



15-inch MacBook Pro with Thunderbolt 3 Environmental Report



Models MLH32, MLH42, MLW72, MLW82
Date introduced
October 27, 2016

Environmental Status Report

The 15-inch MacBook Pro with Thunderbolt 3 is designed with the following features to reduce environmental impact:

- Arsenic-free display glass
- Mercury-free LED-backlit display
- Brominated flame retardant-free
- Beryllium-free
- PVC-free
- Recyclable aluminum enclosure
- Greenhouse gas emissions from aluminum enclosure reduced by 35 percent



Meets ENERGY STAR®
Version 6.1 requirements



Achieves a Gold rating
from EPEAT³

Apple and the Environment

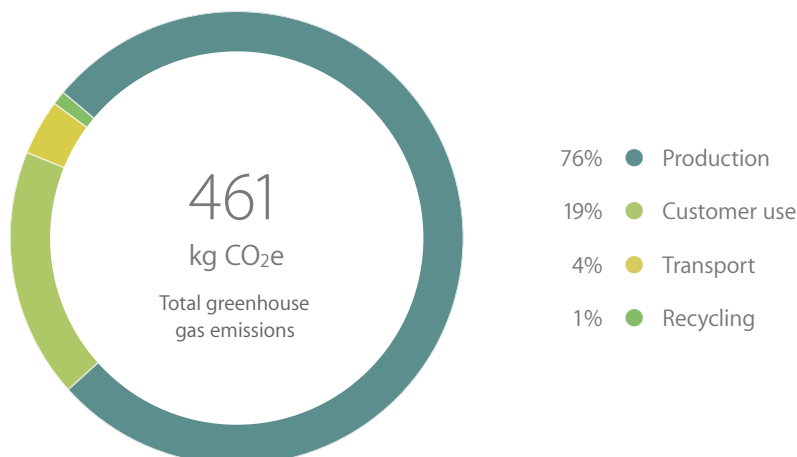
Apple believes that improving the environmental performance of our business starts with our products. The careful environmental management of our products throughout their life cycles includes controlling the quantity and types of materials used in their manufacture, improving their energy efficiency, and designing them for better recyclability. The information below details the environmental performance of the 15-inch MacBook Pro with Thunderbolt 3 as it relates to climate change, energy efficiency, material efficiency, and restricted substances.¹

Climate Change

Greenhouse gas emissions have an impact on the planet's balance of land, ocean, and air temperatures. Most of Apple's corporate greenhouse gas emissions come from the production, transport, use, and recycling of its products. Apple seeks to minimize greenhouse gas emissions by designing products to be as energy efficient as possible, sourcing materials with lower-carbon emissions, and partnering with suppliers to procure clean energy to power their facilities. For example, Apple prioritized aluminum that was smelted using hydroelectricity, and re-engineered its manufacturing process to reincorporate the scrap aluminum. As a result, the greenhouse gas emissions associated with the aluminum enclosure of the 15-inch MacBook Pro are 35 percent less than those of the previous-generation 15-inch MacBook Pro with Retina display. The chart below provides the estimated greenhouse gas emissions for the 15-inch MacBook Pro over its life cycle.²

Greenhouse Gas Emissions for 15-inch MacBook Pro

2.6GHz processor with 256GB storage





Battery design

The 15-inch MacBook Pro features a lithium-ion polymer battery chemistry that is free of lead, cadmium, and mercury. This allows for an extended lifespan and is designed to deliver up to 1000 full charge and discharge cycles before it reaches 80 percent of its original capacity. In addition, adaptive charging reduces the wear and tear on the battery, giving it a lifespan of up to five years.

Energy Efficiency

Because one of the largest portions of product-related greenhouse gas emissions results from actual use, energy efficiency is a key part of each product’s design. Apple products use power-efficient components and software that can intelligently power them down during periods of inactivity. The result is that MacBook Pro is energy efficient right out of the box.

The 15-inch MacBook Pro far exceeds ENERGY STAR Program Requirements for Computers Version 6.1, consuming as little as one fifth of the allowable energy. In addition, it consumes 17 percent less energy than the previous-generation 15-inch MacBook Pro with Retina display. The following table details power consumed in different use modes.

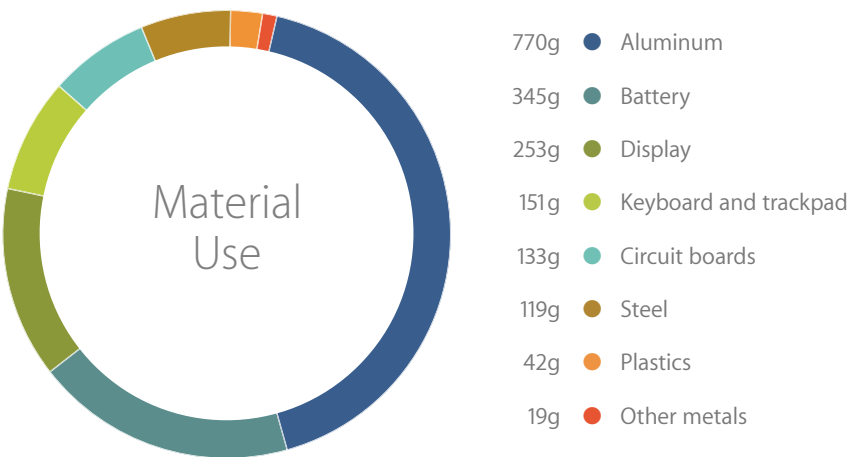
Power Consumption for 15-inch MacBook Pro

Mode	100V	115V	230V
Off	0.25W	0.25W	0.32W
Sleep	0.56W	0.56W	0.61W
Idle—Display on	4.15W	4.15W	4.23W
Power adapter, no-load	0.025W	0.028W	0.054W
Power adapter efficiency	90.5%	90.8%	90.5%

Material Efficiency

Apple’s ultracompact product and packaging designs lead the industry in material efficiency. Reducing the material footprint of a product helps maximize shipping efficiency. It also helps reduce energy consumed during production, and material waste generated at the end of the product’s life. The 15-inch MacBook Pro enclosure is made of aluminum and other materials highly desired by recyclers. In addition, the foot, fan, and keyboard hinge mechanism are made from plastics containing recycled or bio-based content, which reduces dependence on petroleum-based plastics. The chart below details the materials used in this model.⁴

Material Use for 15-inch MacBook Pro





U.S. retail packaging of the 15-inch MacBook Pro contains an average of 38 percent recycled content by weight.

Packaging

The packaging for the 15-inch MacBook Pro is highly recyclable. The packaging fibers in the retail box are made from recycled content or sustainably managed forests. In addition, the retail packaging consumes 7 percent less volume than the previous-generation 15-inch MacBook Pro with Retina display, allowing up to 15 percent more units to fit per shipping container. The following table details the materials used in its packaging.

Packaging Breakdown for 15-inch MacBook Pro

Material	Retail box	Retail and shipping box
Paper (corrugate, paperboard)	412g	911g
High-impact polystyrene	208g	208g
Other plastics	16g	16g

Restricted Substances

Apple has long taken a leadership role in restricting harmful substances from its products and packaging. As part of this strategy, all Apple products comply with the strict European Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment, also known as the RoHS Directive. Examples of materials restricted by RoHS include lead, mercury, cadmium, hexavalent chromium, and the brominated flame retardants (BFRs) PBB and PBDE. The 15-inch MacBook Pro goes even further than the requirements of the RoHS Directive by incorporating the following more aggressive restrictions:

- Arsenic-free display glass
- Mercury-free LED-backlit display
- BFR-free
- Beryllium-free
- PVC-free



Recycling

Through ultra-efficient design and the use of highly recyclable materials, Apple has minimized material waste at the product’s end of life. In addition, Apple offers and participates in various product take-back and recycling programs in 99 percent of the countries where Apple products are sold. All products are processed in the country or region in which they are collected. For more information on how to take advantage of these programs, visit www.apple.com/recycling.

Definitions

Electronic Product Environmental Assessment Tool (EPEAT): A program that ranks computers and displays based on environmental attributes in accordance with IEEE 1680.1-2009. For more information, visit www.epeat.net.

Greenhouse gas emissions: Estimated emissions are calculated in accordance with guidelines and requirements as specified by ISO 14040 and ISO 14044. Calculation includes emissions from the following life-cycle phases contributing to Global Warming Potential (GWP 100 years) in CO₂ equivalency factors (CO₂e):

- **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 the manufacturing site to regional distribution hubs. Transport of products from distribution hubs to end customer is modeled using average distances based on regional geography.
- **Customer 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, collected anonymously. Geographic differences in the power grid mix have been accounted for at a regional level.
- **Recycling:** Includes transportation from collection hubs to recycling centers, and the energy used in mechanical separation and shredding of parts.

Energy efficiency terms: 15-inch MacBook Pro is tested with a fully charged battery and powered by the 87W USB-C Power Adapter with the USB-C Charge Cable (2m). The energy values in this report are based on the ENERGY STAR Program Requirements for Computers Version 6.1. For more information, visit www.energystar.gov.

- **Off:** Lowest power mode of the system. System is shutdown. 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.
- **Idle—Display on:** System is on and has completed loading macOS. Display brightness was set as defined by ENERGY STAR Program Requirements for Computers Version 6.1, and Auto-Brightness was turned off. Connected to Wi-Fi.
- **Power adapter, no-load:** Condition in which the 87W 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 87W 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.

Restricted substances: Apple defines a material as BFR-free and PVC-free if it contains less than 900 parts per million (ppm) of bromine and of chlorine. Apple defines a material as beryllium-free if it contains less than 1000 parts per million (ppm) of beryllium. A complete list of Apple's restrictions on hazardous substances is available at www.apple.com/environment/answers.

1. Product evaluations based on U.S. configurations of Models MLW72 and MLH32.

2. Greenhouse gas emissions vary according to the configuration of the 15-inch MacBook Pro with Thunderbolt 3. The following table details the estimated greenhouse gas emissions for U.S. configurations of 15-inch MacBook Pro over its life cycle.

Configuration	Greenhouse Gas Emissions
2.6GHz Processor with 256GB Storage	461kg CO ₂ e
2.7GHz Processor with 512GB Storage	469kg CO ₂ e

3. The 15-inch MacBook Pro achieved a Gold rating from EPEAT in the United States and Canada.

4. Excludes USB-C Charge Cable and 87W USB-C Power Adapter. Mass will vary by configuration.

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