Product Environmental Report

16-inch MacBook Pro

Date introduced
October 18, 2021

Made with better materials

100%
recycled aluminum enclosure

100%
recycled rare earth elements in all magnets

Tackling climate change

100%
We're committed to transitioning our entire manufacturing supply chain to 100 percent renewable electricity by 2030.

Energy efficient

58%
less energy consumed than the ENERGY STAR® energy efficiency requirement

Smarter chemistry[1]

- Arsenic-free display glass
- Mercury-free
- Brominated flame retardant–free
- PVC-free
- Beryllium-free

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 use less plastic in packaging

Apple Trade In

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

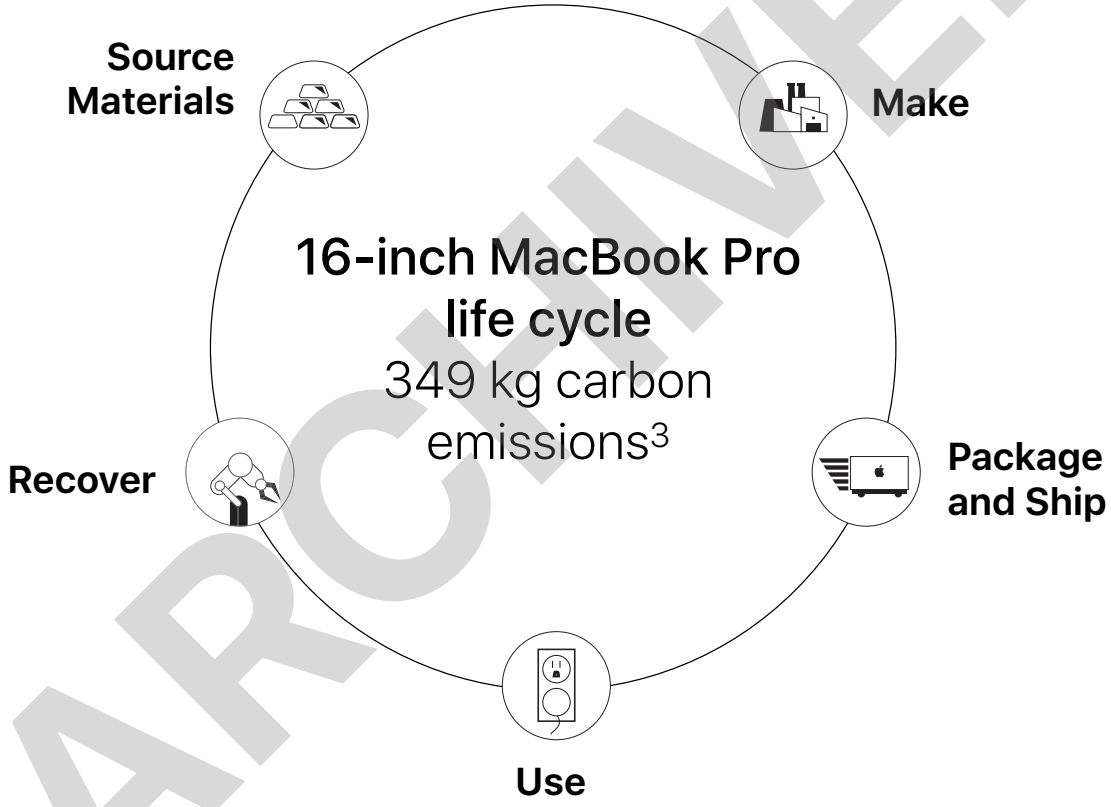
Enclosure made with 100% recycled aluminum

This report includes data current as of product launch. Product evaluations are based on U.S. configuration of 16-inch MacBook Pro.

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.

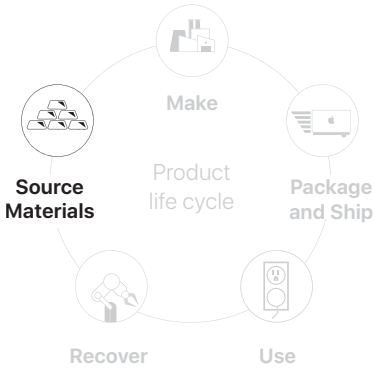


Carbon footprint

We continue to make progress in reducing Apple's contribution to climate change—by focusing on making energy-efficient products with renewable or recycled materials and with renewable energy. Suppliers' use of renewable energy through our Supplier Clean Energy Program helped reduce emissions from production of the 16-inch MacBook Pro. And the more efficiently designed Apple silicon decreased the carbon footprint of the main logic board. Overall, product emissions decreased by about 8 percent compared to the previous generation.[4] Apple is committed to using carbon life cycle assessments to identify opportunities to drive down product greenhouse gas emissions.

16-inch MacBook Pro life cycle carbon emissions

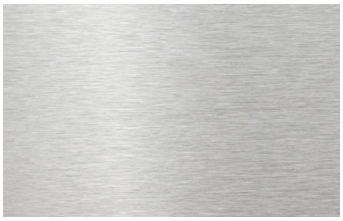
66%	Production
6%	Transport
27%	Use
<1%	End-of-life processing



Source Materials

First Mac notebook made with 100 percent recycled rare earth elements in all magnets.

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.[5] 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 certified recycled aluminum, which we use for the enclosure of the 16-inch MacBook Pro.[6] This alloy delivers the same strength, durability, and flawless finish—without mining any new bauxite (aluminum ore) from the earth.

Plastic

We're transitioning from fossil fuel–based plastics to those made from renewable or recycled sources. For the 16-inch MacBook Pro, we use 35 percent or more recycled plastic in seven components—and we use 50 percent recycled plastic in the power adapter enclosure.

Tin

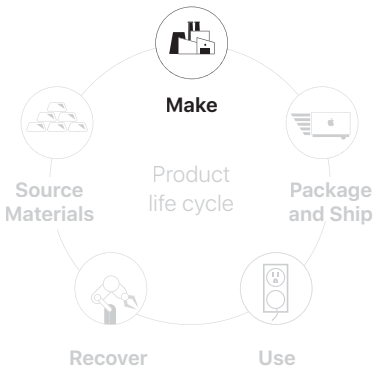
We use 100 percent recycled tin in the solder of the main logic board.

Rare earth elements

We use 100 percent recycled rare earth elements in all magnets, representing 98 percent of the total rare earth elements in the device—a first for a Mac notebook.

Smarter chemistry

The 16-inch MacBook Pro is free of harmful substances like beryllium, brominated flame retardants, PVC, phthalates, arsenic in the display glass, and mercury.[1] And 100 percent of the materials in the 16-inch MacBook Pro 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

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

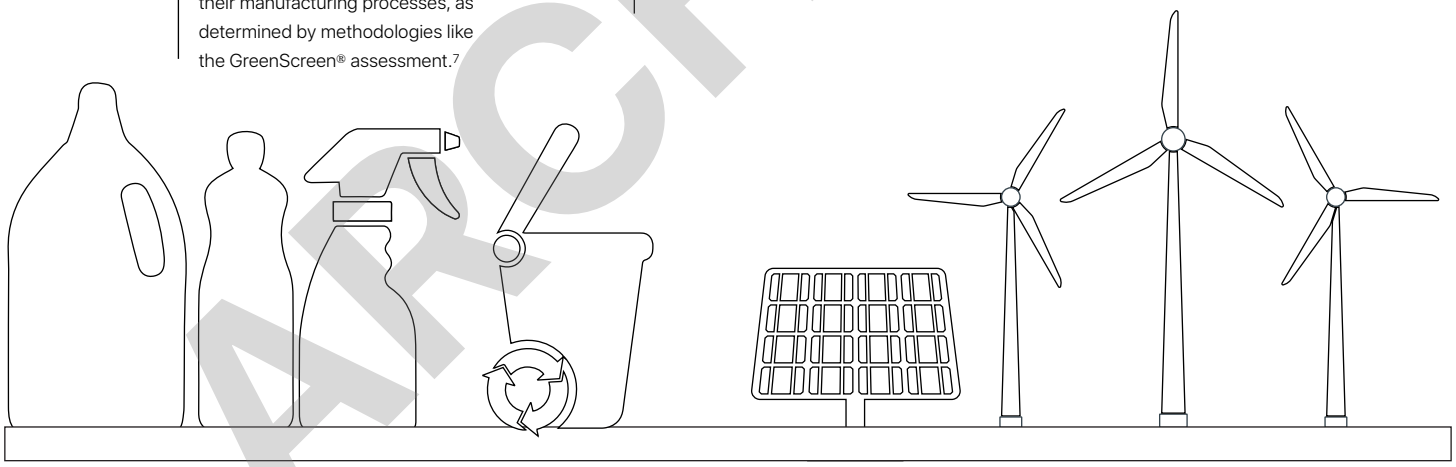
All established 16-inch MacBook Pro final assembly supplier sites use safer cleaners and degreasers in their manufacturing processes, as determined by methodologies like the GreenScreen® assessment.[7]

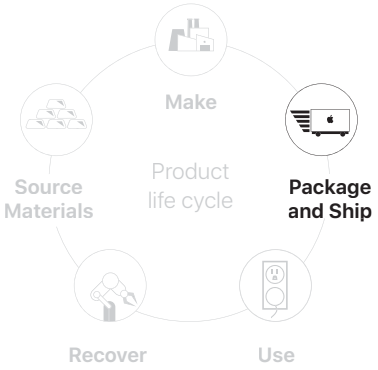
Zero Waste to Landfill

All established 16-inch MacBook Pro final assembly supplier sites do not generate any waste sent to landfill.[8]

Supplier energy use

All 16-inch MacBook Pro final assembly supplier sites are transitioning to 100 percent renewable energy for Apple production.





Package and Ship

The 16-inch MacBook Pro packaging is made with 100 percent recycled and responsibly sourced wood fiber.

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.[9] And we have protected or created enough responsibly managed forests to cover all the virgin wood fiber we use in our packaging.[10] This ensures working forests are able to regrow and continue to clean our air and purify our water.

96%

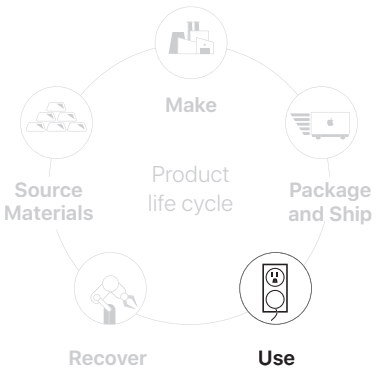
of the packaging[11] is fiber-based, due to our work to use less plastic in packaging

52%

recycled content in fiber packaging

100%

of the virgin wood fiber in the packaging comes from responsibly managed forests[9]



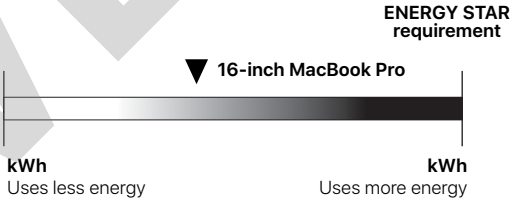
Use

The 16-inch MacBook Pro uses 58 percent less energy than the requirement for ENERGY STAR.[12]

We design our products to be energy efficient, long lasting, and safe. The 16-inch MacBook Pro 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. The 16-inch MacBook Pro consumes 58 percent less energy than the requirement for ENERGY STAR.[12]

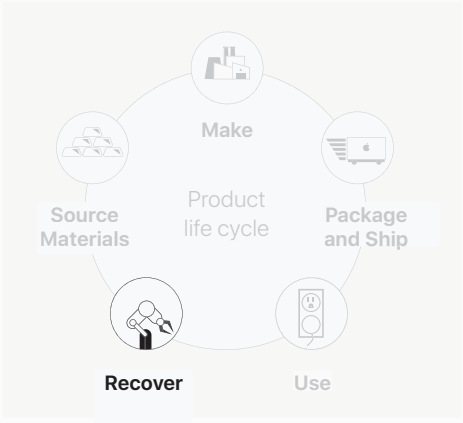


Designed to last

To ensure durability, we assessed the 16-inch MacBook Pro 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

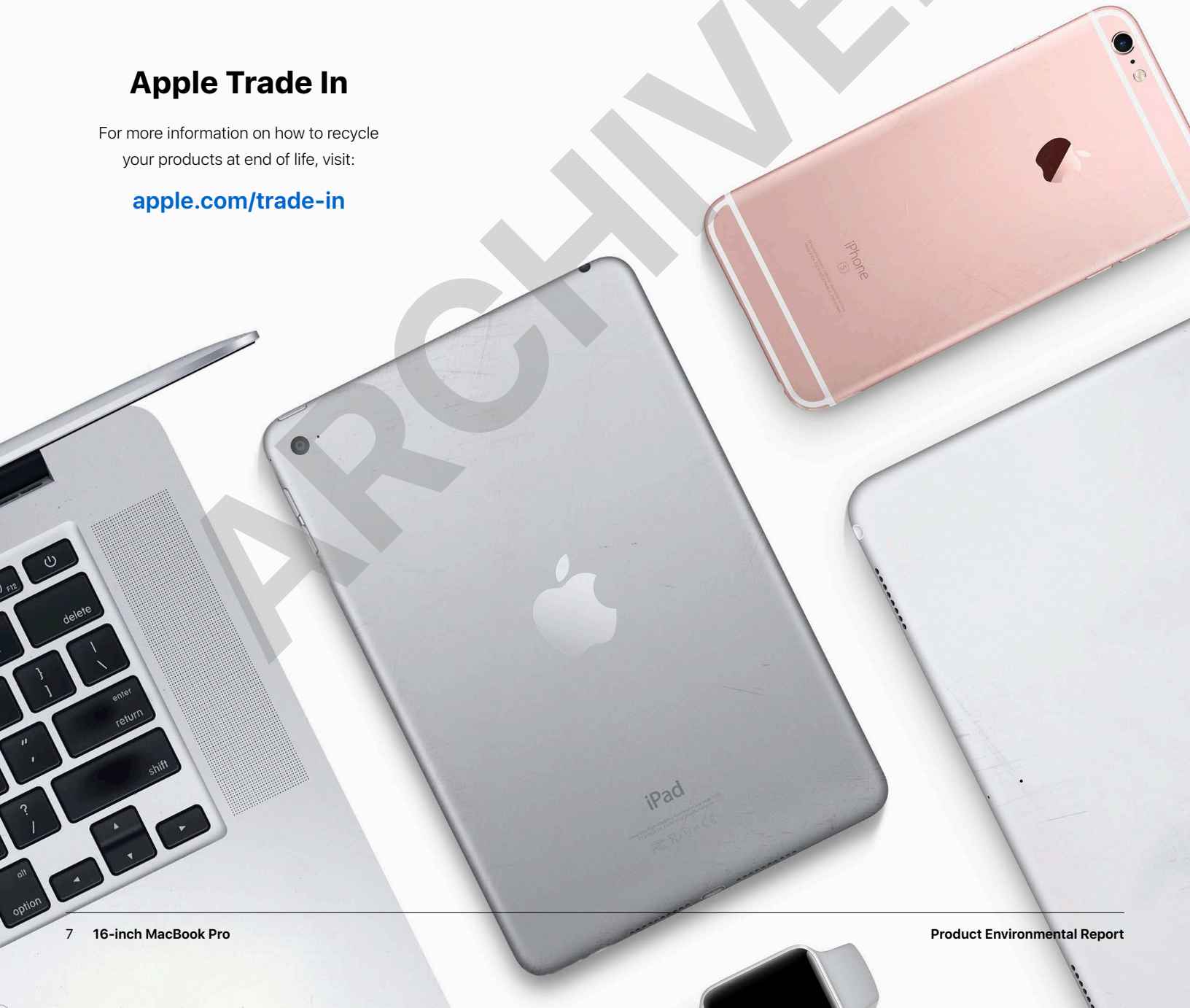
Return your product with Apple Trade In and we'll ensure it has a long life or recycle it for free.

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.[13] 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

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.

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.

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 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.

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.

Endnotes

[1] Apple defines its restrictions on harmful substances, including definitions for what Apple considers to be "free of," in the Apple Regulated Substances Specification. Every Apple product is 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 such as high-temperature solder. Apple is working to phase out the use of these exempted substances where technically possible.

[2] The 16-inch MacBook Pro 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.

[3] Greenhouse gas emissions were calculated using a life cycle assessment methodology in accordance with ISO 14040 and 14044 standards and based on the 16-inch MacBook Pro standard configuration with 512GB storage. We often update our carbon models to leverage new information. As a result, our estimate for the carbon footprint of the previous generation—MacBook Pro (16-inch, 2019) standard configuration with 512GB storage—decreased from 394 kg CO_2e (as published in its Product Environmental Report) to 380 kg CO_2e.

Carbon footprint			
16-inch MacBook Pro (2021)		**16-inch MacBook Pro (2019)**	
Apple M1 Pro with 10-core CPU and 16-core GPU, with 512GB storage	349 kg CO_2e	6-Core Intel Processor with 512GB Storage	380 kg CO_2e
Apple M1 Pro with 10-core CPU and 16-core GPU, with 1TB storage	382 kg CO_2e	8-Core Intel Processor with 1TB Storage	452 kg CO_2e
Apple M1 Max with 10-core CPU and 32-core GPU, with 1TB storage	395 kg CO_2e	—	

Endnotes

[4] The MacBook Pro (16-inch, 2019) was used for comparison as the most recently released and similar device. Preproduction 16-inch MacBook Pro standard configuration with 512GB storage was compared to shipping MacBook Pro (16-inch, 2019) standard configuration with 512GB storage configuration since these are the two lowest storage configurations offered.

[5] 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.

[6] Recycled material claim applies to the enclosure and is based on auditing done by UL LLC.

[7] 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.

[8] All established final assembly supplier sites—or those that have been Apple suppliers for more than one year—for the 16-inch MacBook Pro are third-party certified 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.

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

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

[11] Breakdown of U.S. retail packaging by weight. Select non-plastic, non-fiber materials excluded.

[12] Energy consumption and energy efficiency values are based on the ENERGY STAR Program Requirements for Computers, including the max energy allowance for the 16-inch MacBook Pro. 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.

The 16-inch MacBook Pro is tested with a fully charged battery and powered by the 140W USB-C Power Adapter with the USB-C to MagSafe 3 Cable (2m).

- Off: Lowest power mode of the system. System is shut down.
- 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.
- Idle—Display on: System is on and has completed loading macOS. Display brightness was set as defined by ENERGY STAR Program Requirements for Computers and Auto-Brightness was turned off. Connected to Wi-Fi.
- Power adapter, no-load: Condition in which the 140W USB-C Power Adapter with the USB-C to MagSafe 3 Cable (2m) is connected to AC power, but not connected to the system.
- Power adapter efficiency: Average of the 140W USB-C Power Adapter with the USB-C to MagSafe 3 Cable (2m) measured efficiency when tested at 100 percent, 75 percent, 50 percent, and 25 percent of the power adapter's rated output current.

	Power consumption for 16-inch MacBook Pro		
Mode	**100V**	**115V**	**230V**
Off	0.22W	0.22W	0.25W
Sleep	0.48W	0.47W	0.49W
Idle—Display on	7.09W	7.12W	7.60W
Power adapter, no-load	0.11W	0.16W	0.17W
Power adapter efficiency	92.4%	92.6%	92.6%

[13] 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.