Product Environmental Report

Mac mini

Date introduced
January 17, 2023

Made with better materials

100%
recycled aluminum
in the enclosure

100%
recycled rare earth
elements in all magnets

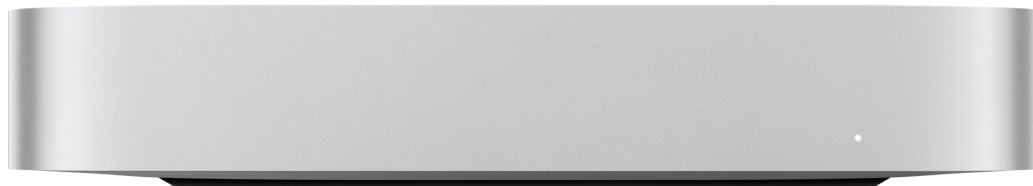### Energy efficient

72%
less energy consumed than
the ENERGY STAR® energy
efficiency requirement

Tackling climate change

30%
Nearly 30 percent decrease in carbon
footprint compared with previous generation

Responsible packaging

100%
of the wood fiber
comes from recycled
and responsible
sources

96%
of the packaging is
fiber-based, due to
our work to eliminate
plastic in packaging

Smarter chemistry[1]

- Mercury-free
- Brominated flame retardant–free
- PVC-free
- Beryllium-free

Apple Trade In

Return your device through
Apple Trade In, and we'll give it
a new life or recycle it for free.

Mac mini is made from over 40 percent recycled content[2]

[3]

Taking responsibility for our products at every stage

We take responsibility for our products throughout their life cycles—including the materials they are made of, the people who assemble them, and how they are recycled at end of life. And we focus on the areas where we can make the biggest difference for our planet: reducing our impact on climate change, conserving important resources, and using safer materials.

We sell millions of products. So making even small adjustments can have a meaningful impact.

Source
Materials

Make

Mac mini
life cycle
112 kg carbon
emissions[4]

Recover

Package
and Ship

Use
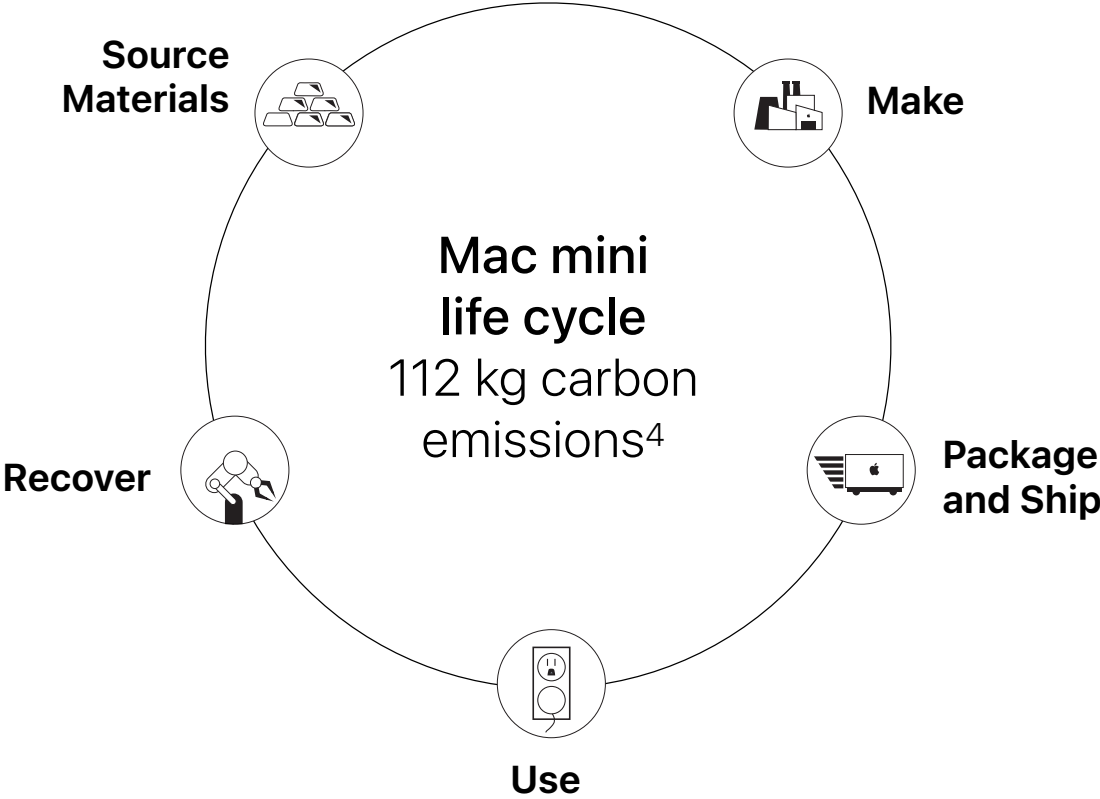
Carbon footprint

We continue to make progress in addressing Apple's contribution to climate change—by focusing on making energy-efficient products with renewable or recycled materials and with renewable energy. We've reduced the carbon footprint of Mac mini with M2 by nearly 30 percent compared with its predecessor,[5] due to improved energy efficiency, a logistics plan that reduces emissions from shipping by over 95 percent, and a nearly 5x increase in suppliers' use of renewable electricity. Mac mini with M2 Pro has an even greater carbon footprint reduction—nearly 50 percent compared with its predecessor,[5] primarily due to the efficiency gains of introducing Apple's chip technology.[6] Apple is committed to making carbon neutral products by 2030.

**Mac mini
Life cycle carbon emissions[7]**

63%	Production
<1%	Transport
36%	Use
<1%	End-of-life processing

Source
Materials

Source Materials

Mac mini now contains recycled gold and rare earth elements—in addition to recycled aluminum, plastic, and tin.

To conserve important resources, we work to reduce the material we use and aim to one day source only recycled or renewable materials in our products. And as we make this transition, we remain committed to the responsible sourcing of primary materials. We map many materials, some to the mineral source, and establish the strictest standards for smelters and refiners. Apple also requires 100 percent of identified tin, tantalum, tungsten, gold, cobalt, and lithium smelters and refiners to participate in third-party audits.[8] We're proud to be recognized as a worldwide leader in the responsible sourcing of minerals in our products. Our product designs also consider the safety of those who make, use, and recycle our products, restricting the use of hundreds of harmful substances. Our standards go beyond what's required by law to protect people and the environment.

Aluminum

Apple created an aluminum alloy made of 100 percent recycled aluminum, which we use for the enclosure of Mac mini. This alloy delivers the same strength, durability, and flawless finish—without mining any new bauxite (aluminum ore) from the earth. For Mac mini with M2 Pro, we also use 100 percent recycled aluminum in the thermal module chassis.

Rare earth elements

All magnets contain 100 percent recycled rare earth elements, representing over 90 percent of the total rare earth elements in Mac mini.

Tin

The solder of multiple printed circuit boards of Mac mini contains 100 percent recycled tin.

Plastic

We're transitioning from fossil fuel–based plastics to those made from renewable or recycled sources. For Mac mini, at least eight components contain 35 percent or more recycled plastic.[9]

Gold

Apple is pioneering industry-leading levels of traceability in recycled materials to build a gold supply chain of exclusively recycled content. Mac mini now contains 100 percent recycled gold in the plating of multiple printed circuit boards.

Smarter chemistry

Mac mini is free of harmful substances like beryllium, brominated flame retardants, PVC, phthalates, and mercury.[1] And 100 percent of the materials in Mac mini are covered by our Regulated Substances Specification. We go beyond what's required by aiming to understand the non-regulated substances in every part of every product—an effort that requires an industry-leading level of transparency through the entire supply chain. We consistently identify the makeup of over 75 percent by mass of Mac devices.

Make

Make

Source Materials

Product life cycle

Package and Ship

Recover

Use

The Apple Supplier Code of Conduct sets strict standards for the protection of people in our supply chain and the planet that we all share. Every year, we assess our suppliers' performance in upholding the standards required by our Code.

We work closely with our suppliers to provide safe and healthy workplaces where people are treated with dignity and respect, and to reduce suppliers' environmental impact. Our requirements apply across our supply chain and include the responsible sourcing of materials. From the strong foundation set by our Code, we go further—from helping suppliers transition to renewable energy, to providing educational opportunities for their employees, to supporting final assembly suppliers in reducing waste.

Greener chemicals

All established Mac mini final assembly supplier sites use safer cleaners and degreasers in their manufacturing processes, as determined by methodologies like the GreenScreen® assessment.[10]

Zero Waste to Landfill

No established Mac mini final assembly supplier sites generate any waste sent to landfill.[11]

Supplier energy use

All Mac mini final assembly supplier sites are transitioning to 100 percent renewable energy for Apple production.
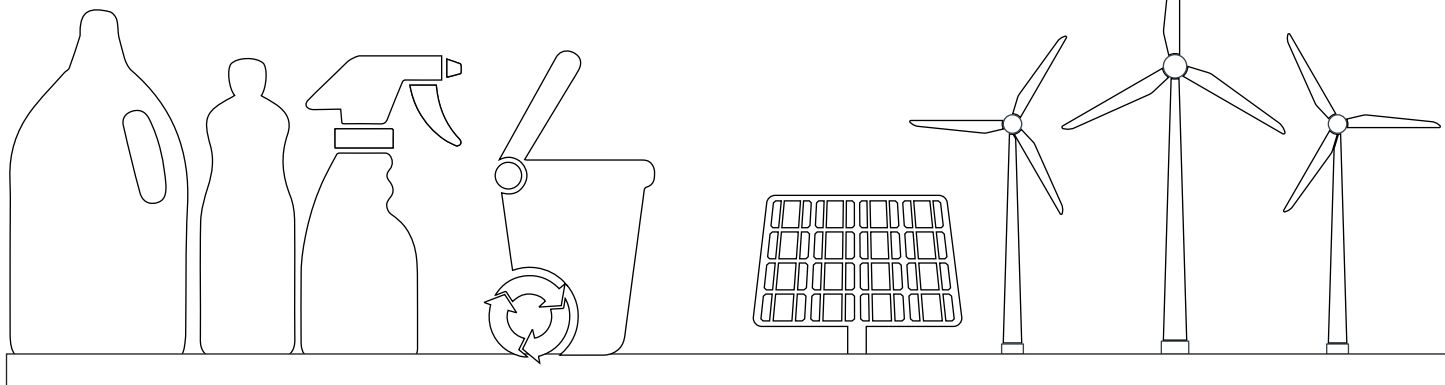
Package and Ship

Mac mini packaging does not use outer plastic wrap, and we replaced the polypropylene system wrap with a fiber-based foot label.[12] This brings us one step closer to our goal of completely removing plastic from all our packaging by 2025.

To improve our packaging, we are working to eliminate plastics, increase recycled content, and use less packaging overall. All of the wood fiber in our packaging is either recycled or comes from responsibly managed forests.[13] And we have protected or created enough responsibly managed forests to cover all the virgin wood fiber we use in our packaging.[14] This ensures working forests are able to regrow and continue to clean our air and purify our water.

96%

of the packaging[15]
is fiber-based, due to
our work to eliminate
plastic in packaging

32%

recycled content in
fiber packaging

100%

of the virgin wood
fiber in the packaging
comes from responsibly
managed forests[13]

Use

Mac mini uses 72 percent less energy than the requirement for ENERGY STAR.[16]

We design our products to be energy efficient, long-lasting, and safe. Mac mini uses software and power-efficient components that intelligently manage power consumption. We also run our own Reliability and Environmental Testing Labs, where our products go through rigorous testing before they leave our doors. Our support continues throughout each product's life cycle, with regular software updates to keep devices current and a network of authorized repair professionals to service them, if necessary.

Energy consumption of ENERGY STAR–rated products

Apple devices consistently rank among the high-performing products rated by ENERGY STAR, which sets specifications that typically reflect the 25 percent most energy-efficient devices on the market. Mac mini consumes 72 percent less energy than the requirement for ENERGY STAR.[16]

▼ **Mac mini**

ENERGY STAR requirement

kWh
Uses less energy

kWh
Uses more energy
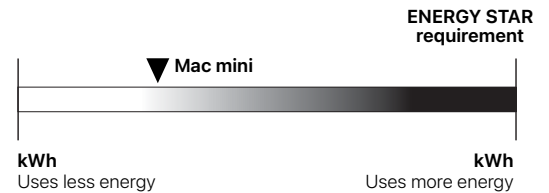
Designed to last

To ensure durability, we assessed Mac mini in our Reliability Testing Lab, using rigorous testing methods that simulate customers' experiences.

Made with smarter chemistry

We apply rigorous controls for materials users touch—all based on recommendations from toxicologists and dermatologists.

Recover

Return your product with Apple Trade In, and we'll ensure it has a long life or recycle it for free.

When products are used longer, fewer resources are extracted from the earth. That's why we launched Apple Trade In—it offers customers a seamless way to return their old devices and accessories to Apple. Eligible devices can be traded in for credit or an Apple Store Gift Card, while accessories and other devices can be recycled for free.[17] We also offer and participate in product take-back and recycling collection programs for 99 percent of the countries where we sell products—and we hold our recyclers to high standards. Our efforts to keep harmful substances out of our products also mean our materials are safer to recover and reuse.

Apple Trade In

For more information on how to recycle your products at end of life, visit:

apple.com/trade-in

Definitions

Bio-based plastics: Bio-based plastics are made from biological sources rather than from fossil-fuel sources. Bio-based plastics allow us to reduce reliance on fossil fuels.

Carbon footprint: Estimated emissions are calculated in accordance with guidelines and requirements as specified by ISO 14040 and ISO 14044. 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. Calculation includes emissions for the following life cycle phases contributing to Global Warming Potential (GWP 100 years) in CO_2 equivalency factors (CO_2e):

- **Production:** Includes the extraction, production, and transportation of raw materials, as well as the manufacture, transport, and assembly of all parts and product packaging.

- **Transport:** Includes air and sea transportation of the finished product and its associated packaging from manufacturing site to regional distribution hubs. Transport of products from distribution hubs to end customers is modeled using average distances based on regional geography.

- **Use:** Apple assumes a three- or four-year period for power use by first owners based on the product type. Product use scenarios are based on historical customer use data for similar products. Energy use is simulated in various ways; for example, by modeling daily battery drain or through performing activities like movie and music playback. Geographic differences in the power grid mix have been accounted for at a regional level.

- **End-of-life processing:** Includes transportation from collection hubs to recycling centers and the energy used in mechanical separation and shredding of parts. For more information on the carbon footprint, visit apple.com/environment/answers

Recycled materials: Recycling makes better use of finite resources by sourcing from recovered rather than mined materials. 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.

Renewable materials: 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 the earth's resources. That's why we focus on sources that are certified for their management practices.

Supplier Clean Energy Program: Since the electricity used to make our products is the largest contributor to our overall carbon footprint, we're helping our suppliers become more energy efficient and transition to new renewable energy sources. We're committed to transitioning our entire manufacturing supply chain to 100 percent renewable electricity by 2030.

Endnotes

[1] 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. Every Apple product is free of PVC and phthalates except for 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 such as high-temperature solder. Apple is working to phase out the use of these exempted substances for new products where technically possible.

[2] Product recycled content is the mass of certified recycled material relative to the overall mass of the device, not including packaging or in-box accessories.

[3] Mac mini achieved a Gold rating in the United States and Canada, in accordance with IEEE 1680.1 or UL 110, and is listed as such on the Electronic Product Environmental Assessment Tool (EPEAT) Registry. EPEAT registers computers, displays, and mobile phones based on environmental requirements in these standards. For more information, visit www.epeat.net.

Endnotes

[4] Greenhouse gas emissions were calculated using a life cycle assessment methodology in accordance with ISO 14040 and 14044 standards and based on Mac mini with M2 standard configuration with 256GB storage. We often update our carbon models to leverage new information. As a result, our estimate for the carbon footprint of the previous generation—Mac mini (M1, 2020) with 256GB storage configuration—decreased from 172 kg CO_2e (as published in its Product Environmental Report) to 156 kg CO_2e (as used in this report for comparison purposes).

Carbon footprint			
	Mac mini (2023)	**Mac mini (M1, 2020)**	**Mac mini (2018) with Intel Core i7**
Mac mini with M2 256GB	112 kg CO_2e	156 kg CO_2e	
Mac mini with M2 512GB	126 kg CO_2e	179 kg CO_2e	
Mac mini with M2 Pro 512GB	150 kg CO_2e		282 kg CO_2e

[5] Mac mini (M1, 2020) was used for comparison to Mac mini with M2 as the most recently released and similar device. Preproduction Mac mini with M2 standard configuration with 256GB storage was compared to shipping Mac mini (M1, 2020) standard configuration with 256GB storage configuration since these are the two lowest storage configurations offered. For Mac mini with M2 Pro, we used the Mac Mini (2018) with 512GB storage configuration for comparison, as the most recently released and similar device. To model carbon emissions from the product use phase for Mac mini, we assumed use with Studio Display. To model carbon emissions of Mac mini (2018) and Mac mini (M1, 2020), we assumed use with LG UltraFine 4K Display and LG UltraFine 5K Display, respectively, as Apple was not selling displays at the time.

[6] The nearly 50 percent reduction in carbon emissions for Mac mini with M2 Pro compared with its predecessor is due to many of the same reasons as Mac mini with M2's reduction compared with its predecessor: improved energy efficiency, a logistics plan that reduces emissions from shipping by over 95 percent, and a significant increase in suppliers' use of renewable electricity. For Mac mini with M2 Pro, we also saw an additional carbon reduction due to the efficiency gains of introducing Apple's chip technology.

[7] Percentages may not total 100 due to rounding.

[8] We map materials in our supply chain and publish a list of identified tin, tantalum, tungsten, and gold (3TG), cobalt, and lithium smelters and refiners in our supply chain. Third-party assessments seek to confirm sourcing practices and are part of our responsible sourcing program. In addition, our efforts consider a broad range of risks, including social, environmental, human rights, and governance risks.

[9] Mac mini with M2 contains nine components with 35 percent or more recycled content.

[10] Chemicals that meet GreenScreen® benchmark 3 or 4 or other equivalent methodologies like U.S. EPA Safer Choice are considered safer and preferred for use. GreenScreen® is a comprehensive hazard assessment tool that evaluates substances against 18 different criteria. For more information, visit www.greenscreenchemicals.org.

[11] All established final assembly supplier sites—or those that have been Apple suppliers for more than one year—for Mac mini 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.

[12] Based on retail packaging as sold by Apple.

[13] Responsible sourcing of wood fiber is defined in Apple's Sustainable Fiber Specification. We consider wood fibers to include bamboo.

[14] For more information about our work to protect and create responsibly managed forests, please read our Environmental Progress Report.

[15] Breakdown of U.S. retail packaging by weight. Adhesives, inks, and coatings are excluded from our calculations of plastic content and packaging weight.

Endnotes

[16] Energy consumption and energy efficiency values are based on the ENERGY STAR Program Requirements for Computers, including the max energy allowance for Mac mini. For more information, visit www.energystar.gov. ENERGY STAR and the ENERGY STAR mark are registered trademarks owned by the U.S. Environmental Protection Agency.

· Off: Lowest power mode of the system when Mac mini is shut down. Also referred to as Standby.

· Sleep: Low power state that is entered automatically after 10 minutes of inactivity (default), or by selecting Sleep from the Apple menu. Wake for network access enabled. Connected to Ethernet.

· Idle—Display on: System is on and has completed loading macOS. Connected to Ethernet.

· Power supply efficiency: Average of the power supply's measured efficiency when tested at 100 percent, 50 percent, and 20 percent of the power supply's rated output power.

	Power consumption for Mac mini		
Mode	100V	115V	230V
Off	0.08W	0.10W	0.11W
Sleep	0.55W	0.50W	0.51W
Idle—Display on	3.92W	3.96W	4.01W
Power supply efficiency	91.3%	91.8%	92.6%

[17] Trade-in values vary based on the condition, year, and configuration of your trade-in device, and may also vary between online and in-store trade-in. You must be at least 18 years old. In-store trade-in requires presentation of a valid, government-issued photo ID (local law may require saving this information). Additional terms from Apple or Apple's trade-in partners may apply.