



# Product Environmental Report

## 16-inch MacBook Pro

Date introduced  
November 13, 2019

### Tackling climate change

# 100%

of the 16-inch MacBook Pro final assembly suppliers have committed to 100% renewable energy for Apple production

### Energy efficient

# 65%

less energy consumed than the ENERGY STAR® energy efficiency limit

### Made with better materials

# 100%

recycled tin in the solder of the main logic board



### Responsible packaging

# 100%

of the wood fiber comes from recycled and responsible sources

# 83%

less plastic in packaging than the previous generation

### Smarter chemistry<sup>1</sup>

- Arsenic-free display glass
- Mercury-free LED-backlit display
- 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.

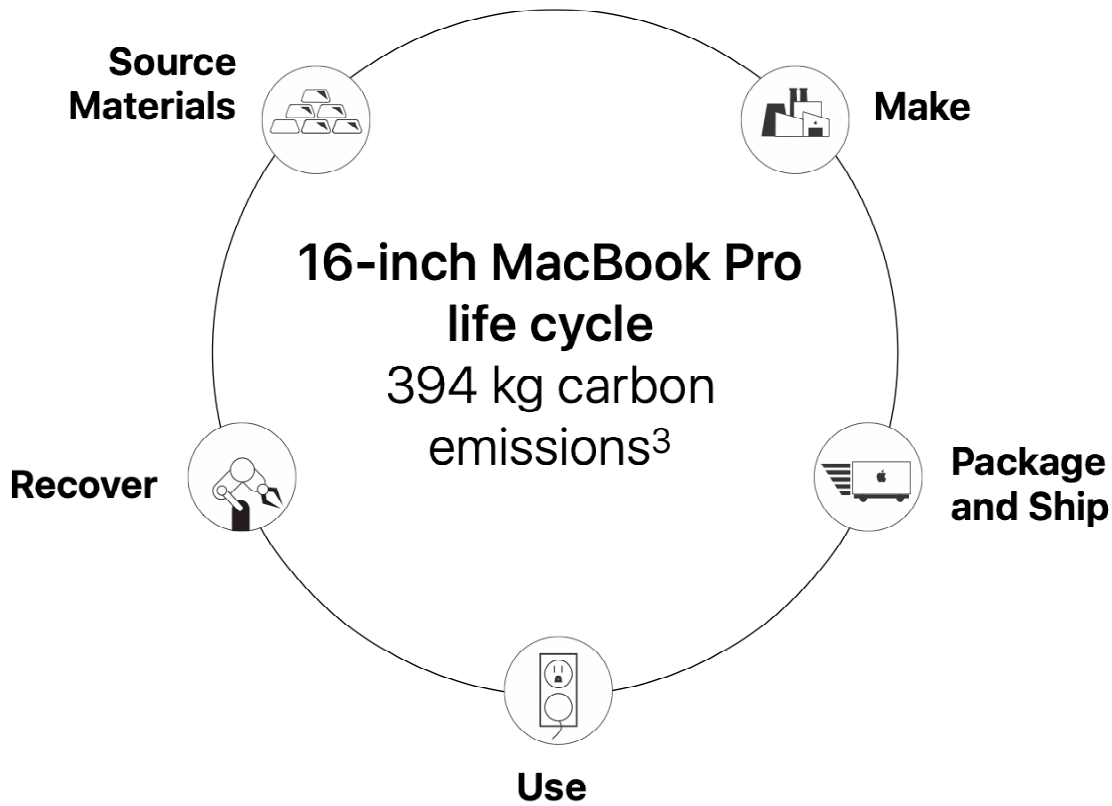
## Enclosure made with low-carbon aluminum



# 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. Total product emissions increased slightly—by about 2 percent—compared to the updated carbon footprint of the 15-inch MacBook Pro.<sup>3,4</sup> This is due in part to the device’s larger size, requiring more energy to transport and power the device. However, these impacts were mitigated by various efforts, including material selection. The low-carbon aluminum used in the 16-inch MacBook Pro enclosure is smelted using hydroelectricity rather than fossil fuels, which reduces the associated greenhouse gas emissions by 68 percent.<sup>5</sup> The enclosure also incorporates recycled content, further reducing its carbon impact. 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

75%	Production
5%	Transport
19%	Use
<1%	End-of-life processing



# Source Materials

The 16-inch MacBook Pro enclosure is made with low-carbon aluminum.

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. 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

Our focus on Apple's carbon footprint extends to the materials we source. So we prioritized aluminum that was smelted using 100 percent hydroelectricity rather than fossil fuels for the enclosure, where the majority of the aluminum is located.



## Plastic

We're transitioning to plastics from renewable or recycled sources as alternatives to fossil fuel-based plastics. For the 16-inch MacBook Pro, we use 35 percent or more recycled plastic in multiple components.



## Tin

We use 100 percent recycled tin in the solder of the main logic board, where the majority of the tin is located. Apple also requires 100 percent of identified tin, tantalum, tungsten, gold, and cobalt smelters and refiners to participate in third-party audits.<sup>6</sup>



## Smarter chemistry

The 16-inch MacBook Pro is free of harmful substances like mercury, brominated flame retardants, PVC, phthalates, arsenic in the display glass, and beryllium.<sup>1</sup> 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 nonregulated substances in every part of every product—an effort that requires an industry-leading level of transparency through the entire supply chain. So far, we've identified the makeup of over 80 percent by mass of the 16-inch MacBook Pro.



# Make

Every year, we assess our suppliers against our Supplier Code of Conduct, which requires suppliers to make workplaces better for employees and the environment.

We work closely with the suppliers that make our products to reduce their environmental impact, and to treat people making Apple products with dignity and respect, provide opportunities to advance, and maintain a safe work environment. Our Supplier Code of Conduct sets high expectations for our suppliers. With strong foundational standards, we can make further progress, from helping suppliers transition to renewable energy to providing educational opportunities for their employees. And in 2018, we achieved UL Zero Waste certification for all Mac final assembly test and packaging facilities.<sup>7</sup>

## Greener chemicals

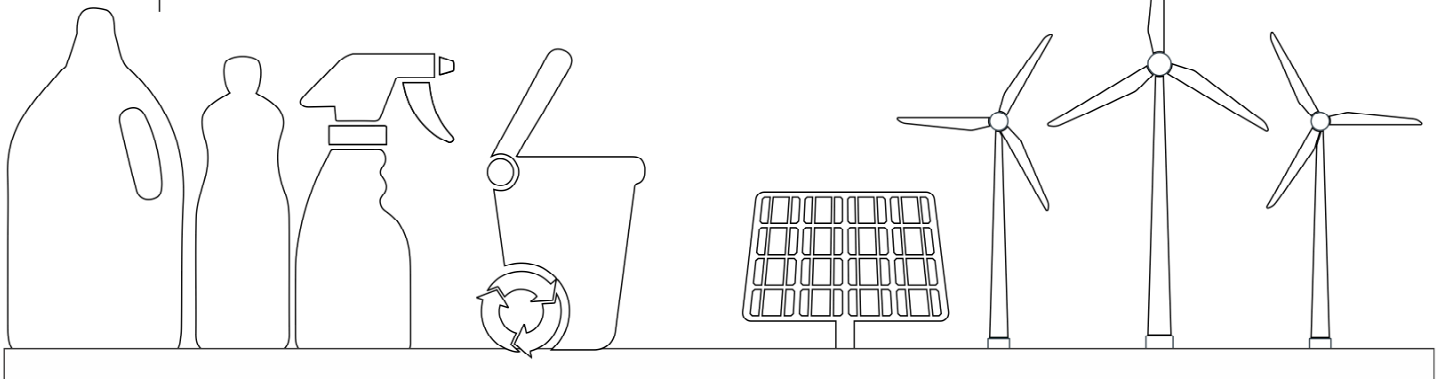
All 16-inch MacBook Pro final assembly supplier sites use safer cleaners and degreasers in their manufacturing processes, as determined by the GreenScreen® assessment method.<sup>8</sup>

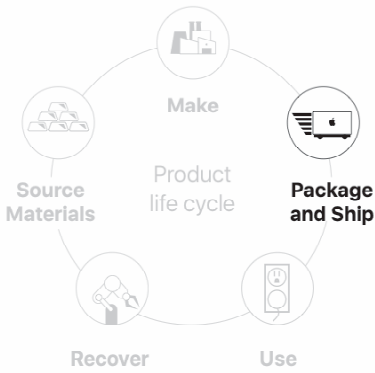
## Zero Waste to Landfill

The 16-inch MacBook Pro final assembly supplier sites do not generate any waste sent to landfill.<sup>7</sup>

## Supplier energy use

All 16-inch MacBook Pro final assembly suppliers have begun transitioning to 100 percent renewable energy for Apple production.





## Package and Ship

In the 16-inch MacBook Pro packaging, we reduced plastic by 83 percent compared to the previous generation.

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.<sup>9</sup> And we have protected or created enough responsibly managed forests to cover all the virgin wood fiber we use in our packaging.<sup>10</sup> This ensures working forests are able to regrow and continue to clean our air and purify our water. For our commercial, education, and institutional customers, we also offer bulk packaging options to further reduce materials used.

**94%**

of the packaging<sup>11</sup> is fiber based, due to a reduction in plastics

**51%**

of the fiber content in packaging is recycled

**100%**

of the virgin wood fiber in the packaging comes from responsibly managed forests<sup>9</sup>





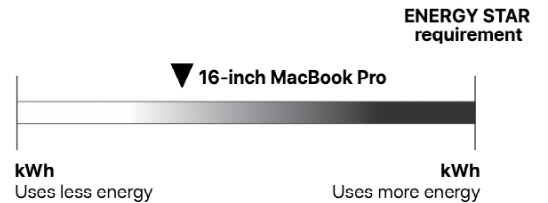
# Use

The 16-inch MacBook Pro uses 65 percent less energy than the requirement for ENERGY STAR.

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, so 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 was established to represent the 25 percent most energy-efficient computers on the market. The 16-inch MacBook Pro consumes 65 percent less energy than the requirement for ENERGY STAR.<sup>12</sup>



## Designed to last

To maximize 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 most—all based on recommendations from toxicologists and dermatologists.



# Recover

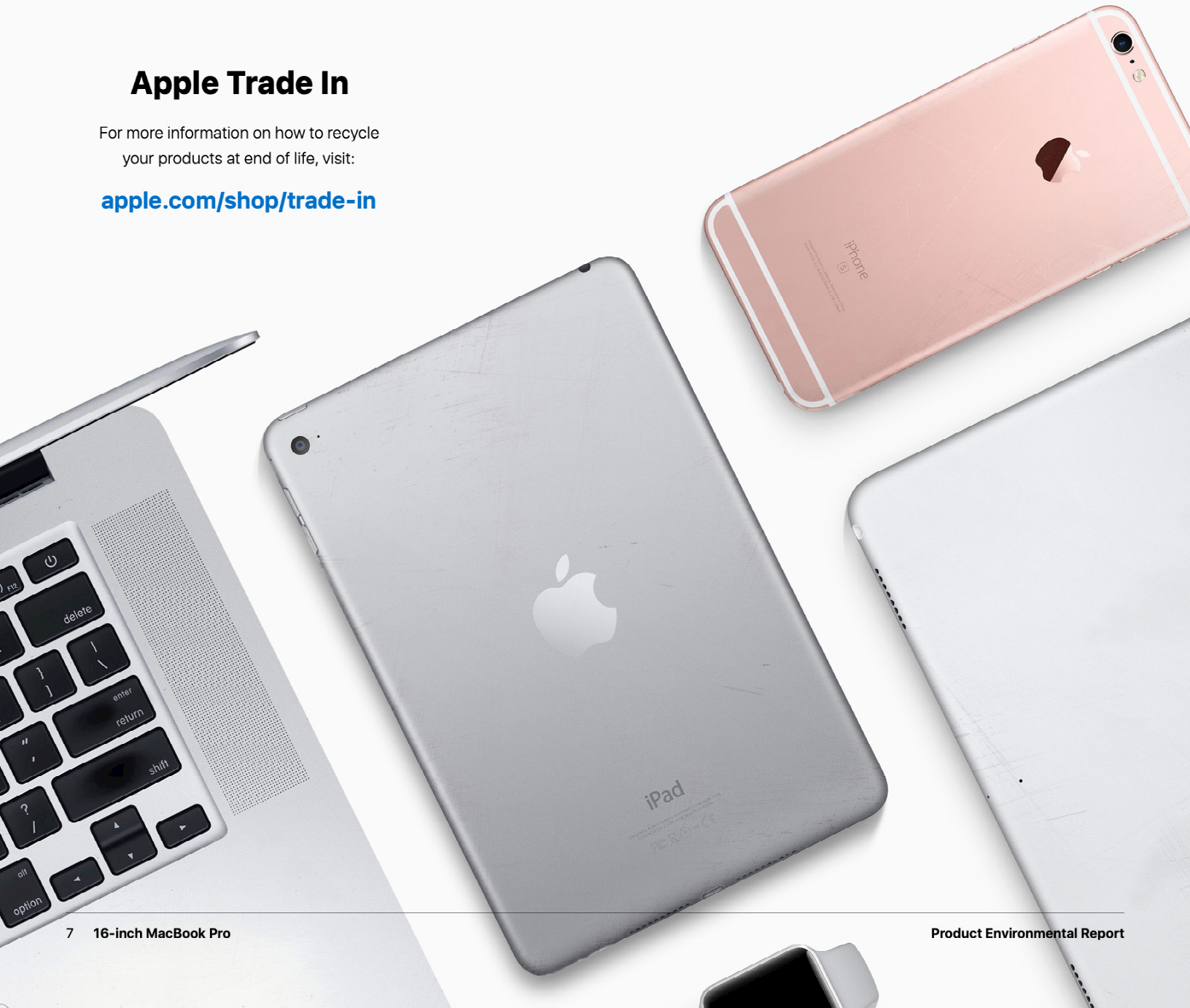
Return your product with Apple Trade In and we'll ensure it has a long life or recycle it for free.

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 to Apple. Customers can trade in eligible devices for an Apple Store Gift Card.<sup>13</sup> If a device is not eligible for credit, we'll recycle it for free. We also offer and participate in [product take-back and recycling 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/shop/trade-in](http://apple.com/shop/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. As part of this program, Apple and our suppliers are working to generate and procure more than 4 gigawatts of new renewable energy worldwide by 2020. This goal represents approximately one-third of our current manufacturing carbon footprint.

**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<sub>2</sub> equivalency factors (CO<sub>2</sub>e):

- **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 conservatively assumes a four-year period for power use by first owners. Product use scenarios are based on historical customer use data for similar products. 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](https://apple.com/environment/answers).

# Endnotes

<sup>1</sup> 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, 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.

<sup>2</sup> The 16-inch MacBook Pro achieved a Gold rating for EPEAT in the United States and Canada. Electronic Product Environmental Assessment Tool (EPEAT) is a program that ranks computers and displays based on environmental attributes in accordance with IEEE 1680.1-2018. For more information, visit [www.epeat.net](http://www.epeat.net).

<sup>3</sup> 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 512GB storage configuration. 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 (15-inch, 2019) standard configuration with 512GB SSD—increased from 354 kg CO<sub>2</sub>e (as published in its Product Environmental Report) to 385 kg CO<sub>2</sub>e.

Carbon footprint			
16-inch MacBook Pro		15-inch MacBook Pro	
—		2.6GHz 6-Core Processor, 256GB Storage	352 kg CO <sub>2</sub> e
2.6GHz 6-Core Processor, 512GB Storage	394 kg CO <sub>2</sub> e	2.3GHz 8-Core Processor, 512GB Storage	385 kg CO <sub>2</sub> e
2.3GHz 8-Core Processor, 1TB Storage	465 kg CO <sub>2</sub> e	—	



# Endnotes

- <sup>4</sup> MacBook Pro (15-inch, 2019) standard configuration with 512GB SSD was used for comparison as the most recently released and similar device, though the display size changed between the two products.
- <sup>5</sup> Enclosure greenhouse gas emission reduction is based on a comparison to average primary aluminum ingot.
- <sup>6</sup> Third-party assessments seek to confirm sourcing practices and are part of our responsible sourcing program. In addition, our efforts consider conflict, human rights, and other risks.
- <sup>7</sup> Final assembly supplier sites for 16-inch MacBook Pro are third-party certified as Zero Waste by UL LLC (UL 2799 Standard). This means these final assembly supplier sites do not generate any waste sent to landfill.
- <sup>8</sup> Only chemicals that meet GreenScreen® benchmark 3 or 4 are considered safer and preferred for use. Final assembly sites for 16-inch MacBook Pro are among the 18 final assembly supplier facilities that have adopted these safer cleaners. GreenScreen® is a comprehensive hazard assessment tool that evaluates substances against 18 different criteria. For more information, visit [www.greenscreenchemicals.org](http://www.greenscreenchemicals.org).
- <sup>9</sup> Responsible sourcing of wood fiber is defined in Apple's [Sustainable Fiber Specification](#). We consider wood fibers to include bamboo.
- <sup>10</sup> For more information about our work to protect and create responsibly managed forests, please read our [Environmental Responsibility Report](#).
- <sup>11</sup> Breakdown of U.S. retail packaging by weight.
- <sup>12</sup> Energy consumption and 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](http://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 96W USB-C Power Adapter with the USB-C Charge 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 96W USB-C Power Adapter with the USB-C Charge Cable (2m) is connected to AC power, but not connected to the system.
  - Power adapter efficiency: Average of the 96W USB-C Power Adapter with the USB-C Charge Cable (2m) measured efficiency when tested at 100 percent, 75 percent, 50 percent, and 25 percent of the power adapter's rated output current.

Mode	Power consumption for 16-inch MacBook Pro		
	100V	115V	230V
Off	0.05W	0.05W	0.05W
Sleep	0.56W	0.60W	0.59W
Idle—Display on	5.22W	5.44W	5.61W
Power adapter, no-load	0.09W	0.08W	0.10W
Power adapter efficiency	91.7%	91.9%	92.0%

- <sup>13</sup> 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.

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