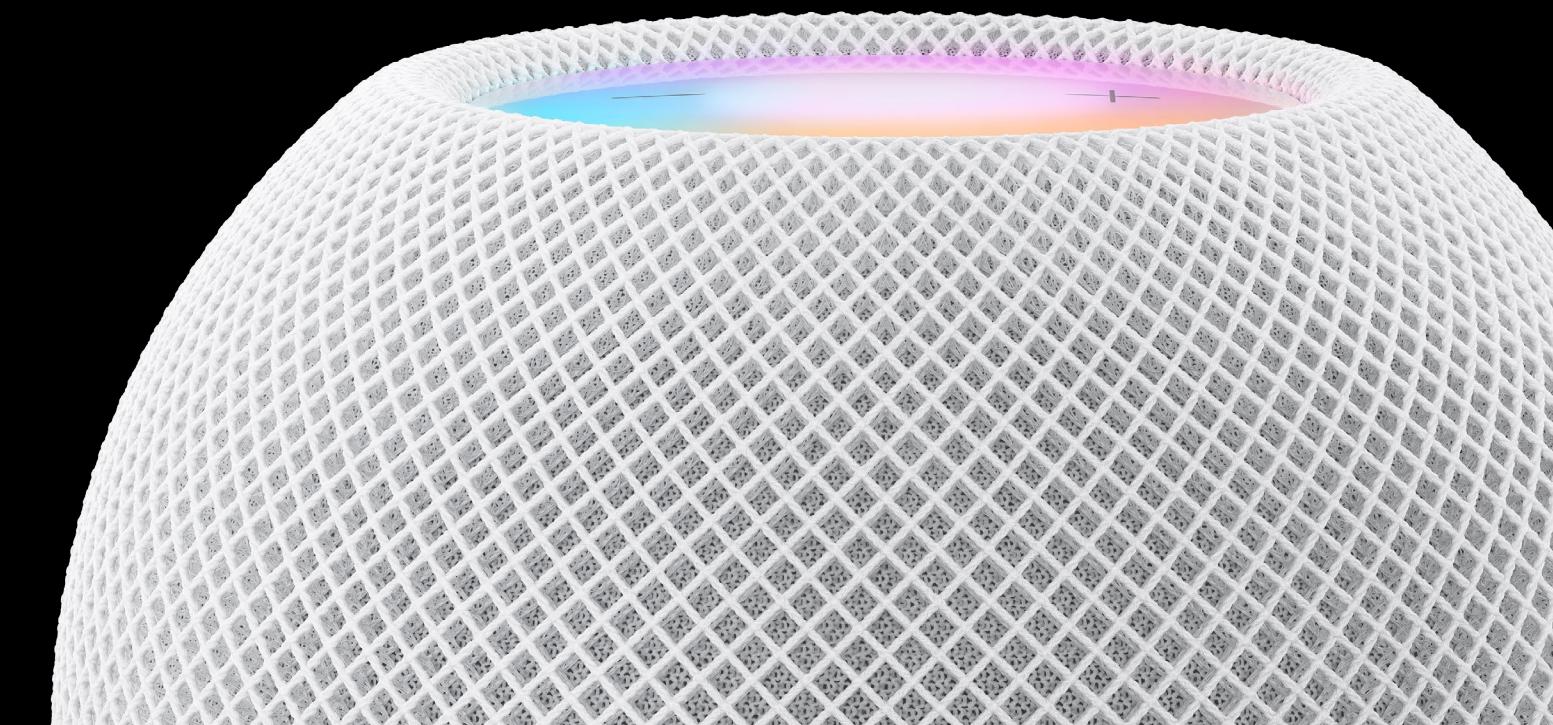
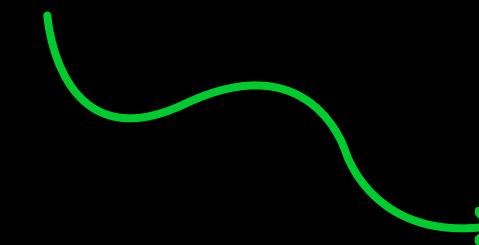
As a signatory, we report on the progress we've made to remove nine process chemicals from our supply chain that have been collectively identified as priorities for replacement at our final assembly sites. We're also accountable for our efforts to protect workers from exposure to potentially harmful substances. We prioritize this work by emphasizing effective engineering solutions and administrative controls across manufacturing processes. While personal protective equipment is essential and foundational to protecting people, we focus on employing safer alternatives from the start, and we support that with PPE as a measure to eliminate exposure to potentially harmful chemicals.

In 2022, we continued our collaboration with IPC, the premier global electronics standard-setting body, by drafting and helping launch IPC-1402, *Standard for Green Cleaners Used in Electronics Manufacturing*. This standard resulted from work over the past two years with the Green Cleaners for Electronics Manufacturing task group, where Apple has served as a chair working with more than 20 industry partners. This new standard will help suppliers across the electronics industry select cleaners that are safer for employees and the environment. Last year, Apple received the IPC Stan Plzak Corporate Recognition Award for our work on this effort and our contributions to the industry.

We continued to partner with ChemFORWARD—a nonprofit organization committed to creating broad access to chemical hazard data and a registry of cleaners—to make it easier for suppliers to choose safer alternatives. We also supported the RBA in producing a comprehensive technical guide on responsible chemical management, as well as over 20 hours of related training content to educate millions of workers across thousands of companies about controlling occupational exposures to hazardous chemicals.

# Engagement and Advocacy

WE HEAR OUR  
STAKEHOLDERS  
LOUD AND CLEAR



# Our approach

Apple is committed to achieving clear impact across our environmental goals — and beyond our footprint as a company. This is urgent work that we can't do without others. As a member of the global community, we see it as part of our responsibility to engage thoughtfully with those addressing environmental challenges — from those in the policy community to the direct stakeholders involved in issues day-to-day and driving change.

This means working with our partners, learning from their feedback, and providing support where we can make a difference. We aim to effect positive change within and beyond our operations and supply chain. And we respond to the world around us by looking for opportunities where our leadership can impact policies, industries, and communities in a transformative way.

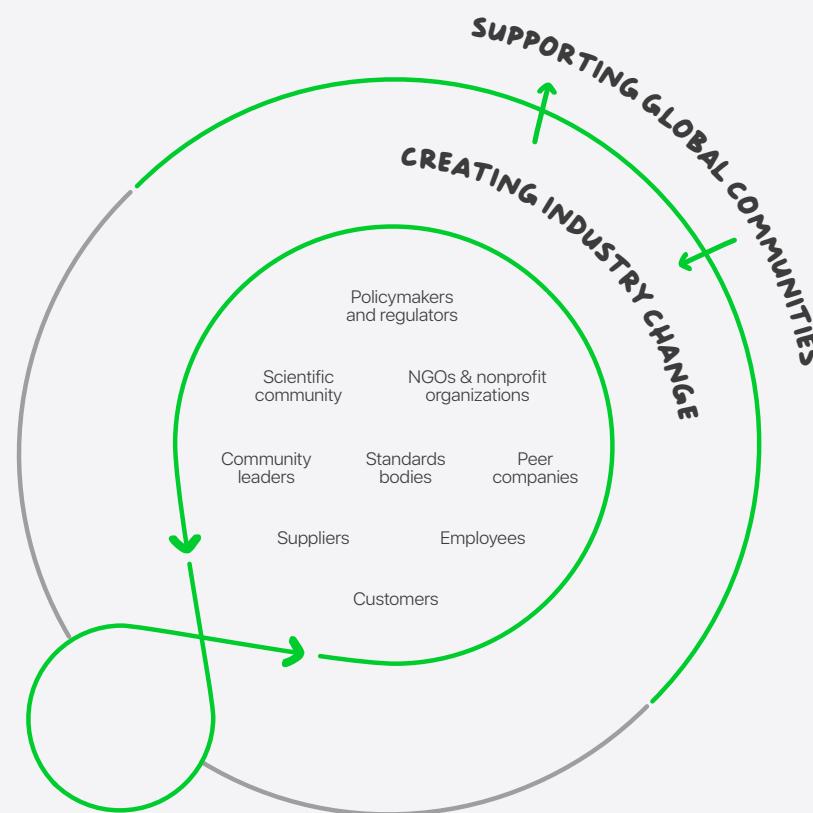
## Listening to voices from a range of backgrounds and experiences

We approach our conversations with others through curiosity and with the intention of learning from diverse communities devoted to environmental stewardship. We purposefully engage those who bring a range of perspectives and understanding of the issues that matter to us. The conversations we have with policy makers, nonprofits, and community leaders help shape how we see regulations, approaches, and the promise of emerging technologies. We learn from this engagement, too. This process helps us discover opportunities to navigate challenges and improve in our efforts to achieve our environmental goals. Ultimately, we're able to put these conversations into action — whether that means aligning with new standards and best practices or exploring the potential that cutting-edge research can have on our operations.

This year, we continued to hold roundtable discussions on environmental issues with key stakeholders, including members of academia and industry associations, to better understand issues and regulations region by region. We value the input that these forums provide; each helps us understand the role that enhanced transparency plays for those working directly on policy. And these conversations also offer the opportunity to share information on our efforts.

We engage with the scientific community to better understand emerging approaches and cutting-edge tools that can support our environmental goals. We're working with researchers at Carnegie Mellon University to create robotic recycling systems to enhance material recovery for Apple and others through the development of advanced mechanisms for product disassembly and material sorting. We also continue to engage our Green Chemistry Advisory Board, an independent group of toxicologists and experts who advise on our smarter chemistry initiatives, including potential updates to the RSS. Their diverse expertise and perspectives help us lead the way to protect our customers and those who make and recycle our products.

We can better achieve a **TRANSFORMATIVE IMPACT** within our industry and for global communities when we work alongside a diverse group of stakeholders



Engaging with others has also helped us refine our approach to industry standards and best practices. We draw from cross-sector engagement platforms to help guide our programs and set standards for environmental efforts. The Alliance for Water Stewardship (AWS) is one example of this. Their expertise defines the world-class water stewardship practices that we've implemented at key Apple and supplier facilities, earning AWS certification for adherence to their Standard.

We're motivated by what we hear from within the business community, including our customers, employees, suppliers, industry partners, and investors. Their input provides vital support for our environmental goals and pushes us further in our efforts. For example, as co-chair of the United States Information Technology Office (USITO) — a trade association representing the U.S. information and communications technology industry in China — we lead the environmental protection and energy efficiency working groups. In this role, we engage with other companies in China as we work to comply with new environmental regulations and with policy makers on future standards. We continually look for more opportunities to hear from others — at the industry and national levels — to receive feedback and make progress.

## Achieving change together

An important part of leadership is the responsibility to influence change — whether through policy advocacy or direct engagement with groups invested in issues. Collective action provides the best means to achieve results on pressing environmental issues. When we take a proactive role in sharing our experiences and contributing to collaborative efforts on our areas of focus and expertise, we can better realize the goals on climate, resources, and smarter chemistry that we share with other stakeholders.

### Policy advocacy

Policy is instrumental in effecting change across industries. Apple supports climate and environmental policy through our actions and stakeholder engagement. This also involves actively advocating for policies that advance environmental objectives — and support the Paris Agreement — by evaluating the positions of our industry partners to align business goals to address climate change.

For example, in the U.S. in 2022, we filed comments with the Federal Energy Regulatory Commission (FERC) to encourage more rapid integration of renewable energy to the transmission grid, a key bottleneck to renewable energy deployment. And Apple, joined by other companies, submitted an Amicus Brief, urging the Supreme Court to uphold the U.S. EPA's authority to regulate greenhouse gases from power plants.

In Asia, we spoke at a carbon neutrality conference calling for Korea's 2030 energy plan to increase the ambition of its target for renewable energy solutions. And we serve as an executive member of the Japan Climate Leaders' Partnership (JCLP), a business coalition focused on renewables and pushing for greater climate ambition in Japan. Partnership and collaboration with the government is essential to this. JCLP has called for an increased focus on the renewable energy transition in alignment with the Paris Agreement's 1.5°C target and the level of carbon pricing needed to incentivize emissions reduction. Read more about how we advocate for climate policy around the world on [page 29](#).

We're also partnered with the Platform for Accelerating the Circular Economy (PACE), a global group of public and private decision-makers focused on the circular economy — and how to push forward the vision and best practices needed to scale advancements. Building community around these efforts is essential to achieving our environmental goals. Through its engagement at key global events, PACE provides a vital platform to pursue solutions across governments, the private sector, and civil society. Read more about our position on circular economy policy on [page 47](#).

### Industry engagement

We engage in dozens of industry initiatives so that we can support beyond our own operations. These allow us to share knowledge and discover additional pathways to advocate for change. Through partnerships and coalitions, we contribute to various industries by sharing proprietary tools and standards and pursuing policy objectives that drive toward our shared goals. This year, with IPC, a global electronics trade association, we developed and released IPC-1402, a new standard for chemical cleaners intended to support safer, greener practices among manufacturers.

Engagement with trade and industry associations helps to achieve alignment with environmental and climate policy in our collaborative efforts. We're deepening our engagement on climate policy with our U.S. federal trade associations. As part of this process, we're evaluating relevant trade association positions on climate and identifying specific areas of misalignment with Apple's values and principles on climate change. We then work with our trade associations to reduce areas of misalignment.

### Collaborative impact

Collective action matters when it comes to taking on environmental challenges. We make public commitments alongside our partners to make our support clear and signal the change we are working to create. We're transparent about the progress we make against these commitments, so that we and our partners can be accountable for results. The work we do with others yields tangible results across our environmental goals — and it provides a catalyst for others to take action.

An example of this is our commitment to 100 percent renewable electricity with members in markets across the globe through RE100, an energy initiative aiming to scale zero carbon grids by uniting the world's most influential businesses committed to transitioning their electricity use to entirely renewables.

We're also part of the First Movers Coalition, a global initiative harnessing the purchasing power of companies to decarbonize seven "hard to abate" industrial sectors that currently account for 30 percent of global emissions according to WEF. Through this initiative, we've committed to moving to sustainable aviation fuel for 5 percent of our passenger air travel footprint; to procuring at least 10 percent of annual primary aluminum at or above First Movers Coalition's definition of "near-zero emissions primary aluminum"; and to ensuring at

least 50 percent of all aluminum procured annually is sourced from secondary aluminum by 2030. We're also supporting investments in forestry and carbon removal through external initiatives like the Forest Investor Club and our own Restore Fund (see page 27), which help us back projects that offer a financial return while contributing to our environmental goals.

Through Race to Zero and America is All In, we're tracking our shared commitment to support the Paris Agreement and efforts to achieve robust near-term emissions targets. As a founding member of the Asia Clean Energy Coalition — launched in 2022 at COP27 — we support accelerated corporate renewable electricity procurement in Asia, as part of a just and equitable energy transition in the region.

We remain committed to addressing issues beyond climate change, including chemical safety and reducing the amount of plastics in our products. As part of the Toward Zero Exposure program with the Clean Electronics Production Network (CEPN), we're working to address health and safety challenges in the electronics supply chain with other stakeholders. We share our pledge to eliminate plastics from our packaging by 2025 with the Ellen MacArthur Foundation.

### Key Partnerships and Memberships

| Stakeholder   | Our engagement  |
|---|---|
| <b>Aluminium Stewardship Initiative</b>                           | Supporting responsible sourcing within the aluminum value chain; recently completed an audit against their Performance Standard of environmental, social, and governance criteria. (Member) |
| <b>Ceres</b>  | Dedicated to taking action to stabilize the climate, protect water and natural resources, and build a just and inclusive economy. (Member of the Ceres company network)                     |
| <b>ChemFORWARD</b>  | Working to advance safer chemistry in product design and manufacturing. (Co-design partner, chair of Technical Advisory Group)  |
| <b>China Association of Circular Economy (CACE)</b>               | Sharing our best practices in their conferences and workshops and partnering with the organization on advocacy efforts focused on recycling and waste. (Senior member)                      |
| <b>Clean Electronics Production Network (CEPN)</b>                | Working to improve chemical safety in the electronics supply chain as part of this multi-stakeholder initiative. (Member of the design team)  |
| <b>Clean Energy Buyers Alliance (CEBA)</b>                        | Promoting customer-driven clean energy use. (Member, serving on the Supply Chain and International Collaboration working group)   |
| <b>Japan Climate Leaders' Partnership</b>                         | Aligning business objectives with climate goals. (Executive member)   |
| <b>MIT Climate and Sustainability Consortium (MCSC)</b>           | Galvanizing the business community to have an impact on broad and intersecting environmental challenges. (Industry Advisory Board Member)   |
| <b>Platform for Accelerating the Circular Economy (PACE)</b>      | Joining global leaders in the effort to transition to a circular economy. (Member of the board)   |
| <b>RE100</b>  | Showing our commitment to 100% renewable energy. (Member of the RE100 Advisory Committee)   |
| <b>Responsible Business Alliance (RBA)</b>                        | Dedicated to responsible business conduct in global supply chains. (Full member, serving on the RBA Board of Directors and steering committee of the Responsible Minerals Initiative)       |
| <b>World Business Council for Sustainable Development (WBCSD)</b> | A community of the world's leading sustainable businesses working toward a net-zero, nature positive, and more equitable future. (Member)   |



The Conservation Fund works to center local organizations, like McIntosh S.E.E.D., to support land retention amongst Black landowners in the rural U.S. South. In 2022, Black landowners from Georgia participated in workshops and trainings hosted by McIntosh S.E.E.D. on topics relevant to climate resiliency.

## Supporting communities around the world

Through our engagement efforts, we have the opportunity to work directly with those who have been addressing environmental injustice in their communities. A range of organizations — from NGOs to startup technology companies — share our goals across climate change, resources, and smarter chemistry. We evaluate each opportunity to collaborate based on the potential to scale a proven environmental approach, test or pilot an innovation, or take steps to improve equity in communities disproportionately impacted by climate change and environmental dangers. When we partner with another organization, we believe success hinges on close collaboration on mutual objectives. To track our progress, we work with each partner to align on the metrics that best reflect the unique contribution that each organization is making to its community.

We value the opportunity to work with partners to contribute beyond our direct corporate operations — outside our areas of expertise and sometimes in new spaces. This is where some of the most vital work is being done to support transformational change for communities. Our work combines both collaborative work and philanthropic contributions, which we determine based on each organization's focus and their potential to effect change. And we recognize the importance of community-driven leadership on many issues by providing support.

In 2022, we supported efforts that span a breadth of work. The Conservation Fund is actively engaging and supporting land retention among Black landowners in the rural U.S. South. Working to support and center local organizations like McIntosh S.E.E.D., this collaboration helps landowners become more resilient to climate change through workshops and trainings on topics like sustainable forestry. World Wildlife Fund is engaged at the community level in developing alternative livelihood and other climate resilience projects through their Climate Crowd program. Beyond Benign works to increase BIPOC representation in smarter chemistry by providing students and faculty in minority-serving institutions with training, resources, networks, and curriculum support. Frank Water works with communities in India by using technology to map local watersheds and monitor the health of water ecosystems. The China Green Carbon Foundation is working on innovative approaches to carbon sequestration, including developing and restoring semi-urban forests and strengthening management practices. And Conservation International founded the Finance Lab for Irrecoverable Carbon to create business models and new approaches for incentivizing the protection and repair of ecosystems essential to meeting global climate goals.

We continue to collaborate with environmental justice groups by providing grants to minority-led and minority-centered organizations that focus on environmental issues. These organizations play a significant and vital role within their communities. They also support our efforts to avoid negative impacts for underrepresented communities as we pursue our environmental goals. We're able to provide both financial support and assistance in amplifying the work and impact that these groups have in and beyond their communities. And we work with these groups to address the global effects of climate change and environmental hazards that traditionally impact overburdened communities.

We expanded our Strengthen Local Communities grant program — which provides funding to local organizations in the communities where Apple team members live and work — to communities outside the United States. In 2022, we supported the Environmental Justice Foundation based in the United Kingdom and the Karrkad Kanjdji Trust and Original Power in Australia with grants that focused on access and equity. We also continued to support organizations in the U.S., including The Green Door Initiative, the Michigan Environmental Justice Coalition, the Environmental Leadership Program, Native Conservancy, and UPROSE.

We're seeing progress, too. Hispanic Access Foundation works to support diverse Latino voices in their communities to advocate for environmental issues that directly affect their daily lives. Through our partnership, the organization was able to double the number of interns that it employs while paying a competitive market wage and jumpstart the Latino Climate Council, a new network of young, talented Latino leaders who are diversifying the field and bringing frontline perspectives to the climate justice movement. And representatives from the Center for Rural Enterprise and Environmental Justice traveled to Japan to learn about the country's approach to renewable energy. They also met with local representatives and partners to better understand Japanese perspectives around equity, inclusion, and justice in connection with the environment.



Apple supports the Hispanic Access Foundation, which focuses on amplifying diverse Latino voices in their communities and advocating for environmental issues that directly affect their daily lives.

**FEATURE**

# Advancing our commitment to equity with the Impact Accelerator

We're working so that environmental progress and equity go hand in hand. And through the Impact Accelerator, we aim to expand access to opportunity through our investments in environmental sectors — such as renewable energy, carbon removal, recycling innovation, and smarter chemistry — which also help fight systemic barriers that impact communities disproportionately affected by environmental issues. As the Impact Accelerator enters its third year, we're deepening our commitment to this initiative.

The Apple Impact Accelerator is designed for Black-, Hispanic/Latinx-, and Indigenous-owned businesses that share our focus on innovation and our commitment to the environment. With customized training and access to Apple experts, our Impact Accelerator helps companies as they achieve their next stage of development. As part of Apple's Racial Equity and Justice Initiative, the Impact Accelerator supports businesses that drive innovation and positive outcomes in our supply chain — so that together, we can work to support communities disproportionately impacted by environmental issues.

In 2022, our second class of the Impact Accelerator included 16 businesses at the leading edge of environmental services and solutions. Each company selected is at least 51 percent owned, operated, and controlled by a Black-, Hispanic/Latinx-, or Indigenous individual and aligns closely with our environmental strategy, including our commitment to become carbon neutral by 2030. Many of them share a focus on bringing clean energy, opportunity, and vital services to vulnerable and underserved communities.

The companies participate in a three-month program aimed at accelerating progress toward their goals. The program includes live virtual sessions, online courses on supply chain management, supplier diversity, financial and legal subjects, and one-on-one mentorship with an Apple expert on topics from renewable energy to responsible sourcing. Executives and their teams receive customized training that provides the knowledge and tools that organizations need to succeed as Apple suppliers, as well as access to Apple mentors and experts to help align their business priorities with Apple's environmental goals. The program culminates in an opportunity for participants to pitch their services and solutions to decision makers and business leaders within Apple.

The companies sustain their commitment after the program. Each participant transitions to Apple's Supplier Success community to further foster the connections developed during the program — and to forge new connections across all generations of the program.

Every business is given the opportunity to attend a business executive leadership program focused on supply chain and growth through a leading university.

Our most recent class featured a diverse set of companies engaged in work on water stewardship, recycling technologies, and green building and engineering, among other areas. The program supports these companies as they better position themselves for growth, improve their abilities to engage larger contracts, and expand their customer base — all while supporting their commitment to the environment. The program has also connected like-minded business leaders, both within our Impact Accelerator classes and at Apple, to create new opportunities for innovation and to realize our shared goals.

The goal of the Impact Accelerator is that Apple's strategic work and investments to protect the environment also help expand access to opportunity for communities of color. Since their participation in the program, companies have seen increased recognition for their work within their sector and local communities, have built connections with public- and private-sector leaders, and have seen their overall business opportunities expand. Several are currently working with Apple as part of the company's supply chain network, and every company has participated in selective opportunities to be assessed for potential business with Apple.



The Impact Accelerator's goal is to ensure that Apple's work to protect the environment also helps advance equity and expand access to opportunity for communities of color. Participants, like Bench-Tek, engage in online courses, live sessions, and mentorship throughout the three-month program, and continue their connection with other program participants through Apple's Supplier Success community.

# Appendix

✓  
FOCUSING ON  
THE FINER DETAILS  
OF OUR PROGRESS



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**Appendix A**

# Environmental data

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## Appendix A

# Apple's life cycle assessment methodology

When conducting a product life cycle assessment (LCA), we calculate carbon emissions using the 100-year time horizon global warming potentials (GWP100) from the 2014 IPCC Fifth Assessment Report (AR5),<sup>\*</sup> including biogenic carbon. The following details the five steps we use to conduct our LCA:

1. To model the manufacturing phase, we use part-by-part measurements of the entire product along with data on part production. In some cases where part-by-part data is not readily available, we also use design-level data for size and weight detail. The measurements help us accurately determine the size and weight of the components and materials in the product, while data on manufacturing processes and yield loss during production allows us to account for the impact of manufacturing. The LCA includes accessories and packaging, as well as decreased emissions through Apple's Supplier Clean Energy Program. When calculating Apple's comprehensive carbon footprint, we also include units that are repaired and replaced through AppleCare.

2. To model customer use, we measure the power consumed by a product while it is running in a simulated scenario. Daily usage patterns are specific to each product and are a mixture of actual and modeled customer use data. For the purposes of our assessment, years of use, which are based on first owners, are modeled to be four years for macOS and tvOS devices and three years for iOS, iPadOS, and watchOS devices. Most Apple products last longer and are often passed along, resold, or returned to Apple by the first owner for others to use. More information on our product energy use is provided in our Product Environmental Reports.

3. To model transportation, we use data collected on shipments of single products and multipack units by land, sea, and air. We account for transporting materials between manufacturing sites; transporting products from manufacturing sites to regional distribution hubs; transporting products from regional distribution hubs to individual customers; and transporting products from final customers to recycling facilities.

4. To model end of life, we use material composition data on our products and estimate the ratio of products that are sent to recycling or disposal. For products sent to recycling, we capture the initial processing by the recycler to prepare the product for recovery of electronic, metal, plastic, and glass material streams. Subsequent downstream recycling processes are not included, as these are considered stages of production and not end-of-life processing. For products sent to disposal, we capture the emissions associated with landfilling or incineration of each type of material.

5. After we collect data about manufacturing, use, transportation, and end of life, we combine it with detailed greenhouse gas emission data. This emission data is based on a combination of Apple-specific and industry-average data sets for material production, manufacturing processes, electricity generation, and transportation. Renewable energy used in the supply chain, initiated by suppliers independently or through the Apple Supplier Clean Energy Program, is also accounted for within the LCA model. Combining product-specific information with emission data in our LCA allows us to compile detailed results for greenhouse gas emissions as they relate to each product. The data and modeling approaches are checked for quality and accuracy by the Fraunhofer Institute in Germany.

There is inherent uncertainty in modeling carbon emissions due primarily to data limitations. For the top component contributors to Apple's carbon emissions, Apple addresses this uncertainty by developing detailed process-based environmental models with Apple-specific parameters. For the remaining elements of Apple's carbon footprint, we rely on industry average data and assumptions.

\* Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, 2013: Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

**Appendix B**

# Corporate facilities energy supplement

## Appendix B

# Corporate facilities energy supplement

Use of renewable energy at our facilities has been a central component of our emissions reduction strategy since 2011. We've learned a lot about how best to secure renewable energy, which has helped us educate suppliers and expand our renewable energy efforts into our supply chain. This appendix summarizes the types of renewable energy solutions we've deployed, and it details how we implement renewable energy at our data centers — our largest energy loads.

## How we procure renewable energy

Since launching our renewable energy program in 2011, we've implemented a number of solutions to procure renewable energy. Our strategy has evolved over time to create the most positive impact.

### Ownership and PURPA

In 2011, Apple's 100 percent equity ownership of our Maiden solar arrays was the first time a nonenergy commercial company built its own utility-scale solar PV project. We used a 1978 federal law called the Public Utility Regulatory Policies Act (PURPA) to structure the project. We then applied this same structure to two more large solar PV and biogas fuel cell projects in North Carolina and two microhydro projects in Oregon. This was a landmark moment in corporate renewable energy development and led to an increased use of PURPA in these states.

### Direct Access

Since 2012, in California and Oregon, we've used a program called Direct Access to bypass the default electricity generation offered by the utilities servicing our data centers in those states. Instead, we contracted directly with independent power producers who could supply 100 percent renewable electricity. After initially buying from existing, third-party-owned projects, we're now procuring renewable energy from projects we created: The Solar Star II and Montague Wind projects deliver renewables to our Oregon data center, and the California Flats solar project delivers renewables to our data centers, offices, and retail stores in California.

### GreenEnergy Rider

In 2013, we opened a new data center in Reno, Nevada. With no PURPA or Direct Access options in Nevada, we worked directly with the local utility, NV Energy, to create a whole new regulatory structure. The Nevada GreenEnergy Rider enables us to secure a long-term, fixed-price contract for renewable electricity from a new solar PV project built for us but managed by the utility. We've used this partnership to create four solar projects totaling 320 megawatts.

### Equity investment

In 2014, we invested in two 20-megawatt solar PV projects in Sichuan, China, to support all our in-country retail stores, corporate offices, and data storage facilities. This project represented the first time a commercial company created a new large-scale project in China for its own use. We've since replicated this model many times for Apple's supply chain.

### Portfolio solutions

In 2015 and 2016, we adapted to land scarcity constraints in Singapore and Japan by contracting for solar PV on 800 rooftops in Singapore and 300 in Japan. We adapted our approach in each country to fit local partnerships and regulatory structures: We signed a long-term agreement similar to a power purchase agreement in Singapore and made an equity investment in Japan. These projects offer us long-term flexibility as our load grows.

### Renewable microgrid

Since 2017, we've been powering Apple Park with 100 percent renewable energy — about 75 percent of which is generated onsite and managed by a microgrid. The onsite generation comes from 14 megawatts of rooftop solar PV and 4 megawatts of baseload biogas fuel cells. Any additional energy required is drawn by Direct Access from the California Flats solar project in nearby Monterey County. The microgrid system with battery storage manages the renewable energy generation and the building's energy use; optimizes demand management, load shifting, and frequency regulation services; and ensures uninterrupted energy reliability against local grid outages.

## A focus on data centers

We used over 2.14 billion kWh of electricity in 2022 to power our data centers and colocation facilities around the world. We're proud that 100 percent of that electricity came from clean, renewable sources including solar, wind, biogas fuel cells, and low-impact hydropower. To cover our needs, we build our own renewable power projects and work with utilities to purchase clean energy from locally obtained resources. We're staying at 100 percent even as Apple's data center presence continues to grow.

We now operate eight data centers, and more are being developed. These data centers are spread across North America, Europe, and Asia. Each has unique design features that conserve energy and reflect the climate, as well as other aspects, of its location.

### Maiden, North Carolina

#### 100 percent renewable since opening June 2010

Between 2011 and 2015, we installed 68 megawatts of Apple-created projects: two 20-megawatt solar projects, an 18-megawatt solar project, and 10 megawatts of biogas fuel cells. We then worked with the local utility, Duke Energy, to help build five solar projects through its Green Source Rider program. These solar projects came online beginning in 2015 and were Duke Energy's first Green Source Rider projects to become operational. We worked with Duke Energy for several years to develop this green energy tariff option, which allowed Apple and Duke Energy to develop new renewable energy projects. The five Green Source Rider projects have a combined

capacity of 22 megawatts. In 2017, we made long-term commitments to five more solar projects in North Carolina, for an additional 85 megawatts of clean energy. In 2022, the Maiden data center was supported by projects that generated 432 million kWh of renewable energy, which is equivalent to the energy used by over 11,000 homes in North Carolina for a year.<sup>2</sup> Use of renewable energy allowed us to avoid over 171,000 metric tons of CO<sub>2</sub>e during the fiscal year.<sup>3</sup>

The energy efficiency measures we've implemented at our Maiden data centers include use of outside air cooling through a waterside economizer during night and cool-weather hours, which, along with water storage, allows the chillers to be idle 75 percent of the time.

### Maiden, North Carolina: Grid mix versus Apple-sourced renewable energy

Electricity use in 2022: 432 million kWh

| Default grid mix (North Carolina) | %  |
|-----------------------------------|----|
| Coal                              | 16 |
| Gas                               | 37 |
| Nuclear                           | 33 |
| Hydro                             | 5  |
| Renewable                         | 10 |
| Other                             | <1 |

Source: eGRID 2021.

| Apple actual renewable energy allocation | %  |
|--|----|
| Apple's solar projects                   | 75 |
| Apple's biogas fuel cells                | 3  |
| Apple's wind projects                    | 21 |

Source: 2022 energy data.

Note: Totals don't add up to 100 percent, due to rounding.

<sup>2</sup> Carbon emissions equivalences calculated using 2021 data from the U.S. Energy Information Administration: [www.eia.gov/electricity/sales\\_revenue\\_price/pdf/table5\\_a.pdf](http://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf).

<sup>3</sup> Emissions avoided are calculated using the GHG Protocol methodology for calculating market-based emissions.

## Prineville, Oregon

### 100 percent renewable since opening May 2012

To support our Prineville data center, we signed a 200-megawatt power purchase agreement for a new Oregon wind farm, the Montague Wind Power Facility, which entered commercial operation at the end of 2019. It's our largest project to date, producing over 562 million kWh of clean, renewable energy a year.

This is in addition to our power purchase agreement for the 56-megawatt Solar Star Oregon II project located just a few miles from our data center. This solar PV project, which came online and began supporting the data center in 2017, produces 141 million kWh of renewable energy per year. To strengthen the connection between Apple and these projects, we use Oregon's Direct Access program to supply the renewable energy from these projects directly to our data center.

Also supporting the data center are two microhydro projects that harness the power of water flowing through local irrigation canals that have been operating for over 60 years. In 2022, these microhydro projects are expected to generate nearly 2 million kWh of renewable energy. To supplement these projects, we executed a long-term purchase agreement for all environmental attributes from a 69-megawatt portfolio of eight solar projects in Oregon.

In 2022, the Prineville data center was supported by projects that generated 275 million kWh of renewable energy, which is equivalent to the energy used by over 8,000 homes in Oregon for a year.<sup>4</sup> Use of renewable energy allowed us to avoid over 196,000 metric tons of CO<sub>2</sub>e during the fiscal year.<sup>5</sup>

Our Prineville data center takes advantage of the cool and dry climate by cooling its servers with outside air whenever possible. Indirect evaporative cooling is enabled when the outside air temperature gets too high to cool the servers with outside air alone.

### Prineville, Oregon: Grid mix versus Apple-sourced renewable energy

Electricity use in 2022: 275 million kWh

| Default grid mix (Oregon) | %  |
|---------------------------|----|
| Gas                       | 35 |
| Hydro                     | 45 |
| Renewable                 | 20 |

Source: eGRID 2021.

| Apple actual renewable energy allocation | %  |
|--|----|
| Apple's microhydro projects              | 1  |
| Apple's solar projects                   | 51 |
| Apple's wind projects                    | 48 |

Source: 2022 energy data.

## Reno, Nevada

### 100 percent renewable since opening December 2012

Unlike competitive energy markets where some of our data centers are located, the regulated electricity supply in Nevada did not offer a simple solution for us to create new renewable energy projects dedicated to our data center. So, in 2013, we created a partnership with the local utility, NV Energy, to develop the Fort Churchill Solar project. Apple designed, financed, and constructed the project, and NV Energy operates it and directs all the renewable energy it produces to our data center. The Fort Churchill Solar project uses a photovoltaic panel with curved mirrors that concentrate sunlight. The 20-megawatt array has an annual production capacity of over 40 million kWh.

To facilitate further renewable development in Nevada, Apple worked with NV Energy and the Nevada utility commission to create a green energy option open to all commercial customers, called the NV GreenEnergy Rider, that does not require the customer to fund project development up front. Thanks to this new option, in 2015 we announced our second Nevada solar project,

the 50-megawatt Boulder Solar II project. This project came online in 2017, producing about 137 million kWh of renewable energy per year. We've used the NV GreenEnergy Rider program two more times, first for the 200-megawatt Techren II solar project. Apple's largest solar project to date, it's estimated to produce over 540 million kWh per year and came online in late 2019.

Next was the 50-megawatt Turquoise Nevada project, which came online in late 2020. The project is estimated to produce 110 million kWh of renewable energy per year. In 2022, the Reno data center was supported by projects that generated 419 million kWh of renewable energy, which is equivalent to the energy used by nearly 12,000 homes in Nevada for a year.<sup>6</sup> Use of renewable energy allowed us to avoid more than 145,000 metric tons of CO<sub>2</sub>e during the fiscal year.<sup>7</sup>

Like in Prineville, our Reno data center takes advantage of the mild climate by cooling its servers with outside air whenever possible. When the outside air is too warm to cool the servers alone, it draws from indirect evaporative cooling.

### Reno, Nevada: Grid mix versus Apple-sourced renewable energy

Electricity use in 2022: 419 million kWh

| Default grid mix (Nevada) | %  |
|---------------------------|----|
| Coal                      | 7  |
| Gas                       | 63 |
| Hydro                     | 5  |
| Renewable                 | 26 |

Source: eGRID 2021.

Note: Total doesn't add up to 100 percent due to rounding.

<sup>4</sup> Carbon emissions equivalences calculated using 2021 data from the U.S. Energy Information Administration: [www.eia.gov/electricity/sales\\_revenue\\_price/pdf/table5\\_a.pdf](http://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf).

<sup>5</sup> Emissions avoided are calculated using the GHG Protocol methodology for calculating market-based emissions.

<sup>6</sup> Carbon emissions equivalences calculated using 2021 data from the U.S. Energy Information Administration: [www.eia.gov/electricity/sales\\_revenue\\_price/pdf/table5\\_a.pdf](http://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf).

<sup>7</sup> Emissions avoided are calculated using the GHG Protocol methodology for calculating market-based emissions.

## Newark, California

### 100 percent renewable since January 2013

Our data center in Newark, California, is powered by 100 percent renewable energy. We hit this milestone in January 2013, when we began serving the data center with energy sourced primarily from California wind power. We acquired this energy directly from the wholesale market through California's Direct Access program. In 2017, Apple's 130-megawatt California Flats solar project in nearby Monterey County came online, and now we use

Direct Access to supply power from that project directly to our data center and other Apple facilities in California.

In 2022, the Newark data center was supported by projects that generated 20 million kWh of renewable energy, which is equivalent to the energy used by nearly 10,000 homes in California for a year.<sup>8</sup> Use of renewable energy allowed us to avoid more than 804 metric tons of CO<sub>2</sub>e during the fiscal year.<sup>9</sup>

## Mesa, Arizona

### 100 percent renewable since opening March 2017<sup>10</sup>

Our global command data center in Mesa, Arizona, came online in 2016. To support this facility, we partnered with the local utility, the Salt River Project (SRP), to build the 50-megawatt Bonnybrooke solar project, which became operational in December 2016. This project produces over 148 million kWh of clean, renewable energy a year, which roughly matches the energy used by the data center.

As the Mesa data center grew, it became apparent that we needed additional sources of renewable energy to maintain our 100 percent renewable electricity goal.

We began to explore onsite solar options at the data center and determined that we could provide valuable shaded parking that paid for itself through energy bill reductions while adding to our renewable energy portfolio. The resulting PV facility includes five elevated parking canopies and three ground-mounted arrays, for a total

generating capacity of 4.67 MW. The onsite PV system began commercial operation in February 2019 and generates approximately 8,000 MWh per year.

In addition, we began working with SRP to develop a customer renewable energy program in 2017, resulting in their Sustainable Energy Offering, which launched in 2019, to provide a diverse mix of commercial electric customers with new renewable energy at an affordable price. Under this program, Apple has executed an agreement with SRP to purchase a portion of the output of their 100 MW Central Line PV facility. The project became operational in April 2022.

In 2022, the Mesa data center was supported by 379 million kWh of renewable energy, which is equivalent to the energy used by over 10,000 Arizona homes.<sup>11</sup> Use of renewable energy allowed us to avoid more than 158,000 metric tons of CO<sub>2</sub>e during the fiscal year.<sup>12</sup>

## Newark, California: Grid mix versus Apple-sourced renewable energy

Electricity use in 2022: 20 million kWh

| Default grid mix (California) | %  |
|-------------------------------|----|
| Coal                          | <1 |
| Gas                           | 49 |
| Nuclear                       | 8  |
| Hydro                         | 7  |
| Renewable                     | 34 |
| Other                         | <1 |

| Apple actual renewable energy allocation | %   |
|--|-----|
| Bundled solar (through Direct Access)    | 100 |

Source: 2022 energy data.

Source: eGRID 2021.

## Mesa, Arizona: Grid mix versus Apple-sourced renewable energy

Electricity use in 2022: 379 million kWh

| Default grid mix (Arizona) | %  |
|----------------------------|----|
| Coal                       | 13 |
| Gas                        | 44 |
| Nuclear                    | 29 |
| Hydro                      | 6  |
| Renewable                  | 8  |

Source: eGRID 2021.

| Apple actual renewable energy allocation | %  |
|--|----|
| Apple's solar projects                   | 83 |
| Apple's wind projects                    | 17 |

Source: 2022 energy data.

<sup>8</sup> Carbon emissions equivalences calculated using 2021 data from the U.S. Energy Information Administration: [www.eia.gov/electricity/sales\\_revenue\\_price/pdf/table5\\_a.pdf](http://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf).

<sup>9</sup> Emissions avoided are calculated using the GHG Protocol methodology for calculating market-based emissions.

<sup>10</sup> Apple took operational control of the building in October 2015 and converted it to a data center that began servicing customers in March 2017.

<sup>11</sup> Carbon emissions equivalences calculated using 2021 data from the U.S. Energy Information Administration: [www.eia.gov/electricity/sales\\_revenue\\_price/pdf/table5\\_a.pdf](http://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf).

<sup>12</sup> Emissions avoided are calculated using the GHG Protocol methodology for calculating market-based emissions.

**Denmark****100 percent renewable energy from the first day of operations**

Our data center came online in 2020. The data center's construction phase was powered with 100 percent wind energy from a local renewable energy retailer in Denmark. Our Northern Jutland PV project achieved commercial operation in late 2019, will meet all the data center's near-term energy needs, and at 42 megawatts, is one of Denmark's largest solar power plants. Our second renewable project in Denmark, a 17 MW wind project, also came online in late 2020. We have secured long-term supply contracts with both Danish renewable projects, which will scale up as our data center loads grow.

The power system design at the data center is based on a resilient substation that eliminates the need for backup diesel generators. This reduces the carbon footprint of the data center and completely eliminates the need for large diesel fuel storage systems and diesel engine emissions that would impact the local community.

In 2022, the Denmark data center sourced 27 million kWh of renewable energy, avoiding more than 14,479 metric tons of CO<sub>2</sub>e.<sup>13</sup>

**China****100 percent renewable energy from the first day of operations**

To cover the electricity load at our two data centers in China, we procure 100 percent renewable electricity from a solar project that came online recently in China.

As the data centers further expand, we'll continue to source renewable electricity in-country to support the growth with renewable electricity.

In 2022, the China data center was supported by 98 million kWh of renewable energy, avoiding more than 60,503 metric tons of CO<sub>2</sub>e during the fiscal year.<sup>14</sup>

<sup>13</sup> Emissions avoided are calculated using the GHG Protocol methodology for calculating market-based emissions.

<sup>14</sup> Emissions avoided are calculated using the GHG Protocol methodology for calculating market-based emissions.

**Denmark: Grid mix versus Apple-sourced renewable energy**

Electricity use in 2022: 27 million kWh

| Default grid mix (Denmark) | %  | Apple actual renewable energy allocation | %   |
|----------------------------|----|--|-----|
| Coal                       | 13 | Apple's wind and solar projects          | 100 |
| Gas                        | 5  |  |     |
| Renewable                  | 76 |  |     |
| Other                      | 6  |  |     |

Source: IEA Electricity Information 2022: [www.iea.org/data-and-statistics/data-product/electricity-information](http://www.iea.org/data-and-statistics/data-product/electricity-information).

**China: Grid mix versus Apple-sourced renewable energy**

Electricity use in 2022: 98 million kWh

| Default grid mix (China) | %  | Apple actual renewable energy allocation | %   |
|--------------------------|----|--|-----|
| Coal                     | 63 | Apple's solar project                    | 100 |
| Gas                      | 3  |  |     |
| Renewable                | 29 |  |     |
| Other                    | 5  |  |     |

Source: IEA Electricity Information 2022: [www.iea.org/data-and-statistics/data-product/electricity-information](http://www.iea.org/data-and-statistics/data-product/electricity-information).

## Our colocation facilities

The majority of our online services are provided by our own data centers; however, we also use third-party colocation facilities for additional data center capacity. While we don't own these shared facilities and use only a portion of their total capacity, we include our portion of their energy use in our renewable energy goals.

Starting in January 2018, 100 percent of our power for colocation facilities was matched with renewable energy generated within the same country or regional grid. As our loads grow over time, we'll continue working with our colocation suppliers to match 100 percent of our energy use with renewables.

## Third-party computing

Beyond the use of our own data centers and colocation facilities, we also use third-party services to support some of our on-demand cloud computing and storage services. As of 2022, all the electricity associated with Apple's load at our third-party computing vendors is matched with 100 percent clean energy.

|                            | <b>Total energy use<br/>(kWh)</b> | <b>Renewable energy<br/>(kWh)</b> | <b>Default utility emissions<br/>(metric tons CO<sub>2</sub>e)<sup>15</sup></b> | <b>Apple's emissions —<br/>including renewable energy<br/>(metric tons CO<sub>2</sub>e)<sup>16</sup></b> | <b>Percent renewable<br/>energy (%)<sup>17</sup></b> |
|----------------------------|-----------------------------------|-----------------------------------|---|--|--|
| <b>FY2011</b>              | 42,500                            | 0                                 | 10  | 10   | 0  |
| <b>FY2012</b>              | 38,552,300                        | 1,471,680                         | 17,200  | 16,500   | 4  |
| <b>FY2013</b>              | 79,462,900                        | 46,966,900                        | 31,800  | 14,500   | 59   |
| <b>FY2014</b>              | 108,659,700                       | 88,553,400                        | 44,300  | 11,000   | 81   |
| <b>FY2015</b>              | 142,615,000                       | 121,086,100                       | 60,500  | 12,700   | 85   |
| <b>FY2016<sup>18</sup></b> | 145,520,900                       | 143,083,200                       | 66,300  | 1,600  | 98   |
| <b>FY2017</b>              | 289,195,800                       | 286,378,100                       | 125,600   | 1,500  | 99   |
| <b>FY2018</b>              | 327,663,800                       | 326,959,700                       | 146,600   | 400  | 99.8   |
| <b>FY2019</b>              | 339,047,649                       | 339,047,649                       | 146,400   | 0  | 100  |
| <b>FY2020</b>              | 372,901,398                       | 372,901,398                       | 153,459   | 0  | 100  |
| <b>FY2021</b>              | 384,727,076                       | 384,727,076                       | 146,780   | 0  | 100  |
| <b>FY2022</b>              | 487,921,930                       | 487,921,930                       | 182,700   | 0  | 100  |

<sup>15</sup> We calculate default utility emissions to provide baseline emissions of what our carbon footprint would have been without the use of renewable energy. This allows us to demonstrate the savings resulting from our renewable energy program.

<sup>16</sup> Apple's greenhouse gas emissions are calculated using the World Resources Institute Greenhouse Gas Protocol methodology for calculating market-based emissions.

<sup>17</sup> We calculate our progress toward our 100 percent renewable energy goal on a calendar-year basis, while the numbers reported in this table are based on fiscal year. Beginning January 1, 2018, all the electricity use at our colocation facilities is from 100 percent renewable energy.

<sup>18</sup> Over the past few years, we've been installing submeters in colocation facilities to better track electricity usage. Beginning in fiscal year 2016, we started reporting this submetered electricity usage. Prior to fiscal year 2016, reported electricity usage was conservatively estimated based on maximum contract capacity quantities. We've updated our fiscal year 2016 colocation facilities footprint to more accurately reflect Apple's operational boundaries. Per the GHG Protocol, we've removed from our electricity usage and scope 2 calculations those emissions associated with colocation facility cooling and building operations.

**Appendix C**

# **Supplier Clean Energy Program supplement**

## Appendix C

# Supplier Clean Energy Program supplement

The Supplier Clean Energy Program is integral to Apple's goal of reaching carbon neutrality by 2030. We're focused on working with our suppliers to help them increase energy efficiency at their facilities and transitioning suppliers to clean, renewable electricity. These efforts are helping reduce product-related carbon emissions, create a more resilient supply chain, and contribute to healthier communities — while offering a model for others to follow.

We're proud of the progress our suppliers have made. As of March 2023, over 250 manufacturing partners in 28 countries have committed to 100 percent renewable electricity for Apple production (see below for the suppliers participating). Additionally, Apple itself has directly invested in nearly 500 megawatts of renewable electricity projects to cover a portion of upstream emissions. The Supplier Clean Energy Program now has over 20 gigawatts of clean energy commitments, of which nearly two-thirds are operational. In 2022, the 13.7 gigawatts of renewable energy online in Apple's supply chain generated 23.7 million megawatt-hours of clean energy, avoiding 17.4 million metric tons of carbon emissions — a 23 percent increase over 2021.<sup>1</sup>

## Apple's clean energy standards

We help our suppliers select projects with the greatest potential for impact and with a clear carbon, ecological, and social benefit, and we consider the life cycle emissions associated with current and emerging clean energy technologies. In most cases, wind and solar solutions meet our criteria. For some energy solutions, such as biomass and hydroelectric generation, we review individual projects so that they deliver positive impact while minimizing harm. We also uphold stringent assurance standards so that all clean energy can be verified through third-party assessment.<sup>2</sup>

We want to be a driving force for the development of new projects and help overcome barriers to bring new renewable electricity online. With the rapidly changing policy dynamics in some of our key countries, we continuously evolve our framework both to comply with local laws and regulations and to yield the most positive and meaningful energy transformation.

## Supplier energy efficiency and clean energy achievements

### 2015

Launch of the **Supplier Clean Energy Program** and **Supplier Energy Efficiency Program**

### 2018

Launch of the **China Clean Energy Fund**, which enables Apple and our suppliers to invest in more than 1 gigawatt of renewable energy in China

### 2017

Launch of the **Supplier Clean Energy Portal**

Initial Apple **investment toward the development of 500 megawatts** of solar and wind projects to address upstream emissions in Apple's supply chain

**Supplier Code of Conduct** requires suppliers to maintain an inventory of air emissions, including greenhouse gases

### 2019

**Key supplier commitments** reached in major supply chain countries

First **in-person training** hosted by Apple for over 30 suppliers in China

### 2020

More than 100 suppliers committed to **100 percent renewable electricity** for Apple production

All Apple products' final assembly sites committed to **100 percent renewable electricity** for Apple production

### 2022

Apple called on its global supply chain to **decarbonize by 2030**

### 2021

**214 suppliers** across 26 countries committed to 100 percent renewable electricity for Apple production

### 2023

Over 250 suppliers committed to **100 percent renewable electricity** for Apple production, corresponding to over 80 percent of Apple's direct manufacturing spend

<sup>1</sup> 2021 renewable electricity figures associated with Apple's Supplier Clean Energy Program do not include REC purchases that Apple made to address a small increase to its carbon footprint. When accounting for the REC purchases, the total renewable energy online in Apple's supply chain was 10.6 gigawatts, generating 18.6 million megawatt-hours and avoiding 14.2 million metric tons of carbon emissions.

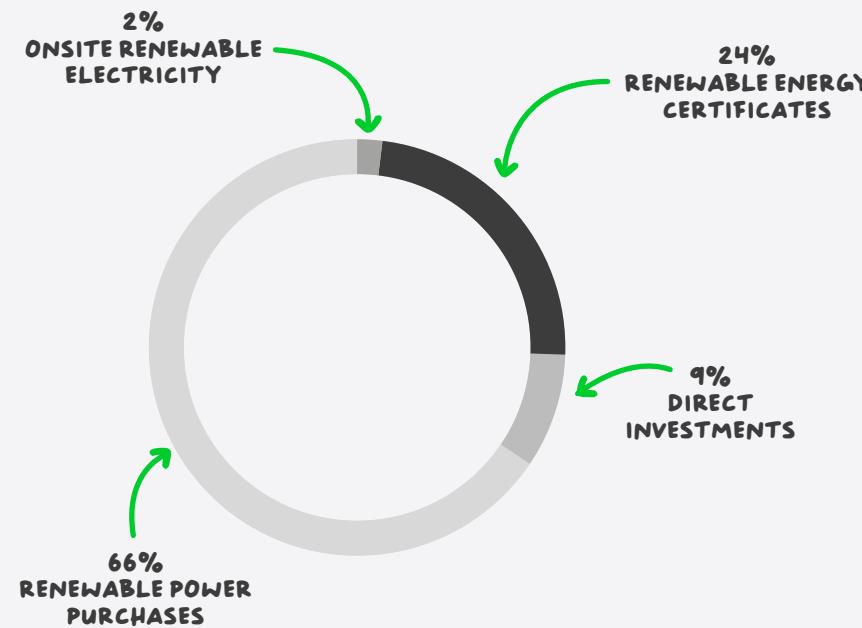
<sup>2</sup> Apple's independent assurance provider for the Supplier Clean Energy Program conducts work against standard procedures and guidelines for external verification of sustainability reports, based on current best practice in independent assurance. The procedures are based on principles and methods described in *International Standard on Assurance Engagements (ISAE) 3000 (Revised), Assurance Engagements Other than Audits or Reviews of Historical Financial Information (Effective for assurance reports dated on or after December 15, 2015)*, issued by the International Auditing and Assurance Standards Board, and ISO 14064-3:2019, *Greenhouse gases — Part 3: Specification with guidance for the verification and validation of greenhouse gas statements*.

## Supplier renewable electricity solutions

The following charts include breakdowns of the contracting mechanisms and technologies that suppliers have identified to help meet their commitments.

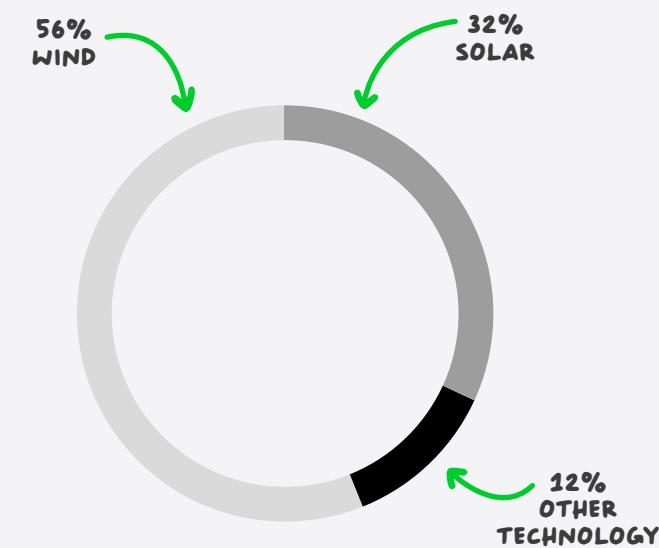
### Supplier renewable energy procurement mechanisms (FY2022)

Apple's suppliers are implementing clean energy solutions using a variety of contracting mechanisms — with renewable power purchases representing the majority of solutions implemented to date, at 66 percent.



### Supplier renewable energy technologies (FY2022)

We work with our suppliers to select projects with the greatest potential for impact and with a clear carbon, ecological, and social benefit. "Other technology" includes clean energy sources such as some forms of biomass, geothermal, and small-scale, low-impact hydro.



Note: Above total doesn't add up to 100 percent due to rounding.

**Appendix E**

# **Environment, Health and Safety Policy**

**Appendix E**

# Environment, Health and Safety Policy

## Mission Statement

Apple Inc. is committed to protecting the environment, health and safety (EHS) of our employees, contractors, and customers in the design, research, manufacture, distribution, and use of our products and services and the global communities where we operate.

We recognize that by integrating sound EHS management practices into all aspects of our business, we can offer technologically innovative products and services while conserving and enhancing resources for future generations.

Apple strives for continuous improvement in our EHS management systems and in the environmental quality of our products, processes, and services.

## Guiding Principles

Meet or exceed all applicable EHS requirements.

Where laws and regulations do not provide adequate controls, apply higher standards to protect human health and the environment.

Design, manage, and operate our facilities safely, promote energy efficiency and renewable energy, and protect biodiversity and the environment.

Encourage contractors, vendors, and suppliers to provide safe working conditions, treat workers with dignity and respect, act fairly and ethically, use environmentally responsible practices, and have effective programs for the control of environmental aspects, wherever they perform services for Apple.

Support and promote sound scientific principles, practices, and public policy initiatives that enhance environmental quality, health and safety performance, and ethical sourcing of materials.

Communicate EHS policies and programs to Apple employees and stakeholders, and ensure suppliers operate in accordance with Apple's Supplier Code of Conduct. Supplier Responsibility resources and Supplier Code of Conduct are available at [apple.com/supplier-responsibility](http://apple.com/supplier-responsibility).

Strive to create products that are safe in their intended use, conserve energy and materials, and prevent pollution throughout the product life cycle, including design, manufacture, use, and end-of-life management.

Pursue continual improvement through the evaluation of our EHS performance by monitoring ongoing performance results and through periodic management reviews, as well as a commitment to correcting EHS nonconformities.

Ensure that all employees are aware of their role and responsibility to fulfill and sustain Apple's EHS management systems and policy by providing training and tools in the user's primary language.

**Luca Maestri**

Senior Vice President and CFO  
February 2023