



# Environmental Progress Report



Covering fiscal year 2021



Connecting  
COMMUNITIES  
around the world



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**Cover photo:** We aim to reduce our emissions in ways that consider the low-income and historically marginalized communities that too often bear the brunt of the effects of climate change. We are bringing renewable electricity to 3500 households in South Africa that previously lacked access to electricity.

# Reflections

**In a year where the technology we make touched more lives than ever, teams across Apple never stopped innovating to protect the planet. Whether it's using more recycled materials in our products, or transitioning our supply chain to 100 percent clean energy, there is no part of Apple this work does not reach.**

This year's Environmental Progress Report shows the breadth of the environmental solutions we're advancing, and the scale of collaboration that helped make them possible. The details here matter, because they add up to meaningful, substantive progress in our work for the planet. We are laser-focused on our commitment to achieve carbon neutrality for our entire footprint by 2030, a goal we have already reached for our own operations. At the same time, we're working to one day make our products without taking from the earth, and to be a force for equity in the world around us.

Across all of these efforts, we never lose sight of our primary mission — working to address the climate crisis. It's an urgent challenge no one company, entity or individual can tackle alone, and this year, we're addressing it with more ambition than ever before. In fact, we've begun to decouple business growth from emissions as we drive towards our goal of bringing our entire carbon footprint to net zero by 2030 — including our supply chain and the use of our products. While our revenue grew 33 percent, our net emissions remained flat.

Today, 213 of our suppliers — representing the majority of Apple's direct supplier spend — are committed to using 100 percent renewable energy for their Apple business. In the last year, we more than doubled the amount of clean energy used to manufacture Apple products.

We're also making great strides toward our goal of one day making our products without mining. In fiscal year 2021, nearly 20 percent of the materials we shipped in Apple products came from recycled sources. We've more than doubled our use of recycled tungsten, rare earth elements, and cobalt. And initiatives like our Apple Trade In program, and advancements in recycling technology, continue to reduce our impact on the planet by using yesterday's products to help build tomorrow's.



Lisa Jackson  
Vice President,  
Environment, Policy  
& Social Initiatives

We also know that a greener future must be a more equitable one. It's why we continue to advance our Impact Accelerator, which invests in a diverse class of entrepreneurs developing next generation innovations in green technologies. That includes leaders like Karl Johnson, whose company develops environmentally-friendly adhesives that make it easier to repair and recycle new technologies, or Betty Manetta whose company has pioneered an AI-based, real-time data collection process to assess energy consumption for its users.

Equity also drives the mission of our Power for Impact initiative, which we launched to help connect underserved communities with clean, renewable energy. In communities from South Africa to the Philippines, from Thailand to Israel, we've helped bring solar and wind energy to schools, hospitals, and rural communities.

And, working with Conservation International and Goldman Sachs, our Restore Fund invests to develop working forests — which support local economic opportunity while sequestering carbon from the atmosphere.

At Apple, we believe in making bold commitments to improve the world around us — and taking bold steps to meet them. We set measurable goals, and then we get to the hard work of getting them done. And along the way, we share updates with our customers, our partners, and the communities we touch.

As always, we're grateful for your interest in this work and to all our partners for joining Apple's journey. And we can't wait to share all of the innovations we have in store.

**Lisa Jackson**



# Our environmental strategy

The environmental challenges we face today are significant, and we are responding with urgency and dedication. We approach our work by focusing on fundamental questions. What matters most? And where can we make the greatest impact? These questions guide our work across our strategic pillars of climate change, resources, and smarter chemistry — and inform our goals in how we can best achieve change. 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 lift local communities along the way.

## 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, and then investing in carbon removal solutions for the remaining emissions.

- Low-carbon design
- Energy efficiency
- Renewable electricity
- Direct emissions abatement
- Carbon removal

## Resources

We aim to make durable, long-lasting products and packaging using only recycled or renewable materials, and 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

By engaging with others on our environmental work, we can achieve 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 are 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 planet and the resources that we all depend on. Setting ambitious goals is essential to this — to drive the innovation and collaboration that makes change possible and to be transparent and accountable to our progress.

## Climate Change

Achieve carbon neutrality for our entire carbon footprint by 2030, and reach our science-based emissions reduction target

Create products with net zero carbon impact by 2030

Transition our entire product supply chain to 100% renewable 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

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 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



# Report highlights

In this past year, we've continued to show considerable progress — a testament to the dedication, hard work, and innovative approaches to complex challenges of our employees, suppliers, industry partners, and stakeholders. Our objectives remain clear: to reduce our impact, create equitable solutions, and drive broader change within the industry and our communities. Our progress can be measured by our achievements across our business. And the challenges that remain galvanize our efforts and drive us forward.



## Carbon neutral for corporate emissions

Since April 2020, we've achieved carbon neutrality for our corporate emissions by sourcing 100 percent renewable electricity for Apple facilities, implementing energy efficiency initiatives, and securing carbon offsets for remaining emissions.

→ Read more on [page 15](#)

## 40% overall emissions reductions

In fiscal year 2021, our environmental initiatives avoided over 23 million metric tons of emissions across all scopes, and we reduced our carbon footprint by 40 percent compared with fiscal year 2015. Efforts and initiatives that we've been growing for years made this possible — like sourcing 100 percent renewable electricity for our facilities, transitioning suppliers to clean energy, and using low-carbon materials in products.

→ Read more on [page 14](#)

## 213 suppliers committed to renewable electricity

As of March 2022, 213 suppliers have committed to renewable electricity for Apple production, representing the majority of Apple's direct supplier spend. In fiscal year 2021, Apple and its suppliers brought online over 10 gigawatts of renewable energy in our supply chain, doubling the amount from the prior year.

→ Read more on [page 24](#)



## Supported 10 renewable projects through Power for Impact

We funded 10 clean energy projects that support economic growth, social impact, and equity in under-resourced communities around the world, while advancing Apple's carbon neutrality goal.

→ Read more on [page 27](#)





## More products with more recycled content

We're making progress toward our goal of transitioning to 100 percent recycled and renewable materials in our products. In fiscal year 2021, we more than doubled our use of recycled tungsten, rare earth elements, and cobalt — and introduced certified recycled gold for the first time in an Apple product.

→ Read more on [page 34](#)

## Suppliers eliminating landfill waste

Established final assembly and sub-assembly sites for Apple Watch Series 7 do not send any waste to landfill. This builds on our progress of all final assembly sites making Apple products without sending waste to landfill.

→ Read more on [page 58](#)

## Continuing innovation on material recovery

This year we introduced our latest recycling machine, Taz, which is designed to recover modules containing rare earth magnets typically lost in conventional shredders, helping improve our overall material recovery rate. We've also expanded Daisy's recycling capabilities from 15 to 23 models of iPhone and continue to develop Dave, our robot that disassembles Taptic Engines and helps recover valuable rare earth magnets, tungsten, and steel.

→ Read more on [page 50](#)

## 75% less plastic in packaging compared with 2015

In fiscal year 2021, plastics accounted for only 4 percent of our packaging — which marks significant progress toward our goal to eliminate plastics from our packaging entirely by 2025.

→ Read more on [page 42](#)



## Partner of the Year award from the EPA

For the second year in a row, we received the EPA Safer Choice Partner of the Year Award, recognizing our work to scale the use of safer process chemicals and protect those working in our supply chain. In 2020, Apple was the first consumer electronics company to receive this award.

→ Read more on [page 71](#)



## Welcomed the first class of the Impact Accelerator

Fifteen Black-, Hispanic/Latinx-, and Indigenous-owned businesses on the cutting edge of green technology and clean energy participated in Apple's inaugural Impact Accelerator, a unique program designed to expand opportunities within Apple's supply chain and beyond. The Accelerator aims to help combat systemic barriers to opportunity, while also advancing innovative solutions to environmental challenges like climate change.

→ Read more on [page 81](#)

# Climate Change

We're committed to making all of our products **CARBON NEUTRAL** by 2030



# Goals and progress

At Apple, we're committed to doing our part to fight climate change. For us, this means taking bold action. Our goal to be carbon neutral by 2030 is both ambitious and necessary. The efforts that support this goal require innovations at scale — like designing and implementing new technologies, mobilizing innovative financing, and rapidly deploying renewable energy. This chapter looks at our latest progress. We are continuing to deploy solutions to address our remaining footprint with great urgency.

Achieve **carbon neutrality** for our entire carbon footprint, including products, by 2030. And reduce related emissions by 75% compared with fiscal year 2015



40% emissions reduction since 2015 across our value chain



Established the \$200M Apple Restore Fund with the aim of removing over 1M metric tons of carbon per year



23M metric tons of emissions avoided in fiscal year 2021 alone due to carbon reduction initiatives across our value chain

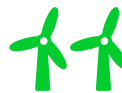
Become **carbon neutral** for corporate operations



Achieved since April 2020 by implementing energy efficiency initiatives, sourcing 100% renewable electricity for Apple facilities, and securing carbon offsets for the remaining corporate emissions



Transition our entire manufacturing supply chain to **100% renewable electricity** by 2030



As of March 2022, 213 suppliers have committed to 100% renewable electricity for Apple production, representing the majority of Apple's direct worldwide spend for materials, manufacturing, and assembly of products





# Our approach

With each year, the impacts of climate change become more clear. From shifting weather patterns that threaten food production, to widespread wildfires that devastate entire communities and ecosystems, the dangers are global in scope and unprecedented in their pace of change. They pose a threat to fundamental human rights — life, health, food, and adequate standard of living — and are experienced disproportionately in low-income and historically marginalized communities. Global, comprehensive, and immediate action today can prevent even worse impacts of climate change.

As a global business, we believe it is our responsibility to take strong, decisive, and inclusive steps to mitigate our climate impact. We've committed to achieving carbon neutrality — reducing emissions 75 percent compared with fiscal year 2015 and balancing the residual emissions with carbon removal — across the life cycle of our products by 2030.<sup>1</sup> This goal is more aggressive than the recommendation for global carbon neutrality by the Intergovernmental Panel on Climate Change by 20 years.<sup>2</sup> It's an ambitious plan with plenty of challenges ahead. But we're already well on our way, having cut emissions across our value chain by 40 percent since fiscal year 2015.

Our work began years ago, 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 took steps to be carbon neutral for our corporate emissions, including business travel and employee commute.

Our philosophy for achieving carbon neutrality follows these principles:

**Calculate our footprint across our value chain:** Our responsibility extends beyond our direct operations to 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>3</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 neutrality by 2030 centers around our strategy to reduce emissions by 75 percent, relative to our fiscal year 2015 carbon footprint. This reduction aligns with what current climate science shows is necessary to limit warming to 1.5°C.<sup>4</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 using renewable electricity and emissions from transportation using alternative fuels and lower-carbon modes of transport. By matching solutions to carbon sources, we will do our part to decarbonize the economy.

**Make environmental progress good for our business:** We are proving every day that there is no trade-off between what is good for the planet and what is good for business. That means that we seek out climate solutions that are cost-competitive, offer a financial return, or benefit our customers — for example, creating investment funds for clean energy and nature-based solutions, designed 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, we aim to harness the power of markets to replicate our solutions at scale, creating an 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 Green Bond Impact Report, we share progress on the projects funded in fiscal year 2021.

[Read our latest Green Bond report \(PDF\).](#)

**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, creating novel financial instruments 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 are committed to disclosing our carbon footprint, climate strategy and progress, as well as climate-related risk. By sharing our approach, we aim to send clear signals to our partners and invite them to work with us. We also hope to empower our peers in their pursuit of carbon neutrality and engage investors through green bonds. This means sharing our setbacks with our successes. We recognize the difficulty of this work and acknowledge when our progress does not align with our projections. Our annual Environmental Progress Reports, as well as our response to the global disclosure nonprofit CDP, provide details on our progress.

**Consider 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 consider 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 investing in renewable energy projects in emerging markets. And we're targeting carbon removal projects that aim to improve the livelihoods of local and Indigenous communities.

## Our 10-year Climate Roadmap is addressing Apple's carbon footprint through five pillars:



### Low-carbon design

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



### Energy efficiency

We will increase energy efficiency at our facilities and in our supply chain by finding opportunities, such as retrofitting, to reduce energy use.



### Renewable electricity

We will maintain our use of 100 percent renewable electricity for our facilities and transition our entire supply chain to 100 percent clean, renewable sources of electricity.



### Direct emissions abatement

We will reduce direct greenhouse gas emissions in our facilities and our supply chain through process innovation, emissions abatement, and the use of non-fossil-based low-carbon fuels.



### Carbon removal

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

.....  
**>75% EMISSIONS REDUCTION**

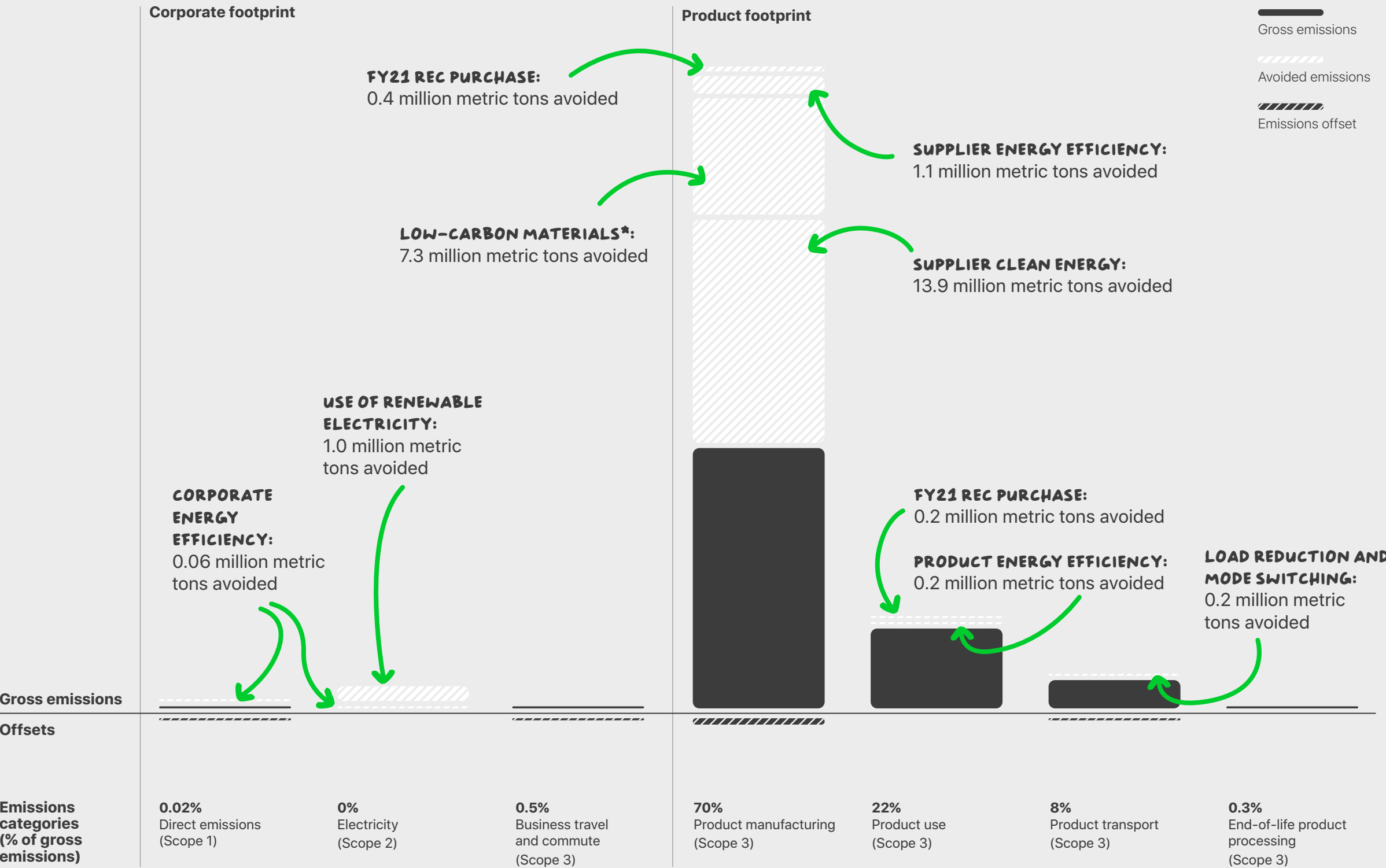
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**<25% OF FOOTPRINT**

# Apple’s comprehensive carbon footprint

This past year we intensified our efforts to reduce Apple’s emissions. In fiscal year 2021, we avoided over 23 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 clean energy, and using low-carbon materials in products — yielded indisputable results.

Thanks to this work, we’ve begun to decouple business growth from emissions: While our revenue grew 33 percent, our emissions grew by less than 5 percent. To mitigate this increase in emissions, we applied an additional 0.6 million tons of renewable energy credits (RECs) and 0.5 million metric tons of carbon offsets to proportionally cover electricity use and direct emissions, respectively, across our value chain.<sup>5</sup> This represents a short-term bridging solution as we grow our carbon reduction programs to meet the scale of the challenge.

22.5 MILLION METRIC TONS  
net carbon emissions\*\*



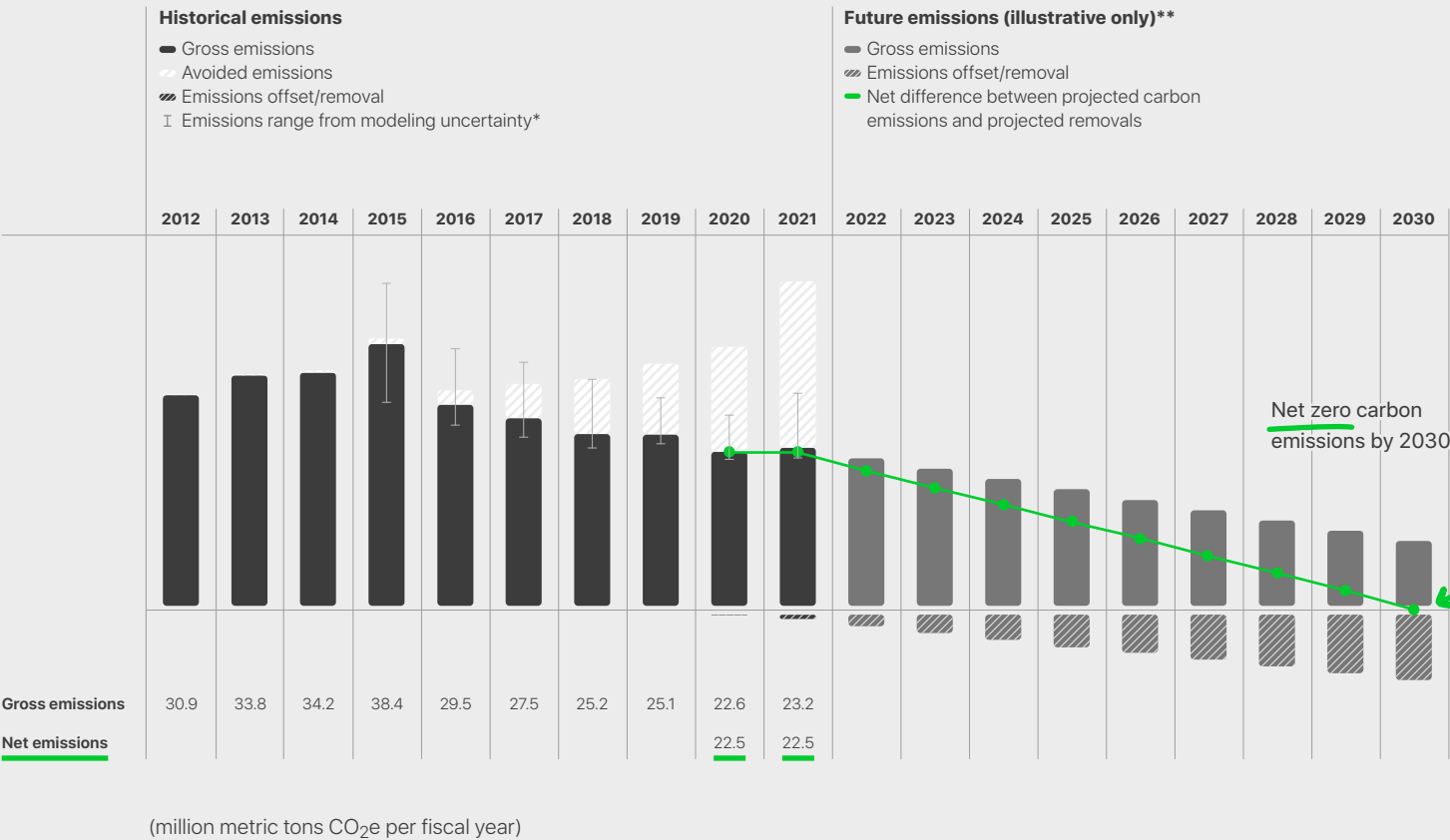
\* Low-carbon materials represents emissions savings from transitioning to recycled materials in our products, or use of low-carbon aluminum, as described on page 17.

\*\* Net carbon emissions represents our total gross footprint minus carbon offsets applied to each category. Percentages shown for each emissions category represent the share of Apple's gross footprint. Totals add up to more than 100 percent, due to rounding.



# Progress toward net zero

Our plan to become carbon neutral by 2030 centers around a 75 percent emissions reduction target, compared with our fiscal year 2015 footprint. We plan to address residual emissions through carbon removals. Already, we’ve reduced our gross carbon footprint<sup>6</sup> by 40 percent since fiscal year 2015. However, in recent years we have seen our footprint level out with the substantial growth of our business. We continue to scale the projects underpinning our 2030 Climate Roadmap, in order to yield further reductions in the medium term.



\* Error bars: We’re continuously refining our methodology to improve our carbon footprint estimate. However, there is 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.

## We're carbon neutral for our corporate emissions

Since April 2020, we have been carbon neutral for our corporate emissions, including direct emissions (scope 1), electricity-related emissions (scope 2), as well as emissions from business travel and employee commute (scope 3). 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, even as our business grew. We've addressed the remaining scope 1 and 2 emissions, as well as scope 3 emissions from business travel and employee commute (for a total of 167,000 metric tons) by securing high-quality carbon credits from projects that protect and restore forests, wetlands, and grasslands.

## How we measure our footprint

We calculate our comprehensive carbon footprint using 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 verified by a third party each year to help ensure accuracy and transparency (see [Appendix C](#)). Improving the accuracy of our carbon footprint is an ongoing process — as we learn more, we revise our roadmap to incorporate new information. And, as our data improves, we will continue to refine our emissions accounting for previous years, as well as our projections.

## We're evaluating climate risks

We've 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. And we assessed geographies around the world to capture both corporate and supplier activities. The analysis highlighted how our renewable energy program and carbon neutrality goals could contribute to our corporate resiliency. It also provided environmental data that we consider in developing business strategies, including considerations around supply chain diversification, as well as safeguarding our global assets.



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 [2021 CDP submission \(PDF\)](#).

We're **CARBON NEUTRAL** for our corporate operations, having reduced scope 1 and 2 emissions by **67%** since 2011



Offices



Retail stores



Data centers



Employee commute



Business travel

# Low-carbon design

Apple sells hundreds of millions of products each year. Each product represents an opportunity to reduce our carbon footprint — small changes can yield enormous results. Our carbon footprint helps us identify opportunities to reduce the carbon intensity of our product designs. We are working to transition to materials from recycled sources and those made using low-carbon energy. We prioritize the materials and components that account for significant portions of our carbon emissions, so that the choices we make product-by-product can scale toward reducing our overall footprint.

## Improving material and manufacturing efficiency

Less means more when it comes to our approach to materials and how we process them. By reducing the amount of materials used to make our products, we reduce the emissions from transporting and processing these materials, and limit the amount of scrap generated along the way. And as we progress toward our 2030 carbon neutrality goal, we continue to investigate new materials and new ways to manufacture efficiently.

In 2021, we continued to improve the carbon efficiency of the integrated circuits we use in our products — components we've prioritized because they are carbon-intensive. Integrated circuits perform vital functions in electronic devices, yet require significant energy to manufacture. With the Apple M1 chip, we've created a more efficiently designed chip built specifically for Mac devices. For example, switching to the Apple M1 chip for the 13-inch MacBook Pro reduced the energy needed to manufacture and use the device, driving down the product's carbon footprint by over 8 percent.



To minimize the carbon footprint of our products, we seek to create less waste in the processing of materials, reduce machining time and the associated energy used, more efficiently transform material into the shapes we need, and maximize recovery and reprocessing of manufacturing scrap.

To take these efforts one step further, in October 2021, Apple became the first public company to join the Sustainable Semiconductor Technologies and Systems research program of Imec, a world-leading research and innovation hub in nanoelectronics and digital technologies. 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 continue to investigate new opportunities for improved efficiency across our product manufacturing processes. In 2021, we invested in research and development projects aimed at creating less waste in the processing of materials, reducing machining time and the associated energy used, more efficiently transforming material into the shapes we need, and maximizing recovery and reprocessing of manufacturing scrap. Once successfully developed, we plan to deploy these improved processes at scale at our supplier facilities.

## imec

Apple was the first public partner to join the new Imec research program aimed at reducing the carbon footprint of the entire semiconductor value chain.



## Using recycled materials to lower our product footprint

Material 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 materials and components that make up a large part of our carbon footprint to move us closer to our goal of product carbon neutrality.

We've seen clear progress with aluminum, which in 2015 represented over a quarter of our product manufacturing footprint. We've continued to expand our use of 100 percent recycled aluminum in the enclosures of a number of products: All iPad models in our lineup now use 100 percent recycled aluminum in their enclosures — joining Apple Watch Series 7, Apple Watch SE, MacBook Air, Mac mini, and the 14-inch and 16-inch MacBook Pro devices. For products released in 2021 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. These changes alone have decreased the carbon emissions associated with our use of aluminum by 68 percent since 2015.

We're also making progress in how we source recycled aluminum. The material we derive from our manufacturing scrap provides high-quality aluminum with fewer associated carbon emissions than newly mined materials. And we're expanding our sourcing to include post-consumer recycled aluminum from building and construction scrap that meets the high standards our products require. These emissions reduction efforts have driven down our aluminum-related emissions to less than 9 percent of our product manufacturing footprint, compared with 27 percent in 2015.



# 68%

By switching to recycled and low-carbon aluminum, our carbon emissions associated with aluminum have decreased by 68 percent since 2015.



Read more about how we plan to address emissions from our customers' use of our Apple products on [page 26](#).

All these products contain **100% RECYCLED** aluminum enclosures



## Driving product energy efficiency

We approach low carbon product design by working to enhance performance, while pursuing energy efficiency. Product energy use accounts for 22 percent of our gross carbon footprint — and 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 software operates to the power requirements of individual components.

With each generation of products, we make improvements to energy efficiency. The transition to Apple silicon on Mac devices, for example, continues to drive these improvements — the Mac mini consumes up to 60 percent less energy while in active use than the previous generation.<sup>7</sup> We've cut the product energy use across all major product lines by more than 70 percent since 2008 through our energy efficiency improvements.<sup>8</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 fiscal year 2021, over 99 percent of Apple eligible products, by revenue, received an ENERGY STAR rating for superior energy efficiency.<sup>9</sup> And over 99 percent of Apple eligible products, by revenue, met the requirements for EPEAT registration.<sup>10</sup> EPEAT, another environmental rating system for electronic products, considers energy efficiency as well as a number of other environmental criteria.

### Product energy efficiency



Over the course of a year, Mac Studio will use up to **1000 KILOWATT-HOURS** less energy than a high-end PC desktop.<sup>11</sup>



Mac mini uses up to **60 PERCENT** less energy while in active use than the previous generation, thanks to the use of Apple silicon.<sup>12</sup>



iPhone 13 uses **54 PERCENT** less energy than the U.S. Department of Energy requirements for battery charger systems.<sup>13</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, which benefits the communities where our suppliers operate: Drawing less energy from electrical grids — many of which still rely heavily on fossil fuels — helps reduce local air pollution and improve air quality for nearby communities.

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

Finding ways to avoid using energy in the first place is the central focus of our energy efficiency program. We consider natural gas and electricity usage at each site — our offices, data centers, R&D facilities, and retail stores — 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 ensure that our facilities are utilized efficiently and productively.

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, emphasizing energy use reduction and operational efficiency.

For example, we conducted a comprehensive retrocommissioning of one section of our campus in Cupertino, California, over the past several years. This effort was a partnership between our Apple Energy and Controls teams with significant support from the local energy utility. In the site audit, we uncovered several opportunities for energy efficiency, including optimizing HVAC scheduling and start sequences, and improving outside air economizer operation. These adjustments resulted in energy savings of over 670,000 kilowatt-hours per year, with a simple payback of just under four months.

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.

We further improved energy efficiency at data centers by developing a specification requiring our servers to be powered by high-efficiency power supplies — exceeding even the efficiency requirements for ENERGY STAR certification. We deployed these high-performance power supplies to hundreds of thousands of servers in 2021, resulting in over 4 million kilowatt-hours per year in energy savings.

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.

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.



## 15.7M

We reduced Apple's facilities energy use by 15.7 million kilowatt-hours through efficiency efforts implemented in fiscal year 2021.

In fiscal year 2021, our energy efficiency program avoided an additional 15.7 million kilowatt-hours of electricity and 27,000 therms of natural gas per year through adjustments made to 7.1 million square feet of new and existing buildings. Together, these new initiatives reduced total energy use by 7 percent in targeted buildings and will avoid an additional 6,100 metric tons of CO<sub>2</sub>e per year. Combined with ongoing energy savings from past years, we are now cumulatively saving over 60,000 metric tons of CO<sub>2</sub>e in fiscal year 2021. In addition to these savings, Apple further reduced its energy use by adjusting lighting and climate controls during the periods of reduced occupancy resulting from the COVID-19 pandemic.<sup>14</sup>

## A more energy-efficient supply chain

The energy used to manufacture Apple products accounts for 70 percent of Apple's gross carbon footprint. To address this impact, we're collaborating closely with our suppliers to prioritize energy reductions and efforts to shift to renewable energy sources.

We launched our Supplier Energy Efficiency Program in 2015 with the goal of helping suppliers optimize their facilities and operations to use as little energy as possible. Finding energy efficiencies reduces the energy intensity of manufacturing, which translates to reduced direct carbon emissions. We provide guidance designed to help suppliers uncover opportunities for energy efficiency. We also assist them with assessments and technical support where appropriate. Typical projects may include replacing outdated or inefficient heating, cooling, and lighting systems; repairing compressed air leaks; and recovering waste heat.

We've focused our efforts on the impact of some of our most popular products. One example is our three-year initiative to improve the efficiency of iPhone manufacturing. Collectively, the six participating supplier facilities achieved their goal of 20 percent reductions by the end of 2020 compared with the 2017 baseline. In addition, final assembly sites for AirPods, iPad, and Apple Watch all launched multiyear energy reduction initiatives in 2020.

While the program has resulted in significant energy savings since launching, scaling it across Apple's entire manufacturing supply chain remains a challenge, because of the level of support we provide to individual suppliers. To address this challenge, we've focused on improving measurement and data collection, capacity building, and access to funding opportunities.

Reducing energy use begins with measuring and understanding the carbon footprint of one's 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.<sup>15</sup> By understanding the sources and quantity of a supplier's carbon emissions, we are able to provide resources to support the supplier in creating an action plan with the goal of becoming optimally energy efficient.

We also provide broad support to suppliers through workshops and trainings, including multiday classroom trainings for employees, resulting in plans for energy efficiency measures to be implemented at their respective facilities. 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. To date, US\$8.5 million of investments have been made in supplier efficiency projects using the Asia Green Fund.

Working with our suppliers to reduce their energy consumption, we avoided more than 1.15 million metric tons of carbon from manufacturing Apple products in fiscal year 2021. That year, more than 100 supplier facilities participated in our Supplier Energy Efficiency Program, actively tracking and reporting on more than 2000 projects — a 39 percent increase since the prior year.



# 1.15M

Suppliers in our Supplier Energy Efficiency program avoided more than 1,150,000 annualized metric tons of supply chain carbon emissions in fiscal year 2021.



# Renewable electricity



Since 2018, Apple has sourced all of the electricity for its facilities from 100 percent renewable energy. The 200-megawatt Montague wind farm in Oregon is one of Apple's largest projects and supports our Prineville data center.

**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, stronger economies, and lower carbon emissions.**

Apple has generated or sourced 100 percent renewable electricity for its corporate operations since 2018 and we are now committed to transitioning our entire supply chain to 100 percent renewable electricity as well.

As we grow, we continue to bring new renewable electricity projects online around the world. In the long term, 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 those of our suppliers, with greater control over energy supply and reduced exposure to cost fluctuations. And by adopting

green technologies, we are in a unique position with our suppliers to drive environmental action and support our goal of carbon neutrality by 2030.

Our approach is twofold. We find ways to consume energy more efficiently, and we seek out opportunities to transition to renewable sources that support our goal of 100 percent renewable electricity across our operations and supply chain.

With the renewable energy we source, we aim to achieve positive impacts. Before we engage in an energy project, we evaluate it with a holistic view of its potential environmental and social impact. Whenever 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 accountability standards to verify our clean energy projects.

## Maintaining 100% renewable electricity for Apple facilities

Our retail stores, data centers, and offices around the world currently source 100 percent renewable electricity. We are 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

We focus on creating new renewable electricity projects. New 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 over 90 percent of the renewable electricity our facilities use — around 1.5 gigawatts currently in use.

We define "Apple-created" projects to include:

- **Direct ownership**

(~9 percent of Apple-created projects)

We build our own projects, including solar, biogas fuel cells, and low-impact hydro projects, where feasible, to provide renewable electricity.

- **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**

(~87 percent of Apple-created projects)<sup>16</sup>

We sign long-term contracts for renewable electricity when needed. Through 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.

To cover any gaps in our renewable energy needs beyond what's provided by Apple-created projects (about 4.5 percent of our total corporate load in fiscal year 2021), we directly purchase renewable electricity through available utility green energy programs. Colocation facility vendors also supply about 3.5 percent of our total load of renewable energy. And in certain situations, we purchase RECs — for example, when we need to cover usage over the short term, before a renewable energy project comes online or when there's a lack of availability of renewable energy projects in-region. These RECs, which account for about 2 percent of our total load, must be tied to recently constructed projects, be Green-e Energy certified, where available, and share the same power grid as the Apple facility they support. These purchases are subject to the same standards as our Apple-created renewables. Appendix C provides additional details on Apple's renewable energy solutions.

### Supporting social impact

Power for Impact™, the program we launched in 2019, continues to 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 10 renewable electricity projects around the world, including in the Philippines, Thailand, and South Africa. For more information, [read more about Power for Impact on page 27](#).



# 90%

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

### 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.

In fiscal year 2021, a Denmark-based wind energy project that Apple had supported became operational. It features two 200-meter-tall turbines, the world's largest, that are expected to produce 62 gigawatt-hours each year — enough to power almost 20,000 homes. The power produced onsite will support Apple's data center in Viborg, with all surplus energy going into the Danish grid. The project will also act as a test site for powerful offshore wind turbines. Apple's long-term virtual power purchase agreement provides the revenue certainty that made the project financially feasible.

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 storage project — an industry-leading grid-scale energy storage project capable of storing 240 megawatt-hours of electricity — came online in fiscal year 2021. This project supports our 130-megawatt California Flats solar farm that provides all of our renewable energy in California, by storing excess energy generated during the day and deploying it when it is 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.



Apple helped create a new utility-scale battery storage project that supports the 130-megawatt California Flats solar farm, which provides renewable energy for our California facilities.



## Transitioning our suppliers to renewable electricity

Electricity usage in our supply chain is the single greatest contributor to our carbon emissions. That's why our efforts to facilitate the transition of our entire supply chain to renewable electricity are essential to reaching our 2030 goal of carbon neutrality. While this is a global issue, the impacts are experienced locally. Bringing renewable energy online with our suppliers and displacing fossil fuels helps decarbonize power grids and improve local air quality. This work presents challenges: technical and regulatory barriers, capital requirements, and lack of awareness on where to find and access high-quality and cost-effective solutions.

We continue to experience tremendous progress toward our goal of transitioning our manufacturing supply chain to 100 percent renewable electricity by 2030. As of March 2022, 213 manufacturing partners in 25 countries have committed to 100 percent renewable energy for Apple production. We've targeted carbon-intensive suppliers or those that represent a large portion of Apple's direct spend with suppliers. But the platform we've built can support suppliers of any size. To that end, both large and small suppliers have committed to 100 percent renewable electricity for Apple production. Over 70 percent of companies on Apple's Supplier List — those suppliers that make up 98 percent of Apple's direct spend for materials, manufacturing, and assembly of our products worldwide — have committed to 100 percent renewable electricity. In addition, many other smaller suppliers have also made these commitments. In total, the Supplier Clean Energy Program now has almost 16 gigawatts of clean energy commitments, of which nearly two-thirds is already operational.

To cover emissions even further upstream, we have already invested directly in nearly 500 megawatts of solar and wind projects in China and Japan — and we plan to continue to invest in renewable energy projects to cover the load of suppliers we cannot reach directly. Beyond 2030, we believe that even our upstream suppliers will be in a position to transition to renewable electricity.

In fiscal year 2021, the 10.3 gigawatts of renewable energy already online in Apple's supply chain generated 18.1 million megawatt-hours of clean energy, avoiding 13.9 million metric tons of carbon emissions — a 62 percent increase over fiscal year 2020.<sup>17</sup>

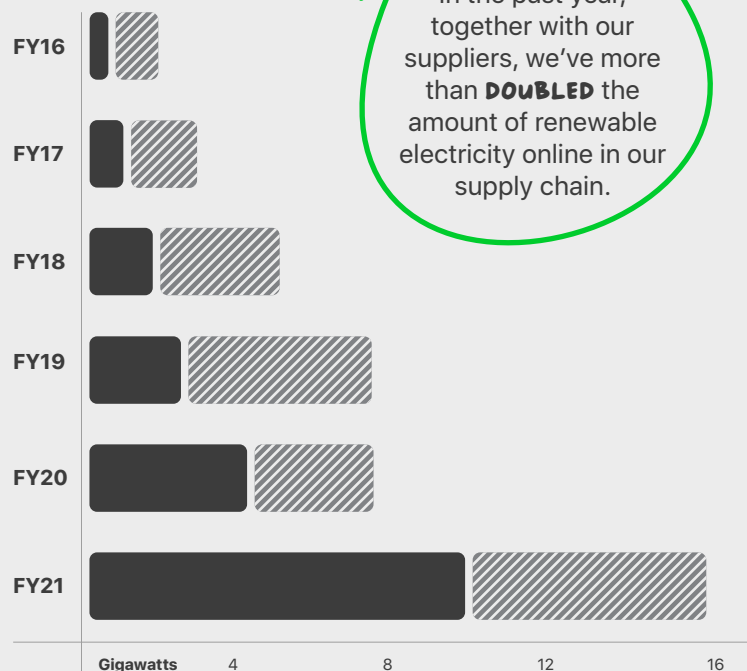


For more information about which suppliers have joined Apple in transitioning to 100% clean energy, read our [2022 Supplier Clean Energy Update \(PDF\)](#).

### Supply chain clean energy progress

Renewable electricity operational and committed in gigawatts (GW)

■ Operational  
▨ Committed





Our Supplier Energy Efficiency and Supplier Clean Energy Programs work hand in hand to reduce the energy used in our supply chain and help transition the remaining electricity to renewable sources. We measure progress and account for emissions generated in our supply chain as part of our carbon footprint. But we also know that we can achieve even more significant climate impact by providing a model for other companies to follow with their suppliers, helping to reduce emissions beyond our industry.

Our experience in transitioning our facilities to 100 percent renewable electricity gives us knowledge we can share. And we help break down barriers through engagement, innovative funding structures, and advocacy of clean energy-friendly policies.

### Galvanizing internal champions

Apple employees are passionate about the environment and driven to help meet our 2030 carbon neutrality goal. We're empowering supplier-facing employees with the tools they need to support this goal and speed a supplier's transition

to renewable electricity. It starts with data and transparency. We track the progress 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. We've also created internal trainings and crafted a simple engagement process, backed by resources for both Apple employees and our 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. We introduce suppliers to resources and training materials with country-specific information to guide them in their transition to renewables. These tools are available through our Supplier Clean Energy Portal. 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.



New clean energy commitments from suppliers help support Apple's goal to be carbon neutral for its supply chain and products by 2030. Corning Incorporated utilizes clean power from Duke Energy Sustainable Solutions' Conetoe, North Carolina, solar installation as part of its commitment to power its Apple operations with 100 percent renewable electricity.

Long-standing energy structures can make it difficult to bring new renewable energy online in some regions, prompting some of our suppliers to maximize proven renewable energy solutions — like onsite solar installations. Others have leveraged new purchasing methods, created renewable energy businesses, or even participated in some of the world's largest and most innovative renewable energy deals.

### Expanding access to renewable electricity

The transition to renewables means helping our suppliers find energy solutions and make the right investments to address their specific needs. When we face barriers to accessing cost-effective clean energy, we innovate. One such innovation, the China Clean Energy Fund, enables Apple and our suppliers to invest in clean energy. As of March 2022, the fund has invested in 465 megawatts of renewable electricity projects. 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

Government policies and rules can present some of the largest barriers to transitioning to renewables. We lend our voice and stand with other companies and NGOs to break down policy barriers to achieve thriving clean energy markets with, for example, enhanced grid resiliency and greater energy innovation. Across regions where our suppliers operate, we engage with policymakers to support renewable energy that is cost-effective, accessible to companies, and sourced from high-quality projects with a material impact on local markets. We recognize that to transition to renewable energy effectively, clean energy investments need to make financial sense. However, carbon-intensive energy sources, like coal and gas, often have an unfair price advantage because of explicit subsidies and the ignored costs of externalities — like air pollution and carbon emissions. So we are 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're particularly focused on encouraging clean energy policies in countries where we and our suppliers operate. In Vietnam, we continue to encourage the government to adopt ambitious targets for renewable energy development in Power Development Plan 8, and to enshrine net zero goals

announced by the government into national legislation. We support a timely rollout of a cost-competitive direct power purchase agreement (DPPA) pilot program there. We've also supported policies in South Korea to develop renewable corporate procurement options such as power purchase agreements (PPA), green pricing auctions, and RECs that will be impactful and cost-effective. In Japan, we continue to support expansion of corporate procurement options such as more cost-competitive offsite PPAs, development of a virtual PPA system, as well as improved transparency and corporate access to procure Non-Fossil Certificates. We've also called for enhanced climate ambition and renewable energy deployment in the nation's Basic Energy Plan and Nationally Determined Contribution (Japan's plan to reduce emissions in furtherance of the Paris Agreement), and for decarbonization policies to prioritize support for new technologies that can fully account for reducing emissions across their life cycle.

## Product use

The electricity our customers use to charge their Apple devices represents 22 percent of Apple's gross carbon footprint. While increased energy efficiency helps drive down emissions from product use, we are also developing a strategy 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 to renewable energy. Over the last decade, as more companies have adopted 100 percent renewable electricity targets aimed at matching the electricity used with the renewable energy generated on an annual basis, it has become increasingly clear that not all renewable electricity is created equal from a carbon reduction and social impact standpoint. As we address emissions tied to the electricity our products use globally, our guiding principles focus on (1) exploring innovative solutions to minimize carbon emissions from product use, including energy efficiency; (2) building renewable energy projects aimed at maximizing carbon reductions and social impact; and (3) engaging with our customers to educate and provide opportunities to support the decarbonization of the grid.

We are continuing to develop our strategy and we will provide updates on our progress.

# Power for Impact

Access to clean energy sources not only benefits the climate, it can create opportunities within communities. This is the idea driving Power for Impact, an initiative we launched in 2019 to provide under-resourced communities with renewable power while supporting economic growth and social impact.

The program funds mutually beneficial clean energy projects, giving local communities and organizations access to cost-effective energy while Apple retains the environmental attributes of each project.

Apple is supporting 10 new renewable projects around the world through its Power for Impact program:

**Colombia:** Apple is helping to bring online a rooftop solar power system at the Santa Ana Hospital Infantil. 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 under-resourced youth, will help the group advance its sustainable development goals.

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

**Nigeria:** Apple will support the development of a solar power system to serve a primary healthcare center in the state of Ondo, as well as 200 households in the surrounding region.

**Philippines:** Apple will help fund an educational institution that provides scholarships to high-achieving, under-resourced students by offsetting electricity expenses through a new rooftop solar installation in Central Luzon.

**South Africa:** Apple is bringing electricity to over 3500 households that previously lacked access. The company will also help reduce electricity costs for the Pioneer School for the Visually Impaired by funding rooftop solar installations at three schools across South Africa.



In South Africa, new solar installations are bringing 3500 households access to electricity, as well as employment.

**Thailand:** Apple is participating in an effort 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 are increasing local renewable energy production and battery storage to help ensure reliable access to electricity.

**United States:** Apple is working with the Oceti Sakowin Power Authority, formed by six Sioux tribes to jointly develop tribal renewable energy resources by financing, developing, constructing, and operating power generation and transmission facilities for the wholesale market. This project is on track to create a large-scale wind power development in the Midwest.

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

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.

# 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, as well as emissions abatement, and switching to low-carbon fuels or modes of transport.

## Rethinking how aluminum is made

In May 2018, Apple 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.

As part of Apple's commitment to reducing the environmental impact of our products through innovation, we helped accelerate the development of this technology — by facilitating the joint partnership and providing initial funding and ongoing technical support. In spring 2022, Elysis announced it had built out a commercial-scale prototype within its R&D center in Quebec — enabling Elysis to begin producing commercial-purity primary aluminum at scale. This milestone for the project prompted Apple to make an additional purchase of the aluminum, with plans to use it for iPhone SE. In 2019, Apple purchased the first-ever commercial batch of aluminum resulting from the joint venture, using it in the production of the 16-inch MacBook Pro.<sup>18</sup>

## Addressing fluorinated greenhouse gas emissions

Many components essential to products like ours, including integrated circuit chips and display panels, currently rely on manufacturing processes that use fluorinated gases. We're partnering closely with key manufacturers to prevent these gases from being released into the atmosphere, where they have high global warming potential. First, we encourage suppliers to optimize manufacturing processes — reducing the use of fluorinated greenhouse gases. Then we ask suppliers to deploy abatement technologies — curtailing the release of emissions from the gases that remain.

## Transporting products

Each year, we ship hundreds of millions of products from our manufacturers to our consumers. We're shifting whenever possible toward less carbon-intensive shipping modes, such as rail and ocean. And we're seeking out technical innovations, including alternative fuels and electric vehicles. In fiscal year 2021, Apple avoided 180,000 metric tons of CO<sub>2e</sub> by shifting the mode of transport and reducing product weight through the removal of the power adapter from iPhone devices.

In Europe, we're working with carriers who are advancing "carbon neutral delivery" 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.

At COP26, Apple joined the "First Movers Coalition," a partnership between the World Economic Forum and the U.S. Office of the Special Presidential Envoy for Climate to maintain our commitment to becoming a carbon-neutral company by 2030. The First Movers Coalition is a new platform for companies to harness their purchasing power and supply chains to create early markets for innovative clean energy technologies that are key for tackling the climate crisis — with a focus on sectors central to global decarbonization efforts, including aviation.



# Carbon removal

The focus of our 2030 Climate Roadmap is to reduce our emissions by 75 percent compared with 2015 levels. In addition, we will need to scale up carbon removal strategies to address the emissions that we can't yet avoid. This is consistent with the Intergovernmental Panel on Climate Change, which notes that all pathways limiting warming to 1.5°C require carbon removal for unavoidable emissions.<sup>19</sup>

Carbon removal projects take carbon dioxide out of the atmosphere and store it in long-term carbon sinks — whether natural, like forests, wetlands, and grasslands, or geological, in formations such as saline aquifers or other suitable geological sites. We are exploring a range of carbon removal solutions to meet our 2030 carbon neutrality goal. 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.

## We're investing in nature

The earth's trees, plants, and soils provide some of the greatest capabilities to remove carbon from the atmosphere. Carbon credits provide an opportunity to invest in these solutions, but carbon markets have not yet scaled to meet the recent increases in demand for these credits. That's why we are expanding nature-based investments to support our goal of achieving carbon neutrality across our full product life cycle by 2030. By investing in forests, grasslands, and wetlands, we support proven, scalable approaches to carbon removal — while supporting ecosystems and the livelihoods of local communities.

We believe that this can be done while achieving a financial and environmental return on our investment. That is why we partnered with Conservation International and Goldman Sachs to launch the Restore Fund. This innovative fund seeks to blend responsible forestry practices with carbon removal: We're working with forestry managers to create sustainably managed forests that optimize for both carbon and wood production,

creating revenue from timber, and generating high-quality carbon credits. Apple will invest up to \$200 million in projects that aim to remove carbon from the atmosphere and store it, all while meeting clear social and environmental impact criteria and offering a financial return. In its pilot phase, the Restore Fund has a goal of removing at least 1 million metric tons of carbon dioxide per year.

Since announcing the Restore Fund, together with Conservation International and Goldman Sachs, we have screened over a hundred projects to identify those with the most potential for restoration that also relieve pressure on existing natural forests. The projects we've identified seek to maximize environmental impact, including carbon, hydrology, and habitat restoration. We've also established strong relationships with forestry managers working on sustainable forestry around the world, who will be responsible for managing the projects. Finally, we're exploring innovative approaches to track the progress of our projects, such as the use of satellites to measure and verify the carbon removal impacts of the Restore Fund. And we work with independent auditors to help ensure the integrity of these projects.

The projects in the Restore Fund will align with international standards developed by organizations such as the Verified Carbon Standard (VCS), the Climate, Community & Biodiversity Standard (CCBS), and the Forest Stewardship Council (FSC). Use of these international standards help ensure that the carbon stored in forests is being measured and reported to the highest standards, and that projects have the most up-to-date safeguards in place to mitigate risks to project performance. The projects we select will also have a meaningful positive impact on the livelihoods of local communities by bringing economic opportunities to often underserved rural economies. We will continue to focus on projects that protect lands with high conservation values.

By 2030, we aim to use initiatives like the Restore Fund to remove enough carbon dioxide from the atmosphere to cover the direct emissions across our value chain that we're unable to avoid directly. This fund is unique because it aims to change carbon removal from a cost to a 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 in the future — encouraging capital investment in carbon removal around the globe.



# 1M

The Apple Restore Fund aims to remove over 1 million metric tons of carbon per year by investing in nature-based solutions.

## 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 every solution at our disposal, including 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.

Since April 2020 we have been carbon neutral for our corporate emissions. We started by reducing our corporate emissions through the use of 100 percent renewable electricity and energy efficiency efforts at our facilities. However, there are some activities where emissions remain difficult to avoid — including the use of natural gas in some of our buildings or the emissions from business air travel and employee commute. As the Restore Fund projects come online, we've partnered with Conservation International to develop and invest in projects that generate carbon credits to cover our remaining corporate emissions. These projects include the protection and restoration of a 27,000-acre mangrove forest in Colombia, which is expected to sequester 1 million metric tons of CO<sub>2</sub> over the project's lifetime; the restoration of degraded savannas in the Chyulu Hills region of Kenya; and through investment in a "micro-forestry" company that partners with and empowers tens of thousands of marginalized farmers to earn a living from sustainable tree farming. We retired 167,000 metric tons of carbon credits from the [Chyulu Hills project](#) in Kenya to maintain carbon neutrality for our corporate emissions in fiscal year 2021.

While we did more than ever to reduce our emissions from our product life cycle in fiscal year 2021, our business also performed well, resulting in a small increase in our carbon footprint. To make up for the increase in direct emissions,



We're protecting and restoring 27,000 acres of mangrove forests in Colombia. Mangroves play an important role in removing carbon from the atmosphere, as they can store up to ten times more carbon per acre than a typical terrestrial forest.

we retired credits from the Chyulu Hills project described above, and purchased carbon credits from two additional projects to offset a total of 500,000 metric tons of direct emissions across our value chain. The [first project](#), a REDD+ coastal conservation project in Guatemala, protects and conserves forests from deforestation and degradation. The [second project](#) aims to establish forests on about 46,000 hectares of barren land that is not otherwise in use across seven counties in the Guizhou Province of China. Both projects are certified to the same high standards that we require for projects in the Restore Fund, including VCS and CCBS.



Learn more about the [nature-based solutions in Kenya and Colombia](#) that we've developed in partnership with Conservation International.

# Advocating for strong climate policies

“We’re determined to do our part to fight climate change & believe transparency is an important part of this. Apple has publicly disclosed our greenhouse gas emissions for a decade, and we believe other companies should do the same,” wrote Lisa P. Jackson, vice president of Environment, Policy and Social Initiatives at Apple, in a tweet on April 13, 2021.

This 38-word tweet marked a milestone with a large, public U.S. company calling for mandatory disclosures of global greenhouse gases across all emissions scopes. The statement also focused the discussion within industry and government toward greater transparency, and increased attention by regulators.

In May, Apple also became the first company to voice support for the enactment of the Clean Energy Standard (CES) that would decarbonize the power grid by 2035. In a discussion with Secretary of Energy Jennifer Granholm, Jackson stressed that the opportunities that come with decarbonization must be inclusive: “Government has to lead here when it comes to making sure that there’s economic equity in the policies that are being promoted.”

And at the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow, Scotland, in 2021, Apple called for bold government action on climate change, joining several new initiatives, including the First Movers Coalition, the Forest Investor Club, and the Clean Energy Demand Initiative.

Apple’s climate policy advocacy centers on the following principles, each of which governs Apple’s public policy positions on climate:

## **Set strong targets based on science**

Policymakers should set national or regional targets that seek to limit warming to no more than 1.5°C. These goals need to include interim targets and mechanisms to enforce short-term accountability. To meet these targets requires a price on carbon and parallel participation in international policy negotiation.

## **Disclose comprehensive emissions**

Measurement and disclosure are essential tools to reduce emissions. Rules governing the release of information covering all scopes of emissions, direct and indirect, across the value chain will help establish best practices and promote competition.

## **Create sector-specific policies**

Limiting warming to 1.5°C is a goal that requires actions across the entire economy. Policies need to address sector-specific needs and facilitate the transition to decarbonize industries where there are challenges or there is a need for infrastructure to support the goal.

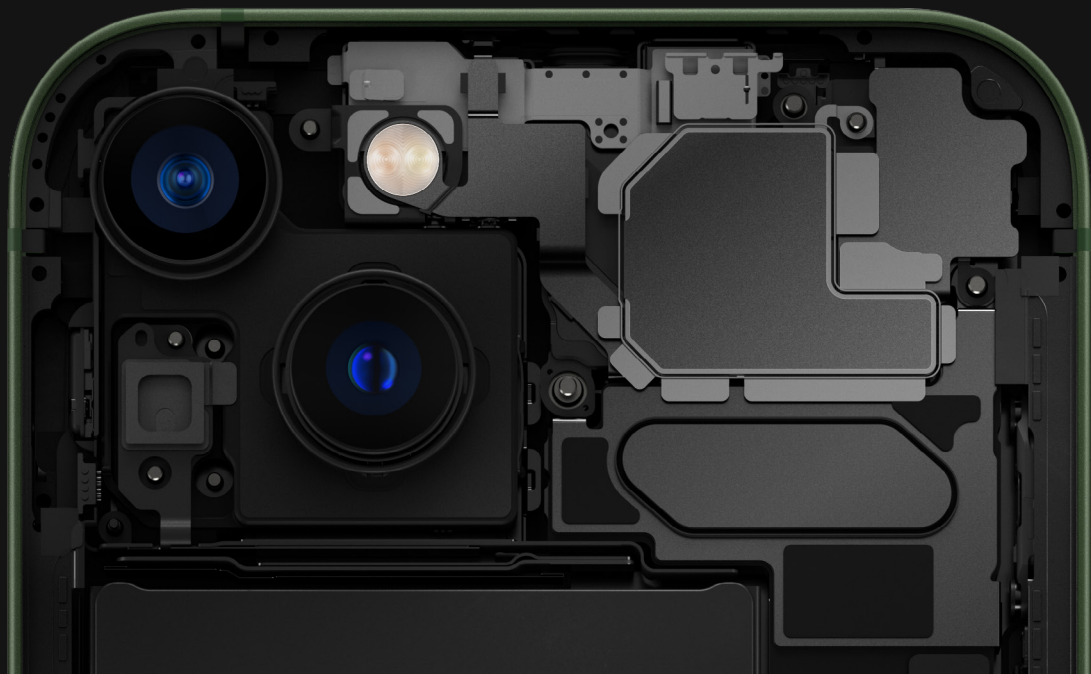
## **Support a green economy for all**

Climate policies should support the development of the new green economy, with 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.



Apple’s vice president of Environment, Policy and Social Initiatives, Lisa Jackson, alongside President Joe Biden and other leaders from around the world at the 2021 United Nations Climate Change Conference. Photo credit: World Economic Forum.

# Resources





# Goals and progress

We're committed to making the most of the resources we use. This commitment includes our goal to one day make our products using only recycled and renewable materials, while we continue to source materials responsibly, whether from primary, recycled, or renewable sources. And the innovations we're pursuing to build long-lasting products and create improved recycling technologies play an important role. Each of these efforts helps conserve the earth's finite resources. And they also support our objective to achieve carbon neutrality by 2030, by helping reduce the carbon footprint of our products.

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



8 products released in fiscal year 2021 with 20 percent or more recycled content



In fiscal year 2021, we more than doubled our use of recycled tungsten, rare earth elements, and cobalt — and introduced certified recycled gold for the first time in an Apple product



Our newest recycling machine, Taz, brings shredding to a new level

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



All established final assembly and sub-assembly sites for Apple Watch Series 7 send zero waste to landfill<sup>1</sup>



Eliminate plastics in our packaging **by 2025**



75% less plastic in packaging used across product lines compared with 2015



No outer plastic wrap was used in iPhone 13 packaging



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



Our Prineville data center and 17 supplier facilities have been certified by Alliance for Water Stewardship for leading water management practices

# Our approach

Natural resources make our work possible — and we take responsibility for how we source, use, and recycle the materials we rely on to create our products. As a starting point, this means sourcing responsibly, minimizing our freshwater use, and eliminating waste across our operations and those of our suppliers. But we're also seeking to redefine the overall resource footprint of our products. This requires broader engagement, through collaborations enabling the stewardship of shared resources.

Our goal is to one day make products using only responsibly sourced recycled and renewable materials. We aim to build durable, long-lasting products that make the best use of the resources required to make them. And, in collaboration with leading recyclers, we're developing recycling strategies of the future for the end of each product's life. Through these engagements, we can support research and take on industry-wide challenges.

Water is a vital resource that we rely on to manufacture products and run our offices, data centers, and stores. We take our stewardship responsibilities seriously in each community where we operate. This begins with optimizing how we use water, leveraging alternative and recycled sources of water, and managing our discharge responsibly. But our efforts go a step further. We're focused on working collectively with other companies, NGOs, and local governments to improve the health of the water basins, extending our efforts miles beyond our suppliers' facilities.

We're working to eliminate landfill waste. Reducing waste and increasing reuse and recycling is vital to conserve the world's resources. We aim to leave no waste behind in the communities in which we and our suppliers work, and to reduce the flow of waste to communities around the world that have disproportionately borne the burdens of waste disposal. Our progress is measured in how we decrease the amount of waste we create, innovate opportunities for reuse, and open up new opportunities to recycle in partnership with local businesses.

Progress on all of our goals relies on collaborative efforts. Through direct engagement with suppliers, NGOs, recyclers, community stakeholders, and other innovators, we can advance — and reduce our carbon and material footprint by doing more with less.

## Within resources, we focus on three main areas of impact



### Materials

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



### Water

Reducing water impacts in the manufacturing of our products, use of our services, and operation of our facilities. At the same time, transitioning to alternative sources, improving the quality of water we discharge, and protecting shared water resources.



### Zero waste

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

# Materials

We aim to have our products be part of thriving, responsible, circular supply chains — where finite material extraction is replaced by continual recycling and reuse. We're increasingly sourcing more of the materials we use from circular supply chains drawn from recycled content and renewable resources.

Our goal is to one day achieve independence from mined resources. Extracting materials continuously from the earth is a carbon-intensive process and can have an impact in the regions from which these resources are derived. We're making progress toward this goal with each generation of new products — and we're doing so without sacrificing quality and durability. We're also pursuing innovations in recycling to enhance material recovery and support circular supply chains for ourselves and others.

This goal represents a significant challenge and a great opportunity to reduce our footprint. We see this with each change we make, whether a technological innovation or new supply chain. These developments affect the people who interact with our products, influence the markets in which we operate, and create change for broader global communities. And our actions carry results that extend beyond our business.

We're using three different levers to reduce our footprint and achieve circularity:

## Sourcing and efficiency

Sourcing recycled and renewable materials for our products and packaging, and using these materials more efficiently. And we source materials responsibly, whether from primary, recycled, or renewable sources.

## Product longevity

Making 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 or reused.

## Product end-of-life

Enhancing product collection and recycling innovation, so we and others can use old devices as raw material sources for the future.

## How we pursue circularity for our products



# Sourcing and efficiency

## We've made progress in the past few years toward the goal of relying solely on recycled and renewable materials for our products and our packaging.

This has made it clear to markets that we place a value on the source of our materials, particularly those that do not deplete the earth's resources. Many partners have joined us in our efforts to move toward recycled and renewable content — and we look forward to engaging with many others as part of a broader global transition. And as we design new products, we continue to source materials responsibly and use materials more efficiently.

Last year, we made progress across materials — from expanding our use of recycled rare earth elements to designing cameras with recycled gold. In September, we introduced iPhone 13, with more certified recycled materials than any previous version of iPhone. This included recycled rare earth elements, tin, tungsten, aluminum, and for the first time, certified recycled gold. We also introduced 100 percent recycled plastic in the mesh of the ear cushions of AirPods Max, as well as 100 percent recycled aluminum enclosures on every single model in the iPad lineup.

Across our business, we released eight products with more than 20 percent recycled content.<sup>2</sup> The MacBook Air with M1 chip (2020) had the highest total — made with 44 percent recycled content device-wide, including 100 percent recycled aluminum in the enclosure. These and other innovations helped us increase our use of recycled or renewable content to 18 percent of all the material shipped in products in fiscal year 2021.<sup>3</sup> Suppliers have not only confirmed they sourced recycled material, but have also achieved third-party certification for more than half of this content, engaging organizations including UL LLC.

The amount of recycled material in our products is just one measure of our progress. We have prioritized 14 materials, evaluating their environmental, social, and supply impacts outlined in their Material Impact Profiles — including biodiversity factors. Some of the materials prioritized through this process include lower-mass but higher-impact materials. But by considering broader impacts, we know our efforts are going to the greatest benefit for the world. (See [page 39](#) for the full list of our priority materials.)

As we source these priority materials, the lack of readily available recycled and renewable options presents a key obstacle. Apple teams are doing the work required to make this transition — seeking out sources of recycled and renewable content, building new supply chains, and enhancing industry transparency and traceability.

And our teams, in collaboration with many diverse partners, are overcoming numerous challenges. Material performance is one example of this. With aluminum, we designed a new alloy that could incorporate recycled content and still meet our high performance standards. Traceability, the ability to trace materials back to their source, represents another challenge. For iPhone 13, we built our first exclusively recycled gold supply chain, which incorporated end-to-end traceability — unprecedented in the industry — allowing us to determine that only materials from recycled sources entered the supply chain. This effort allowed us to use 100 percent certified recycled gold in select components of iPhone for the first time.

Some of the barriers we face are within our control, but others are further outside of Apple's direct control and require collective action. When we work collaboratively with those in the material space to overcome these, the effects can be felt beyond our business. We're helping create supply chains to serve not only our footprint. We're working to promote the availability of quality materials across geographies, ideally at a competitive cost.



Apple is committed to setting the highest standards for responsible sourcing of 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](https://apple.com/supplier-responsibility).



As we work, we continue to uphold high standards. Our recycled and renewable material specifications follow standards set out by the international community. To ensure that these materials meet our standards, we require our suppliers to obtain third-party certifications.<sup>4</sup> This measure helps us 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>5</sup> As we introduce materials from new sources, we continue to evaluate each for its chemical safety. Through this process we're able to scale our use of materials that are better for the environment, while ensuring that they are also safe for use in our products.

This diligence carries over to sourcing. We obtain our resources responsibly, regardless of whether we are 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 Responsible Sourcing Standards 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 2021, 100 percent of the identified tin, tantalum, tungsten, gold, cobalt, and lithium smelters and refiners in Apple's supply chain participated in an independent third-party audit program. These audits are designed to assess and identify a broad range of risks, including social, environmental, human rights, and governance risks. 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 partnering with the smelters and refiners identified through this process, as well.



Since iPhone 12, we've been making our Taptic Engines with 100 percent recycled tungsten.

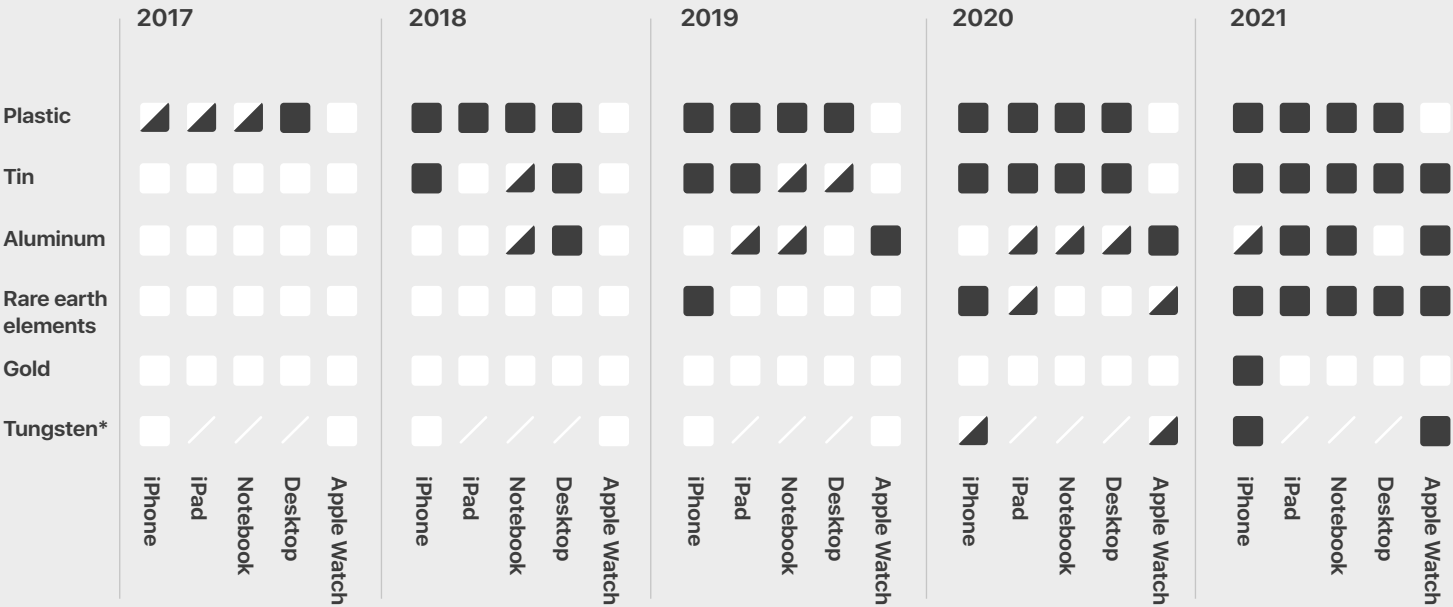
We continue to engage with multiple industry initiatives as we focus on responsible sourcing and recycled content. For example, Apple serves on the steering committee of the Responsible Minerals Initiative (RMI) — part of the Responsible Business Alliance — which is one of the most utilized resources for companies from a range of industries that are working to address responsible mineral sourcing issues in their supply chains. We also collaborate with the Aluminium Stewardship Initiative and other industry organizations working to promote transparency across supply chains and establish additional auditing and due diligence systems.

Our efforts to use recycled and renewable materials also support our climate goals, since our recycled content has a lower carbon footprint than primary materials. As we make this transition, we're working with policymakers to support international standards that enable the use of these materials globally.

# Our transition to certified recycled materials by product line

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

We've expanded use of **CERTIFIED RECYCLED MATERIALS** over time



Products launched by calendar year

\*Material is considered "not applicable" as it is found only in small quantities in dispersed module applications.

# Progress across our priority materials

In fiscal year 2021, 18 percent of the material we shipped in products came from recycled and renewable sources. This milestone is part of our broader strategy focusing on 14 materials that account for more than 90 percent of the total product mass shipped to our customers.


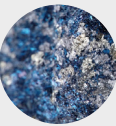
We’re making progress in transitioning these materials to recycled and renewable sources, while we continue to source materials responsibly. But, as we work, we’re encountering challenges in creating circular supply chains.




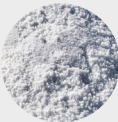


## Key challenges to developing circular supply chains:

<b>Technical properties</b> The properties of a recycled or renewable material may differ from the primary material, which needs to be accounted for during product design. 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.	<b>Availability and access</b> Supply of recycled and renewable materials can be constrained by the limited availability of scrap sources or production of renewable content. Even when supply exists in some locations around the world, these new suppliers need to be incorporated into supply chains for the material to be accessed.	<b>Transparency</b> Information about the source of materials — whether mined, recycled, or renewable — may not be readily available.	<b>Scale</b> 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.	<b>Regulatory barriers</b> Transboundary movement regulations — originally intended to create environmental protections — can inhibit the ability to recover materials from scrap, end-of-life products, and parts for use in new products. Read about our support of policies that enable movement of recovered materials to best-in-class recyclers in our feature on <a href="#">resource recovery policy</a> .
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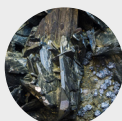
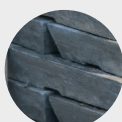
## How we source materials:

<b>Recycled content</b> 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’s confirmed by suppliers, but has not yet received third-party verification.	<b>Responsible sourcing</b> Apple’s Responsible Sourcing of Materials Standard covers all primary and recycled materials. Our standard aligns with leading international standards, including the United Nations Guiding Principles on Business and Human Rights and the Organisation for Economic Co-operation and Development’s Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas (OECD Due Diligence Guidance).
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Material	Key challenges	Progress
<b>Aluminum</b> 	Regulatory barriers Technical properties Scale	After creating a new aluminum alloy that incorporates recycled content without compromising product performance, we’re now scaling recycled content across products. All iPad models in our lineup now use 100 percent recycled aluminum in their enclosures — joining Apple Watch Series 7, Apple Watch SE, MacBook Air, Mac mini, and the 14-inch and 16-inch MacBook Pro devices. Our iPhone 13 model incorporates recycled aluminum content, as well. Since recycled aluminum can have 1/40th the carbon footprint of aluminum from primary sources, this supports our pursuit of low-carbon designs. <sup>6</sup> Overall in fiscal year 2021, 59 percent of the aluminum we shipped came from recycled sources, more than half of which was third-party certified. Our recycled material comes from several sources, including scrap from the manufacture of Apple products, and post-industrial sources. And as our supplier source recycled content, we encourage them to take the additional step to pursue third-party certifications for their recycled content.
<b>Cobalt</b> 	Regulatory barriers Availability and access Scale	In the fiscal year, 13 percent of the cobalt shipped in our products came from certified recycled sources on a mass-balance basis, including both post-industrial scrap and post-consumer scrap from end-of-life batteries. The cobalt from iPhone batteries disassembled by Daisy is being returned to the market. This more efficient and economical approach makes the material available to others beyond our supply chain.

Material	Key challenges	Progress
<b>Copper</b> 	Technical properties Supply chains Scale	Electronics applications require the use of high-performance copper. Yet even as challenges remain in identifying quality scrap sources, we are 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. <sup>7</sup> We also continue testing 100 percent recycled copper in other applications to evaluate its technical properties and performance across product lines. In our printed circuit boards (PCBs) — another key use of copper — we're driving material efficiency by using foils that require less of the material and incorporating recycled copper, primarily from old power line cables. We're working to apply this same approach to other modules.
<b>Glass</b> 	Technical properties Availability and access Scale	Recycled sources are scarce for the quality of glass 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 and incorporate recycled content into the material we use to produce glass parts. Following the precedent set in iPhone 12, the iPhone 13 continues to use recycled glass in multiple components. And by incorporating quality scrap in our applications, we also help keep glass at its highest-purity use for future recovery. As we collect and reuse scrap in new parts, we're also more efficient in how we use the material.
<b>Gold</b> 	Regulatory barriers Transparency	For the first time on any Apple product, iPhone 13 used 100 percent certified recycled gold, found in the plating of the main logic board and the wire in the front camera and the rear cameras. To obtain this from entirely recycled sources required pioneering industry-leading levels of traceability to build a gold supply chain of exclusively recycled content. Gold as a material is often recovered and recycled; as a result, gold from primary and secondary sources is often commingled. So it was only through this level of traceability that we could certify that our material came from 100 percent recycled sources. We've shown this is possible with iPhone 13 and are working to scale our use to other products as well.
<b>Lithium</b> 	Technical properties Availability and access Scale	We're working to shift toward recycled materials recovered from batteries as these options become more viable and economical. While we've been able to identify sources of recycled content, we're now working to test the performance of the recycled material to see if it can meet our requirements — both at the material level and in its application in batteries. This rigorous evaluation process takes time, but it's key to maintaining the performance of our products as we transition to recycled content over the long term. And we're forging relationships with partners and recyclers capable of bringing more of this material into the market.
<b>Paper</b>		For more information on our progress on paper, see our <a href="#">feature on packaging</a> .
<b>Plastics</b> 	Technical properties Availability and access Scale	We use a broad range of plastics in our products — found in hundreds of unique components, from speakers to keycaps. Each plastic material has different performance requirements that we must maintain as we switch to recycled or renewable sources. We are diligently pursuing this effort. In fiscal year 2021 alone, we introduced more than 100 parts with an average of 45 percent recycled plastic. These include the antenna lines on iPhone 13, which use “upcycled” plastic from bottles that have been chemically transformed into a stronger, higher-performance material. And 15 additional components used plastics made with bio-based content rather than fossil fuels, an important step as we continue to pursue certified renewable plastic sources.
<b>Rare earth elements</b> 	Regulatory barriers Availability and access Scale	We're featuring greater percentages of recycled rare earth element content across our latest devices: 98 percent in iPhone 13, 99 percent in Apple Watch Series 7, 99 percent in the 24-inch iMac, and 100 percent in AirPods (3rd generation). More than 45 percent of the total rare earth elements used in the fiscal year came from certified recycled sources, a significant increase since we introduced recycled rare earth elements for the first time in 2019.



Material	Key challenges	Progress
<b>Steel</b> 	Regulatory barriers Technical properties	Since steel is a highly recycled material, we focus on keeping it in the highest-quality form possible, working to make sure high-purity steel gets recovered from our manufacturing scrap and our products at end-of-life. We are working with our supply chain partners on opportunities to expand the use of recycled content further into components of our products and to pursue third-party certifications.
<b>Tantalum</b> 	Regulatory barriers Availability and access Supply chains	We continue to address the challenge of sourcing 100 percent recycled content at the quality we need for use in 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, there may already be some recycled tantalum within our products. However, 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 and building traceable supply chains around exclusively recycled material so that we can verify its use in high quantities in our products.
<b>Tin</b> 	Regulatory barriers Scale	In fiscal year 2021, 30 percent of our tin came from certified recycled sources as we continued to scale our use. All new iPhone, iPad, AirPods, and Mac devices released in the fiscal year featured 100 percent recycled tin in the solder of the main logic board. We're also continuing to use recycled tin in our accessories, including our power adapters, the Wireless Charging Case for AirPods Pro, and Apple Pencil. And we continue to expand to new components as well, including recycled tin in the solder of the True Tone flash of iPad Pro and the battery management unit of iPhone 13. As we scale use across even more components, we seek to engage an exponentially increasing number of suppliers in this effort.
<b>Tungsten</b> 	Regulatory barriers Technical properties	More than 90 percent of the tungsten used in fiscal year 2021 came from recycled sources, a significant milestone from prior years. Both Apple Watch Series 7 and iPhone 13 feature 99 percent recycled tungsten across the entire device. And with the help of our disassembly robots, Daisy and Dave, the tungsten from our Taptic Engine can be recovered and recycled.
<b>Zinc</b> 	Technical properties Supply chains	We continue to work to identify high-quality sources of recycled zinc. This is a challenge as the material is prone to accumulate impurities during the recycling process. Each source we identify we rigorously test to ensure that recycled materials meet our high performance standards. In March 2022, we introduced 100 percent recycled zinc for the first time in Apple Studio Display and Mac Studio, which use 100 percent recycled zinc in the brass prongs of the power cord plug and AC inlet. <sup>8</sup>

# Innovating packaging to reduce our footprint

## We've made significant progress toward eliminating all plastics from our packaging by 2025.

This past year, plastics accounted for only 4 percent of our packaging. Since 2015, we've dedicated our efforts to replacing large plastic trays, wraps, and foam cushioning with fiber alternatives that have higher recovery rates and reduced environmental footprints. And we remain focused on completing this work. We've directed our energies toward eliminating the remaining plastic in our packaging.

This year we released iPhone 13 and iPhone 13 Pro — the first iPhone to be shipped without any plastic packaging components.<sup>9</sup> To achieve this, we eliminated the polypropylene wrap around each box. We've used this plastic wrap since the launch of iPhone 8 to protect the box from damage and tampering. We wanted to retain the benefits of plastic wrap without the environmental impact, while creating a more accessible unboxing experience. Our packaging team took on the challenge to achieve both. The team conducted user studies, assessed the weight and repulpability of materials,

and prototyped designs. For this year's iPhone release, they developed an alternative that relies on two small fiber-based pull-tabs. This replacement of traditional plastic wrap not only provides a tamper seal, it allows us to avoid an estimated 600 metric tons of plastic.

We also made significant improvements on iMac this year. Our team worked on an alternative to the plastic foam we used to protect each iMac during shipping. Previously, we'd designed molded fiber parts to replace foam components in the iMac Pro box.<sup>10</sup> We set out to create a similar alternative to packing foam — one that absorbs energy while maintaining resilience and structure. Our solution was to develop a fiber-based corrugated spring. Using origami-inspired techniques, our team created a design that could perform as well as traditional foam, yet be more easily recycled. This design relied on corrugated cardboard, a widely used packaging material, allowing us to work with existing suppliers. Our fiber-based corrugated spring is the first such use of this material to replace traditional packing foam. Through this innovation, we avoided more than 400 metric tons of plastic.



For the 24-inch iMac, using corrugated fiber rather than foam for shock absorption allowed us to reduce plastic by 72 percent.

These innovations are part of our broader strategy. We're both seeking to reduce waste by eliminating plastic and focusing on recycled and renewable materials in our packaging. Apple's packaging design guidelines also 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>11</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. In fiscal year 2021, all newly released iPhone, iPad, Apple Watch, and MacBook devices shipped in packaging that was more than 90 percent fiber-based. And we continue to supply all of the wood fiber in our packaging from recycled or responsible sources.<sup>12</sup> This year, we've turned our efforts toward developing alternatives to foams, films, and wraps.

We're doing so to ensure that we have well-designed, lower-impact alternatives ready for use. We also advocate for action to reduce plastics, promote the efficient use of low-impact materials, and encourage requirements that consider the entire packaging life cycle.

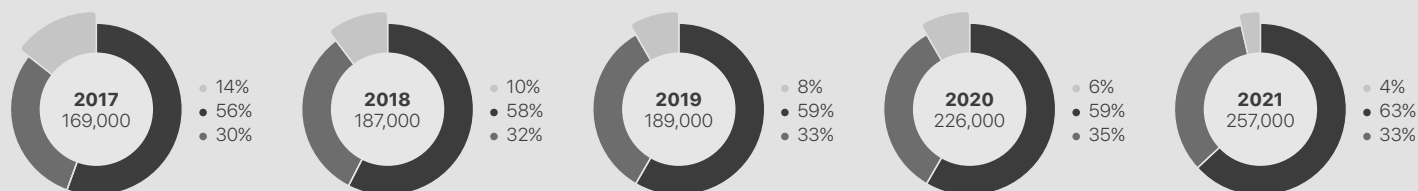
These efforts include our commitment to using responsibly sourced wood fiber while, at the same time, contributing to the global supply of these responsible materials. Through partnerships with The Conservation Fund and World Wildlife Fund, we've protected and improved more than 1 million acres of working forests in the U.S. and China. In fiscal year 2021, these forests generated enough responsibly sourced fiber to balance all the fiber used in our packaging.<sup>13</sup>

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

Our goal is to eliminate all plastics from our packaging by 2025. In fiscal year 2021, only 4 percent of our packaging footprint was from plastic. And 63 percent came from recycled fiber. Since 2017, 100 percent of the virgin wood fiber used in our packaging has come from responsible sources.\*\*

We've **REDUCED PLASTIC** in our packaging by 75% since 2015.

■ Plastic  
 ● Recycled fiber  
 ■ Responsibly sourced virgin fiber\*\*



\* These data include the materials used in our packaging. Fiber used at our corporate facilities represents less than 1 percent of our overall fiber use. Non-fiber, non-plastic materials excluded from these totals. Beginning in 2021, we excluded adhesives from our boundary as these are non-fiber, non-plastic materials.

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

# Product longevity

**We believe long-lasting products are best for the environment. We also believe products that minimize the need for repair or replacement encourage our customers to come back to Apple. We design our products with this goal in mind.**

And for those customers who want the latest devices, we help them unlock the value of their current device through Apple Trade In or third-party trade-in platforms. This not only makes a subsequent purchase more affordable, it enables a new customer to experience Apple products and services and keeps a product in use as long as possible. With more customers able to access Apple products and services, this approach is not only good for the planet, it's good for business.

A product designed for longevity will hold its value longer, benefiting our customers. iPhone, for example, retains value longer than any other smartphone. The iPhone depreciation rate is the lowest among the nine leading smartphone manufacturers, according to a study published last year by BankMyCell, a website that tracks trade-in and sale value of technology products.<sup>14</sup> As of January 2022, iPhone 6s, introduced in 2015, still had monetary value for Trade In in the United States.<sup>15</sup>

These results reflect our commitment to provide long-lasting devices, as well as our collective, ongoing effort to improve the longevity of our products. We've approached this by designing durable hardware, developing access to safe and convenient repair services that meet our customers' needs, and providing software support for years so that more customers can unlock new features and functionality. With every generation of a product, we strive to deliver durability that minimizes the need for repairs through features like water resistance. Designing with repairability in mind is also an essential element of our commitment to long-lasting devices. We've made increasing access to repair options a priority — through Apple Authorized Service Providers, the Independent Repair Provider program, and, announced in 2021, the upcoming Self Service Repair option. Our customers can access the type of repair service

that they feel is best for them, should they need it. And by offering software updates, we aim to help more customers benefit from new features, whether their device is new or several generations older.

## We build durability into our designs

We design our products to be used continuously, with minimal interruption for maintenance or repair. Designing and building durable hardware is core to delivering this customer experience.

Across our products, we develop innovative designs that are engineered to withstand the rigors of everyday use. We assess these designs against our strict durability standards through testing methods that mimic realistic conditions in which our customers use their products. Every aspect of our products is thoroughly assessed by engineers in our Reliability Testing Lab who measure the performance of materials, components, and fully assembled products. The durability standards established by us are based on in-depth user studies to understand how our customers use — and misuse — their products.

Thousands of units are tested during product development, and the results of each test inform the next round of design. We use a "rock tumbler" test to assess the performance of the outer enclosure of iPad and iPhone against scrapes and scratches. This mimics the day-to-day abrasions of coins and keys that a device may experience in a purse or backpack. For Apple Watch, our engineers have created a weighted pendulum test to simulate impacts that a device may endure from an arm swinging into an object. These are in addition to our drop testing, which evaluates products falling from different heights and angles onto a range of surfaces to improve their resilience to an accidental drop. We continue to test recycled or renewable materials to the same performance standards as other materials — making sure our products stay as durable as ever, even as we explore new material sources.



Thousands of units are tested in our Reliability Testing Lab to inform the design of our products.



And just as we advance product features and capabilities with each new generation of a device, we also strive to improve durability. With iPhone 12, we introduced Ceramic Shield, a new front cover made entirely of a new material. Together with the new product design, it gave iPhone 12 four times better drop performance than the previous generation, and we carried that innovation over to iPhone 13. This advancement comes alongside other durability features,

including industry-leading IP68 water resistance. We’ve also made progress with Apple Watch Series 7, which has a water resistance rating of 50 meters (under ISO standard 22810:2010) and is also rated IP6X dust resistant. Each improvement is part of our effort to keep our products in use and out of the repair shop.

iPhone longevity journey

- ✓ Features to enhance durability
- ✓ Repairable at retail stores, Apple Authorized Service Providers, and central repair locations

Increased **DURABILITY** and **REPAIRABILITY** enhance iPhone longevity

iPhone (1st generation)	iPhone 4	iPhone 7	iPhone X	iPhone 13
<ul style="list-style-type: none"><li>✓ SIM tray</li></ul>	<ul style="list-style-type: none"><li>✓ SIM tray</li><li>✓ Battery</li><li>✓ Haptics</li><li>✓ Rear camera</li></ul>	<ul style="list-style-type: none"><li>✓ SIM tray</li><li>✓ Battery</li><li>✓ Haptics</li><li>✓ Rear camera</li><li>✓ Main logic board</li><li>✓ Display</li><li>✓ Splash, water, and dust resistant: IP67*</li><li>✓ Sapphire crystal lens cover</li></ul>	<ul style="list-style-type: none"><li>✓ SIM tray</li><li>✓ Battery</li><li>✓ Haptics</li><li>✓ Rear camera</li><li>✓ Main logic board</li><li>✓ Display</li><li>✓ Bottom speaker</li><li>✓ Enclosure</li><li>✓ Splash, water, and dust resistant: IP67*</li><li>✓ Sapphire crystal lens cover</li><li>✓ Surgical-grade stainless steel</li></ul>	<ul style="list-style-type: none"><li>✓ SIM tray</li><li>✓ Battery</li><li>✓ Haptics</li><li>✓ Rear camera</li><li>✓ Main logic board</li><li>✓ Display</li><li>✓ Bottom speaker</li><li>✓ Top speaker</li><li>✓ Enclosure</li><li>✓ Splash, water, and dust resistant: IP68*</li><li>✓ Sapphire crystal lens cover</li><li>✓ Surgical-grade stainless steel</li><li>✓ Ceramic Shield</li></ul>
A black and silver first-generation iPhone with a multi-touch screen showing various app icons.	A black iPhone 4 with a multi-touch screen showing various app icons.	A black iPhone 7 with a multi-touch screen showing various app icons.	A silver iPhone X with a multi-touch screen showing various app icons.	A black iPhone 13 with a multi-touch screen showing various app icons.
2007	2010	2016	2018	2021

\* iPhone 7, iPhone X, and iPhone 13 models are splash, water, and dust resistant and were tested under controlled laboratory conditions. iPhone 7 and iPhone X have a rating of IP67 under IEC standard 60529 (maximum depth of 1 meter up to 30 minutes). iPhone 13 has a rating of IP68 under IEC standard 60529 (maximum depth of 6 meters up to 30 minutes). Splash, water, and dust resistance are not permanent conditions and resistance might decrease as a result of normal wear. Do not attempt to charge a wet iPhone; refer to the user guide for cleaning and drying instructions. Liquid damage not covered under warranty.

## We're making repairs more convenient

We design our products to minimize the need for repair in the first place. If a repair is needed, we believe our customers should have convenient access to quality repair services to get their product back up and running as quickly as possible.

Over the past three years, we've nearly doubled the number of service locations with access to genuine Apple parts, tools, and training, offering more ways for consumers to get repairs. These repair options include Apple Store locations, Apple Authorized Service Providers (AASP), participating Independent Repair Providers, mail-in repair centers, or onsite service and, starting in 2022, Self Service Repair. Our repair network has grown to over 5000 AASP locations and over 3000 Independent Repair Providers around the world — in addition to our 500 Apple retail locations.

For the past three years, our Independent Repair Provider program has enabled independent repair businesses — large and small — access to genuine Apple parts, tools, diagnostics, and training. In 2021, this program expanded from the U.S., Europe, and Canada to more than 200 countries worldwide. We're also increasing coverage for onsite service options in select cities across the United States, providing greater convenience to our customers. We actively train and certify service personnel to service Apple products. Our global training system currently supports over a hundred thousand active technicians. This helps ensure that points of failure are correctly diagnosed, and services and repairs are performed successfully, preventing damage to the device and ensuring that the device works as it should.

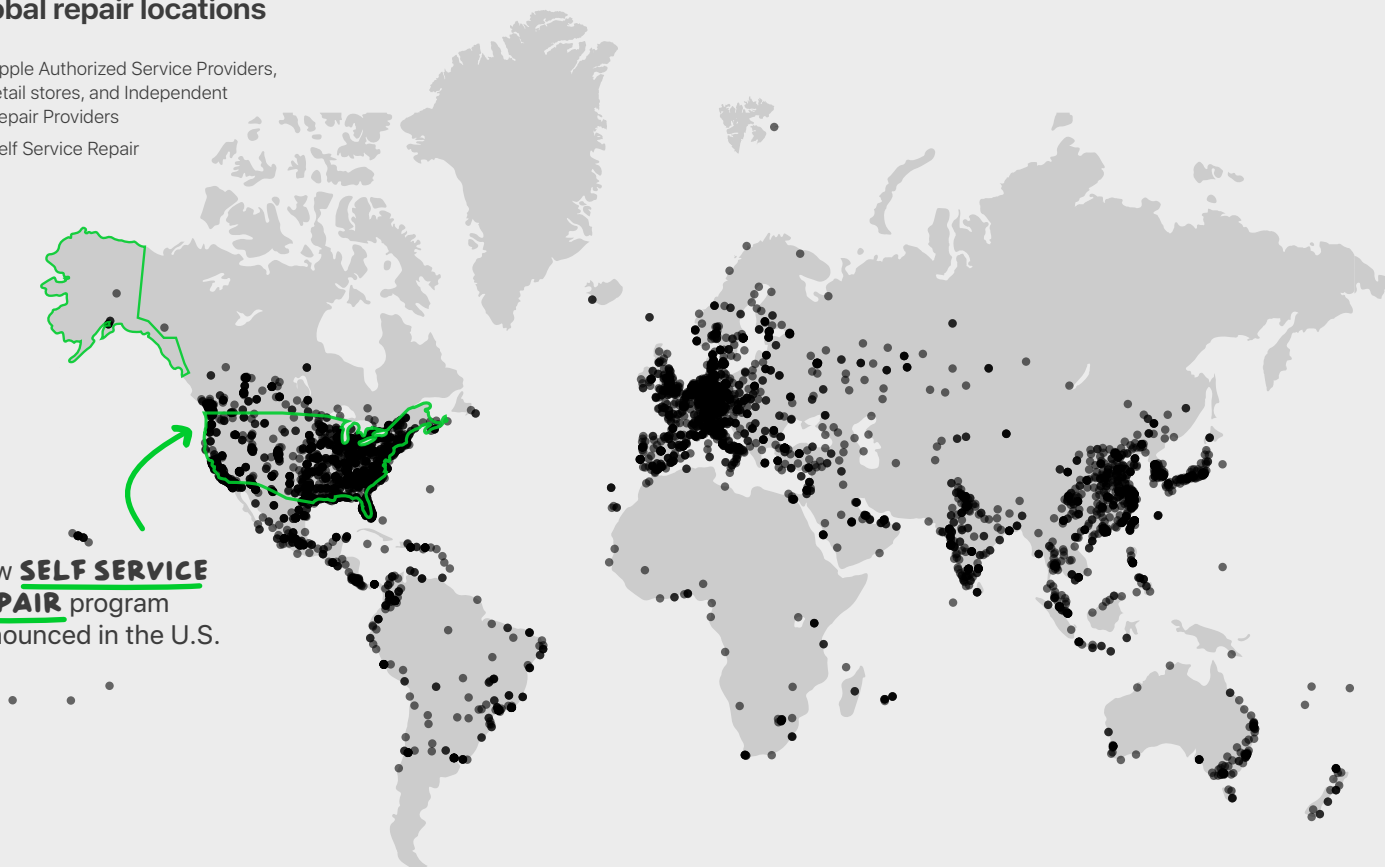


In 2021, we announced Self Service Repair, a new program that offers Apple genuine parts and tools, as well as repair manuals, to customers.

## Global repair locations

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

New **SELF SERVICE REPAIR** program announced in the U.S.



We also announced Self Service Repair coming later this year for iPhone 12 and iPhone 13 for customers who are comfortable completing their own repairs. The program will start in the U.S. and offers access to genuine Apple parts and tools, as well as a Repair Manual for the most common repairs on iPhone 12 and iPhone 13. And we'll be expanding the program to more products — starting with Mac computers featuring M1 chips — and additional countries throughout 2022. Following a repair, customers who send in their used parts for recycling will receive credit back from their purchase. Self Service Repair is intended for customers with the knowledge and experience to repair electronic devices. For most customers, visiting a professional repair provider with certified technicians who use genuine Apple parts is the safest way to repair a device.

## We're designing products with repairability in mind

Our goal is to avoid the interruption a repair may cause for our customers, which is why we optimize designs for durability. But if a product requires a repair, it should be as convenient as possible. We continue to design our products with features that enhance repairability. For instance, iPhone has continued to improve repairability by increasing the number of repairable modules while also adding durability features like water resistance. The iPhone 12 and iPhone 13 designs, for example, allow for more repairs to be performed at more repair locations than ever before. Now these products' displays, batteries, cameras, speakers, and haptics, among other parts, can be repaired at central locations including retail stores and AASPs. And MacBook Air (Retina, 13-inch, 2018) and later models include a stretch-release adhesive, which facilitates battery replacement. We've also expanded repair part availability in



Apple's Independent Repair Provider Program expanded to more than 200 countries worldwide in 2021.

countries around the world for vintage products sold up to seven years previously.<sup>16</sup> A new program for Mac notebooks makes battery repair available for up to 10 years after a product was last distributed.<sup>16</sup> These efforts are just some of the ways we continue to make progress on the repairability of our products.

## We keep our products current with software updates

Apple provides free software upgrades to improve our customers' experience and help our products last longer. Our customers can count on the latest software features and security updates to their existing devices for years. We continually improve the operating systems that power our products and engineer each software release to run seamlessly on all supported devices. This allows more customers to benefit from the latest software updates, whether their device is brand new or several generations older.

iOS 15, our most recent release, extends support back to iPhone 6s (2015). iPadOS 15 compatibility goes back to iPad Air 2 (2014) and macOS Monterey supports MacBook models from 2015 onward. The updates in each operating system make the latest capabilities — from FaceTime and SharePlay to Continuity features — available to a broad user base, keeping their devices up to date and extending their usability. These updates also help ensure that more customers have access to the newest security and privacy features available.

Our updates remain popular with our customers. By January 2022, more than 70 percent of all iPhone devices introduced in the last four years had updated to iOS 15. And iPadOS 15 was being used on 57 percent of devices released in the last four years. These continually high rates of adoption make clear that our customers see value in software updates. And for a period of time, we also provided customers with the option to update iOS 14 and iPadOS 14 with new security features — helping those customers who wanted more time before updating to the newest operating system.

## We extend 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. We can lower the impact each device has on the environment — including carbon intensity per year of life — by finding ways to refurbish and reuse these products. And by building our products to serve more than one owner and encouraging customers to exchange devices for an upgrade, we extend the life of our products.

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 fiscal year 2021, we sent 12.2 million devices and accessories to new owners for reuse. Our Trade In program extends to 25 countries, providing customers with options for product end-of-life — to access the value of their current device if they want to upgrade to a newer model, or to recycle their devices for free.

The success of our trade-in programs and those of third parties is because of our customers. Their actions help realize the long-term value we've designed and built into our products — whether through trading or passing down their devices, or by purchasing refurbished products. Each product that goes through this process marks progress toward reducing our overall environmental footprint.

We're also working on getting the most from the parts inside our devices. At the end of life of a product we can realize the potential of components through recovery and reuse, either as replacement parts or in new creative applications. We're also expanding the number of parts that can be recovered, 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. And we continue to look for innovative opportunities to reuse accessories sent for recycling as well. 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.



Visit our [Certified Refurbished](#) site where we offer products backed by the same one-year warranty as our new products and the Apple Certified Refurbished promise.<sup>17</sup>



# Product end-of-life

Each stage in the life cycle of our products is significant, including end-of-life. When a product or part no longer functions as intended, it can still be a source of valuable materials for the next generation of products.

By effectively recovering these materials, we enable the circular supply chains that make the best use of finite resources. This requires collaboration — with our customers who trade in their used products and recyclers who recover materials from them. Through this approach, we're reducing the need to mine new materials and the amount of energy needed to manufacture new products, ultimately driving down emissions and conserving resources.

## We're using partnerships and innovation to optimize how we recycle

Recycling is at the center of our efforts to create circular supply chains. We strive to make it easier for our customers to recycle our products. In 99 percent of the countries where we sell products, we continue to provide and participate in product take-back and recycling collection programs. These include our retail locations, where our customers can trade in devices they are no longer using to be reused or recycled, as well as recycling programs offered by local operators. Customers also have access to even more recycling options through online platforms like Trade In. With the help of customer and employee participation across recycling programs, we directed more than 38,000 metric tons of e-waste to recycling globally in fiscal year 2021.

We have high standards for our recycling partners. We seek out and work with recyclers and refiners who are the best-in-class, who can deliver high recovery rates and meet our rigorous requirements. In fiscal year 2021, we conducted 75 recycler audits globally, for compliance on topics including labor and human rights, security, and EHS regulations. We also work closely with these recyclers to further encourage the use of best practices in their facilities. Each one of our recyclers in North America is either e-Stewards or R2 certified, the electronics industry's leading certifications.



With the support of recycling partners around the world, we directed more than 38,000 metric tons of e-waste to recycling globally in fiscal year 2021.

We help our recyclers develop the capabilities and resources to effectively recycle each Apple product. This requires collaboration, training, and ongoing support. Our experts work onsite at the recycling locations with our recycling partners' staff to better understand their needs and the challenges they face. Last year, we introduced new Apple Recycler Guides to provide guidance for professional electronics recyclers on how to safely disassemble Apple products — and maximize recovery of resources. The guides are developed by our engineering teams, to optimize recovery and make sure that the processes can be completed using tools and procedures available to a wide range of professional recyclers. Each guide provides valuable insight on the steps for disassembly, as well as recommended downstream material recyclers for our disassembled parts. And we're always looking to innovation to support recyclers. This year we'll be piloting a simple-to-use augmented reality tool to better train our partners on disassembly and recovery. We're also working to develop a vision system for machines to better sort and organize scrap, enabling better material recovery.



While we offer and participate in e-waste recycling programs around the world, we continue to explore ways to make recycling even more convenient for our customers. That's why, through our membership with CEF, we're collaborating with Google, Amazon, Dell Technologies, and Microsoft to pilot a doorstep recycling program. This pilot allows customers in the city of Denver to order e-waste recycling pick-up directly from their homes starting in February 2022.

## We're constantly developing new approaches to disassembly and recovery

At our Material Recovery Lab (MRL), also located in an R2-certified facility, we're working on developing better, more efficient means of disassembling products that maximize material recovery, while minimizing waste. The MRL's work assesses the recyclability of our products, helping to inform design decisions that support disassembly and recovery. And it engages with the educational community. Interns from universities across the U.S. joined our engineers in 2021, developing new approaches to the unique challenges of recycling. Interns have helped benchmark the performance of computer vision systems and modeled recycling processes to predict performance, among other projects. We've also opened the MRL's internship to students earlier in their undergraduate years, to provide them with access and experience to help develop their careers.

We've also continued to innovate on disassembly technologies. Our disassembly robot Daisy quickly and skillfully disassembles iPhone devices into discrete components to enable better material recovery and recycling. Last year, we expanded Daisy's disassembly capabilities from 15 to 23 models of iPhone, including all models between iPhone 5 to iPhone 12. All of this effort to disassemble iPhone devices creates meaningful results. From just one metric ton of iPhone main logic boards, flexes, and camera modules recovered by Daisy, our recycling partner was able to recover the same amount of gold and copper as more than 2000 metric tons of mined rock.<sup>18</sup> And we hope that Daisy can inspire similar efforts. Last year, the U.S. Patent and Trademark Office issued Apple five patents related to Daisy, which we're willing to license to researchers and other electronics manufacturers developing their own disassembly processes.<sup>19</sup>

We're also continuing to develop other tools. Dave, our robot that disassembles Taptic Engines, helps recover valuable rare earth magnets, tungsten, and steel. And Taz, our latest recycling machine, is designed to recycle modules containing rare earth magnets as an alternative to the conventional shredder many recyclers rely on. While rare earth magnets are typically lost in these conventional shredders, Taz is designed to keep these valuable materials intact to improve our overall recovery rate. We've also worked on other manual and semi-automated tools, including 3D printed tools to improve the ergonomics and safety of battery recovery, as well as a custom-designed jig to disassemble AirPods charging cases.

## We're designing for the next generation of recycling

Recycling innovation requires a long-term approach. Our current technologies serve a vital role in recovering valuable materials — and we're committed to continuously improving how we do this. At the same time, new and emerging technologies represent some of the best opportunities to impact the future. Research and development in these areas have the potential for transformative changes. This is what drives our investment and support of initiatives that are poised to redefine disassembly and recovery.

For the past three years, we've worked with Carnegie Mellon University's Biorobotics Lab on new approaches and methods for recycling. This has included developing machine learning models to sort e-waste at scale, an innovation with the potential to enable recyclers to recognize valuable modules and devices to recover their resources within a diverse waste stream. We've also worked with the lab on incorporating X-ray imaging with RGB imaging to improve the accuracy of disassembly and recovery of materials. And we're optimizing how our robots function, enabling a robot to "feel" by using high-frequency force feedback and machine learning, so it can adjust behavior when contacting an object. This is a small step in a larger effort toward developing truly intelligent disassembly technology.



In October 2021, we launched a partnership with Atea — the 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 located in the Netherlands. And we are eager for more of our customers to return more end-of-life devices to us, so we can keep our fleet of recycling and disassembly robots busy. To learn more about our recycling programs, visit the [Apple Recycling Programs site](#).

# Our position on resource recovery policy

To achieve truly circular products and supply chains requires innovative approaches — to technical obstacles and policy challenges.

Over the last year, we reached new milestones in how we use recycled materials in our products, extend the life of our devices, and enhance recycling of our products. iPhone 13 made extensive use of certified recycled content, including rare earth elements, tungsten, aluminum, and for the first time, gold. Our new iPad devices incorporated a 100 percent recycled aluminum enclosure. The global expansion of our Independent Repair Provider program, and the announcement of our Self Service Repair program, will make repair options more accessible for those seeking to extend the life of their Apple products. And our disassembly robot Daisy expanded its capabilities to take apart an even greater range of iPhone devices, for better material recovery. Each of these is part of our ongoing efforts to build, support, and participate in circular supply chains.

We're also working to improve policy to scale product recovery and material recycling so global industries can meet key environmental goals. Part of this requires reframing the understanding of the product life cycle. Products at the end of their life should be viewed as a source of materials for new products — with significant environmental opportunities. For example, we're able to recover one metric ton of gold and copper from end-of-life iPhone components that would otherwise require mining more than 2000 metric tons of rock.<sup>20</sup> This represents both an achievement for circular supply chains and significant carbon savings. Recycled aluminum, for example, can have 1/40th the carbon footprint of primary aluminum.<sup>21</sup>

Yet, existing policies don't see recovered materials as resources. They often view products and materials no longer serving their intended use as waste — and, in some cases, more stringently as hazardous waste. We fully support the intent of these policies to protect vulnerable communities

from global waste streams. But some policies can also limit the ability to move recovered materials to best-in-class recyclers or refiners, which can unintentionally make mining the earth more cost-effective than reuse of materials. We believe there could be a new approach to regulations — that better protect communities and help the broader electronics industry realize the full potential of recovered material as a resource. This would make movement of some materials around the world to recyclers and refiners more transparent and efficient. It would also increase the recovery and reuse of materials, while strengthening environmental and community protections.

To make progress on resource recovery, we need a global paradigm shift on how materials are moved. One key first step would be for the U.S. to ratify the Basel Convention.<sup>22</sup> The Convention serves as the global framework that governs how some waste can be moved around the world for recycling, recovery, and disposal in an environmentally responsible way. It provides critical protections against the movement of hazardous waste into countries that lack the resources to manage them properly. It has been ratified by 189 countries, meaning that those nations can move waste covered by the Convention among themselves under the agreement's requirements. The U.S. is one of a very small number of nations that is not a party to the Basel Convention. As a result, 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 is highly restricted, requiring specific trade agreements with that country. Not only is it harder for the U.S. to participate in the international movement of material for purposes of recycling, it is also limited in the ability to influence policy as the Convention evolves and to create more efficient and effective circular supply chains for electronics. But there is an opportunity for a new approach. By ratifying the Basel Convention, the U.S. could unlock the potential to influence policy and create more efficient and effective circular supply chains.



## 1/40th

Recycled aluminum has 1/40th the carbon footprint of primary aluminum — another reason to support efficient transport of end-of-life products to top recyclers.<sup>23</sup>

# Water

## Every drop of water counts in the design and use of our products, services, and sites.

In many locations, freshwater resources have become increasingly scarce and vulnerable to the effects of climate change. We're committed to managing the resources we share with the communities where we and our suppliers operate. This means taking steps to reduce our freshwater withdrawals and return clean water to watersheds. Using this approach, we're helping address one significant aspect of the water challenge — availability. We aim to reserve freshwater use to applications where it's essential — like drinking water — and switch to lower-quality water for applications like irrigation and cooling. We're also working to maintain the quality of water we use and discharge to help make water available at a quality fit for its next use. Finally, water access matters to us. Broader communities and ecosystems within the watershed also need access to water resources. Our approach to water stewardship takes each of these three factors into consideration. And we look beyond the needs and activities happening within our facilities and those of our suppliers to the needs of the communities where we operate.

Context matters in this approach. We use tools like the World Resources Institute (WRI) Water Risk Atlas to provide geographically specific water use and water-related risks that inform our local strategy. Areas with high water risk — where approximately 39 percent of our corporate water use occurs — are our priority, but our strategy also works to proactively address areas of medium risk.<sup>24</sup> And we use assessments of water stress along with site-level water use to guide our supply chain efforts as well.

What we know about our local water footprint informs how we prioritize and target our efforts. We measure and continually monitor usage at our facilities, and we survey our direct suppliers on the water impact of their sites as well. These efforts already exceed the industry standard, but we go even further. To add to the data collected from direct suppliers, we've also invested in life cycle assessment tools to begin to estimate water use even further upstream in material supply chains. It's not common to account for these upstream uses within our



We help our suppliers collect and reuse water, through efforts including condensate recovery.

industry. We believe this rigorous and holistic measurement of our supply chain's impact is essential to driving effective water management across the value chain.

Our efforts to address the water footprint of our corporate sites and of our suppliers' sites focus on the following key efforts:

- Using water efficiently.
- Expanding the use of alternative water sources, including onsite reuse.
- Discharging water responsibly.
- Enhancing our water stewardship to keep watersheds healthy for all who rely on them.

## We're improving efficiency across our operations

Minimizing freshwater use remains a priority. We focus our efforts on high water risk regions, taking steps to reduce our freshwater usage. At each of our corporate and supplier sites, we rely on water for sanitation, climate control, maintaining green spaces, or manufacturing. Even as we promote more efficient uses, we're committed to doing more.

We're committed to improving efficiency, to decouple the amount of freshwater we use from the growth in our corporate facilities. In fiscal year 2021, our facilities used about 1.4 billion gallons of water. We saved 133 million gallons of freshwater this fiscal year due to efficiency projects implemented since 2017.<sup>25</sup>

Our local efforts are driving this progress. At our data centers in Maiden, North Carolina, and Reno, Nevada, we piloted an innovative approach to water treatment. Using a plant-based treatment method for process cooling water, we're able to increase water efficiency, while avoiding chemical usage and

reducing discharge. This method also reduces waste since the plant material is compostable. In addition, the majority of our data center sites have water management plans in place, further supporting the overall management of nearly 30 percent of Apple total corporate water use.

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. The more than 195 participating supplier sites increased their average reuse rate to 41 percent and saved our suppliers 12.3 billion gallons of freshwater in fiscal year 2021 — for a total of 50.3 billion gallons of water savings since the program's launch in 2013.<sup>26</sup> These savings come from a range of initiatives such as reuse of reclaimed water, upgrades to water-efficient equipment, or countercurrent rinse methods.

## Water use at corporate facilities

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

### — Freshwater

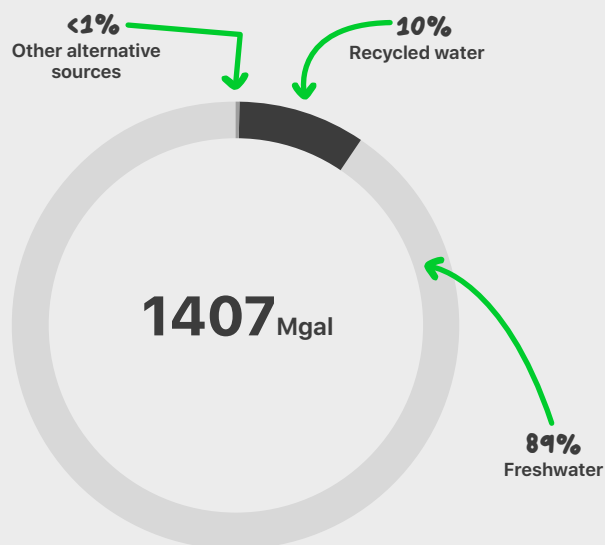
We define freshwater as drinking-water quality, the majority of which comes from municipal sources and less than 5 percent comes from groundwater.

### — Recycled water

We source recycled water as a key alternative to freshwater and use it primarily for irrigation, cooling systems, or toilet flushing. Our recycled water comes primarily from municipal treatment plants, with less than 5 percent from onsite treatment.

### — Other alternative sources

We also capture rainwater and recover condensation as another alternative water source for use onsite.





## We're using alternatives to freshwater

We're addressing water availability by utilizing alternatives to freshwater, including recycled water, reclaimed water, rainwater, and condensate. We're also supporting water quality by matching different qualities of water to appropriate uses. When we increase our reliance on alternative water sources at each of our locations, we lessen our impact on freshwater demand within the local watershed.

Last year, alternative water sources accounted for 10 percent of our total corporate water usage — primarily from recycled water sources.<sup>27</sup> At Apple locations in Texas, North Carolina, Ireland, Taiwan, and Japan, we utilized rainwater capture systems to source 7 million gallons of water. We continue to introduce advanced water recovery systems. And in Santa Clara Valley and North Carolina we're expanding our condensate recovery.

Our suppliers are also implementing innovations to use alternative sources of water. Several suppliers have begun to collect steam that condenses from boilers — a central piece of equipment at these supplier sites. Steam collection not only provides a new water source, but also reduces the frequency that boilers need to be cleaned of impurities. This yields both water and energy savings. Through initiatives like these, the suppliers within our Clean Water Program reused an average of 41 percent of wastewater in 2021.

## We're managing the quality of water we discharge

When we return water to the watershed, we want to ensure that others can use it. This requires taking active steps to manage the quality of the water we discharge. We've made this a pillar of our water stewardship approach because it directly effects the availability of water to the communities with which we share this resource.

Activities at Apple facilities — like offices, data centers, and retail stores — are largely low risk with regard to water discharge quality. Most wastewater is discharged to the sanitary sewer; for example, up to 54 percent of the water we use at our corporate locations is discharged back into the local water system rather than consumed.<sup>28</sup> Where sites have an industrial wastewater discharge, we monitor our water quality and have policies to ensure that each site meets or exceeds local discharge requirements.

We 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 to minimize process water impacts and adopt best practices in wastewater treatment. For example, we advise that our suppliers avoid combining wastewater streams to simplify cleaning and filtration. This enables wastewater reuse and reduces reliance on freshwater resources. We support these efforts with training, offering guidance on advanced wastewater treatment methods and technologies to empower our suppliers to improve the quality of water they discharge so it's ready for its subsequent use. We are also piloting the use of acid recovery and filtration technologies to clean process water so it can be used again and again — enabling a high reuse rate for a critical manufacturing process. This technology extracts and cleans all chemicals out of water used in a final step in the aluminum casting process. The extracted materials are either reused or disposed of, while the water remains within the production cycle. This avoids discharge and ensures the continual reuse of water. The pilot ran successfully at a supplier site and will continue at an Apple facility to further prove the technology's application — new to our industry.

## We're working to keep watersheds healthy

Water is a shared natural resource, and managing local watersheds requires shared responsibility and collective effort. We're committed to understanding our impacts on the watersheds where we operate and engaging in action critical to ensuring their health. In Prineville, Oregon, we partnered with the city to bring an aquifer storage and recovery system online in May 2021. In fiscal year 2021, this system stored nearly 100 million gallons of water during winter months, reducing pressure on the local watershed during drier summer months.<sup>29</sup>

Prineville was also the location of our first Apple-owned or operated site — and the first data center worldwide — to achieve certification under the Alliance for Water Stewardship (AWS). The Alliance is a global membership collaboration between public and private sector members and NGOs to promote a shared framework on the sustainable use of water. These certifications reflect each facility's efforts to consider impacts to local water basins to benefit local communities and ecosystems. And we're expanding our commitment to AWS by pursuing certification of our remaining owned and operated data centers.



# 1st

Apple, alongside other partners, helped the Suzhou Industrial Park become the first industrial park in the world to earn Alliance for Water Stewardship certification.



Apple works with the Alliance for Water Stewardship and others to promote water stewardship that protects the health of water basins, including the Kunshan watershed in China.

Our supplier facilities are also aligning to these best practices in water stewardship. As of the end of fiscal year 2021, 17 supplier facilities have received certification, of which 15 were Platinum status, the highest level of recognition by AWS. In 2021, we also signed a Memorandum of Understanding (MOU) with the Suzhou Industrial Park Administrative Committee and TEDA Eco Center with the aim of Suzhou becoming the world's first industrial park to achieve AWS certification. Of the more than 1700 companies operating out of the 278-square-kilometer industrial park, 11 are Apple suppliers. In January 2022, after months of collaborative engagement with suppliers and partners, the industrial park officially obtained the AWS Gold Level certification. With this milestone, Suzhou Industrial Park achieved the objective of becoming the first industrial park in the world to obtain AWS certification.

As we pursue water stewardship within our own supply chain, we are also working to catalyze broader industry change through collaborations with groups, including AWS and the Responsible Business Alliance (RBA). In 2021, we supported the translation of the AWS standard into Japanese and developed guidelines on best practices for Apple suppliers.

And we continued our work with AWS and RBA on the Information and Communications Technology (ICT) water stewardship working group. We're aiming to expand the dialogue on water use to industries that have historically been less involved in water issues, while providing opportunities to share knowledge and best practices.

We've also worked with NGOs like the Alliance for Water Stewardship, The Nature Conservancy (Qiandao Lake Waterfund Project), and Conservation International to foster collaboration at the basin level, particularly in high-risk areas. For the past three years, in an effort to raise broader awareness of water challenges and opportunities in local communities in China, Apple has organized a series of hands-on learning experiences for a diverse group of stakeholders we call Water Champions. To have a real effect on water resources requires collaboration, which is why we've engaged broadly to work with others.

# Zero waste

**Sending materials to landfill makes poor use of the world's resources, while also contributing to global emissions. And the most vulnerable communities around the world are disproportionately exposed to the negative consequences of waste disposal. This is why we've made waste-free operations a priority.**

We're working to send nothing to landfill from our offices, retail locations, data centers, and construction sites. This effort also extends to our suppliers. We're also taking steps to eliminate waste generated during manufacturing, engaging with local specialty recyclers and composters to redirect materials from landfills. This work requires innovative approaches and local solutions, to preserve the resources we rely on and to build our processes around this objective. If we can stop waste at the source, we create meaningful progress — protecting each community where we and our suppliers operate.

## **We're working on new approaches to waste at our corporate facilities**

Across our corporate operations, we're reducing the amount of waste we generate and directing more toward recycling programs. We launched the Zero Waste Program in 2018 with a focus on our major U.S. campuses and global retail stores. Since then, our operations have grown both in the U.S. and globally. But our objective remains the same: to send zero waste to landfill.

In fiscal year 2021, recycling and composting efforts allowed us to achieve a waste diversion rate of 68 percent, limiting landfill waste from our global operations to about 15,000 metric tons.<sup>30</sup> Our overall waste generated also remained low in part due to COVID-related temporary closure of facilities. We're continuing to make strategic progress across our sites. In 2015, our campus in Cork, Ireland, became the first Apple facility to

receive UL's Zero Waste to Landfill certification. Last year, our Mesa, Arizona, data center became the second Apple facility to receive TRUE certification, following the Prineville data center in 2020.<sup>31</sup> TRUE recognizes that more than 90 percent of waste from a facility is sent to recycling or compost, or is redirected for reuse. We upgraded our infrastructure to allow for better waste separation, and by switching to reusable alternatives from single-use materials. Each certification also involved coordinating with local composters, as well as identifying and partnering with local plastics recyclers that could handle specific materials, including plastic wraps and foams. These providers are local businesses that provide broader solutions than municipal waste disposal programs. And our work with them is an opportunity to support the local economies around recycling and composting.

As our company continues to grow and change, we've made construction and demolition waste a priority. This year we were able to achieve a waste diversion rate of 85 percent, approximately 13,000 metric tons of construction and demolition material, through recycling and source separation efforts. At our corporate office in New York City, we were able to recycle over 170 metric tons of drywall from landfill by partnering with a local specialty recycler. At several locations in Santa Clara Valley, California, we piloted an effort to separate waste onsite, which allowed us to unlock opportunities to generate revenue from recyclers seeking specific types of waste, like copper cables. These recycling efforts allowed us to achieve an impressive 100 percent waste diversion rate across sites — an effort we aim to scale. For preservation projects at our retail locations in the U.S. and Canada, we require vendors to recycle, compost, or reuse at least 75 percent of construction and demolition waste — and ask them to disclose materials that were landfilled.

And we're focused on reducing waste. This starts with identifying key sources of waste — like packaging materials or commonly used equipment. We're collaborating with our suppliers to move toward bulk packaging, or packaging made with materials that are recyclable or reusable. We are also switching to reusable air filters across our data center sites — a commonly used and replaced piece of equipment without a recycling solution. We partnered with a car filter manufacturer to develop a new reusable air filter that fits the specific performance requirements of our data center equipment. And these filters are also available to other companies. As we build out and maintain our data centers, we will use only reusable filters in the future.

For the waste we can't avoid, we're taking steps to keep it out of landfills. The first step is to ensure that items end up sorted correctly. This requires clear messaging and the availability of containers to redirect waste. We continue to roll out consolidated bins for recycling, composting, and landfill, and improved signage to reduce contamination and increase recycling rates. The majority of our corporate sites worldwide recycle paper, plastic, aluminum, and cardboard materials. And more than 450 of our offices and retail stores globally participate in composting as well.

We've continued our focus on end-of-life options for personal protective equipment for the COVID-19 pandemic, including a waste-to-energy solution for face masks and gloves used in our offices in the Santa Clara Valley and at more than 250 retail locations in the United States.<sup>32</sup> The health of employees, customers, and communities remains our priority; we're working to align the needs to operate safely with our zero waste objectives.

We also maintain our commitment to the safe and responsible management of hazardous waste, both onsite and offsite. The Treatment, Storage, and Disposal facilities (TSDFs) we utilize are audited to ensure that the waste is treated, recycled, or incinerated within the governing safety standards for health and the environment. Any facility that doesn't meet our requirements is replaced by another approved waste facility.

## We're developing zero waste manufacturing with our suppliers

We're committed to leaving no waste behind in the communities where we build our products. To achieve this, we've partnered with our suppliers, recyclers, and waste solution providers to eliminate waste from our manufacturing processes. Since we launched the Zero Waste Program for our manufacturing partners in 2015, we've achieved considerable progress. At the close of fiscal year 2021, more than 100 facilities had been zero waste verified — nearly half of the supplier facilities that are part of our Zero Waste Program.<sup>33</sup>

All participating facilities across 12 countries can access resources including guidance on how to reduce waste and then reuse, recycle, or compost the waste they do create. Suppliers can also access tools to improve waste management, and in some cases, onsite support. And we're seeing results: in fiscal year 2021, suppliers redirected 491,000 metric tons of waste from landfills, bringing the total to over 2 million metric tons since the program's inception — the equivalent of eliminating more than 2.5 million square meters of landfill space.

We've been successful at achieving this goal at our final assembly supplier sites. For the second year in a row, 100 percent of established final assembly sites including iPhone, iPad, Mac, Apple Watch, AirPods, HomePod, Apple TV, and Beats maintained zero waste to landfill operations in fiscal year 2021.<sup>34</sup>

The next challenge is a level deeper into the sub-assembly module suppliers who assemble 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. We started with Apple Watch Series 7: By the end of the fiscal year, all established final assembly sites and all key module sub-assembly sites achieved zero waste — including the sites assembling the display, battery, housing, band, and packaging.<sup>35</sup> Eliminating landfill waste across these sites marks both a significant effort and achievement, helping keep more than 35,000 metric tons of waste out of landfills.



# 100+

Apple supplier facilities are zero waste verified.



# 2M+

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



To do this we've partnered with our suppliers and local businesses to create new recycling options and develop opportunities for materials reuse. Recycling and reuse not only provides environmental benefits, but also can help our suppliers increase material efficiency and reduce the costs associated with material waste. At final assembly supplier sites, more of our suppliers use the recyclable and reusable alternatives 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. In 2021, iPhone 13 and iPhone 13 Pro were assembled using only RPFs.

Access to recycling and reuse varies from region to region, and some of our suppliers have limited access to recycling infrastructure. This was the case for our final assembly supplier site in Vietnam. To help this supplier become the first zero waste certified site in the country, we saw an opportunity to introduce a successful tray reuse program currently used by our suppliers in China. Trays play an essential role in our manufacturing process, carrying modules suppliers build to the final assembly site. We helped the third-party tray recycler expand their business from China to Vietnam, so they could collect, clean, and return plastic trays back to our supplier for reuse. Tray reuse across supplier sites reduced use of virgin plastic for component trays by 5000 metric tons in fiscal year 2021.

Yet, challenges remain for many suppliers — whether it's a lack of access to recycling technologies, the absence of local infrastructure, or the lower value of recyclable material that impacts the economics of recycling. To address these challenges together, and across our supply chain, we've designed a "Waste to Resource" database to provide access to the existing available technologies and local recyclers that we collected from the suppliers we work with. To date, we have compiled information on more than 700 recycling resources across more than 170 cities in China. As more of our supplier locations achieve their zero waste goals, they will continue to share valuable resources through the database. In the future, we plan to make this information public for the benefit of the entire electronics industry.

This is a collaborative effort between Apple, suppliers, and recycling vendors. We will continue to work with more module suppliers to continue this momentum, to share best practices, to continue to innovate on reducing waste, and to help our suppliers match with more capable recycling technologies — as we work to eliminate the waste generated while we manufacture our products.



In 2021, Apple and UL co-developed 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 site level. The new assurance procedure significantly accelerates the verification process and establishes a new model that companies across industries can employ to verify zero waste programs at scale.

# Designing buildings with the environment in mind



In 2021, we opened Apple Bağdat Caddesi with environmental features, including natural lighting and rainwater capture.

**When we build a new store or facility, we set out to create a space that reflects our values — from creativity and innovation to respect for the environment. This approach applies to all of our sites, including offices, retail locations, and data centers.**

We align our design and construction criteria to industry-recognized best practices for green buildings, promoting water conservation, energy efficiency, and responsible material sourcing. Currently, 92 of our sites are LEED (Leadership in Energy and Environment Design) or BREEAM (Building Research Establishment Environmental Assessment Method) certified. That number grows each year as we develop more than 16 million square feet of green building space globally.

For our retail stores, we set out to have a minimal environmental impact. To that end, we've prioritized locations that make use of existing construction. This provides an opportunity to build a space that meets our needs while limiting materials and resources that may otherwise be used in new construction. We've focused on historical sites that can be reimaged to revitalize locations and the surrounding communities. Last year, we opened Apple Tower Theatre, a retail location, which housed the first motion picture theater in Los Angeles wired for film and sound when it opened in 1927. The restoration brought back to life a site that had lain empty and unused since 1987, creating an entirely new destination in downtown Los Angeles. Last May, in Rome, Italy, we opened Apple Via del Corso, the newest retail location nestled in one of city's most vibrant areas. The store preserves the grand Palazzo Marignoli, paying homage to Rome's rich history of art and culture, and making it one of Apple's most significant restoration projects. These restorations contribute to maintaining the heritage of communities where we open locations, without the resources and carbon intensity that goes with new construction.

In Istanbul, we opened Apple Bağdat Caddesi — our third retail location in Turkey — which marked significant environmental milestones in construction and design. During the store build-out, the project redirected 75 percent of construction and demolition materials from landfill. The location's glass facade and skylight contribute to an energy savings of 22 percent, serving dual purposes of utilizing daylight to illuminate the space while connecting the site to the exterior environment. An on-site rainwater collection system, which treats and recycles water for toilet flushing and landscaping, will reduce water consumption by 45 percent off of the baseline. We've also been able to switch to a refrigerant with lower Global Warming Potential (GWP) than the baseline standard for LEED.

These efforts extend to our corporate offices and data centers. Our global footprint requires that we adapt to the needs of different locations and climates, while pursuing our overall objectives. This year, two new data centers in China — in Gui'an and Wulanchabu — received LEED

Gold certification. These certifications recognized several achievements, such as up to 14 percent energy savings from features such as high-efficiency cooling systems, and about 40 percent reduction in indoor water use through high-efficiency fixtures. Both data centers make use of harvested rainwater for irrigation, further reducing water demand.

The COVID-19 pandemic continued to have an impact on how we manage our spaces. We're evolving our approach to the new use patterns and capacity levels, actively adjusting our use of lighting and HVAC systems. For those who have already returned to our facilities, we're constantly monitoring occupancy to determine what additional ventilation and air filtration are needed to protect our employees.

Our locations need to coexist with their environments while meeting our standards for human-centric design. To achieve this balance is a constant challenge — one that inspires creative solutions and novel approaches to urgent needs.

  
**92**

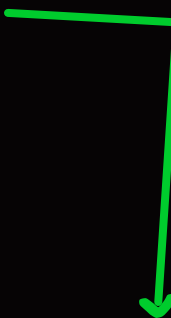
Apple buildings worldwide are LEED or BREEAM certified for environmental performance.



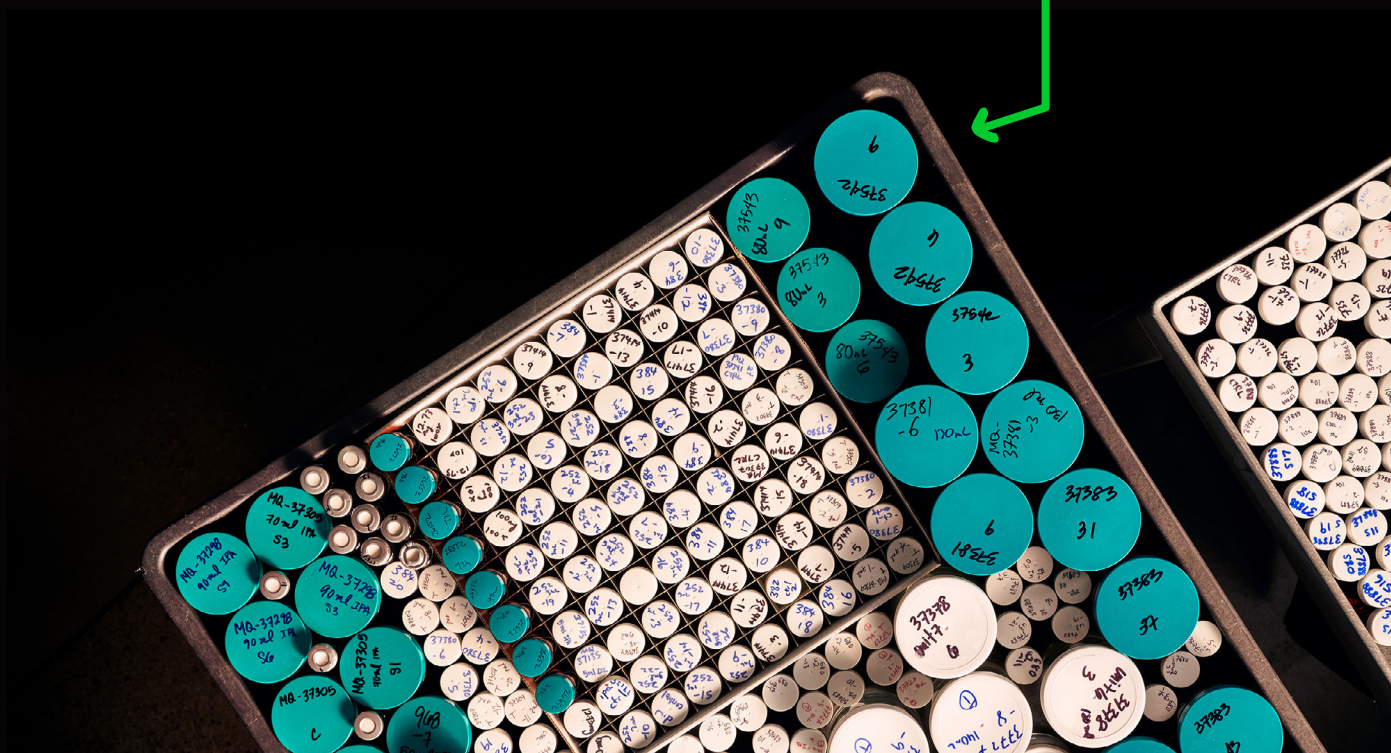
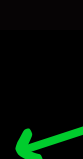
Restorations like the Apple Tower Theatre in Los Angeles not only help maintain the heritage of communities, but also reduce the resource and carbon intensity associated with opening new retail stores.



# Smarter Chemistry



~~Mercury~~  
~~PVC~~  
~~Beryllium~~  
~~BFR~~



# Goals and progress

The well-being of our employees, customers, people in our supply chain, and the planet is a priority for Apple, which is why we're committed to using safer materials to create safer products. This commitment requires diligent work — to build a comprehensive picture of chemicals across our supply chain, to insist on rigorous chemical management processes, to promote adoption of safer chemical alternatives, and to innovate through design smarter approaches to making our products. Using safer chemistry in our products also enables recycling and material recovery, so that our products can be the raw materials for the next generation.

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



1000+ manufacturing partner facilities shared how chemicals are used and safely managed



1000+ parts and material suppliers have been onboarded into Apple's Full Material Disclosure program



45K+ materials included in our comprehensive material library



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



Safer Choice Partner of the Year award from the EPA for the second consecutive year

# A<sup>+</sup>

A+ rating received from the Mind the Store campaign<sup>1</sup>

# #1

Ranked #1 of 50 retailers on the Mind the Store Retailer Report Card

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



100% of our final assembly supplier sites have used only safer alternative cleaners and degreasers since 2018



1000 new materials evaluated for biocompatibility in fiscal year 2021



Founding signatory of CEPN's Toward Zero Exposure program to help eliminate electronics workers' exposure to hazardous chemicals





# Our approach

We are dedicated to creating circular supply chains around our products. We start by sourcing recycled and renewable materials. Yet we also want the materials in our products to be recycled and used again. This goal is possible only if we deeply consider the chemicals we use. Through smarter chemistry, we identify chemicals that best serve all of our efforts, including safety, performance, and environmental impact. This process not only facilitates our efforts to create circular supply chains for our products, it also seeks to protect global communities impacted by waste. And our efforts to remove potentially harmful chemicals help create a safe and healthy workplace for the people in our supply chain.

These efforts also focus on limiting potentially harmful chemicals in the materials used to manufacture our products — and pushing our industry to follow suit. We've made considerable progress in accounting for the materials we use, both in our products and our manufacturing processes. This has allowed us to better protect the people who design, make, use, and recycle our devices — as we take steps to protect the environment. We're doing this through close engagement with others, including leading members of the scientific community, NGOs, and industry organizations. This work extends beyond our products, as we push for a global transition to materials that are safer to use and reuse.

We're proactive in promoting the use of safer materials and chemicals, establishing safety requirements that, in many cases, exceed local industry standards. And we empower our suppliers to not only meet these requirements, but also to find alternatives that are safer, are better for the environment, and deliver the performance we need. We've built an infrastructure to do this work, 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 the process of creating these systems with others in the industry — and push for transformational change.

This work requires leadership. We're committed to advocating for safer and more sustainable materials made with smarter chemistry — and working with our suppliers and material manufacturers to create alternatives that can help move our industry forward.

## The pillars of 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, allowing us to drive change that goes beyond what is 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 also support industry-wide change.

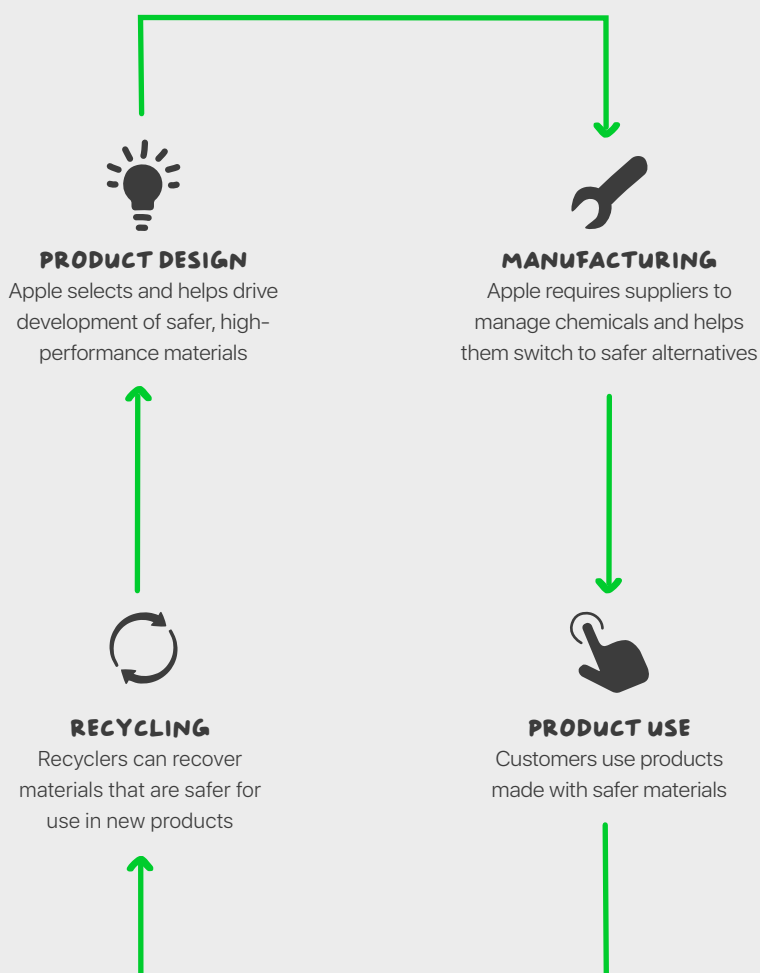
# Mapping and engagement

Our commitment to creating quality products also encompasses their health and environmental impacts. That means understanding the materials and the chemistries that go into them. This requires collaboration — to develop a clear picture of the chemicals in the materials used to make our products and make improvements.

We're doing this in a few ways. First, our Full Material Disclosure (FMD) program maps the chemicals used in our products. Then we look at how our products are manufactured. Our Chemical Safety Disclosure (CSD) program engages with supply chain partners to get up-to-date information on which materials are in use. This information includes the volume of materials being consumed, and how they're being applied, stored, and handled — as well as the steps being taken to protect their employees.

Our goal is to identify material chemistries that meet our criteria on performance, environmental impact, and safety. That requires a holistic view of the impacts of material chemistries at each phase in a product's life, from design and manufacturing, to the customer experience, through recycling and material recovery. With early engagement and effective data collection, we're best able to achieve these goals.

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



And we're leading in these efforts by doing the work required to understand the detailed chemical composition of the materials used to make our products and of the chemicals used during manufacturing. This effort requires working closely with our supply chain partners to understand the materials they use. And the information we gather is necessary to make the right decisions when it comes to potential toxicological risks. The way 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. With progress across our industry, we can build circular economies at scale.

## We're comprehensively identifying the materials in our products

Our process begins with gathering detailed and comprehensive information to inform our decision-making. Since it launched five years ago, the Full Material Disclosure (FMD) program aims to catalog and map each of the chemicals in the materials used in our products. Material manufacturers play a critical role in this program. They provide detailed reporting on material compositions from deep in our supply chain. This material chemistry data is proprietary. But once this data is shared through our innovative and secure data collection system, Apple has the information to make informed choices about the materials we use. Better choices based on better data are fundamental to delivering safer products.

We require each of our suppliers to participate in the program, collectively sharing information on thousands of materials used to manufacture our products. We've also taken steps to make this process easier. Our advanced collection system provides suppliers with access to a library of over 45,000 materials, including detailed information that we have researched and validated. This materials library serves as a reference for our suppliers to help them better identify and describe the materials they use in our products. If the supplier is using a material not yet listed in our library, we work with them and the material manufacturer to authenticate the new material.

Through the FMD program, we're creating a detailed inventory of the materials used to make our products. For iPhone, iPad, and Mac products released in fiscal year 2021, we collected detailed chemical information on 89 percent of each product by mass, on average. For the 24-inch iMac (2021), we collected information on more than 92 percent of the product by mass. Our efforts across product lines include tens of thousands of parts and assemblies. We also prioritize the collection of information on those materials that are key for biocompatibility. We continue to collect detailed chemical information for all materials that come under prolonged skin contact and require qualification from our biocompatibility team.

The creation of our FMD program has been an innovative approach to a challenge faced across our industry. Identifying opportunities to reduce toxicological risk — and potentially develop new chemistries — requires deep knowledge. The comprehensive materials library provides an important foundation for this approach. It helps inform decisions across our product life cycle. We make assessments of the materials we specify, how we choose to manufacture our products, and eventually, how we recycle them. And we continue to innovate. We're using machine learning to digitize data from chemical tests so this information can be more easily assessed. We're also advocating for an industry standard to help encourage the digital exchange of this important information. Through these efforts, we can improve not only the safety of our products, but that of the broader electronics industry.



# 45,000

materials are stored in our comprehensive materials library.



# 92%

We collected detailed chemical information for 92% of the 24-inch iMac by mass.

## We're also creating an inventory of chemicals used in manufacturing

The health and safety of the people in our supply chain are our priority. 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. And we take into account how the process of selecting and managing chemicals used within our supply chain can impact the people working within our supply chain.

This begins with having the right information — not only the chemicals used by our suppliers as they make Apple products, but also how they are stored, handled, and consumed at each location. Our Chemical Safety Disclosure (CSD) program

makes this possible. Suppliers provide this data as part of our program's rigorous disclosure process. Once suppliers provide a chemical inventory, we're able to help support compliance and identify opportunities to implement safer alternatives if needed.

More than 1000 supplier facilities have shared their chemical inventories as well as storage and safety protocols. Through this process, we've identified more than 17,000 chemicals and applications. This extensive reporting includes suppliers representing the majority of Apple's direct spend, including over 95 percent of Apple-managed suppliers in China. All of these efforts contribute to a safer work environment for people across our supply chain.

## Comprehensive chemical mapping



## We're working with suppliers to meet global requirements

Our role goes further than setting the requirements for our suppliers to meet. We've created systems that support ongoing efforts to track and assess the materials our suppliers use. Those frameworks not only help suppliers meet our requirements, but also help their operations follow global standards and regulations. The Full Material Disclosure (FMD) and Chemical Safety Disclosure (CSD) programs allow suppliers to gather and share information on chemistries they're using.

We support supplier engagement with these programs — and the Regulated Substances Specification (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. In 2021, our suppliers in China worked under the new regulations governing the use of materials containing Volatile Organic Compounds (VOCs). While we already had requirements in place for select applications of these materials, we provided additional support for suppliers with trainings on the new regulations that were attended by more than 2000 participants. We went even further to support compliance by testing and qualifying over 5000 low-VOC chemistries for use, helping our suppliers transition to these alternatives. And by deploying a new VOC specification worldwide, we're also helping drive adoption of low-VOC alternatives around the world.



With equipment like this gas chromatography–mass spectrometry system, we evaluate materials for substances restricted in our Regulated Substances Specification, including VOCs.



# Assessment and management

The data we collect on chemicals and materials forms the foundation for key decisions that have an impact on our product designs, manufacturing processes, and approach to recycling and reuse. This data enables us to establish requirements for our suppliers, including those set in our Regulated Substances Specification (RSS) and the Restricted Chemicals for Prolonged Skin Contact Materials list.

These requirements provide clear guidelines on potentially harmful materials, including those that are restricted. Our assessment system helps to ensure that only materials that meet our stringent requirements are used in Apple products. Both the data we gather on chemicals and our rigorous assessments allow us to make informed decisions and manage chemicals, 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.

## We're setting — and maintaining — rigorous chemical safety requirements

We first published the Regulated Substances Specification (RSS) in 2002, setting requirements for the use of chemical substances or materials in our products, accessories, manufacturing processes, and packaging. This effort builds on our history of advancements in material safety — and it reflects our dedication to the collection of necessary data to make these choices.

The RSS continues to evolve alongside the latest research and standards. It draws from regulations, international standards, and voluntary requirements. The specification aligns with Apple's internal policies, incorporates the latest scientific research, and is regularly updated with new chemicals and scopes of restrictions. Many of our RSS restrictions exceed local regulatory requirements in order to protect human health and the environment. The RSS both designates restricted substances and requires reporting on additional substances that are not restricted.



We test products in liquids mimicking sweat to evaluate for biocompatibility.

We also leverage the diverse experience and expertise of our Green Chemistry Advisory Board members, who share feedback on key initiatives, like potential RSS updates. This independent group of leading researchers and academics helps to ensure that we're leading the way to protect our customers and those who make or recycle our products.

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



Our restrictions on potentially harmful chemicals are available online in the [Apple Regulated Substances Specification \(PDF\)](#) and in [Apple's Restricted Chemicals for Prolonged Skin Contact Materials \(PDF\)](#) list.

## We're working on standards in the Environmental Testing Lab

At our Environmental Testing Lab, we evaluate the safety of our products and materials through chemical analyses. Our chemists test materials for safety and monitor compliance with our specifications. As we do this work, the Lab continues to grow in its mission and capacity. We're expanding our testing facilities with new technologies to conduct chemical analysis as we expand our Full Material Disclosure (FMD) and Chemical Safety Disclosure (CSD) programs. Our teams also review test reports from suppliers to evaluate substances against the RSS and Restricted Chemicals for Prolonged Skin Contact Materials list. In fiscal year 2021, we performed toxicological assessments on 1000 new materials to proactively evaluate and eliminate potentially harmful substances from our products.

The data we collect from our disclosure programs drives our assessments. We're able to generate comprehensive assessments, like GreenScreen®, a methodology we use to gauge the impact of chemicals on individual health and the environment based on 18 criteria. For new chemicals, we develop toxicological profiles, using both scientific literature and internal assessments. These profiles detail the features of each chemical, providing data that allows us to evaluate the safety of the use of a substance in a particular product. And, in 2021, we continued to expand the scope of biocompatibility testing beyond individual materials to include modules and whole products. This offers an even more comprehensive view of each product and details the impact that assembly has on overall safety. Within these products we perform toxicological evaluations of materials to help guide our evaluations of material safety. And what we share through the RSS and material specifications benefits our suppliers and those we collaborate with in the industry.



In A Protocol for [Prioritizing Chemicals of Concern in the Electronics Industry \(PDF\)](#), we share a framework to help actors across industries systematically evaluate chemistries.



In our Environmental Testing Lab, our team of chemists evaluate new materials before they are used in Apple products.

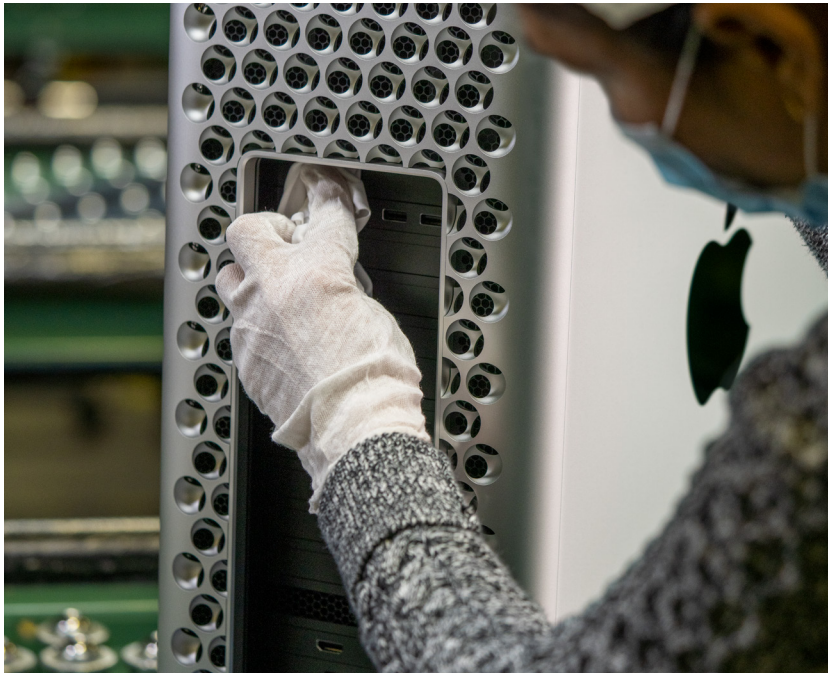
## We're creating a list of safer cleaners

An area where we are making an immediate impact is the application of cleaners and degreasers. These substances account for some of the highest-use materials at final assembly sites — and their chemistries have been the focus of considerable attention from regulators and environmental health and safety organizations. We're investing in the due diligence required to identify preferred alternatives so that suppliers and others in the industry can also benefit.

We have decided to take a proactive approach that provides a list of cleaners and degreasers that are safer to use. We invested in the in-depth assessment and evaluation of these substances, incorporating leading guidance by GreenScreen® and the U.S. Environmental Protection Agency's Safer Choice program. To date, we have evaluated and identified more than 90 cleaners.

These efforts have a direct impact and the potential to change how our industry operates. We're driving 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. Since 2018, all our final assembly sites have used only safer alternative cleaners and degreasers. We're also looking across a wider group of materials, including adhesives, dyes, and other high-volume materials used in our supply chain, to begin driving the adoption of safer alternatives for more and more materials. In 2020, we were the first consumer electronics company to receive the EPA Safer Choice Partner of the Year Award. And in 2021, we received this recognition again for our work to scale the use of safer process chemicals, and protect those working in our supply chain.

We are also looking outside of our own supply chain to promote a broader transition to safer chemicals. See [page 74](#) for more about how we're advocating for safer cleaners and degreasers across our industry.



Since 2018, all our final assembly supplier sites have used only safer alternative cleaners and degreasers, protecting those working in our supply chain as well as the environment.



# Innovation

**We're continuing to develop our knowledge of material properties to make improvements in chemical safety and also in the performance and environmental impact of the materials. When we assess substances considering these three factors together, it helps drive innovations that don't require trade-offs.**

The work we do in mapping, assessing, and managing the chemicals within our supply chain underpins our innovations. We rely on detailed information on the material properties, including toxicological data and environmental performance characteristics. We also look at how these materials are used at each point in the product life cycle, from design, to manufacturing, to end-of-life. This allows us to seek out and support the development of safer chemistries that have an impact on each phase — and contribute to continually improving the overall safety of our products and processes.

## **We're innovating the designs and processes used to make our products**

The earlier we focus on materials during product development, the more options we have along the way to make improvements through innovation. The criteria we consider — safety, performance, and environmental impact — represent our holistic approach to smarter chemistry: designing to our customers' needs, so that our products exceed expectations, while being safer for use, reuse, and recycling.

The process of choosing both the substances we design into our products and those our suppliers use in manufacturing is foundational to achieving these goals. We rely on our comprehensive chemical profiles of each material to inform these choices. When a material is introduced into our supply chain, our CSD and FMD programs help provide information to assess a substance and its suitability. Our toxicological assessments look at each chemical within a material, with a particular focus on those that come into prolonged contact with skin. We also look at the conditions that the material is used within, to make recommendations that reflect the existing controls around a substance. As we select the materials to include in our products, we assess the process chemicals required with each design choice. We work proactively with our suppliers to help ensure that their employees are protected through proper storage, handling, and material application controls.

And, finally, we consider what happens when our products reach their end-of-life. We work to protect those recycling our products and prevent potential releases into the environment during the recycling process. We monitor chemistries that are harmless in small quantities but become more concentrated through recycling cycles. We also look at how potentially harmful substances impact the recyclability of a material. This can lead to downcycling — use of the material in lower-quality applications — or could make the material unsafe for any use.

Through our efforts to share information across our supply chain, perform detailed chemical assessments, and partner with suppliers on chemical management, we unlock material science innovations that lead to better products. This not only protects those who make and use our products, but also enables the reuse of key materials. By keeping potentially harmful chemicals out of our supply chain at the outset, we make it possible for ourselves and others to recover materials for the next generation of products.



We also aim to support a broader industry transition toward safer chemistry through the creation of industry tools. For example, we joined the nonprofit ChemSec, and other industry partners in an effort to develop ChemCoach, a step-by-step approach to help companies advance chemical safety within their products and supply chains.

"Chemicals safety is a global, shared responsibility, so ChemSec is thrilled to have Apple and other industry leaders join in sharing these practical tools for adopting sustainable practice. We hope this resource inspires more companies within the manufacturing industry to maximize the safety of their operations and products."

**Anne-Sofie Bäckar,**  
Executive Director  
at ChemSec



## We're creating new safer chemistries to move the industry forward

Safer materials are a priority for our business — and we've used our procurement process to encourage our suppliers to share this priority. Our strict requirements governing potentially harmful substances in our products and processes have helped create a market for safer alternatives. We're working with our suppliers to meet this demand, lending the expertise we've developed to create safer chemistries where none exist. We've also begun to phase out chemistries that don't meet our specifications. This work isn't limited to our company or our products. We're trying to catalyze change across our industry

by investing in safer alternatives. By promoting the use of safer and cleaner chemistries now, we're supporting the circular supply chains of the future.

We've collaborated with others on this goal, using our extensive research and analysis of materials to enable our suppliers to find safer alternatives. If an alternative has yet to be created, we lend our technical capabilities in material science as we work with our suppliers to develop entirely new chemistries. These new alternative materials face the same rigorous testing and evaluation against our high safety, performance, and environmental standards.

## Substances we keep out of our products\*



### PVC and phthalates

Replaced with safer thermoplastic elastomers. Both are still used by other companies in power cords and headphone cables.



### Brominated flame retardants (BFRs)

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



### Mercury

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



### Lead

Phased out of display glass and solder in 2006.



### Arsenic

Eliminated from display glass since 2008. Arsenic was traditionally used in glass.



### Beryllium

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



### PFOA and PFOS

Eliminated PFOA and PFOS from our products, with RSS restrictions added in 2010 and 2013 respectively. These types of chemicals are commonly used in the manufacturing of water-resistant materials.

\* 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, eco-label 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 2-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.

And we have a long history of leading in the identification and successful removal of potentially harmful substances. We've done so since the late 1990s, rigorously assessing chemicals and removing those that don't align with our goals. We phased out brominated flame retardants (BFRs) before this practice became a requirement and industry standard. Starting in 2010, we restricted the use of perfluorooctanesulfonic acid (PFOS) through our RSS, and in 2013 added restrictions for perfluorooctanoic acid (PFOA). We were proactive on this, taking action ahead of global requirements because research showed that these chemicals remain persistent in the environment. Each phaseout we undertake requires developing alternatives, whether creating safer compounds to replace potentially harmful chemistries or replacing components with alternatives that meet our safety standards. In some cases, we've redesigned our products to eliminate the need for parts that incorporate potentially harmful chemistries.

Our work has been recognized. Apple has received an A+ rating from Mind the Store, an external campaign that evaluates the largest retailers in North America on how they ensure the chemical safety of their products and packaging, for the past three years.<sup>2</sup> We also ranked #1 of 50 retailers on the Mind the Store Retailer Report Card.<sup>3</sup>

## We're advocating for safer alternatives across our industry

As we work toward minimizing potentially harmful chemistries in our products and processes, we're also making the transition to safer alternatives accessible to others. Much of our focus centers on cleaners and degreasers — and building out a safer cleaners innovation ecosystem through multiple efforts. In 2021, Apple became a founding signatory of the Clean Electronics Production Network's (CEPN) Toward Zero Exposure program. CEPN, a multi-stakeholder initiative led by the NGO Green America, developed the Toward Zero Exposure platform to accelerate companies' efforts to eliminate the potential for worker exposure to hazardous chemicals, and boost awareness of the need to improve chemical management practices across the global electronics manufacturing industry. Apple contributed to developing CEPN's list of priority chemicals for substitution and has already eliminated the use of these nine chemicals in our supply chain.

We're also developing a new standard around cleaners — IPC-1402 — to define more clearly what qualifies as a "green" cleaner in electronics manufacturing. The standard builds on our success in managing cleaners used for final product assembly and applies that knowledge for cleaners used deeper in the supply chain at module and sub-assembly sites. We're aiming to reach both the chemistry and toxicology experts that conduct material assessments and the electronics engineering teams to lay out expectations on the use of safer cleaners. Our work on this standard is a collaborative effort involving more than 20 companies, which we expect to introduce in 2022.

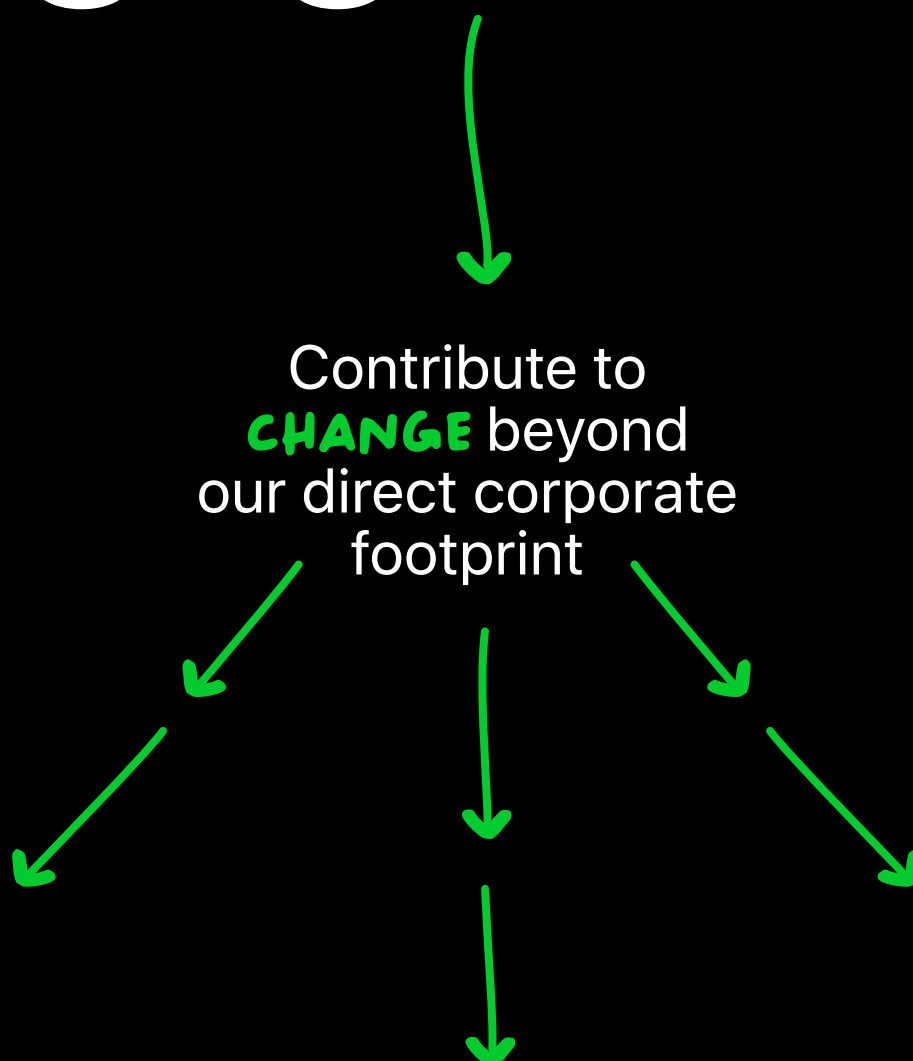
Last year, we also supported the development of a new certification for assessing the safety of cleaners used in the electronics industry and beyond in partnership with Clean Production Action (CPA) — a globally recognized NGO advocating for green chemicals and sustainable materials. The GreenScreen Certified™ for Cleaners & Degreasers is a free and publicly available tool to assess and promote safer chemicals. It's part of an effort to drive broader, industry-wide change by making information about safer alternatives readily available to companies globally. We've used the leading GreenScreen tool, as well as the EPA Safer Choice criteria, within our supply chain, leading to the transition of 100 percent of our final assembly sites to safer alternatives for cleaners and degreasers. The creation of a new certification will allow other companies beyond our supply chain to better protect workers making electronics products around the world.

We're also partnering with NGOs to make information about these materials readily available throughout the electronics industry. One effort is ChemFORWARD, a nonprofit collaboration of brands, retailers, suppliers, and environmental organizations that share high-quality, actionable chemical hazard assessment data via a globally harmonized repository. With ChemFORWARD, we'll share our list of safe cleaners and degreasers and our evaluation framework with companies beyond our suppliers and even our industry.



Apple signed on as a founding member of the Clean Electronics Production Network's (CEPN) Toward Zero Exposure program — an initiative that seeks to eliminate workers' exposure to hazardous chemicals.

# Engagement



# Our approach

Apple is committed to creating positive environmental impact. This includes the environmental challenges our world faces that extend far beyond our footprint as a company. As a member of the global community, we see it as part of our responsibility to engage with stakeholders doing impactful work directed at these challenges. This means working with others, learning from their feedback, and providing support where we can make a difference. We take advantage of opportunities to effect change both within and beyond our operations and supply chain. Engagement also allows us to respond to the world around us, looking for ways to play a positive role in the industries, issues, and communities where our involvement can be transformative.

## Working with our stakeholders

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





# Achieving change together

## We're in conversation with stakeholders around the world

Through active engagement, we hear from stakeholders who bring different points of view and understanding of the issues we care about. Our conversations with policymakers, nonprofits, and community leaders help inform our understanding of how regulations, methods, and new technologies are evolving. They also help us learn, improve, and find new opportunities to overcome barriers to our environmental goals. We take action based on what we learn, whether that means aligning with the latest standards and best practices, or understanding the implications for cutting-edge research on our operations.

Just this year, we conducted more than a dozen roundtables on environmental topics across the U.S., Europe, and China with key stakeholders, including members of academia and industry associations, to understand issues and regulations region by region. These forums also allowed us to share information on our efforts and understand where enhanced transparency would support those directly working on policy.

We're also working with the scientific community to understand new approaches and cutting-edge tools that can help us achieve our environmental goals. This includes our work with researchers at [Carnegie Mellon University](#) developing robotic recycling systems to enhance material recovery for Apple and others. We also continue to engage our [Green Chemistry Advisory Board](#), an independent group including toxicologists and experts who advise on our smarter chemistry initiatives.

Through engagement, we refine our approach and work to industry standards and best practices. We look to cross-sector engagement platforms to help guide our programs and set standards for environmental efforts. In one initiative, we've achieved [Alliance for Water Stewardship \(AWS\)](#) certification for a number of key Apple and supplier facilities, relying on the AWS's expertise in defining world-class water stewardship practices. We're also partnering with forestry experts at Conservation International as we invest in working forests through our [Restore Fund](#).



Isabel Ge Mahe, Vice President and Managing Director for Apple Greater China speaks at the ceremony where Apple, the Suzhou Industrial Park Administrative Committee, and TEDA Eco Center signed a Memorandum of Understanding (MOU). This collaboration aimed to support Suzhou Industrial Park in becoming the world's first industrial park to achieve certification to the Alliance for Water Stewardship (AWS) standard.

The voices from within the business community, including our customers, employees, suppliers, industry partners, and investors, also motivate us to find ways we can support one another's environmental goals and push our efforts even further. As co-chairs of the United States Information Technology Office (USITO), a trade association representing the United States 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 regulation and engage with policymakers on future standards. We continually look for more opportunities to work with others — at an industry and national level — to receive feedback and make progress.

## We're supporting broader change across industries

An important part of our role within our industry is to influence change. Our industry can best achieve results through collective action on key environmental issues. And Apple can better realize our goals on climate, resources, and smarter chemistry when we actively share our experience and contribute to industry-wide improvements.

To facilitate efforts beyond our footprint, we engage in dozens of industry initiatives to share what we have learned and find new opportunities to advocate for change. As part of these partnerships and coalitions, we make direct contributions to the broader industry by creating tools and standards, and by pursuing policy objectives that support our shared goals. For example, as a co-design partner in [ChemFORWARD](#), we're supporting the creation of a registry to expand the use of safer cleaners and degreasers, a part of our efforts to limit toxic chemical exposure and advance human and environmental equity.

Policy plays a key role in industry change, as well. And we actively advocate for policies that advance environmental objectives, from tackling climate change to enhancing material recovery. Learn more about our efforts on [climate policy](#), [page 31](#), and [resource recovery policy](#), [page 51](#).

When it comes to taking action on environmental challenges, collective action matters. Which is why we're also making public commitments alongside our partners to signal the kind of change we are working to create. And by being transparent about our progress against these commitments, we hold ourselves and our partners accountable. We believe collective action can help us both address environmental challenges directly and serve as a catalyst for others to act.

### Key industry engagements

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

At the United Nations Climate Change Conference (COP26), we affirmed our support of the Clean Energy Demand Initiative (CEDI) launched by the U.S. State Department, which seeks to advance clean energy goals through corporate clean energy commitments. Through another energy initiative, RE100, we've committed to 100 percent renewable electricity with members in markets across the globe. We also pledged to move to sustainable aviation fuel equal to 5 percent of our passenger air travel footprint by 2030 as part of the First Movers Coalition, a new platform for companies to create market demand for low-carbon technologies. We're investing in forestry and carbon removal, as well, backing projects that offer a financial return for investors and participating in initiatives, including The Forest Investor Club. (See [page 29](#) for more detail on our Restore Fund.) And we continue to support the Paris Climate Agreement through the Race to Zero, a campaign to halve global emissions by 2030 through transparent action plans and robust near-term targets. This includes our role as a signatory to America Is All In, a declaration by 3800 state, tribal, local, and business leaders to meet the Paris Climate Agreement's goals.

We're also making commitments to address issues beyond climate change, including chemical safety and reducing the amount of plastics in our products. We've joined the Toward Zero Exposure program with the [Clean Electronics Production Network \(CEPN\)](#), a multi-stakeholder initiative working to address health and safety challenges in the electronics supply chain. With the Ellen MacArthur Foundation, we've pledged to eliminate plastics from our packaging by 2025.

## **We're collaborating with others to effect change in communities**

Engagement also means collaborating with those who have been addressing environmental injustice in their communities. There are opportunities for us to play a part in helping others achieve change. And we can also learn from the experiences of those working directly on these issues. We strive to integrate their points of view into our environmental approach, to respect their voices, and where possible, provide a broader context for them to be heard.

We also have an opportunity to contribute beyond our direct corporate operations — and outside our areas of expertise. This is where some of the most vital opportunities to support transformational change for communities can be found. We've only just begun supporting those leading this important work, but we aim to contribute to the change these organizations are creating. We determine our grants based on the focus of each organization and their potential to affect change. And we recognize the importance of community-driven leadership on many issues by providing support where our contributions will yield results.

Environmental justice groups have played a significant and vital role in advancing communities. To honor the ongoing commitment of these organizations, we've made grants to minority-led and centered organizations that focus on environmental issues. Recent recipients include the Hispanic Access Foundation, which is working to address environmental hazards directly affecting the Latino community and establish bridges that provide equal access to a more healthy, natural environment, and First Nations Development Institute, which supports ecological stewardship and environmental justice within the Indigenous community. We've also supported NDN Collective, Outdoor Afro, the Deep South Center for Environmental Justice, and others.



Through giving, we can also catalyze nascent projects and technologies that may help the industry over the long term or simply contribute to other meaningful environmental causes. With the Alliance for Brazil, we're supporting efforts to restore areas within the Amazon forest that are under threat from forest fires. The Alliance's reforestation work also includes training and outreach programs to empower local communities in protection and governance practices, while developing and strengthening livelihood models that support economic development.

We also support the National Park Foundation in the U.S., which has provided more than 1,000,000 students with meaningful national park experiences since 2011, encouraging young people to connect with the natural world. In addition, we're backing the Foundation's work to advance outdoor equity by eliminating barriers and promoting access. And in the Chyulu Hills region of Kenya, we're supporting community empowerment programs for Maasai smallholder farmers, including educational scholarships for local students as well as pastureland management training.



Apple supports the National Park Foundation, which has provided more than 1,000,000 U.S. students access to national parks.



With support from Apple and other partners, the National Park Foundation launched the ParkVentures program, investing in equity-focused outdoor leaders and organizations. Photo credit: Young Masterminds, Inc.



# Apple's Impact Accelerator

As we work toward a cleaner economy, we want to ensure that companies that traditionally have not been included in the financial growth that comes with change are not left out. We're taking steps to make sure that businesses led by people of color are positioned to benefit from investments in environmental solutions.

Last year, we welcomed the first class to our Impact Accelerator, a training and mentorship program for Black-, Hispanic/Latinx-, and Indigenous-owned businesses headquartered in the United States that share our focus on innovation and our commitment to the environment. Part of Apple's Racial Equity and Justice Initiative, the Accelerator aims to help combat systemic barriers to opportunity, while also advancing innovative solutions for communities most impacted by climate change. We selected our first class of 15 businesses on the cutting edge of green technology and clean energy to begin the program in August 2021. 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 share a specific focus on bringing clean energy, opportunity, and vital services to vulnerable and underserved communities.

The three-month program included live virtual sessions, online courses on supply chain management, supplier diversity, financial and legal subjects, as well as one-on-one mentorship with an Apple expert on topics from renewable energy to responsible sourcing. The program culminated in Demo Week, an opportunity for participants to pitch decision-makers and business leaders within Apple. Following the program, every business was given the opportunity to attend a minority business executive leadership program through leading universities, and each participant has since engaged with our competitive services procurement process. These businesses then transitioned to Apple's Supplier Success community, to further foster the connections developed during the program.

The goal of the Impact Accelerator is to better position the participating companies for growth, to improve their abilities to take on larger contracts, and to expand their customer base — all while fostering their environmental commitment. By making connections between innovators, both in our inaugural class and at Apple, we're creating opportunities to support our shared goals. For example, last October we announced that we will be working with the Oceti Sakowin Power Authority, formed by six Sioux tribes to jointly develop tribal renewable energy resources, on a project to create a wind power development in the Midwest. And following the success of this year's class, our efforts continue. This spring, applications opened for the next class to join our Impact Accelerator.

**"On our journey to our 2030 carbon neutral goal for our supply chain and products, we're determined to help create a greener and more equitable future for all people. The businesses we're partnering with today are poised to become tomorrow's diverse and innovative industry leaders, creating ripples of change to help communities everywhere adapt to the urgent challenges posed by climate change."**

## Lisa Jackson

Apple's vice president  
of Environment, Policy and Social Initiatives



Impact Accelerator participant Karl Johnson leads Detroit-based Diversified Chemical Technologies, Inc., which promotes excellence, sustainability, and social responsibility in their chemical manufacturing.

# Appendix

Holding ourselves  
**ACCOUNTABLE**  
to our progress



# Appendix

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## Appendix A

# Greenhouse gas emissions

		Fiscal year				
		2021	2020	2019	2018	2017
<b>Corporate emissions<sup>1</sup> (metric tons CO<sub>2</sub>e)</b>	<b>Scope 1 (gross emissions)</b>	<b>55,200</b>	<b>47,430</b>	<b>52,730</b>	<b>57,440</b>	<b>47,050</b>
	Natural gas, diesel, propane	40,070	39,340	40,910	42,840	36,210
	Fleet vehicles	12,090	4,270	6,950	11,110	8,300
	Process emissions <sup>2</sup>	3,040	3,830	4,870	3,490	2,540
	<b>Scope 2 (market-based)</b>	<b>2,780</b>	<b>0</b>	<b>0</b>	<b>8,730</b>	<b>36,250</b>
	Electricity	0	0	0	8,730	36,250
	Steam, heating, and cooling <sup>3</sup>	2,780	-	-	-	-
	<b>Scope 3 (gross emissions)<sup>4</sup></b>	<b>23,130,000</b>	<b>22,550,000</b>	<b>24,980,000</b>	<b>25,070,000</b>	<b>27,330,000</b>
	Business travel <sup>5</sup>	22,850	153,000	326,000	337,000	121,000
	Employee commute <sup>6</sup>	85,570	134,000	195,000	183,000	172,000
<b>Product life cycle emissions<sup>8</sup> (metric tons CO<sub>2</sub>e)</b>	Corporate carbon offsets <sup>7</sup>	-167,000	-70,000	-	-	-
	Manufacturing (purchased goods and services)	16,200,000	16,100,000	18,900,000	18,500,000	21,100,000
	Product transportation (upstream and downstream)	1,750,000	1,800,000	1,400,000	1,300,000	1,200,000
	Product use (use of sold products)	4,990,000	4,300,000	4,100,000	4,700,000	4,700,000
	End-of-life treatment	80,000	60,000	60,000	50,000	40,000
	Product carbon offsets <sup>9</sup>	-500,000	-	-	-	-
<b>Total gross carbon footprint (without offsets)<sup>10</sup> (metric tons CO<sub>2</sub>e)</b>		<b>23,200,000</b>	<b>22,600,000</b>	<b>25,100,000</b>	<b>25,200,000</b>	<b>27,500,000</b>
<b>Total net carbon footprint (after applying offsets)<sup>10</sup> (metric tons CO<sub>2</sub>e)</b>		<b>22,530,000</b>	<b>22,530,000</b>	<b>25,100,000</b>	<b>25,200,000</b>	<b>27,500,000</b>

1. Apple is carbon neutral for corporate emissions as of April 2020.

2. Emissions from R&D processes.

3. Beginning in FY2021, we're accounting for scope 2 emissions from the purchase of district heating, chilled water, and steam.

4. In fiscal year 2017, we started calculating scope 3 emissions not listed above. In fiscal year 2021, these include electricity transmission and distribution losses amounted to about 28,000 metric tons CO<sub>2</sub>e and life cycle emissions associated with renewable energy amounted to about 95,000 metric tons CO<sub>2</sub>e. We have not accounted for emissions resulting from employees working from home, because we anticipated these emissions are small relative to our carbon footprint and we are still evolving our methodology.

5. We regularly revisit our methodology to hold ourselves to high accountability standards. So in fiscal year 2018, we changed how we calculate emissions from business travel in order to better account for classes of service in air travel. As a result of this change, our scope 3 transportation emissions increased by 77 percent between 2017 and 2018. Without the methodology change, these emissions would have increased by 14 percent, which reflects the growth in our business.

6. Beginning in fiscal year 2020, we updated our methodology to reflect the impact of COVID-19 on employee commute.

7. We retired 167,000 metric tons of carbon credits from the Chyulu Hills project in Kenya to maintain carbon neutrality for our corporate emissions in fiscal year 2021. This project is certified to the VCS and CCB standards.

8. Because we're committed to accuracy and transparency, we regularly refine our product life cycle assessment model and sources of data. For example, we recently obtained more granular data summarizing in which countries our products are sold and used, resulting in more granularity possible for grid emission factors used in the carbon footprint of the product use phase. The net result was an increase in our 2021 carbon footprint. When using the same level of data granularity and model as 2021, our product use carbon emissions in 2021 would have been about 2.5 percent lower.

9. For fiscal year 2021, we retired credits from the Chyulu Hills project in Kenya, and purchased carbon credits from two additional projects to offset a total of 500,000 metric tons of direct emissions across our value chain. The first project, a REDD+ coastal conservation project in Guatemala, protects and conserves forests from deforestation and degradation. The second project aims to establish forests on about 46,000 hectares of barren land that is not otherwise in use across seven counties in the Guizhou Province of China. Both projects are certified to the same high standards that we require for projects in the Restore Fund, including VCS and CCBs. These projects are all certified to the VCS and CCB standards.

10. Due to rounding, our gross and net carbon footprints do not always the sum of the subtotals disclosed above.

**Notes:** For data on previous years, please reference past Environmental Progress Reports, available at [apple.com/environment](https://apple.com/environment). Dash indicates data that are not available. Due to rounding, totals may not be the sum of the subtotals above.



## Appendix A

# Apple's life cycle assessment methodology

Apple uses five steps when conducting a product life cycle assessment (LCA):

1. To model the manufacturing phase, we use part-by-part measurements of the entire product along with data on part production. 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 datasets 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.

## Appendix A

## Energy

			Fiscal year				
Unit			2021	2020	2019	2018	2017
Corporate facilities energy use							
Electricity	Total	MWh	2,854,000	2,580,000	2,427,000	2,182,000	1,832,000
	U.S.	MWh	2,377,000	2,192,000	2,075,000	1,830,000	1,536,000
	International	MWh	477,000	389,000	351,000	351,000	296,000
Fuel	Total	MWh	467,280	439,170	462,680	494,460	420,650
	Natural gas	MWh	203,010	202,360	202,340	204,970	174,420
	Biogas	MWh	208,620	210,820	217,140	226,660	193,280
	Propane liquid	MWh	40	140	280	280	280
	Gasoline	MWh	34,880	14,910	23,950	37,740	31,310
	Diesel (other)	MWh	9,780	9,610	16,450	20,270	20,670
	Diesel (mobile combustion)	MWh	10,950	1,330	2,520	4,540	690
Other	Steam, heating, and cooling <sup>1</sup>	MWh	22,480	-	-	-	-
Energy efficiency <sup>2</sup>							
Corporate facilities	Electricity savings <sup>3</sup>	MWh/year	260,390	244,690	208,640	113,200	69,980
	Fuel savings	mmBTU/year	299,780	297,090	277,120	254,140	245,340
Supplier facilities <sup>3</sup>	Electricity savings	MWh/year	1,418,825,350	1,101,440	943,890	798,930	473,510
	Fuel savings	mmBTU/year	1,047,440	752,680	25,120	25,120	5,620
Renewable electricity							
Corporate facilities	Renewable electricity use	MWh	2,854,000	2,580,000	2,430,000	2,170,000	1,770,000
	% Renewable electricity <sup>4</sup>	percent of total energy	100%	100%	100%	99%	97%
	Scope 2 emissions avoided	metric tons CO <sub>2</sub> e	1,063,720	948,000	899,000	690,000	589,000
Supply chain <sup>5</sup>	Renewable electricity capacity (operational)	GW	10.3	4.5	2.7	1.9	1.2
	Renewable electricity capacity (committed)	GW	15.9	7.9	5.1	3.3	2
	Renewable electricity use	MWh	18,100,000	11,400,000	5,700,000	4,100,000	1,900,000

Notes: For data on years prior to 2017, please reference past Environmental Progress Reports, available at [www.apple.com/environment](http://www.apple.com/environment)

Dash indicates data that are not available.

- Beginning in FY2021, we're accounting for the purchase of district heating, chilled water, and steam.
- Because energy efficiency measures have lasting benefits, energy efficiency savings are calculated cumulatively since 2012. All efficiency measures are retired based on their effective useful lifetime as documented by the California Energy Commission. Due to the COVID-19 pandemic, corporate facilities energy use declined temporarily as we adjusted lighting and climate controls due to shutdowns and reduced occupancy. These savings are not included in the total savings from our energy efficiency program initiatives. We also recognize that energy use at our employees'

homes likely increased during this period. We have not accounted for this energy use, because we anticipated this impact is small relative to our overall energy use and we are still evolving our methodology.

- Energy savings from supplier energy efficiency improvements are reported as annualized annual numbers. Prior to 2020, supplier energy savings are calculated on a calendar year basis. Beginning in 2020, supplier energy savings are calculated based on the fiscal year.
- Beginning January 1, 2018, 100 percent of the electricity we use to power our global facilities is sourced from renewable energy.
- Supply chain renewable electricity capacity (operational) and renewable electricity use for FY2021 do not include REC purchases Apple made, equivalent to 0.3 GW and 500,000 MWh, respectively, to address a small increase to its carbon footprint.

## Appendix A

## Resources

			Fiscal year				
	KPI	Unit	2021	2020	2019	2018	2017
<b>Water</b>							
Corporate facilities	<b>Total</b>	<b>million gallons</b>	<b>1,407</b>	<b>1,287</b>	<b>1,291</b>	<b>1,258</b>	<b>1,000</b>
	Freshwater <sup>1</sup>	million gallons	1,259	1,168	1,178	1,190	973
	Recycled water <sup>2</sup>	million gallons	141	113	106	63	24
	Other alternative sources <sup>3</sup>	million gallons	7	5	7	4	3
Supply chain	<b>Freshwater saved</b>	<b>million gallons</b>	<b>12,300</b>	<b>10,800</b>	<b>9,300</b>	<b>7,600</b>	<b>5,100</b>
<b>Waste</b>							
Corporate facilities <sup>4</sup>	<b>Landfill diversion rate</b>	<b>percent</b>	<b>68%</b>	<b>70%</b>	<b>66%</b>	<b>67%</b>	<b>71%</b>
	Landfilled (municipal solid waste)	pounds	33,202,200	25,826,550	38,317,120	32,372,890	31,595,200
	Recycled	pounds	73,489,220	63,812,300	72,338,130	66,380,630	68,509,300
	Composted	pounds	4,844,960	6,302,410	10,882,120	10,397,430	14,567,500
	Hazardous waste	pounds	3,525,840	4,053,770	6,096,600	6,277,800	3,342,700
	Waste to energy	pounds	657,890	786,250	1,129,080	1,105,140	645,000
Supply chain	<b>Waste diverted from landfill</b>	<b>metric tons</b>	<b>491,000</b>	<b>400,000</b>	<b>322,000</b>	<b>375,000</b>	<b>351,000</b>
<b>Product packaging footprint</b>							
	<b>Total packaging</b>	<b>metric tons</b>	<b>257,000</b>	<b>226,000</b>	<b>189,000</b>	<b>187,000</b>	<b>169,000</b>
	Recycled fiber	percent	63%	60%	59%	58%	56%
	Responsibly sourced virgin fiber <sup>5</sup>	percent	33%	35%	33%	32%	30%
	Plastic	percent	4%	6%	8%	10%	14%

1. We define freshwater as drinking-water quality, the majority of which comes from municipal sources and less than 5 percent comes from onsite groundwater sources.
2. Recycled water represents a key alternative water source. Our recycled water is sourced primarily from municipal treatment plants, with less than 5 percent from onsite treatment. Recycled water is primarily used for irrigation, make-up water in cooling, or toilet flushing.
3. Other alternative sources of water include rainwater and recovered condensate that is captured onsite. Water used for construction activities like dust control is not included in this total, and represents 13 million gallons of water used in fiscal year 2021.

4. Total does not include construction and demolition waste nor electronic waste. We're refining our methodology for collecting this data and plan to include it in future years. We have also re-stated the total for 2018 without these categories of waste.
5. Responsible sourcing of wood fiber is defined in Apple's Sustainable Fiber Specification. Since 2017, all of the virgin wood fiber used in our packaging has come from responsible sources.

Appendix A

# Normalizing factors\*

	Fiscal year				
	2021	2020	2019	2018	2017
Net sales (in millions)	\$365,817	\$274,515	\$260,174	\$265,595	\$229,234
Number of full-time equivalent employees	154,000	147,000	137,000	132,000	123,000

\* As reported in Apple's Form 10-K Annual Report filed with the SEC.

**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 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 have 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 non-energy 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 micro-hydro 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 to our data center, offices, and retail stores in California.

### Green 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 Green 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 of 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.



## Facilities renewable energy projects

To reach 100 percent renewable electricity for Apple's own facilities, Apple has helped to create 1549 MW of renewable energy around the world. The projects listed to the right represent Apple-created renewable energy projects supporting Apple facilities' electricity use and contributing to cleaner grids around the world. Operational projects apply a mix of clean energy technology including wind (22.9 percent), solar (76.0 percent), micro-hydro (0.21 percent), and biogas fuel cells (0.9 percent).

This table represents all *operational* renewable energy projects that Apple has helped create.

Location	Renewable energy technology	Size (MW)
Australia	PV	0.5
Brazil	Wind	0.5
China mainland	PV	130
Colombia	PV	0.2
Denmark	PV	42
Denmark	Wind	17
France	PV	<0.1
India	PV	2
Israel	PV	5
Japan	PV	12
Mexico	Wind	0.8
Philippines	PV	0.1
Singapore	PV	35
South Africa	PV	0.2
Taiwan	PV	1
Turkey	PV	4
USA (AZ)	PV	55
USA (CA)	Biogas fuel cell	4
USA (CA)	PV	146
USA (IL)	Wind	112
USA (NC)	Biogas fuel cell	10
USA (NC)	PV	164
USA (NV)	PV	320
USA (OR)	Micro-hydro	3
USA (OR)	PV	125
USA (OR)	Wind	200
USA (TX)	PV	1
USA (TX)	Wind	25
USA (VA)	PV	133.6
<b>Total</b>		<b>1549</b>

Note: Data current as of February 2022 (operational).

## Fiscal year 2021 energy and carbon footprint (corporate facilities)

The chart below provides a detailed breakdown of fiscal year 2021 energy use, which we used to calculate our greenhouse gas emissions.

Location	Scope 1			Scope 2		
	Total gas (mmBTU)	Renewable biogas (mmBTU)	Scope 1 emissions (metric tons CO <sub>2</sub> e)	Electricity (million kWh)	Renewable electricity (million kWh)	Scope 2 emissions (metric tons CO <sub>2</sub> e) <sup>1</sup>
<b>Corporate</b>	<b>830,190</b>	<b>202,978</b>	<b>33,369</b>	<b>730</b>	<b>730</b>	<b>0</b>
Cupertino, CA	673,446	202,978	24,999	370	370	0
Elk Grove, CA	10,202	-	543	15	15	0
Austin, TX	12,598	-	669	59	59	0
Other USA	64,053	-	3,411	78	78	0
Cork, Ireland	18,605	-	988	14	14	0
Singapore	152	-	8	16	16	0
China	2,809	-	152	27	27	0
Other international	48,325	-	2,599	151	151	0
<b>Data centers</b>	<b>501,425</b>	<b>508,870</b>	<b>109</b>	<b>1,927</b>	<b>1,927</b>	<b>0</b>
Maiden, NC	508,870	508,870	27	392	392	0
Mesa, AZ	346	-	18	332	332	0
Newark, CA	-	-	-	71	71	0
Prineville, OR	1,210	-	64	279	279	0
Reno, NV	-	-	-	395	395	0
Viborg, Denmark	N/A	N/A	N/A	15	15	0
Colocation facilities (USA) <sup>2</sup>	N/A	N/A	N/A	291	291	0
Colocation facilities (International) <sup>2</sup>	N/A	N/A	N/A	94	94	0
China	N/A	N/A	N/A	58	58	0
<b>Retail stores</b>	<b>63,933</b>	<b>0</b>	<b>3,396</b>	<b>197</b>	<b>197</b>	<b>0</b>
Domestic (USA)	38,852	-	2,064	95	95	0
International	25,081	-	1,332	102	102	0
<b>Total</b>	<b>1,409,549</b>	<b>719,344</b>	<b>36,874</b>	<b>2,854</b>	<b>2,854</b>	<b>0</b>

Dash indicates data that are not available.

N/A = Gas use at colocation facilities are considered outside of Apple's operational control.

- Beginning in fiscal year 2021 we are also accounting for purchased steam, heating, and cooling which amounts to 2780 metric tons of scope 2 emissions.
- We've updated our fiscal year 2016 colocation facilities footprint to reflect more accurately Apple's operational boundaries. Per the WRI Greenhouse

Gas Protocol, we've removed electricity use associated with colocation facility cooling and building operations. This energy use, however, is still covered by renewable energy.

## A focus on data centers

We used over 1.96 billion kWh of electricity in fiscal year 2021 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 hydro power. 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

#### Solar + Biogas Fuel Cells 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 partnered 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 work together 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 fiscal year 2021, the Maiden data center was supported by projects that generated 392 million kWh of renewable energy, which is equivalent to the energy used by over 31,000 homes in North Carolina for a year.<sup>1</sup> Use of renewable energy allowed us to avoid over 106,000 metric tons of CO<sub>2</sub>e during the fiscal year.<sup>2</sup>

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 vs. Apple-sourced renewable energy Electricity use in fiscal year 2021: 392 million kWh

Default grid mix (North Carolina)	(%)	Apple actual renewable energy use	(%)
Coal	23	Apple’s solar projects	77
Gas	31	Apple’s biogas fuel cells	14
Nuclear	32	Duke Green Source Rider (100 percent solar)	10
Hydro	5	Source: Actual fiscal year 2021 energy data. Totals don’t add up to 100% due to rounding.	
Renewable	8		
Other	<1		

Source: eGrid 2019

1. Carbon emissions equivalences calculated using U.S. Energy Information Administration, 2019 data: [www.eia.gov/electricity/sales\\_revenue\\_price/pdf/table5\\_a.pdf](https://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf).

2. Emissions avoided are calculated using the World Resources Institute Greenhouse Gas Protocol methodology for calculating market-based emissions.

Prineville, Oregon

Wind + Solar + Low-Impact Hydro  
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 micro-hydro projects that harness the power of water flowing through local irrigation canals that have been operating for over 60 years. In fiscal year 2021, these micro-hydro projects generated nearly 3 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 fiscal year 2021, the Prineville data center was supported by projects that generated 279 million kWh of renewable energy, which is equivalent to the energy used by over 25,000 homes in Oregon for a year.<sup>3</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>4</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 vs. Apple-sourced renewable energy  
Electricity use in fiscal year 2021: 279 million kWh

Default grid mix (Oregon)	(%)	Apple actual renewable energy use	(%)
Coal	4	Apple’s micro-hydro projects	1
Gas	34	Oregon solar and wind (via Direct Access)	99
Hydro	49		
Renewable	14		

Source: eGrid 2019. Totals don't add up to 100% due to rounding.

Source: Actual fiscal year 2021 energy data.

3. Carbon emissions equivalences calculated using U.S. Energy Information Administration, 2019 data: [www.eia.gov/electricity/sales\\_revenue\\_price/pdf/table5\\_a.pdf](https://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf).

4. Emissions avoided are calculated using the World Resources Institute Greenhouse Gas Protocol methodology for calculating market-based emissions.

Reno, Nevada

Solar  
100 percent renewable since opening December 2012

Unlike competitive energy markets where we’ve located some of our data centers, 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 43 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 Nevada Green 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 have used the Nevada Green Rider two more times, first for the 200-megawatt Techren Solar II project. Apple’s largest solar project to date, it is 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 fiscal year 2021, the Reno data center was supported by projects that generated 395 million kWh of renewable energy, which is equivalent to the energy used by nearly 34,000 homes in Nevada for a year.<sup>5</sup> Use of renewable energy allowed us to avoid more than 106,000 metric tons of CO<sub>2</sub>e during the fiscal year.<sup>6</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 vs. Apple-sourced renewable energy  
Electricity use in fiscal year 2021: 395 million kWh

Default grid mix (Nevada)	(%)	Apple actual renewable energy use	(%)
Coal	7	Apple’s solar projects (via the Nevada Green Rider program)	100
Gas	65		
Hydro	6		
Renewable	23		

Source: eGrid 2019. Totals don’t add up to 100% due to rounding.

Source: Actual fiscal year 2021 energy data.

5. Carbon emissions equivalences calculated using U.S. Energy Information Administration, 2019 data: [www.eia.gov/electricity/sales\\_revenue\\_price/pdf/table5\\_a.pdf](https://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf).

6. Emissions avoided are calculated using the World Resources Institute Greenhouse Gas Protocol methodology for calculating market-based emissions.



**Newark, California**

**Solar**  
**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 as well as other Apple facilities in California.

In fiscal year 2021, the Newark data center was supported by projects that generated 71 million kWh of renewable energy, which is equivalent to the energy used by nearly 10,000 homes in California for a year.<sup>7</sup> Use of renewable energy allowed us to avoid more than 5000 metric tons of CO<sub>2</sub>e during the fiscal year.<sup>8</sup>

**Newark, California: Grid mix vs. Apple-sourced renewable energy**  
**Electricity use in fiscal year 2021: 71 million kWh**

Default grid mix (California)	(%)	Apple actual renewable energy use	(%)
Coal	<1	Bundled solar (via Direct Access)	100
Gas	43	Source: Actual fiscal year 2021 energy data.	
Nuclear	8		
Hydro	19		
Renewable	29		
Other	1		

Source: eGrid 2019. Totals don’t add up to 100% due to rounding.

7. Carbon emissions equivalences calculated using U.S. Energy Information Administration, 2019 data: [www.eia.gov/electricity/sales\\_revenue\\_price/pdf/table5\\_a.pdf](https://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf).

8. Emissions avoided are calculated using the World Resources Institute Greenhouse Gas Protocol methodology for calculating market-based emissions.

Mesa, Arizona

Solar  
100 percent renewable since opening March 2017<sup>9</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 is expected to generate 9000 MWh per year.

In addition, we began working with SRP to develop a customer renewable energy program in 2017, resulting in their Sustainable Energy Initiative, 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 proposed 100 MW Central Line PV Facility, expected to begin operations in 2022.

In fiscal year 2021, the Mesa data center was supported by 332 million kWh of renewable energy, which is equivalent to the energy used by over 25,000 Arizona homes.<sup>10</sup> Use of renewable energy allowed us to avoid more than 144,000 metric tons of CO<sub>2</sub>e during the fiscal year.<sup>11</sup>

Mesa, Arizona: Grid mix vs. Apple-sourced renewable energy  
Electricity use in fiscal year 2021: 332 million kWh

Default grid mix (Arizona)	(%)	Apple actual renewable energy use	(%)
Coal	21	Apple's solar project	100
Gas	41		
Nuclear	28		
Hydro	6		
Renewable	5		

Source: eGrid 2019. Totals don't add up to 100% due to rounding.

Source: Actual fiscal year 2021 energy data.

9. Apple took operational control of the building in October 2015 and converted it to a data center that began servicing customers in March 2017: [www.srpnet.com/about/stations/pdfx/2018iirp.pdf](http://www.srpnet.com/about/stations/pdfx/2018iirp.pdf).

10. Carbon emissions equivalences calculated using U.S. Energy Information Administration, 2019 data: [www.eia.gov/electricity/sales\\_revenue\\_price/pdf/table5\\_a.pdf](http://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf).

11. Emissions avoided are calculated using the World Resources Institute Greenhouse Gas Protocol methodology for calculating market-based emissions.

Denmark

Solar  
100 percent renewable energy from its 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 of 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 fiscal year 2021, the Denmark data center sourced 15 million kWh of renewable energy, avoiding more than 6000 metric tons of CO<sub>2</sub>e.<sup>12</sup>

Denmark: Grid mix vs. Apple-sourced renewable energy  
Electricity use in fiscal year 2021: 15 million kWh

Default grid mix (Denmark)	(%)
Coal	11
Gas	4
Renewable	78
Other	7

Source: International Energy Agency 2021. Totals don't add up to 100% due to rounding.

Apple actual renewable energy use	(%)
Apple's solar project	100

Source: Actual fiscal year 2021 energy data.

12. Emissions avoided are calculated using the World Resources Institute Greenhouse Gas Protocol methodology for calculating market-based emissions.

China

Solar  
100 percent renewable energy from the first day of operation

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 will continue to source renewable electricity in country to support the growth with renewable electricity.

In fiscal year 2021, the China data center was supported by 58 million kWh of renewable energy, avoiding more than 36,000 metric tons of CO<sub>2</sub>e during the fiscal year.<sup>13</sup>

China: Grid mix vs. Apple-sourced renewable energy  
Electricity use in fiscal year 2021: 58 million kWh

Default grid mix (China)	(%)	Apple actual renewable energy use	(%)
Coal	67	Apple's solar project	100
Gas	3		
Renewable	78		
Other	7		

Source: International Energy Agency 2021.

Source: International Energy Agency 2021.

Air quality

Data centers often rely on diesel-powered emergency generators to provide a backup source of power in case of electrical outages. Emergency generators must be exercised periodically to ensure their operational reliability. These preventative maintenance activities as well as emergency operations during power outages consume diesel fuel and result in air pollutant emissions. As a source of air pollutant emissions, the emergency generators at Apple's data centers are operated under air permits issued by regulatory agencies. These permits require monitoring, testing, inspection, and reporting at regular intervals.

To further reduce air emissions at our data centers, we're finding innovative ways to minimize the use of diesel-powered emergency generators. In Denmark, we've deployed a new substation design, in conjunction with the local utility, with the highest level of resiliency and automation. It will allow Apple to eliminate emergency generators altogether—in addition to eliminating air emissions associated with diesel fuel delivery. At our data centers in Nevada, North Carolina, and Oregon, we have added a second transmission line, which increases the reliability of the power supply and, therefore, minimizes the need for emergency operation of the generators.

We've voluntarily installed emissions control systems on our emergency generators to reduce emissions of nitrogen oxides and particulates. And we're standardizing our approach to preventative maintenance activities to minimize annual testing hours.

13. Emissions avoided are calculated using the World Resources Institute Greenhouse Gas Protocol methodology for calculating market-based emissions.

## 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 state or NERC region for facilities in the United States, or within the same country or regional grid for those around the world. As our loads grow over time, we'll continue working with our colocation suppliers to match 100 percent of our energy use with renewables.

Furthermore, we worked with one of our main suppliers of colocation services to help it develop the capability to provide renewable energy solutions to its customers. This partnership advances Apple's renewable energy program and those of other companies that use this colocation provider.

## 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. We are requiring these suppliers to adopt a 100 percent renewable energy strategy for their Apple energy use, and we continue to work with our suppliers to refine estimates for the carbon emissions associated with their services.

	<b>Total energy use (kWh)</b>	<b>Renewable energy (kWh)</b>	<b>Default utility emissions<sup>14</sup> (metric tons CO<sub>2</sub>e)</b>	<b>Apple's emissions – including renewable energy<sup>15</sup> (metric tons CO<sub>2</sub>e)</b>	<b>Percent renewable energy<sup>16</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>17</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%

14. 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.

15. Apple's greenhouse gas emissions are calculated using the World Resources Institute Greenhouse Gas Protocol methodology for calculating market-based emissions.

16. 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 of the electricity use at our colocation facilities is from 100 percent renewable energy.

17. Over the past few years, we have been installing submeters in colocation facilities to better track electricity usage. Beginning in FY2016, 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 reflect more accurately Apple's operational boundaries. Per the WRI Greenhouse Gas Protocol, we've removed from our electricity usage and scope 2 calculations those emissions associated with colocation facility cooling and building operations.



## Appendix C

# Assurance and review statements

Gross comprehensive carbon footprint (Fraunhofer Institute)

Product end use program data (Apex)

Facilities energy, carbon, waste, paper, and water data (Apex)

Supplier clean energy program (Apex)

Supplier clean energy efficiency program (Apex)

Packaging plastic footprint (Fraunhofer Institute)

Comprehensive fiber footprint (Fraunhofer Institute)



## Letter of Assurance

### Comprehensive Carbon Footprint – Scope 3: Product related Carbon Footprint for Fiscal Year 2021

Fraunhofer IZM reviewed Apple's scope 3 carbon footprint data related to the products manufactured and sold by Apple Inc. in fiscal year 2021.

#### 1 Summary

This review checks transparency of data and calculations, appropriateness of supporting product related data and assumptions, and overall plausibility of the calculated comprehensive annual carbon footprint comprised of emissions derived from the life cycle assessment (LCA) of Apple products shipped in fiscal year 2021. This review and verification focuses on Scope 3 emissions for products sold by Apple Inc. (as defined by WRI/WBCSD/Greenhouse Gas Protocol – Scope 3 Accounting and Reporting Standard). It is noted that emissions relating to the facilities that are owned or leased by Apple (scope 1 and 2 emissions) as well as business travel and employee commute were subject to a separate third party verification and are therefore excluded from the scope of this statement. Confidential data relating to product sales and shipments were also excluded from the scope of this verification.

This review and verification covers Apple's annual greenhouse gas emissions and does not replace reviews conducted for individual product LCAs for greenhouse gas emissions (GHGs). The life cycle emissions data produced by Apple for individual products has been calculated in accordance to the standard ISO 14040/14044: Environmental management – Life cycle assessment – Principles and framework / Requirements and guidelines. This review and verification furthermore complies with ISO 14064-3: Greenhouse gases – Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions.

The review of the annual carbon footprint has considered the following criteria:

- The system, boundaries and functional unit are clearly defined
- Assumptions and estimations made are appropriate
- Selection of primary and secondary data is appropriate and methodologies used are adequately disclosed

These criteria are also fundamental to the review of LCAs conducted for individual product emissions. The reviewers note that the largest share (99%) of Apple Inc. annual carbon



footprint is comprised of scope 3 emissions from individual products. The aforementioned criteria have been regularly reviewed by Fraunhofer IZM since 2007 with a view to providing independent feedback that can facilitate continuous improvement and refinement in the LCA methodology applied by Apple Inc.

Data reported by Apple is as follows:

	Manufacturing	Transportation	Product Use	Recycling	Corporate
2021	16.20	1.75	4.99	0.08	0.17
	[MMT CO <sub>2</sub> e]	[MMT CO <sub>2</sub> e]	[MMT CO <sub>2</sub> e]	[MMT CO <sub>2</sub> e]	[MMT CO <sub>2</sub> e]
	(1)		(2)		(3)

MMT CO<sub>2</sub>e: million metric tons carbon dioxide equivalents

(1): includes CO<sub>2</sub>e reductions due to Apple's Clean Energy Program and Renewable Energy Certificates, which are not covered by this verification statement

(2): includes CO<sub>2</sub>e reductions due to Renewable Energy Certificates, which are not covered by this verification statement

(3): not covered by this verification statement

Including a reported value of 0.17 million metric tons CO<sub>2</sub>e for facilities (out of scope of this verification), total comprehensive carbon footprint is reported to be 23.18 million metric tons CO<sub>2</sub>e (gross total).

Apple's comprehensive carbon footprint includes an increasing amount of greenhouse gas emissions reductions for manufacturing resulting from Apple renewable energy projects, supplier renewable electricity purchases, and supplier renewable electricity installations. These reductions are part of Apple's Clean Energy Program. Fraunhofer IZM has not verified these emissions reductions.

Based on the process and procedures conducted, there is no evidence that the Greenhouse Gas (GHG) assertion with regards to scope 3 carbon footprint

- is not materially correct and is not a fair representation of GHG data and information, and
- has not been prepared in accordance with the related International Standard on GHG quantification, monitoring and reporting.

## 2 Reviewed Data and Plausibility Check

A verification and sampling plan as required by ISO 14046-3 has been established for the comprehensive carbon footprint review and verification, defining the level of assurance, objectives, criteria, scope and materiality of the verification.

As part of this review and verification Apple disclosed following data to Fraunhofer IZM:



- Sales data for FY2021, including accessories and including AppleCare, Apple's extended warranty and technical support plans for their devices.
- Life cycle GHG emissions for all products, differentiating the actual product configurations (e.g., memory capacity)
- Calculation methodology for the comprehensive carbon footprint and methodological changes implemented in 2021
- The total carbon footprint – scope 3 for the fiscal year 2021
- Detailed analysis of the comprehensive carbon footprint including:
  - The breakdown of the carbon footprint into life cycle phases manufacturing, transportation, product use and recycling
  - Detailed product specific split into life cycle phases
  - The contribution of individual products and product families to the overall carbon footprint

The data and information supporting the GHG assertion were projected (use phase and recycling) and historical (i.e., fiscal year 2021 data regarding sales figures, manufacturing, transportation, use patterns where available).

This review comprises a check of selected data, which are most influential to the overall carbon footprint. The overall plausibility check addressed the following questions:

- Are product LCAs referenced and updated with more recent data correctly?
- Are results for products, for which no full LCA review was undertaken, plausible?
- Are carbon emission data for individual products plausible in the light of methodological changes as indicated by Apple?

This review was done remotely.

### 3 Findings

In FY2021 and beginning of FY2022 14 recent product LCA studies have been reviewed successfully against ISO 14040/44. These LCAs cover product segments iPhone, iPad, MacBook Air, MacBookPro, iMac, and Apple Watch. These recently reviewed LCA studies cover products which represent in total 44.6% of the total scope 3 carbon footprint. Representatives of other product segments (iPod, Mac Pro, HomePod, AirPort Express /



AirPort Extreme, Apple TV, AirPods and Beats products) underwent no or only minor design changes compared to those which went through a full LCA review in former years. All reviewed LCA studies up to now cover in total 67.3% of the total scope 3 carbon footprint.

All questions raised in the course of the review were answered by Apple and related evidence was provided where needed.

## 4 Conclusions

Apple's assessment approach is excellent in terms of granularity of the used calculation data. A significant share of components is modelled with accurate primary data from Apple's suppliers.

For all product LCA calculations, where exact data was missing, the principle of a worst-case approach has been followed and results have been calculated with rather conservative estimates.

The review has not found assumptions or calculation errors on the carbon footprint data level that indicate the scope 3 carbon footprint has been materially misstated. The excellent analysis meets the principles of good scientific practice.

Berlin, March 21, 2022

A handwritten signature in blue ink, appearing to read "K. Schischke".

- Karsten Schischke -  
Fraunhofer IZM  
Dept. Environmental and  
Reliability Engineering

A handwritten signature in blue ink, appearing to read "M. Proske".

- Marina Proske -  
Fraunhofer IZM  
Dept. Environmental and  
Reliability Engineering

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### Reviewer Credentials and Qualification

**Karsten Schischke:** Experience and background in the field of Life Cycle Assessments include

- Life Cycle Assessment course and exam as part of the Environmental Engineering studies (Dipl.-Ing. Technischer Umweltschutz, Technische Universität Berlin, 1999)
- more than 130 Critical Reviews of LCA studies since 2005 (batteries, displays, mobile devices, networked ICT equipment, home automation devices, servers, desktop computers, inverters, digital advertising solutions, smart cards) for 8 different industry clients and of the EPEAT Environmental Benefits Calculator





- Coordination of and contribution to compilation of more than 100 ELCD datasets (available at [www.lca2go.eu](http://www.lca2go.eu); product groups: hard disk drives, semiconductors, printed circuit boards, photovoltaics)
- Environmental Lifecycle Assessments following the MEEuP / MEErP methodology in several Ecodesign Product Group Studies under the European Ecodesign Directive since 2007 (mobile phones and tablets, external power supplies, complex settop-boxes, machine tools, welding equipment)
- various environmental gate-to-gate assessments in research projects since 2000 (wafer bumping, printed circuit board manufacturing)

Further updated information at: [www.linkedin.com/in/karsten-schischke](https://www.linkedin.com/in/karsten-schischke)

**Marina Proske:** Experience and background in the field of Life Cycle Assessments include

- Life Cycle Assessment course and exam as part of the Environmental Engineering studies (Dipl.-Ing. Technischer Umweltschutz, Technische Universität Berlin, 2009)
- Critical Reviews of LCA studies incl. water, fiber and plastic footprints since 2012 for 2 industry clients and of the EPEAT Environmental Benefits Calculator
- Life Cycle Assessment of two modular smartphones (Fairphone 2, Fairphone 3)
- Studies on the environmental assessment and carbon footprint of ICT
- Studies on material and lifetime aspects within the MEErP methodology

Further updated information at: <https://de.linkedin.com/in/marina-proske-74347164/en>

## INDEPENDENT ASSURANCE STATEMENT

**To: The Stakeholders of Apple Inc.**

### Introduction and objectives of work

Apex Companies, LLC (Apex) was engaged by Apple Inc. (Apple) to conduct an independent assurance of its Product End Use Program data. This assurance statement applies to the related information included within the scope of work described below. The intended users of the assurance statement are the stakeholders of Apple. The overall aim of this process is to provide assurance to Apple's stakeholders on the accuracy, reliability and objectivity of the reported information.

This information and its presentation are the sole responsibility of the management of Apple. Apex was not involved in the collection of the information or the drafting of the reported information.

### Scope of work

Apple requested Apex to include in its independent review the following:

- Assurance of Product End Use Program emissions for the fiscal year 2021 reporting period (September 28, 2020 through September 26, 2021), specifically, in accordance with Apple's definitions:
  - Greenhouse Gas (GHG) emissions associated with Product End Use;
  - Appropriateness and robustness of underlying reporting systems and processes, used to collect, analyze, and review the information reported.

Excluded from the scope of our work is any assurance of information relating to:

- Activities outside the defined assurance period.

### Methodology

As part of its independent verification, Apex undertook the following activities:

1. Interviews with relevant personnel of Apple;
2. Review of documentary evidence produced by Apple;
3. Audit of performance data;
4. Review of Apple's systems for quantitative data aggregation.

Our work was conducted against Apex's standard procedures and guidelines for external Verification of Sustainability Reports, based on current best practice in independent assurance. Apex procedures are based on principles and methods described in the 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 Dec. 15, 2015), issued by the International Auditing and Assurance Standards Board and ISO 14064-3: Greenhouse gases -- Part 3: Specification with guidance for the validation and verification of greenhouse gas statements.

The work was planned and carried out to provide limited, rather than reasonable assurance and we believe it provides an appropriate basis for our conclusions.

## Our Findings

Apex verified Greenhouse Gas emissions for the fiscal year 2021 reporting period:

Period	Quantity	Units	Boundary / Protocol
FY2021 (9/28/2020-9/26/2021)	4,990,000	Metric tons of carbon dioxide equivalent (MtCO <sub>2</sub> e)	Apple Internal Protocol

On the basis of our methodology and the activities described above:

- Nothing has come to our attention to indicate that the reviewed emissions data within the scope of our verification are inaccurate and the information included therein is not fairly stated and have not been prepared in accordance with Apple's stated protocols for the Product End Use Program;
- It is our opinion that Apple has established appropriate systems for the collection, aggregation and analysis of quantitative data such as energy and associated GHG emissions reductions.

This independent statement should not be relied upon to detect all errors, omissions or misstatements that may exist.

## Statement of independence, integrity and competence

Apex has implemented a Code of Ethics across the business to maintain high ethical standards among staff in their day to day business activities. We are particularly vigilant in the prevention of conflicts of interest.

No member of the assurance team has a business relationship with Apple, its Directors or Managers beyond that required of this assignment. We have conducted this verification independently, and there has been no conflict of interest.

The assurance team has extensive experience in conducting verification and assurance over environmental, social, ethical and health and safety information, systems and processes, has over 30 years combined experience in this field and an excellent understanding of Apex standard methodology for the Assurance of Sustainability Reports.

### Attestation:



Trevor A. Donaghu, Lead Assuror  
Program Manager  
Sustainability and Climate Change Services  
Services



David Reilly, Technical Reviewer  
Principal Consultant  
Sustainability and Climate Change

March 8, 2022

## INDEPENDENT ASSURANCE STATEMENT

**To: The Stakeholders of Apple Inc.**

### Introduction and objectives of work

Apex Companies, LLC (Apex) was engaged by Apple Inc. (Apple) to conduct an independent assurance of select environmental data reported in its 2021 environmental report (the Report). This assurance statement applies to the related information included within the scope of work described below. The intended users of the assurance statement are the stakeholders of Apple. The overall aim of this process is to provide assurance to Apple's stakeholders on the accuracy, reliability and objectivity of Subject Matter included in the Report.

This information and its presentation in the Report are the sole responsibility of the management of Apple. Apex was not involved in the collection of the information or the drafting of the Report.

### Scope of Work

Apple requested Apex to include in its independent review the following (Subject Matter):

- Assurance of select environmental data and information included in the Report for the fiscal year 2021 reporting period (September 28, 2020 through September 26, 2021), specifically, in accordance with Apple's definitions and World Resources Institute (WRI)/World Business Council for Sustainable Development (WBCSD) Greenhouse Gas Protocol:
  - Energy: Direct (Million Therms) and Indirect (Million kilowatt hours (mkWh))
  - Renewable Energy (mkWh)
  - Water Withdrawal (Million Gallons)
  - Greenhouse Gas (GHG) Emissions: Direct Scope 1 emissions by weight, Indirect Scope 2 emissions by weight, Indirect Scope 3 emissions by weight (Employee Commute and Business Travel) (Metric Tonnes of Carbon Dioxide equivalent)
  - Waste Quantities and Disposition (Metric Tonnes)
  - Paper Quantities (Metric Tonnes)
  - Appropriateness and robustness of underlying reporting systems and processes, used to collect, analyze, and review the environmental information reported

Excluded from the scope of our work is any assurance of information relating to:

- Text or other written statements associated with the Report
- Activities outside the defined assurance period

### Assessment Standards

Our work was conducted against Apex's standard procedures and guidelines for external Verification of Sustainability Reports, based on current best practice in independent assurance. Apex procedures are based on principles and methods described in the 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 Dec. 15, 2015), issued by the International Auditing and Assurance Standards Board and ISO 14064-3: Greenhouse gases -- Part 3: Specification with guidance for the validation and verification of greenhouse gas statements.

### Methodology

Apex undertook the following activities:

1. Virtual remote site visits to Apple facilities in Herzeliya, Israel; Haifa, Israel; and Prineville, OR, USA;
2. Remote visit/meetings with personnel from Apple corporate offices in Cupertino, California;
3. Interviews with relevant personnel of Apple;

4. Review of internal and external documentary evidence produced by Apple;
5. Audit of environmental performance data presented in the Report, including a detailed review of a sample of data against source data; and
6. Review of Apple information systems for collection, aggregation, analysis and internal verification and review of environmental data.

The work was planned and carried out to provide reasonable assurance for all indicators and we believe it provides an appropriate basis for our conclusions.

## Our Findings

Apex verified the following indicators for Apple's Fiscal Year 2021 reporting period (September 28, 2020 through September 26, 2021):

Parameter	Quantity	Units	Boundary / Protocol
Natural Gas Consumption	14.0	Million Therms	Worldwide occupied properties / Apple Internal Protocol
Electricity Consumption	2,854	Million kilowatt hours (mkWh)	Worldwide occupied properties / Apple Internal Protocol
Renewable Energy	2,854	Million kilowatt hours (mkWh)	Worldwide / Invoiced quantities & self-generated
Scope 1 GHG Emissions	55,202	metric tons of carbon dioxide equivalent (tCO <sub>2</sub> e)	Worldwide occupied properties / WRI/WBCSD GHG Protocol
Scope 2 GHG Emissions (Location-Based)	1,003,246	tCO <sub>2</sub> e	Worldwide occupied properties / WRI/WBCSD GHG Protocol
Scope 2 GHG Emissions (Market-Based)	2,783	tCO <sub>2</sub> e	Worldwide occupied properties / WRI/WBCSD GHG Protocol
Scope 3 GHG Emissions – Business Travel	22,800	tCO <sub>2</sub> e	Worldwide occupied properties / WRI/WBCSD GHG Protocol Value Chain (Scope 3)
Scope 3 GHG Emissions – Employee Commute	85,600	tCO <sub>2</sub> e	Worldwide occupied properties / WRI/WBCSD GHG Protocol Value Chain (Scope 3)
Water Withdrawal	1,407	Million gallons	Worldwide occupied properties / Apple Internal Protocol
Water Discharge	771	Million gallons	Worldwide occupied properties / Apple Internal Protocol
Trash disposed in Landfill	15,060	Metric tonnes	Worldwide occupied properties / Apple Internal Protocol
Hazardous Waste (Regulated waste)	1,599	Metric tonnes	Worldwide occupied properties / Apple Internal Protocol
Recycled Material (Removal by recycling contractor)	33,334	Metric tonnes	Worldwide occupied properties / Apple Internal Protocol
Composted Material	2,198	Metric tonnes	Worldwide occupied properties / Apple Internal Protocol
Waste to Energy	298	Metric tonnes	Worldwide occupied properties / Apple Internal Protocol
Paper Used	385	Metric tonnes	Worldwide occupied properties / Apple Internal Protocol



## Our Conclusion

Based on the assurance process and procedures conducted regarding the Subject Matter, we conclude that:

- The Energy, Water, Waste, Paper, and Scope 1, 2 & 3 GHG Emissions assertions shown above are materially correct and are a fair representation of the data and information;
- Apple has established appropriate systems for the collection, aggregation and analysis of relevant environmental information, and has implemented underlying internal assurance practices that provide a reasonable degree of confidence that such information is complete and accurate.

## Statement of independence, integrity and competence

Apex has implemented a Code of Ethics across the business to maintain high ethical standards among staff in their day to day business activities. We are particularly vigilant in the prevention of conflicts of interest.

No member of the assurance team has a business relationship with Apple, its Directors or Managers beyond that required of this assignment. We have conducted this verification independently, and there has been no conflict of interest.

The assurance team has extensive experience in conducting verification and assurance over environmental, social, ethical and health and safety information, systems and processes, has over 30 years combined experience in this field and an excellent understanding of Apex standard methodology for the Assurance of Sustainability Reports.

### Attestation:



Trevor A. Donaghu, Lead Assuror  
Program Manager  
Sustainability and Climate Change Services



David Reilly, Technical Reviewer  
Principal Consultant  
Sustainability and Climate Change Services

March 8, 2022

## INDEPENDENT ASSURANCE STATEMENT

**To: The Stakeholders of Apple Inc.**

### Introduction and objectives of work

Apex Companies, LLC (Apex) was engaged by Apple Inc. (Apple) to conduct an independent assurance of its Supplier Clean Energy Program data reported in its 2021 environmental report (the Report). This assurance statement applies to the related information included within the scope of work described below. The intended users of the assurance statement are the stakeholders of Apple. The overall aim of this process is to provide assurance to Apple's stakeholders on the accuracy, reliability and objectivity of select information included in the Report.

This information and its presentation in the Report are the sole responsibility of the management of Apple. Apex was not involved in the collection of the information or the drafting of the Report.

### Scope of Work

Apple requested Apex to include in its independent review the following:

- Methodology for tracking and verifying supplier clean energy contributions, including the Energy Survey, Renewable Energy Agreement, and other forms of supporting documentation provided by suppliers where available;
- Assurance of Clean Energy Program data and information for the fiscal year 2021 reporting period (September 28, 2020 through September 26, 2021), specifically, in accordance with Apple's definitions:
  - Energy: Reported megawatt-hours (MWh) of clean energy attributed to the Clean Energy Program for suppliers;
  - Avoided Greenhouse Gas (GHG) emissions associated with clean energy attributed to the Clean Energy Program;
  - Operational Capacity in megawatts (MWac) of clean energy in support of Apple manufacturing as a part of Apple's Supplier Clean Energy Program;
  - Appropriateness and robustness of underlying reporting systems and processes, used to collect, analyze, and review the information reported.

Excluded from the scope of our work is any assurance of information relating to:

- Text or other written statements associated with the Report
- Activities outside the defined assurance period

### Assessment Standards

Our work was conducted against Apex's standard procedures and guidelines for external Verification of Sustainability Reports, based on current best practice in independent assurance. Apex procedures are based on principles and methods described in the 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 Dec. 15, 2015), issued by the International Auditing and Assurance Standards Board and ISO 14064-3: Greenhouse gases -- Part 3: Specification with guidance for the validation and verification of greenhouse gas statements.

### Methodology

Apex undertook the following activities:

1. Remote virtual visit to Apple corporate offices in Cupertino, California;
2. Interviews with relevant personnel of Apple;
3. Review of internal and external documentary evidence produced by Apple;
4. Audit of reported data, including a detailed review of a sample of data against source data; and

5. Review of Apple information systems for collection, aggregation, analysis and internal verification and review of environmental data.

The work was planned and carried out to provide reasonable assurance for all indicators and we believe it provides an appropriate basis for our conclusions.

## Our Findings

Apex verified the following indicators for Apple's Fiscal Year 2021 reporting period (September 28, 2020 through September 26, 2021):

Parameter	Quantity	Units	Boundary / Protocol
Clean Energy Use	18.6	Million megawatt hours (mMWh)	Apple suppliers / Apple Internal Protocol
Avoided GHG Emissions	14.24	Million metric tons of carbon dioxide equivalent (mMtCO <sub>2</sub> e)	Apple suppliers / Apple Internal Protocol
Operational Capacity	10,596	Megawatts (MWac)	Apple suppliers / Apple Internal Protocol

## Our Conclusion

Based on the assurance process and procedures conducted, we conclude that:

- The Clean Energy Use, Avoided GHG Emissions, and Operational Capacity assertions shown above are materially correct and are a fair representation of the data and information; and
- Apple has established appropriate systems for the collection, aggregation and analysis of relevant environmental information, and has implemented underlying internal assurance practices that provide a reasonable degree of confidence that such information is complete and accurate.

## Statement of independence, integrity and competence

Apex has implemented a Code of Ethics across the business to maintain high ethical standards among staff in their day to day business activities. We are particularly vigilant in the prevention of conflicts of interest.

No member of the assurance team has a business relationship with Apple, its Directors or Managers beyond that required of this assignment. We have conducted this verification independently, and there has been no conflict of interest.

The assurance team has extensive experience in conducting verification and assurance over environmental, social, ethical and health and safety information, systems and processes, has over 30 years combined experience in this field and an excellent understanding of Apex standard methodology for the Assurance of Sustainability Reports.

### Attestation:



Trevor A. Donaghu, Lead Assuror  
Program Manager  
Sustainability and Climate Change Services



David Reilly, Technical Reviewer  
Principal Consultant  
Sustainability and Climate Change Services

March 8, 2022

## INDEPENDENT ASSURANCE STATEMENT

**To: The Stakeholders of Apple Inc.**

### Introduction and objectives of work

Apex Companies, LLC (Apex) was engaged by Apple Inc. (Apple) to conduct an independent assurance of its Supplier Energy Efficiency Program data. This assurance statement applies to the related information included within the scope of work described below. The intended users of the assurance statement are the stakeholders of Apple. The overall aim of this process is to provide assurance to Apple's stakeholders on the accuracy, reliability and objectivity of the reported information.

This information and its presentation are the sole responsibility of the management of Apple. Apex was not involved in the collection of the information or the drafting of the reported information.

### Scope of work

Apple requested Apex to include in its independent review the following:

- Methodology for tracking and verifying supplier energy efficiency projects, including supplier energy audit reports, supplier progress reports, energy efficiency project verifications, and other forms of supporting documentation provided by suppliers where available;
- Assurance of Energy Efficiency Program data and information for the fiscal year 2021 reporting period (September 28, 2020 through September 26, 2021), specifically, in accordance with Apple's definitions:
  - Avoided Greenhouse Gas (GHG) emissions associated with energy reductions attributed to the Energy Efficiency Program;
  - Appropriateness and robustness of underlying reporting systems and processes, used to collect, analyze, and review the information reported.

Excluded from the scope of our work is any assurance of information relating to:

- Activities outside the defined assurance period.

### Methodology

As part of its independent verification, Apex undertook the following activities:

1. Interviews with relevant personnel of Apple;
2. Review of documentary evidence produced by Apple;
3. Audit of performance data;
4. Review of Apple's systems for quantitative data aggregation.

Our work was conducted against Apex's standard procedures and guidelines for external Verification of Sustainability Reports, based on current best practice in independent assurance. Apex procedures are based on principles and methods described in the 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 Dec. 15, 2015), issued by the International Auditing and Assurance Standards Board and ISO 14064-3: Greenhouse gases -- Part 3: Specification with guidance for the validation and verification of greenhouse gas statements.

The work was planned and carried out to provide limited, rather than reasonable assurance and we believe it provides an appropriate basis for our conclusions.

## Our Findings

Apex verified Avoided Greenhouse Gas emissions for the calendar year and fiscal year 2021 reporting periods:

Period	Quantity	Units	Boundary / Protocol
FY2021 (9/28/2020-9/26/2021)	1,1581,364	Metric tons of carbon dioxide equivalent (MtCO <sub>2</sub> e)	Apple suppliers / Apple Internal Protocol
CY2021 (1/1/2021-12/31/2021)	Not yet complete	Metric tons of carbon dioxide equivalent (MtCO <sub>2</sub> e)	Apple suppliers / Apple Internal Protocol

On the basis of our methodology and the activities described above:

- Nothing has come to our attention to indicate that the reviewed emissions data within the scope of our verification are inaccurate and the information included therein is not fairly stated and have not been prepared in accordance with Apple's stated protocols for the Supplier Energy Efficiency Program;
- It is our opinion that Apple has established appropriate systems for the collection, aggregation and analysis of quantitative data such as energy and associated GHG emissions reductions.

This independent statement should not be relied upon to detect all errors, omissions or misstatements that may exist.

## Statement of independence, integrity and competence

Apex has implemented a Code of Ethics across the business to maintain high ethical standards among staff in their day to day business activities. We are particularly vigilant in the prevention of conflicts of interest.

No member of the assurance team has a business relationship with Apple, its Directors or Managers beyond that required of this assignment. We have conducted this verification independently, and there has been no conflict of interest.

The assurance team has extensive experience in conducting verification and assurance over environmental, social, ethical and health and safety information, systems and processes, has over 30 years combined experience in this field and an excellent understanding of Apex standard methodology for the Assurance of Sustainability Reports.

### Attestation:



Trevor A. Donaghu, Lead Assuror  
Program Manager  
Sustainability and Climate Change Services  
Services



David Reilly, Technical Reviewer  
Principal Consultant  
Sustainability and Climate Change

March 8, 2022





## Review Statement

### Corporate Packaging Plastic Footprint

Fraunhofer IZM reviewed Apple's corporate packaging plastic footprint data related to corporate packaging plastic usage from products and retail operations in fiscal year 2021.

## 1 Summary

This review checks transparency of data and calculations, appropriateness of supporting product and packaging related data and assumptions, and overall plausibility of the calculated corporate annual packaging plastic footprint of Apple products shipped in fiscal year 2021 and of retail operations in the same period.

As there is no standardised method available for calculating a packaging plastic footprint Apple defined a methodology for internal use. The scope of the plastic packaging footprint includes Apple's corporate packaging plastic usage from products and retail operations. The packaging plastic footprint tracks the total amount of plastic, adhesives, and ink, that Apple uses in packaging. Apple obtains and analyses supplier-specific data for each product line and sums up these figures for the entire company using sell-in numbers. For some products, a representative supplier is chosen to calculate the product-specific packaging. The output is a total packaging plastic footprint.

The review of the corporate annual packaging plastic footprint has considered the following criteria:

- The system boundaries are clearly defined
- Assumptions and estimations made are appropriate
- Use of supplier data is appropriate and methodologies used are adequately disclosed

Data reported by Apple is as follows:



2021	Total Plastic	Packaging Plastic	Retail Bags
Plastic	12,700	12,500	200
Plastic w/o adhesives	9,200	9,200	–
	[metric tons plastic]	[metric tons plastic]	[metric tons plastic]

All results and figures reviewed for fiscal year 2021 are plausible.

## 2 Reviewed Data and Findings

As part of this review Apple disclosed following data to Fraunhofer IZM:

- Calculation methodology for the corporate packaging plastic footprint
- Sales data for FY2021, including accessories
- Selected product and supplier specific data on packaging materials and production yields
- Aggregated packaging plastic data for all products and the total corporate packaging plastic footprint for the fiscal year 2021

The methodology paper provided by Apple (Packaging Plastic Footprint at Apple – Methodology Description – V1.0) in 2018, is considered a sound and appropriate guidance for determining the company packaging plastic. Where appropriate, this approach follows methodological principles applied for state-of-the-art Life Cycle Assessments.

This review comprises a check of packaging plastic data for selected products (iPhone 13 mini and iPhone 12).

Plausibility of some data has been questioned and discussed with Apple in detail. No corrections were needed.

This review was done remotely. All questions raised in the course of the review were answered by Apple and related evidence was provided where needed.



Based on the process and procedures conducted, there is no evidence that the corporate packaging plastic footprint is not materially correct and is not a fair representation of plastic data and information. The excellent analysis meets the principles of good scientific practice.

Berlin, March 24, 2022

A handwritten signature in black ink, appearing to read "M. Proske".

- Marina Proske -  
Fraunhofer IZM  
Dept. Environmental and  
Reliability Engineering

A handwritten signature in black ink, appearing to read "K. Schischke".

- Karsten Schischke -  
Fraunhofer IZM  
Dept. Environmental and  
Reliability Engineering



## Review Statement

### Comprehensive Fiber Footprint

Fraunhofer IZM reviewed Apple's comprehensive fiber footprint data related to corporate fiber usage from products, corporate, and retail operations in fiscal year 2021.

## 1 Summary

This review checks transparency of data and calculations, appropriateness of supporting product and packaging related data and assumptions, and overall plausibility of the calculated corporate annual fiber footprint of Apple products shipped in fiscal year 2021 and of corporate and retail operations in the same period.

As there is no standardised method available for calculating a product or company fiber footprint Apple defined a methodology for internal use. The scope of the Fiber Footprint includes Apple's corporate fiber usage from products, corporate, and retail operations. The fiber footprint tracks the total amount of wood, bamboo, and bagasse fiber, both virgin and recycled, that Apple uses in packaging, and other paper products. Apple obtains and analyses supplier-specific data for each product line and sums up these figures for the entire company using sell-in numbers. For some products, a representative supplier is chosen to calculate the product-specific packaging. The output is a total fiber footprint.

The review of the corporate annual fiber footprint has considered the following criteria:

- The system boundaries are clearly defined
- Assumptions and estimations made are appropriate
- Use of supplier data is appropriate and methodologies used are adequately disclosed

Data reported by Apple is as follows:



2021	Total Fiber	Virgin Fiber	Recycled Fiber
Packaging Fiber	247,100	84,800	162,300
Retail Bag Fiber	8,200	7,200	1,000
Corporate Fiber	400	300	100
<b>Total</b>	<b>255,700</b>	<b>92,300</b>	<b>163,400</b>
	[metric tons fiber]	[metric tons fiber]	[metric tons fiber]

All results and figures reviewed for fiscal year 2021 are plausible.

## 2 Reviewed Data and Findings

As part of this review Apple disclosed following data to Fraunhofer IZM:

- Calculation methodology for the corporate fiber footprint
- Sales data for FY2021, including accessories
- Aggregated fiber data for all products and the total corporate fiber footprint for the fiscal year 2021

The methodology paper (Fiber Footprint at Apple - Methodology Description - V1.1) provided by Apple and reviewed in 2017, is considered a sound and appropriate guidance for determining the company fiber footprint. Where appropriate, this approach follows methodological principles applied for state-of-the-art Life Cycle Assessments.

This review comprises a check of packaging fiber data for selected products (iPhone 12 and iPhone 13 mini).

Plausibility of some data has been questioned and discussed with Apple in detail. Corrections were made accordingly.

This review was done remotely. All questions raised in the course of the review were answered by Apple.





Based on the process and procedures conducted, there is no evidence that the corporate fiber footprint is not materially correct and is not a fair representation of fiber data and information.

Berlin, March 17, 2022

A handwritten signature in black ink, appearing to read "M. Proske".

- Marina Proske -  
Fraunhofer IZM  
Dept. Environmental and  
Reliability Engineering

A handwritten signature in black ink, appearing to read "K. Schischke".

- Karsten Schischke -  
Fraunhofer IZM  
Dept. Environmental and  
Reliability Engineering

## Appendix D

# 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 Code available at <https://www.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, and 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 2022

## Appendix E

# ISO 14001 certification

Apple operates manufacturing facilities in Cork, Ireland. We certify 100 percent of these facilities with ISO 14001.



# NSAI

## Certificate of Registration of Environmental Management System to I.S. EN ISO 14001:2015

### Apple Operations Europe

Hollyhill Industrial Estate  
Hollyhill  
Cork  
Ireland

NSAI certifies that the aforementioned company has been assessed and deemed to comply with the provisions of the standard referred to above in respect of:-

The management of all EMEA operational activities related to manufacturing, sales, delivery and after sales support for direct retail and channel customers

Approved by:  
Stewart Hickey  
Head - Business Excellence, NSAI

Registration Number: 14 0202  
Original Registration: 20 March 2001  
Last amended on: 14 July 2021  
Valid from: 14 July 2021  
Remains valid to: 10 July 2024



This certificate remains valid on condition that the Approved Environmental Management System is maintained in an adequate and efficacious manner. NSAI is a partner of IQNet - the international certification network ([www.iqnet-certification.com](http://www.iqnet-certification.com))



All valid certifications are listed on NSAI's website - [www.nsa.ie](http://www.nsa.ie). The continued validity of this certificate may be verified under "Certified Company Search"





## CERTIFICATE

NSAI has issued an IQNet recognised certificate that the organisation:

**Apple Operations Europe**  
Hollyhill Industrial Estate  
Hollyhill  
Cork  
Ireland

has implemented and maintains a

### **Environmental Management System**

for the following scope:

**The management of all EMEA operational activities related to manufacturing, sales, delivery and after sales support for direct retail and channel customers.**

which fulfils the requirements of the following standard:

## **I.S. EN ISO 14001:2015**

Issued on: 14 July 2021  
First issued on: 20 March 2001  
Expires on: 10 July 2024

*This attestation is directly linked to the IQNet Partner's original certificate and shall not be used as a stand-alone document*

*Registration Number: IE-14.0202*



Alex Stoichitoiu  
President of IQNet

Stewart Hickey  
Head – Business Excellence, NSAI



IQNet Partners\*:  
AENOR Spain AFNOR Certification France APCER Portugal CCC Cyprus CISQ Italy CQC China CQM China CQS Czech Republic Cro Cert Croatia DQS Holding GmbH Germany FCAV Brazil FONDONORMA Venezuela ICONTEC Colombia Inspecta Sertifiointi Oy Finland INTECO Costa Rica IRAM Argentina IQA Japan KFQ Korea MIRTEC Greece MSZT Hungary Nemko AS Norway NSAI Ireland NYCE-SIGE Mexico PCBC Poland Quality Austria Austria RR Russia SII Israel SIQ Slovenia SIRIM QAS International Malaysia SQS Switzerland SRAC Romania TEST St Petersburg Russia TSE Turkey YUQS Serbia IQNet is represented in the USA by: AFNOR Certification, CISQ, DQS Holding GmbH and NSAI Inc.

\* The list of IQNet partners is valid at the time of issue of this certificate. Updated information is available under [www.iqnet-certification.com](http://www.iqnet-certification.com)

# Report notes

**About this report**

This report is published annually, typically in April, and focuses primarily on fiscal year activities. This report addresses environmental impacts and activities at Apple facilities (corporate offices, data centers, and retail stores), as well as the life cycle impacts of our products, including in the manufacturing, transportation, use, and end-of-life phases. To provide feedback on this report, please contact [environment-report@apple.com](mailto:environment-report@apple.com).

**Reporting year**

We track our environmental progress based on Apple's fiscal year. When referencing years in the report, if fiscal year is not specified, we are referring to activities within the calendar year.

**Data assurance**

We obtain third-party verification for some of the information in this report from Apex Companies and the Fraunhofer Institute in Germany. Data in this report, including data or verification from third parties, reflects estimates using methodologies and assumptions believed to be reasonable and accurate. Those estimates, methodologies, and assumptions may change in the future as a result of new information or subsequent developments. In addition, recycled content claims for materials used in our products have been verified by an independent third party to a recycled content standard that conforms to ISO 14021. Product claims are accurate as of product launch.

**Forward-looking statements**

The report does not cover all information about our business. References in this report to information should not be construed as a characterization regarding the materiality of such information to our financial results or for purposes of the U.S. securities laws. While certain matters discussed in this report may be significant, any significance should not be read as necessarily rising to the level of materiality used for the purposes of complying with the U.S. federal securities laws and regulations. The information covered by the report contains forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995, including statements regarding our environmental goals, commitments, and strategies and related business and stakeholder impacts. These statements involve risks and uncertainties, and actual results may differ materially from any future results expressed or implied by the forward-looking statements.

These risks and uncertainties include, without limitation, any failure to meet stated environmental goals and commitments, and execute our strategies in the time frame expected or at all, global sociodemographic and economic trends, changing government regulations, technological innovations, climate-related conditions and weather events, our ability to gather and verify data regarding environmental impacts, the compliance of various third parties with our policies and procedures, and our expansion into new products, services, technologies, and geographic regions. More information on risks, uncertainties, and other potential factors that could affect our business and performance is included in our filings with the U.S. Securities and Exchange Commission, including in the "Risk Factors" and "Management's Discussion and Analysis of Financial Condition and Results of Operations" sections of the company's most recently filed periodic reports on Form 10-K and Form 10-Q and subsequent filings. We assume no obligation, and expressly disclaim any duty (including in response to new or changed information) to update any forward-looking statements or information, which speak as of their respective dates. Readers should not place undue reliance on the forward-looking statements made in this report. Moreover, many of the assumptions, standards, metrics, and measurements used in preparing this report continue to evolve and are based on assumptions believed to be reasonable at the time of preparation, but should not be considered guarantees. Given the inherent uncertainty of the estimates, assumptions, and timelines contained in this report, we may not be able to anticipate whether or the degree to which we will be able to meet our plans, targets, or goals in advance.

### **For more information**

Learn more about Apple's efforts to advance initiatives across Environment, Social and Governance (ESG) topics in our [ESG Report](#).

Respect for human rights shapes how we make our products and services. Our responsibilities go beyond our stores and corporate offices: They extend to our supply chain, the communities we're a part of, and the planet we all share. Read about Apple's [Commitment to Human Rights](#).

Apple's [Racial Equity and Justice Initiative](#) aims to help dismantle systemic barriers to opportunity and combat injustices faced by communities of color.

Read more about our work to uphold the highest standards of labor and human rights, health and safety, and environmental stewardship across our global supply chain in our [2022 Annual Progress Report](#).



# End notes

## Climate Change

1. Apple's 2030 goals refer to the end of fiscal year 2029.
2. Intergovernmental Panel on Climate Change (IPCC) Press Release: Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C approved by governments. <https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/>
3. Refer to Appendix A for a description of our methodology for calculating life cycle carbon emissions.
4. IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp. The Science Based Targets initiative (SBTi) has validated the following emissions reduction target for Apple: 61.7 percent by fiscal year 2030 relative to our fiscal year 2019 emissions. This SBTi-validated target is derived from our target to reduce emissions by 75 percent by fiscal year 2030 — only with a 2019 base year, instead of 2015.
5. The result is a gross footprint of 23.2 million metric tons (after accounting for the additional REC purchase), and a net carbon footprint of 22.5 million metric tons (after accounting for the purchase of carbon offsets).
6. Gross carbon footprint refers to Apple's carbon footprint before applying carbon offsets. Our net carbon footprint incorporates carbon offsets.
7. Testing conducted by Apple in October 2020 using a preproduction Mac mini with Apple M1 chip, 8GB of memory, 256GB SSD, and LG UltraFine 5K Display, and a shipping Mac mini with a quad-core Intel Core i3 processor, 8GB of memory, 256GB SSD, and LG UltraFine 5K Display. Energy consumption was measured during wireless browsing of top websites.
8. Based on sales-weighted averages of Mac, iPad, iPhone, Apple Watch, Apple TV, HomePod, AirPods, and Beats.
9. Eligible products are those in a product category for which ENERGY STAR certification exists. For more information, visit [www.energystar.gov](http://www.energystar.gov). ENERGY STAR and the ENERGY STAR mark are registered trademarks owned by the U.S. Environmental Protection Agency.
10. Calculated in accordance with the SASB standard, metric TC-HW-410a.2. Apple lists eligible products sold in the United States and Canada on the Electronic Product Environmental Assessment Tool (EPEAT) Registry. To calculate this metric, we considered "eligible for the EPEAT Registry" all products sold globally that correspond to those listed on the EPEAT Registry. Eligible products are those in a product category for which EPEAT registration exists, which includes desktop computers, notebook computers, computer displays, and mobile phones. For more information, visit [www.epeat.net](http://www.epeat.net).
11. Testing was conducted by Apple in February 2022 using preproduction Mac Studio systems with Apple M1 Ultra with 20-core CPU and 64-core GPU. Power was measured using a representative workload in a commercial application. High-end PC desktop data comes from testing Alienware Aurora R13 with Core i9-12900KF and GeForce RTX 3090. Performance tests are conducted using specific computer systems and reflect the approximate performance of Mac Studio.
12. Testing conducted by Apple in October 2020 using a preproduction Mac mini with Apple M1 chip, 8GB of memory, 256GB SSD, and LG UltraFine 5K Display, and a shipping Mac mini with a quad-core Intel Core i3 processor, 8GB of memory, 256GB SSD, and LG UltraFine 5K Display. Energy consumption was measured during wireless browsing of top websites.
13. Efficiency performance is based on the U.S. Department of Energy Federal Energy Conservation Standards for Battery Chargers. Energy efficiency terms: The energy efficiency values are based on the following conditions:
  - Power adapter, no-load: Condition in which the Apple USB Power Adapter with the USB-C to Lightning Cable (1m) is connected to AC power, but not connected to iPhone.
  - Power adapter efficiency: Average of the Apple 20W USB Power Adapter with the USB-C to Lightning Cable (1m) measured efficiency when tested at 100 percent, 75 percent, 50 percent, and 25 percent of the power adapter's rated output current.
14. While we saw some reductions in energy use resulting from office shutdowns during the COVID-19 pandemic, we also recognize that energy use at our employees' homes likely increased during this period. We did not build out new methodologies to account for this increased energy use, because it was temporary in nature. We will continue to revisit this into the future.
15. Greenhouse gas reporting is included in Apple's Supplier Code of Conduct and Supplier Responsibility Standards.
16. "Apple-created project" percentages don't add up to 100 due to rounding.
17. FY2021 renewable electricity figures associated with Apple's Supplier Clean Energy Program do not include REC purchases 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 14.24 million metric tons of carbon emissions.
18. Elysis was used in the production of the 16-inch MacBook Pro that was released in 2019. The 16-inch MacBook Pro released in 2021 now features a 100% recycled aluminum enclosure.
19. Rogelj, J., D. Shindell, K. Jiang, S. Ffita, P. Forster, V. Ginzburg, C. Handa, H. Khesghi, S. Kobayashi, E. Kriegler, L. Mundaca, R. Séférian, and M.V.Vilariño, 2018: Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press. [https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15\\_Chapter2\\_Low\\_Res.pdf](https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15_Chapter2_Low_Res.pdf)

## Resources

1. As of the end of fiscal year 2021, all established sub-assembly/module supplier sites — or those that have been Apple suppliers for more than one year — for major components including display, speaker, battery, housing, Taptic Engine, antenna, SiP, band, charger, and packaging are third-party verified as Zero Waste by UL LLC (UL 2799 Standard). Sub-assembly/module suppliers are those that assemble modules prior to final assembly of Apple products. These suppliers are also commonly referred to as Tier 1 suppliers. UL requires at least 90 percent diversion through methods other than waste to energy to achieve Zero Waste to Landfill (Silver 90–94 percent, Gold 95–99 percent, and Platinum 100 percent) designations.
2. Includes the 13-inch MacBook Air, Apple TV 4K, 13-inch MacBook Pro, Mac mini, iPad mini, 11-inch iPad Pro, iPad, and the 24-inch iMac. Recycled content accounts for materials that are third-party certified and supplier reported. The actual total recycled content may be higher given industry-average recycled content not included here.
3. Total recycled material shipped in products is driven by product material composition and total sales, and may fluctuate based on the number and type of products sold each year.
4. Recycling makes better use of finite resources by sourcing from recovered rather than mined materials. We ask our suppliers to have recycled content verified by an independent third party to a standard that conforms to ISO 14021.
5. We define bio-materials as those that can be regenerated in a human lifespan, like paper fibers or sugarcane. Bio-materials can help us use fewer finite resources. But even though bio-materials have the ability to regrow, they are not always managed responsibly. Renewable materials are a type of bio-material managed in a way that enables continuous production without depleting earth's resources. That's why we focus on sources that are certified for their management practices.
6. Compares carbon footprint of aluminum from recycled sources to primary aluminum smelted with electricity generated from coal.
7. This achievement was made in 2022 so is not reflected in the total estimated recycled content, which captures fiscal year 2021 data.
8. This achievement was made in 2022 so is not reflected in the total estimated recycled content, which captures fiscal year 2021 data.
9. Plastic packaging components refer to any packaging part made of majority plastic, including plastic wraps, plastic trays, or plastic screen films. Some plastic is still found on packaging components made primarily of fiber.
10. Refers to retail packaging.
11. Standard applies to retail packaging and shippers, and excludes plastic-based components, wraps, and adhesives.
12. Responsible sourcing of wood fiber is defined in Apple's Sustainable Fiber Specification (PDF).
13. Based on expected equivalent fiber production from our forestry projects and virgin fiber used for Apple product packaging. To determine the output of Apple's projects, we work with our partners to understand the productive potential of these working forests. The forest management plans required to achieve or maintain certification limit harvest volumes to sustainable levels. We use these potential harvest volumes to estimate the sustainable productive capacity of these forests.
14. Turner, Ash, "2020–2021's Phone Depreciation Report," BankMyCell.
15. This applies specifically to our U.S.-based Trade In program.
16. Owners of iPhone, iPad, iPod, Mac, or Apple TV products may obtain service and parts from Apple service providers, including Apple Retail Stores and Independent Repair Providers, for a minimum of 5 years from when Apple last distributed the product for sale. Service and parts may be obtained for longer, as required by law or for up to 7 years, subject to parts availability. Additionally, Mac notebooks may be eligible for an extended battery-only repair period for up to 10 years from when the product was last distributed for sale, subject to parts availability.
17. Refurbished products are not available in all countries.
18. Estimated based on rock-to-metal ratios from USGS — a change from our previous report, which used ore-to-metal ratios — and on recovery rates from iPhone main logic boards and flexes.
19. Apple is willing to license five patents relating to Daisy and certain other associated IP on reasonable, royalty-free terms.
20. Estimated based on rock-to-metal ratios from USGS — a change from our previous report, which used ore-to-metal ratios — and on recovery rates from iPhone main logic boards and flexes.
21. Compares carbon footprint of aluminum from recycled sources to primary aluminum smelted with electricity generated from coal.
22. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.
23. Compares carbon footprint of aluminum from recycled sources to primary aluminum smelted with electricity generated from coal.
24. We define high risk as those areas with high or extremely high overall water risk based on the WRI Aqueduct Water Risk Atlas tool.
25. These savings do not include reduction in water use from facility closures and reduced occupancy due to the Covid-19 pandemic. We consider those savings temporary and also acknowledge that the water use was transferred to employees' homes.
26. We are now accounting for savings through this program on a fiscal year basis, rather than a calendar year basis as was reported in previous years.

27. This total includes freshwater use as well as alternative water sources including recycled water, rainwater, and recovered condensate. We define freshwater as drinking-water quality, the majority of which comes from municipal sources and less than 5 percent comes from onsite groundwater sources. Recycled water represents a key alternative water source. Our recycled water is sourced primarily from municipal treatment plants, with less than 5 percent from onsite treatment. Recycled water is primarily used for irrigation, make-up water in cooling, or toilet flushing. Other alternative sources of freshwater include rainwater and recovered condensate that is captured onsite. Water used for construction for activities like dust control is not included in this total, and represents 13 million gallons of water used in fiscal year 2021. Our actual water discharge may vary by 10 percent relative to our estimates. In these estimates, we've taken into account consumptive activities including irrigation and cooling towers.
28. We calculate water discharge based on known evaporation, from activities like cooling and irrigation. For sites where these evaporative activities are not present we estimate that water withdrawn is returned to municipal systems. We estimate our margin of error to be approximately 10 percent, and will continue to update our model with new sources of data.
29. Includes total water stored within aquifer for use by multiple different parties contributing to the project.
30. Waste diversion rates do not include construction and demolition waste or electronic waste for fiscal year 2020. Electronic waste is accounted for in the total metric tons of electronic waste we sent to recycling found on [page 49](#).
31. Our Mesa and Prineville data centers are third-party certified as Zero Waste by USGBC TRUE. TRUE requires 90 percent diversion or higher from the landfill without the use of waste-to-energy to achieve Zero Waste to Landfill.
32. This waste-to-energy option is not yet available to sites in Alaska and Hawaii.
33. These sites have been third-party verified by UL LLC against the UL 2799 Standard. UL requires at least 90 percent diversion through methods other than waste to energy to achieve Zero Waste to Landfill (Silver 90–94 percent, Gold 95–99 percent, and Platinum 100 percent) designations.
34. All established final assembly supplier sites — or those that have been Apple suppliers for more than one year — for iPhone, iPad, Mac, Apple Watch, AirPods, HomePod, Apple TV, and Beats are third-party verified as Zero Waste by UL LLC (UL 2799 Standard). UL requires at least 90 percent diversion through methods other than waste to energy to achieve Zero Waste to Landfill (Silver 90–94 percent, Gold 95–99 percent, and Platinum 100 percent) designations.
35. As of the end of fiscal year 2021, all established sub-assembly/module supplier sites — or those that have been Apple suppliers for more than one year — for major components including display, speaker, battery, housing, Taptic Engine, antenna, SIP, band, charger, and packaging are third-party verified as Zero Waste by UL LLC (UL 2799 Standard). Sub-assembly/module suppliers are those that assemble modules prior to final assembly of Apple products. These suppliers are also commonly referred to as Tier 1 suppliers. UL requires at least 90 percent diversion through methods other than waste to energy to achieve Zero Waste to Landfill (Silver 90–94 percent, Gold 95–99 percent, and Platinum 100 percent) designations.

## Smarter Chemistry

1. Most recent Mind the Store rating was released in 2021.
2. The Mind the Store ranking for 2022 has not yet been released.
3. The Mind the Store ranking for 2022 has not yet been released.