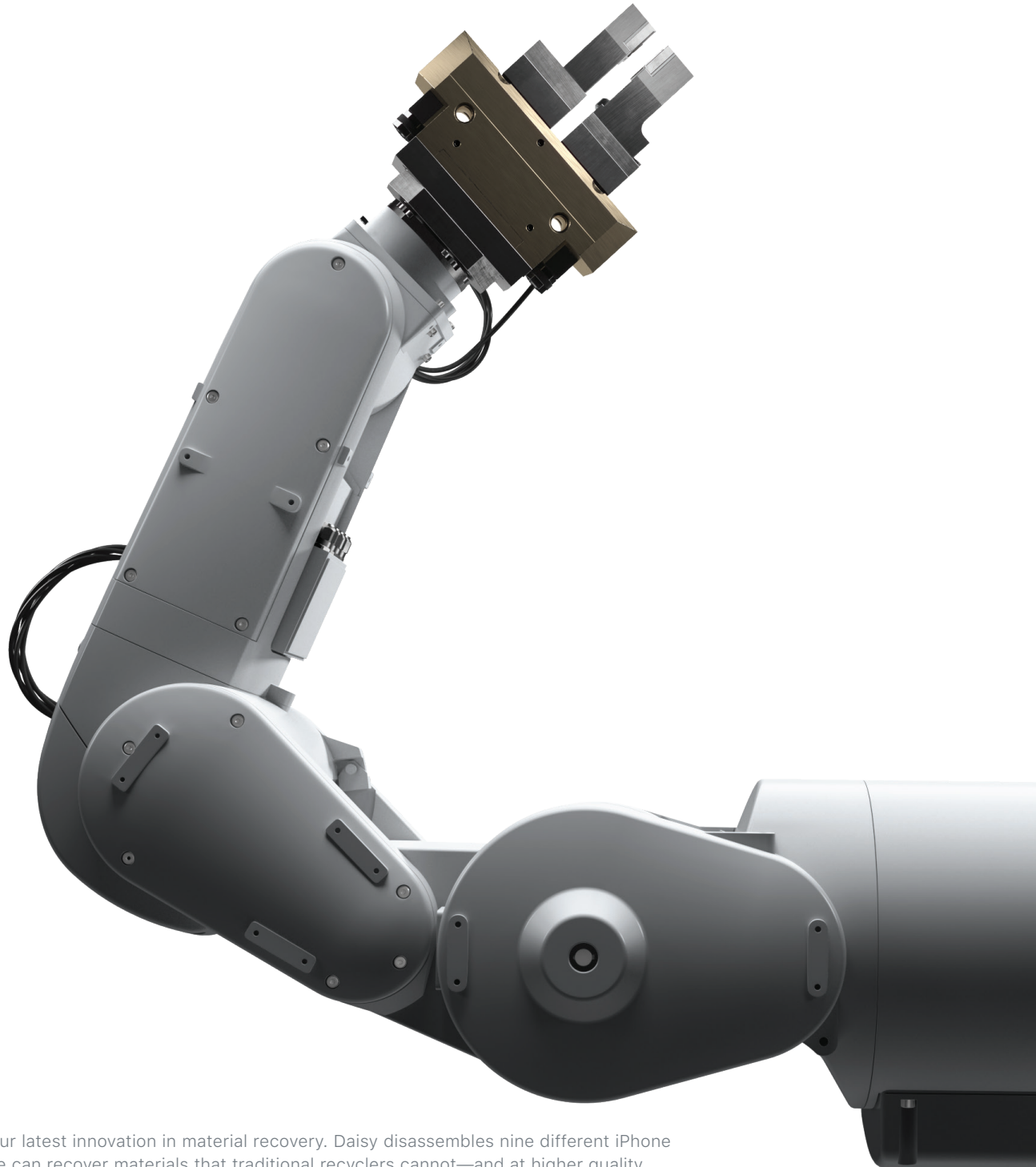




# Environmental Responsibility Report

2018 Progress Report, Covering Fiscal Year 2017



Meet Daisy, our latest innovation in material recovery. Daisy disassembles nine different iPhone models, so we can recover materials that traditional recyclers cannot—and at higher quality.

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## Environmental Responsibility at Apple

# To ask less of the planet, we ask more of ourselves.



Our work is led by Lisa Jackson, Apple's Vice President of Environment, Policy and Social Initiatives, reporting directly to CEO Tim Cook. The Office of Environment, Policy and Social Initiatives works with teams across Apple to set strategy, engage stakeholders, and communicate progress. Our integrated approach means that decisions about Apple values, including environment, are reviewed and supported at the highest levels of the company.

Apple's mission has never wavered. We are here to change the world. It's what inspires the amazing products and services that reach billions of people around the globe. It's what drives us to relentlessly push the boundaries of innovation and design. And it's why we continuously strive to do more with less—reducing our impact on the Earth we all share, while expanding and redefining the possibilities ahead.

Our 11th annual Environmental Responsibility Report covers fiscal year 2017, and highlights the progress we've made in meeting our environmental objectives. The challenges are complex, but the philosophy is simple: Apply the same innovation that goes into making our products. Today, we remain focused on three priorities where we and our stakeholders believe Apple can make the biggest difference:

- **Climate change:** Reduce our impact on climate change by using renewable energy sources and driving energy efficiency in our products, facilities, and supply chain.
- **Resources:** Conserve precious resources so we all can thrive.
- **Safer materials:** Pioneer the use of safer materials in our products and processes.

In each of these key areas, we set ambitious but measurable goals, then develop smart solutions to meet them. Our work to reduce our greenhouse gas emissions is a great example.

More than a decade ago, we started to transition our electricity use to renewable sources. Today, we're proud to power 100 percent of our operations around the world with 100 percent renewable energy. That means every Apple data center, retail store, corporate office, and colocation facility in 43 countries around the world now runs on clean power. In the process, we've paved the way for other companies and organizations to purchase renewable energy and transition their own operations to greener power.

As we worked to reach 100 percent renewable energy for our own operations, we began to challenge our suppliers to make the same transition to clean energy through our supplier clean energy program. As of April 2018, 23 manufacturers have committed to power all of their Apple operations with 100 percent renewable energy. And we're well on our way to meeting our goal of putting 4 gigawatts of new clean energy online in our supply chain by 2020.

We also made progress toward our goal to one day make new products without mining new materials from the earth. We hope to get there by using only recycled or renewable materials in our products, and returning an equivalent amount of material back to the market, to be used by us or others.

Like everything at Apple, this effort is driven by innovation. We've developed a brand-new robot, Daisy, capable of disassembling nine versions of iPhone, and sorting their high-quality components for recycling. To help keep Daisy busy, we're making it easier than ever for customers to recycle their old Apple devices through our new Apple GiveBack experience.

There's a lot more to our story over the past year. As you read through this Environmental Progress Report, we are busy working toward our next frontiers in clean energy, materials recovery, and green chemistry. We are proud of our work and look forward to continuing our journey.

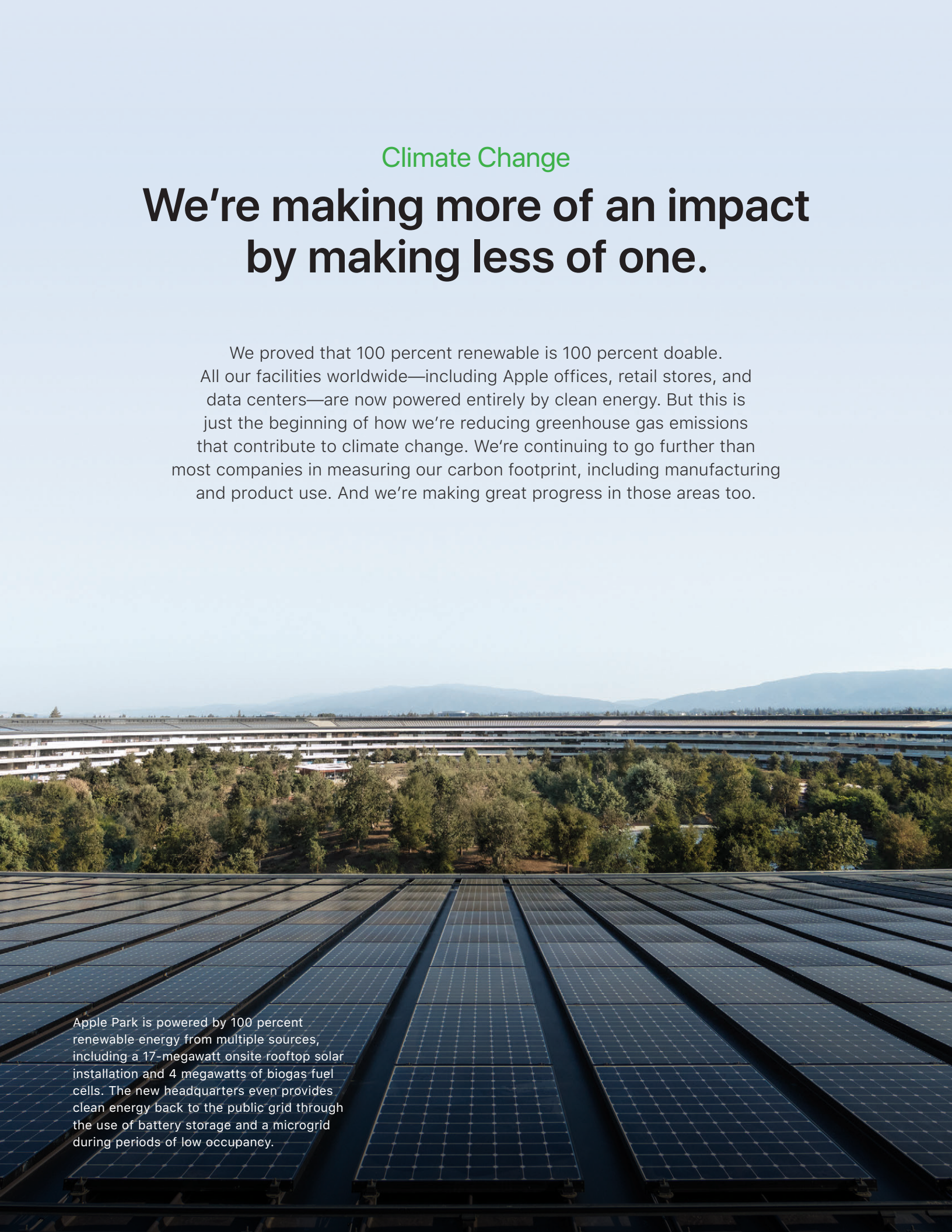
**Lisa Jackson**

Vice President, Environment, Policy & Social Initiatives

## Climate Change

# We're making more of an impact by making less of one.

We proved that 100 percent renewable is 100 percent doable. All our facilities worldwide—including Apple offices, retail stores, and data centers—are now powered entirely by clean energy. But this is just the beginning of how we're reducing greenhouse gas emissions that contribute to climate change. We're continuing to go further than most companies in measuring our carbon footprint, including manufacturing and product use. And we're making great progress in those areas too.



Apple Park is powered by 100 percent renewable energy from multiple sources, including a 17-megawatt onsite rooftop solar installation and 4 megawatts of biogas fuel cells. The new headquarters even provides clean energy back to the public grid through the use of battery storage and a microgrid during periods of low occupancy.

## Comprehensive Carbon Footprint

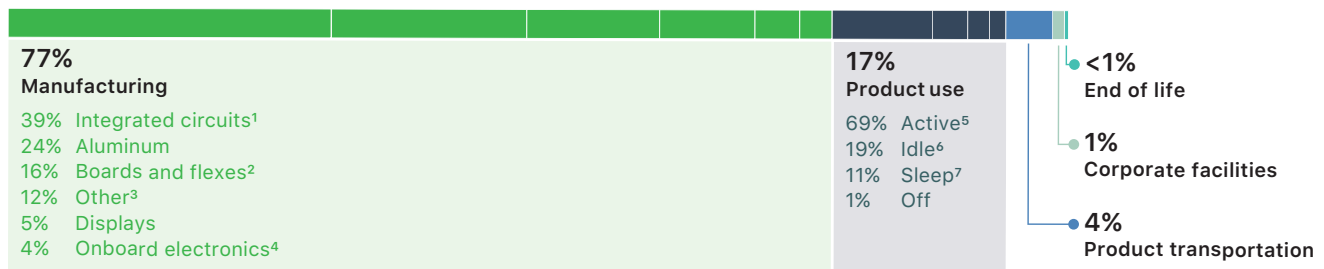
# We measure more. So we can do more.

When we measure our carbon footprint, we don't stop with ourselves. We include hundreds of suppliers, millions of customers, and hundreds of millions of devices. And we're always looking for ways to make the biggest difference in five major areas: corporate facilities, manufacturing, product use, transportation, and end-of-life processing. In 2017, we once again reduced our overall carbon footprint to 27.5 million metric tons of greenhouse gases (CO<sub>2</sub>e). That's down from 29.5 million metric tons in 2016.

Our environmental programs contributed to this decline in our comprehensive carbon footprint, including reduced emissions from aluminum manufacturing, energy efficiency, and increasing use of clean energy at our facilities and in our supply chain. We also refine our product life cycle analysis each year, moving from industry-average data to our own data whenever possible. (See Appendix A to read more about our life cycle carbon analysis.)

### Apple's carbon footprint

27.5 million metric tons of carbon emissions



Our carbon footprint tells us a lot about how we're doing and where there are opportunities to go further. For example, because aluminum represents almost a quarter of our manufacturing emissions, we developed a program to reduce emissions associated with aluminum enclosures.

## Corporate Facilities

# 100% renewable energy for 100% of our facilities.



Our facilities include all of our offices, stores, and data centers in 43 countries.

In 2018, we reached a major milestone: 100 percent of the electricity we use at all of our facilities comes from renewable sources. This outcome is the result of the relentless innovation that goes into everything we do—investing in our own renewable energy projects and supporting industry-leading advances along the way. These efforts have lowered emissions from our facilities to 1 percent of our comprehensive carbon footprint.

Scope 1 emissions are those greenhouse gases resulting from fuel combustion from sources we own or operate—like vehicles or natural gas for heating. Scope 2 emissions refer to those resulting from Apple’s use of electricity. Renewable energy generates minimal Scope 2 emissions, whereas burning coal, oil, or natural gas to produce electricity releases carbon dioxide and other greenhouse gases into the atmosphere. Since 2011, our use of renewable energy has reduced our Scope 1 and Scope 2 emissions by 54 percent and prevented nearly 2.1 million metric tons of CO<sub>2</sub>e from entering the atmosphere. That’s equivalent to taking more than 444,000 cars off the road each year.<sup>8</sup> Without renewable energy, these emissions would have more than tripled since 2011.

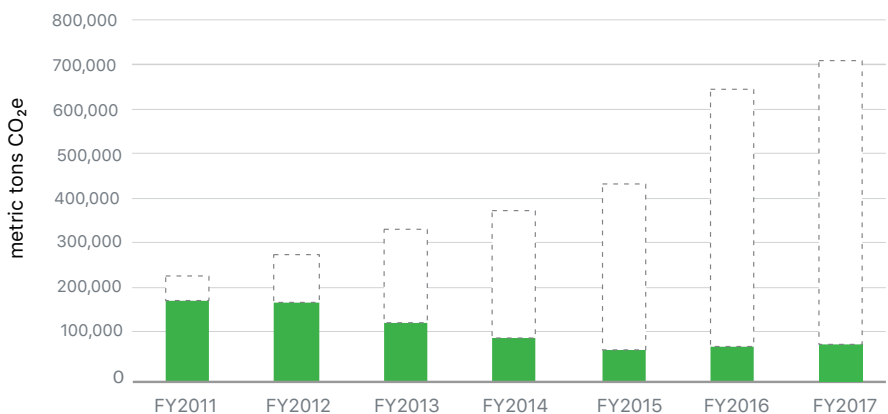
## \$2.5 billion

After the U.S. withdrew from the Paris climate agreement, Apple responded by issuing a \$1 billion green bond for environmental projects, bringing our total to \$2.5 billion.

[Download the 2018 Green Bond Report](#) ↓

### Apple’s emissions (Scopes 1 and 2)

Since 2011, Apple has reduced emissions from our offices, data centers, retail stores, and fleet vehicles worldwide by 54 percent—even while our energy use more than tripled during this same period.



□ Default grid emissions: Total emissions if Apple had no renewable energy program  
■ Apple emissions: Emissions after accounting for Apple’s renewable energy program



Every time you send an iMessage, make a FaceTime call, ask Siri a question, stream a song, or share a photo, it takes energy. And those tasks are handled by our data servers running on 100 percent wind, solar, low-impact hydro, or biogas fuel cell power.

## How we got to 100 percent.

Beginning January 2018, all of the electricity from our facilities worldwide is covered by renewable energy. This is how we did it.

### 9 million square feet

In fiscal year 2017, we implemented energy efficiency measures in more than 9 million square feet of Apple facilities, with a combined annual electricity use of over 300 million kWh—resulting in an average energy savings of about 5 percent.

### Energy efficiency.

The cleanest energy is the energy you never use. That's why we design our facilities for maximum energy efficiency and regularly audit them to identify further opportunities for energy optimization.

We've been systematically expanding our energy efficiency programs from our Santa Clara Valley buildings in California to our other large campuses, including those in Elk Grove and Culver City, California, and in Austin, Texas. Efficiency improvements include upgrading to LED lighting, retro-commissioning building and lighting controls, and upgrading heating, ventilation, and air-conditioning (HVAC) systems.

And in fiscal year 2017, we conducted a comprehensive lighting and HVAC retro-commissioning program throughout our retail stores—resulting in an overall electricity savings of 3.7 million kilowatt-hours (kWh) per year from the evaluation of nearly 500 operating retail stores around the world.

Altogether, we reduced our energy footprint in fiscal year 2017 by 14.7 million kWh and 225,000 therms. Thanks to energy efficiency measures we've implemented since 2011, we are now cumulatively saving 70 million kWh of electricity and over 2.4 million therms of natural gas per year.



## Renewable energy.

We seek to create new renewable energy projects whenever possible. As of January 2018, approximately 66 percent of the renewable energy Apple procures comes from projects that Apple created. And we aim to ultimately cover our entire electricity load with Apple-created projects, which include:

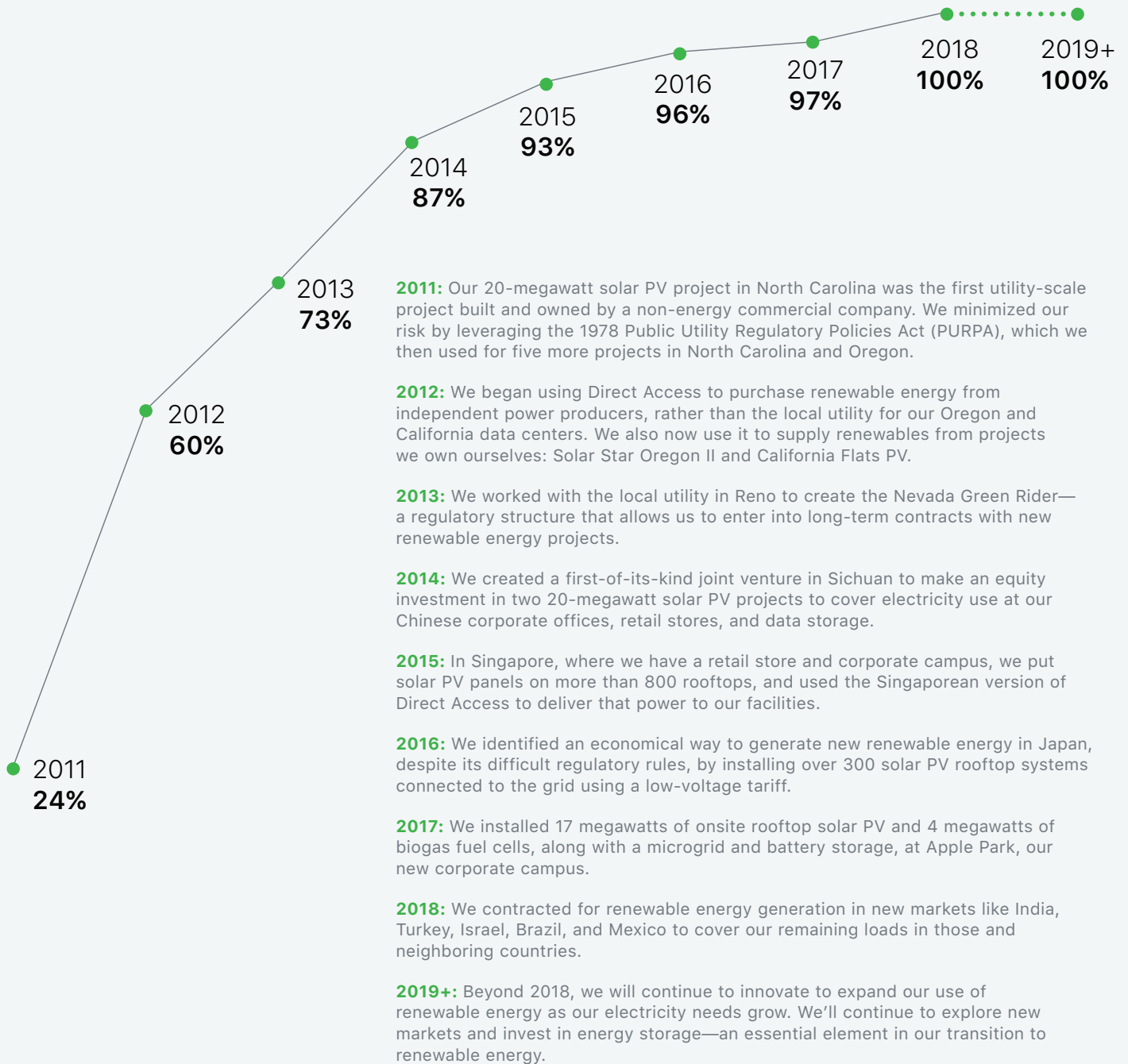
- **Direct ownership.** Where feasible, we produce our own renewable energy by building our own renewable energy projects, including solar arrays, wind farms, biogas fuel cells, and low-impact hydro generation systems.
- **Dedicated renewable energy contracts.** Where it's not feasible to build our own generation, we sign long-term renewable energy purchase contracts, supporting new, local projects that meet our robust renewable energy sourcing principles.

In cases where we need more renewable energy than what's generated by our Apple-created projects, we directly purchase renewable energy from newer projects in nearby markets, or through available utility green energy programs. When these options are not available, we are willing to procure strong renewable energy credits (RECs) tied to recently constructed renewable energy projects, applying the same rigor to these purchases as we do to our Apple-created renewables. When Apple acquires RECs, we require that they are Green-e Energy certified, where available, and come from the same power grid—and preferably in the same state or country—as the Apple facility they support.



# Key innovations in creating or procuring our renewable energy.

Innovation played a key role in how we contracted and built projects to help us reach 100 percent renewable energy starting in 2018\*.



\*We achieved our 100 percent renewable energy goal beginning January 1, 2018.



In China, our solar projects produce enough energy to power all our offices and retail stores in that country. Solar panels are mounted high off the ground to let sunlight shine through, so the grass can grow—and the local yaks can eat it.

## We apply strong principles for procuring renewable energy.

We encounter many legal and regulatory frameworks around the world that limit our renewable energy supply options. In each location, we endeavor to choose the strongest approach available to us as defined by these guiding principles.

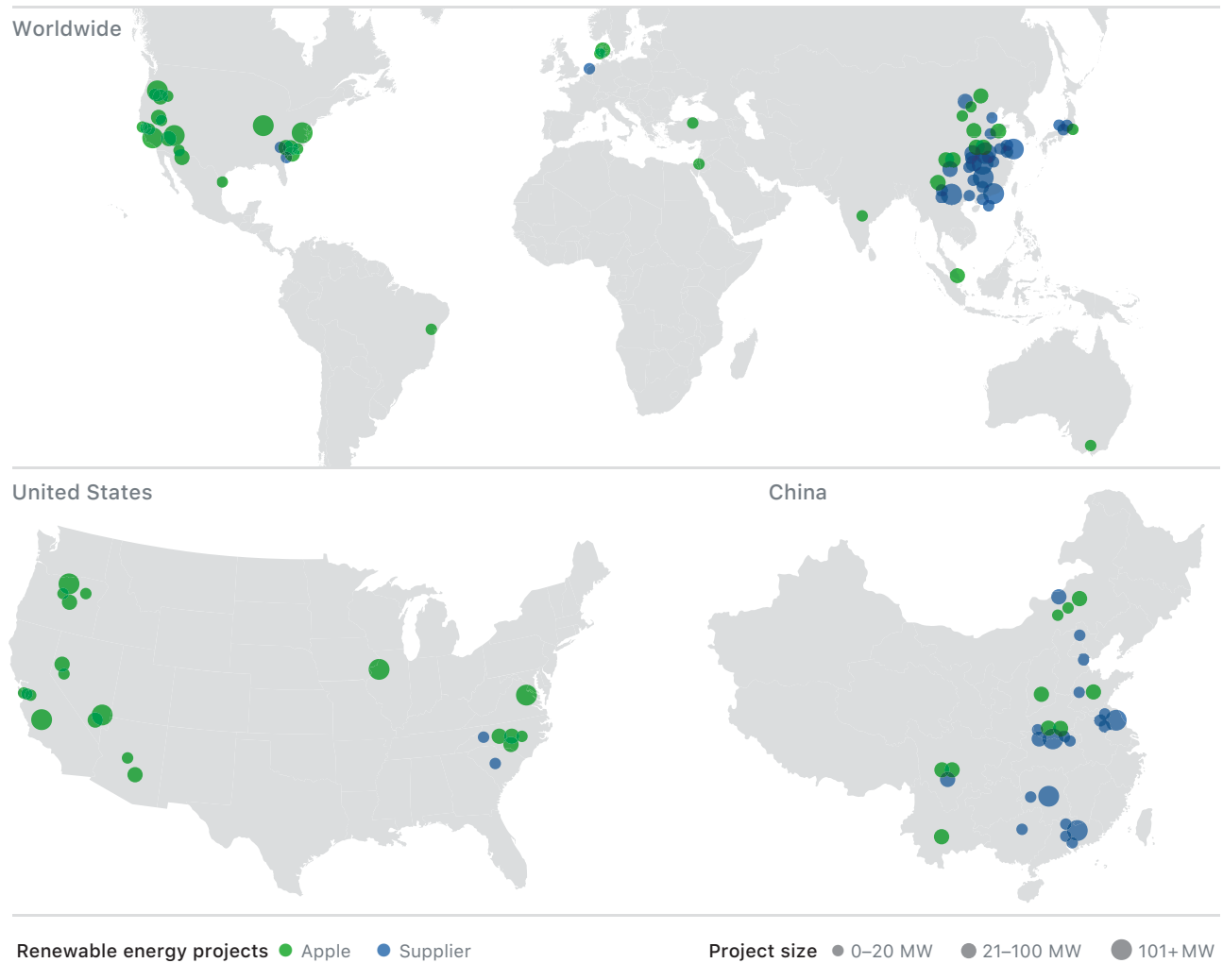
**Displacement.** We seek to displace more-polluting forms of energy in the same electric grid region as our facilities. We accomplish this by having Apple-created projects deliver into the grid an amount of renewable energy equal to the amount of energy our facilities use from that grid. For less than 0.5 percent of our load that occurs in difficult renewable energy markets, we seek a renewable energy solution in the broader geographic region.

**Materiality.** We strive to create new clean energy that adds to the energy sources already delivering to the grid. This means participating in renewable energy projects in a manner that provides material support to the project's success by overcoming financial, regulatory, or other barriers.

**Accountability.** We apply rigor in measuring and tracking our energy supply resources, and use third-party registries such as WREGIS and NC-RETS, certification programs such as Green-e Energy, and contractual provisions to ensure that only Apple takes credit for the renewable energy it generates or procures. When no such system exists, we work with industry partners and governmental entities to create them.

# Apple and supplier-created long-term renewable energy projects.

To reduce our carbon emissions, Apple and our suppliers are generating and procuring renewable energy. The map below represents long term investments into new renewable energy projects supporting Apple facilities, manufacturing, and cleaner grids around the world.\*



To reduce Apple’s own electricity footprint (Scope 2 emissions), we have built or have long-term commitments for renewable energy, of which 626 megawatts is operational and another 775 megawatts is under construction. To address emissions from manufacturing products, Apple and our suppliers have invested or procured 1.1 gigawatts of grid-connected projects, with another 1.9 gigawatts in development. These projects apply a mix of clean energy technology—approximately 48 percent wind, 46 percent solar, 5 percent biomass, and 1 percent low-impact hydro.

\*The map does not include REC and Guarantee of Origin purchases, utility clean energy programs, short-term contracts, and projects that are not yet sited.

### 2017 transportation emissions

We look at the carbon footprint associated with all modes of our employee travel.



**8300**  
metric tons CO<sub>2</sub>e  
vehicle fleet



**121,000**  
metric tons CO<sub>2</sub>e  
business travel



**172,400**  
metric tons CO<sub>2</sub>e  
commute

## Reworking how we get to work.

Even as we shrink the carbon footprint of Apple's facilities, we're continuing to look for ways to reduce carbon emissions from business fleet vehicles, employee commute, and business travel. Our total transportation emissions fell by 3 percent in fiscal year 2017, while our corporate employee head count grew by 9 percent.

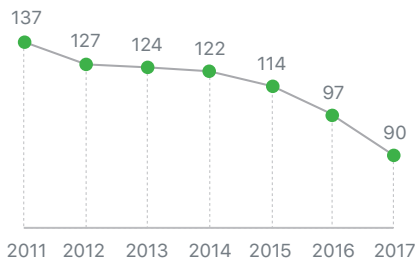
Where possible, we enable telecommuting to minimize emissions from commuting. For example, our At Home Advisor program provides AppleCare customer service by Apple employees working from their homes. This program avoided nearly 23,000 metric tons of CO<sub>2</sub>e emissions in fiscal year 2017—equal to 13 percent of our employee commute footprint. We also offer our U.S. employees a transit subsidy of up to \$100 per month, and we grew our coach bus program in Santa Clara Valley and China to reduce use of single-occupancy vehicles. With the opening of Apple Park, we added 700 new electric vehicle charging ports, more than 2000 new campus bicycles, and a dedicated transit center.

### Manufacturing

## Transforming our manufacturing process to reduce emissions.

### Carbon emissions per product (kg)

Our efforts to reduce emissions from manufacturing products have resulted in a per product year-over-year decline in carbon emissions.



Apple takes responsibility for its entire carbon footprint, including emissions from manufacturing, transporting, and using and recycling our products. These emissions are considered Scope 3 emissions, defined as those emissions outside of Apple's direct control. Manufacturing makes up 77 percent of our carbon footprint. Most of it is due to carbon emissions from the electricity used to make the parts in our products. So we're sourcing lower-carbon materials, partnering with suppliers to reduce their energy use, and helping them switch to renewable energy. We believe that together we can transform the manufacturing process to dramatically reduce emissions.

### We're helping our suppliers switch to renewable energy.

Since the electricity used to make our products is the largest contributor to our overall carbon footprint, we're helping our suppliers reduce their energy use and transition to new renewable energy sources.

In 2015, we started engaging directly with suppliers to help them reduce their energy use. To this end, we conduct audits and train suppliers to uncover opportunities for energy efficiency—like replacing outdated or inefficient heating, cooling, and lighting systems; repairing compressed air leaks; and recovering waste heat. The assessments provide suppliers with a cost-benefit analysis for implementing energy efficiency improvements.

We aim to promote continual improvement, build technical capabilities, and increase awareness of the environmental and financial benefits of energy efficiency.

Since the inception of this program in 2015, we have engaged with 48 suppliers at 71 facilities. In 2017, our program implemented energy efficiency measures that saved a combined annualized \$44.8 million. These measures helped save an annualized 320,000 metric tons of CO<sub>2</sub>e from entering the atmosphere in 2017.



**4 gigawatts = one-third of our manufacturing emissions**

By 2020, Apple and our suppliers will generate or procure 4 gigawatts of clean energy in our supply chain. That's approximately one-third of our current manufacturing footprint.

Our efforts go beyond energy efficiency to spur the development and procurement of renewable energy within our global supply chain. Partners across our supply chain are installing or investing in sizable solar projects, running their factories on 100 percent wind power, and purchasing clean energy from reputable utility programs. We've also helped develop 485 megawatts of wind and solar projects to address upstream emissions. As part of our clean energy program, Apple and our suppliers will generate and procure more than 4 gigawatts of new clean power worldwide by 2020. Once completed, this will represent approximately one-third of our current manufacturing carbon footprint.



Our partner Compal, which assembles iPad devices, is constructing rooftop solar on its facilities across China. By the end of 2018, it will achieve its goal of 100 percent renewable energy for Apple production.



For more information on how our suppliers are fulfilling their renewable energy commitments, [download the Program Update](#)

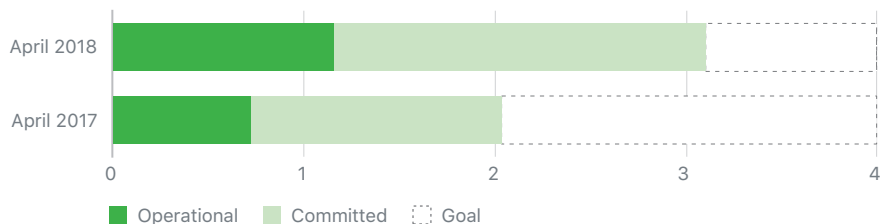
As of April 2018, 23 partners have committed to 100 percent renewable energy for Apple production:

- Arkema
- Biel Crystal Manufactory Ltd.
- Catcher Technology
- Compal Electronics
- DSM Engineering Plastics
- ECCO Leather
- Finisar
- Golden Arrow
- Ibiden
- Jabil
- Lens Technology
- Luxshare-ICT
- Mega Precision
- Pegatron
- Qorvo
- Quadrant
- Quanta Computer
- Solvay
- Sunway Communication
- Sunwoda Electronics
- Taiyo Ink Mfg. Co.
- Wistron
- Yuto

In addition to suppliers committed to 100 percent renewable energy for Apple production, some have made partial commitments. As of April 2018, these commitments represent over 3 gigawatts of new clean energy—well on the way to our 4-gigawatt goal. In fact, more than 1 gigawatt is already operational and has generated close to 1.9 million kWh of renewable energy in fiscal year 2017. This clean energy generation avoided over 1.5 million metric tons of CO<sub>2</sub>e—roughly equivalent to taking more than 300,000 cars off the road each year for the life of the renewable energy projects.

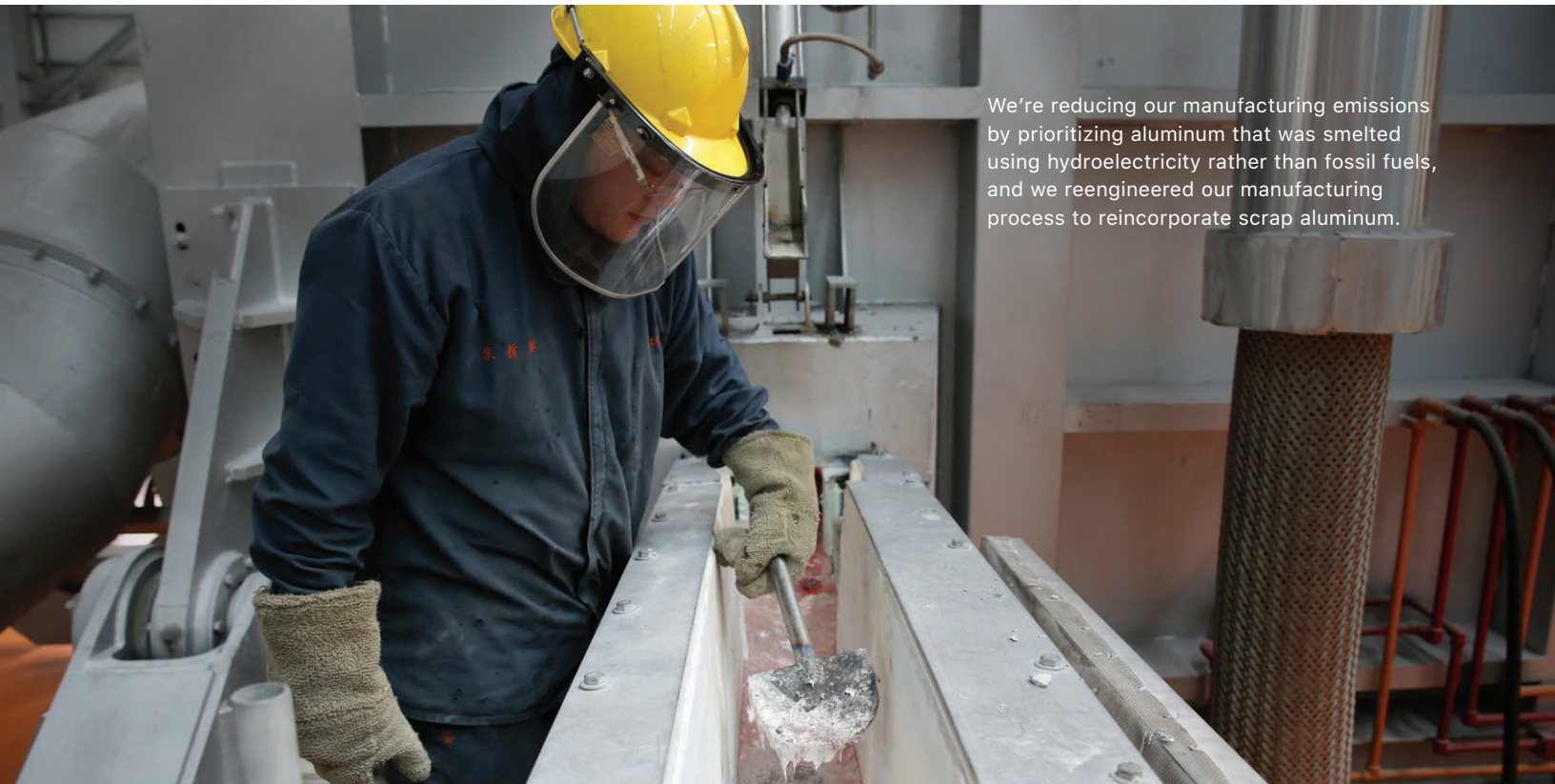
Our supplier clean energy program is helping us to reduce Apple’s manufacturing carbon footprint. To maximize the impact of this program, we use data from our comprehensive carbon footprint to identify and prioritize the most energy-intensive commodities. We then engage with suppliers to discuss options for transitioning to renewable energy. In important manufacturing regions without strong renewable energy markets, we work with suppliers to engage local, regional, and national governments to ensure our program is aligned with regulatory priorities. This encourages the development of policies that will enable scalable renewable energy solutions, including the ability for customers to choose their energy source.

### Progress toward 4 gigawatts



As of April 2018, 23 suppliers operating in more than 10 different countries have committed to 100 percent clean energy for Apple production. Other suppliers have also committed to generate or procure clean energy for portions of Apple production. In addition, Apple has helped develop 485 megawatts of wind and solar projects across six provinces of China to support upstream manufacturing.

We know the transition to renewable energy can be highly complex. It often requires complicated deal structures across many regions with their own regulatory requirements. So in 2017, Apple developed the Clean Energy Portal, an online platform to help suppliers identify commercially viable renewable energy solutions in regions around the world. We will continue to share new resources on the Clean Energy Portal, intended to make adoption of clean energy in key markets even easier. We continually update policy guidance and tools to help suppliers develop commercially viable strategies to achieve 100 percent renewable energy.



We're reducing our manufacturing emissions by prioritizing aluminum that was smelted using hydroelectricity rather than fossil fuels, and we reengineered our manufacturing process to reincorporate scrap aluminum.

**↓2.6 million**

Changes to aluminum production and suppliers transitioning to renewable energy cut our greenhouse gas emissions by 2.6 million metric tons in fiscal year 2017.<sup>9</sup>

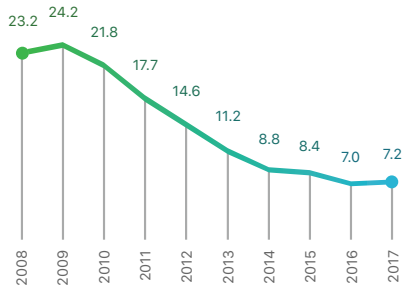
### **Lowering emissions by focusing on aluminum.**

Emissions associated with aluminum manufacturing across all Apple products represent 24 percent of our manufacturing carbon footprint. So we prioritized aluminum that was smelted using hydroelectricity rather than fossil fuels, and we reengineered our manufacturing process to reincorporate the scrap aluminum. As a result, over the past three years we've reduced emissions associated with every gram of aluminum in iPhone by 83 percent. And for the enclosure of the 13-inch MacBook Pro with Touch Bar, it's a 47 percent reduction compared to that of the previous-generation MacBook Pro.<sup>10</sup>



### Product energy use (kWh/yr)

Over time, the average energy our products use compared with previous generations has declined.



### Product Use

Since 2008, we've reduced the average energy consumed by Apple products by 68 percent.<sup>11</sup>

When we measure our carbon footprint, we even include the energy consumers use to run their devices. And we continue to make advancements in our products' efficiency. For example, iMac consumes up to 96 percent less energy in sleep mode than the first generation. The 12-inch MacBook uses less than 0.5 watt in sleep mode. And you can charge your iPhone X once a day for a year for only 75 cents.<sup>12</sup> When you multiply these reductions by all the Apple devices in the world, the impact on our carbon footprint really adds up.



# 61%

MacBook Pro consumes 61 percent less energy than the original MacBook Pro with Retina display.<sup>13</sup>



# 40%

iMac Pro consumes 40 percent less power during sleep and off mode—the result of an innovation in power supply design.<sup>14</sup>



# 96%

iMac consumes up to 96 percent less energy in sleep mode than the first generation.



# 9 watts

When playing music, HomePod consumes less power than an average LED lightbulb.<sup>15</sup>

## Product Transportation/End of Life

# We take responsibility for the energy used to ship and recycle our products.

We include all the energy used for shipping and recycling in our carbon footprint. So we strive to make our packaging smaller or lighter so less fuel is consumed when we transport products by air and sea. We're also adjusting our recycling practices. When collecting end-of-life products, we maximize the environmental benefits of recycling by weighing the availability of recovery technology with the impacts of shipping materials.



The packaging for the 13-inch MacBook Pro with Touch Bar weighs 19 percent less than the previous generation. By designing our packaging to be lighter, we reduce emissions from shipping.<sup>16</sup>

Resources

# Rethinking materials.

We're always thinking of ways to use fewer of the earth's precious resources and ways to use them again. Like recovering more of the high-quality materials in your old devices to make new products. Through more efficient recycling technologies and other innovations, we hope that one day we can stop mining the earth altogether.



## Products

# Our goal is a closed-loop supply chain.

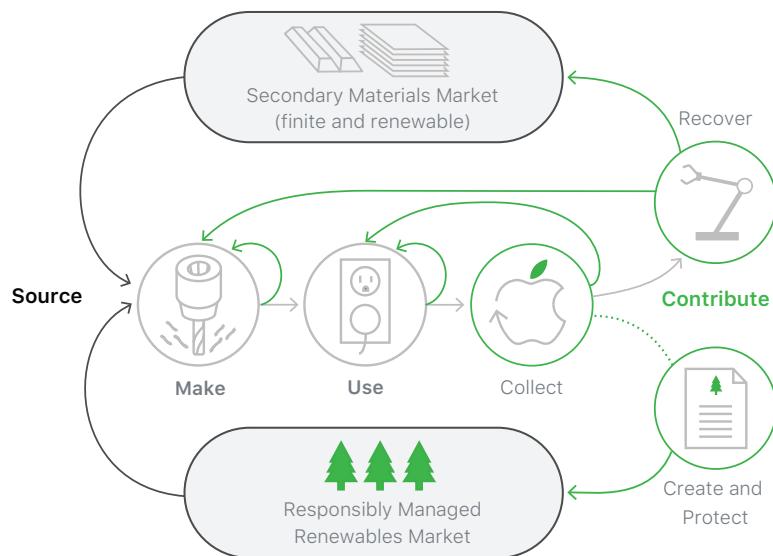
Traditional supply chains are linear. Materials are mined, manufactured as products, and often end up in landfills after use. Then the process starts over and more materials are extracted from the earth for new products. This extraction damages our environment and depletes the resources we all need to thrive. So in 2017, we announced our commitment to a closed-loop supply chain—where products are made using recycled or renewable materials only. And where we return an equivalent amount of material back to the market to be used by us or others. It's an ambitious goal that will require years of collaboration across Apple teams, our suppliers, and recyclers—but our work is already underway.

### Supplier responsibility

We hold ourselves and our suppliers to the highest standard when it comes to human rights, environmental protection, and responsible business practices in our supply chain. [Learn more >](#)

While we transition to this new supply chain model, we are committed to maintain our initiatives that ensure the materials we use in our products are sourced responsibly—through strict standards and programs that drive positive change.

### How we define "closed loop"



### The four aspects of a closed-loop supply chain:

- 1. Source:** Use recycled or renewable materials that are responsibly sourced.
- 2. Make efficiently:** Design and manufacture products to minimize the use of materials.
- 3. Use for a long time:** Design products to be durable, so they can have long lives.
- 4. Contribute:** Replenish market supply with an amount of recycled, reclaimed, or renewable material at least equal to the amount used to make the product.

How we contribute back to market depends on the type of material involved. For finite materials such as aluminum, we seek to recover the material from the manufacturing process and from products at their end of life. We then either redirect that material back into our own supply chain, or ensure it is sent to a secondary materials market. For renewable materials such as the wood fiber in our packaging, our focus is on regeneration of supply, meaning that we create, or protect, an equivalent supply of the resource that we use.

We hold ourselves to a strict definition of closed loop: To meet our goal, we must use 100 percent responsibly sourced recycled or renewable materials and ensure the equivalent amount is returned to market. Recognizing that this goal could take many years to reach, we remain committed to responsible sourcing of primary materials as we make the transition.

### **Our approach.**

Fundamental to this work is our firm belief that we can transition to recycled or renewable materials without compromising the final product.

To prioritize which materials to tackle first, we created Material Impact Profiles for 45 elements and raw materials commonly used in consumer electronics. The profiles identified global environmental, social, and supply risk factors spanning the life of each material. We then combined the impact profiles with data that's more specific to Apple. Finally, in addition to the weighted score assigned to each material, we also considered additional qualitative factors, like whether a material represents unique opportunities for new closed-loop supply chain models or is significant to the customer experience—like the glass they touch or the paper in their product packaging.

Through this process, we identified a short list of materials on which to focus our initial efforts. We've started working to close the loop on these priority materials, and have active projects for aluminum, cobalt, copper, glass, paper, plastics, stainless steel, tin, tungsten, and rare earth elements (neodymium, praseodymium, dysprosium).

### **We're doing more with less.**

We are making changes to our product designs to reduce the amount of material needed. For example, we changed the way we manufacture the enclosure of the 12.9-inch iPad Pro, replacing the extrusion process with a sheet forge design, resulting in a 73 percent reduction in the amount of aluminum needed. And since 2015, we have reduced primary aluminum consumption across all products by 23 percent, despite increasing sales.

# Mining less from the earth. And more from old devices.

## Apple GiveBack

Trade in your device for an Apple Store Gift Card. Or have it recycled responsibly for free. [See how it works >](#)

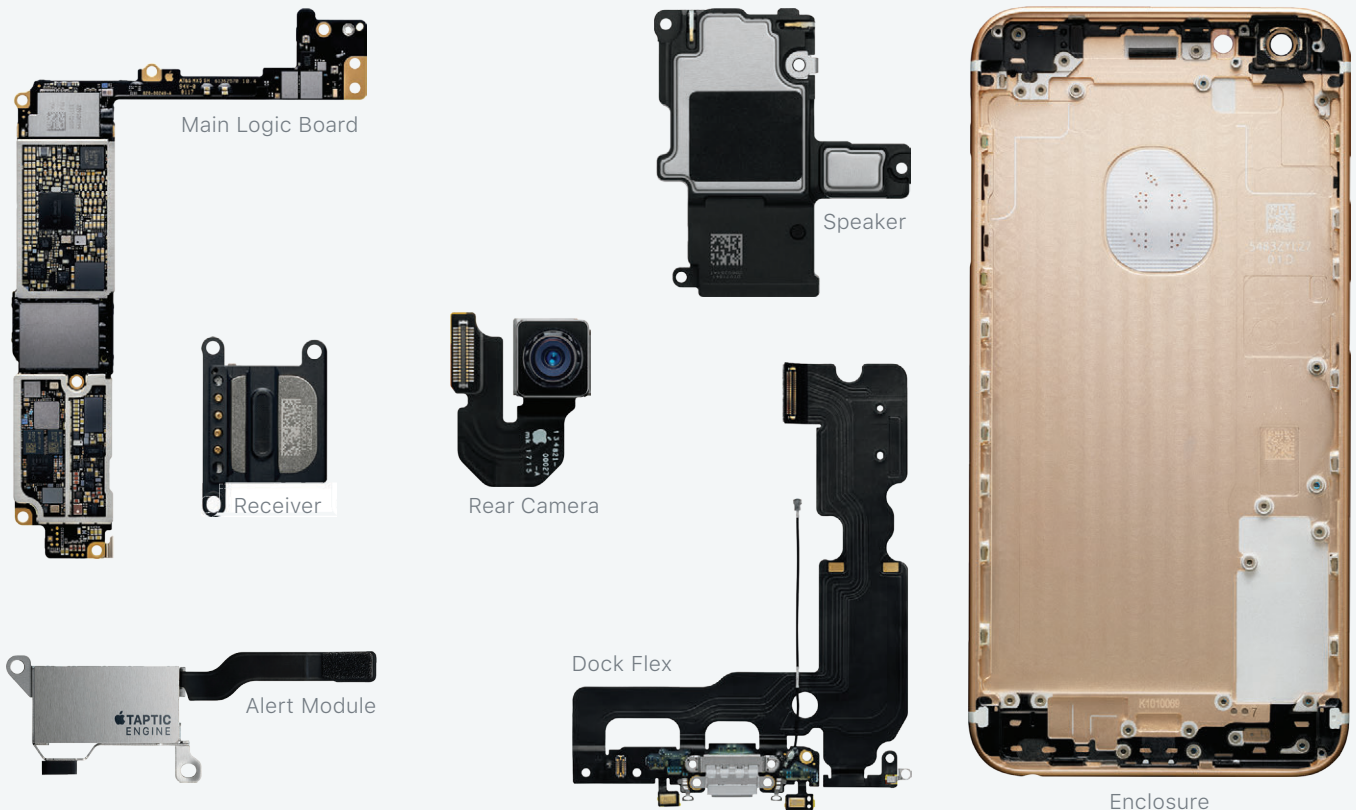
## For every 100,000 iPhone devices, Daisy has the potential to recover:

- Aluminum 1900 kg
- Gold 0.97 kg
- Silver 7.5 kg
- Rare earth elements 11 kg
- Tungsten 93 kg
- Copper 710 kg
- Palladium 0.10 kg
- Tin 42 kg
- Cobalt 770 kg
- Tantalum 1.8 kg

Our newest disassembly robot, Daisy, is the most innovative and efficient way to reclaim more of the valuable materials stored in iPhone. Existing techniques, such as shredding, recover only a few kinds of materials and often diminish their quality. Daisy can take apart up to 200 iPhone devices per hour, removing and sorting components, so we can recover materials that traditional recyclers can't—and at a higher quality. By meticulously disassembling our products, we can direct components and materials to those recyclers who can recover what's important. These materials will then be sent back into secondary materials markets—closing the loop on these materials and reducing the need to mine more resources from the earth.

Daisy builds upon the learnings from Liam, our R&D experiment in automated disassembly that we announced in 2016. We created Daisy to have a smaller footprint and the capability to disassemble multiple models of iPhone with higher variation compared to Liam.

Daisy disassembles iPhone, retrieving components that contain high-quality materials.



Our intention is to install Daisy in multiple locations around the world—starting with the United States and Europe. Daisy will process end-of-life iPhone 5, iPhone 5s, iPhone SE, iPhone 6, iPhone 6 Plus, iPhone 6s, iPhone 6s Plus, iPhone 7, and iPhone 7 Plus devices that are returned to us by customers or via AppleCare. The program’s success depends in part on customers returning their end-of-life devices to Apple, so we are launching Apple GiveBack to make it easier for them to do so.

### **A durable device is a greener device.**

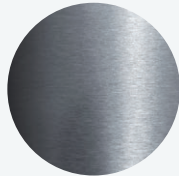
When products can be used longer, fewer resources need to be extracted from the earth to make new ones. So we assess all our products in our Reliability Testing Lab, using rigorous testing methods that simulate customers’ experiences with their devices. For example, we analyze how devices stand up to extreme heat and cold, exposure to water and everyday chemicals, and scratch tests from materials like denim and metal coins. All new materials, including recycled materials, are tested extensively to make sure they meet our performance and durability standards. If a product does require repair, Apple and its authorized service providers provide repair services and parts for five years after the product is no longer manufactured - or longer where required by law.

In our Reliability Testing Lab, one of the tests uses a weighted pendulum that simulates a swinging arm hitting Apple Watch against a hard object.



## Making a material difference.

Our focus to date has been on proving what's possible: identifying barriers to implementing closed-loop solutions and crafting pilot projects from which we can learn. In many cases, we have deepened our understanding and relationships within our downstream recycling supply chain. And in other cases, we're invested heavily in research to identify closed-loop solutions.



**Aluminum.** We've found that one of the best sources of recycled aluminum comes from our own products and processes. That's because we specify such a high grade of the material to make our products strong, durable, and beautiful. And today, the only way to keep the aluminum at this quality level is with a clean material stream—not mixing it with other grades of scrap aluminum, as is typical at recycling facilities. So our challenge is to recover the aluminum from our products and processes without degrading its quality. With Liam, Daisy's predecessor, we found a way to maintain the original aluminum purity from reclaimed phones post disassembly. So we designed Daisy to integrate this step.



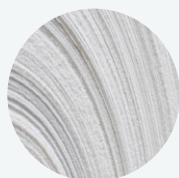
**Cobalt.\*** We primarily use cobalt in batteries. But it is not consistently recovered, and recycled cobalt is not well tracked in the market. So we've implemented a pilot project to ship battery scrap from suppliers that assemble iPhone and Mac in Shanghai to a recycler upstream in Apple's battery supply chain. We plan to account for this material in a way that ensures the cobalt in those batteries is not only recovered and recycled responsibly, but allocated toward production of Apple batteries in the future. In addition, we continue to responsibly source cobalt, and 100 percent of known cobalt refiners are participating in third-party audits.



**Copper.** Copper forms the conductive pathways on printed circuit boards, cables, and connectors. In partnership with our suppliers, we are investigating new methods to manufacture our printed circuit boards that will allow us to reduce the amount of copper needed in the process. And for sourcing, we are exploring ways to increase the amount of recycled copper we use for some of our printed circuit board and copper foil vendors, and directing in-process materials to recyclers who can integrate into our supply chain.



**Glass.** We're working with our cover glass suppliers to ensure that all glass scrap generated during the manufacturing process is recycled at the highest level possible. And we are partnering with them to enhance in-process reuse and reprocessing in ways not traditionally done in this industry.



**Paper.** We've successfully created a closed-loop supply chain for paper. That means that 100 percent of the wood fibers in our packaging is either recycled or comes from sustainably managed forests or controlled wood sources. And we have protected or created enough sustainably managed forests to cover all the wood fiber we use in our packaging.





**Plastics.** Wherever possible, we're moving to recycled or bio-based plastics, and in some cases, like for our packaging, we're working to eliminate the need for plastics altogether. We've reduced the amount of plastics in our product packaging by 29 percent compared to 2016. For the remaining plastics, we're looking for bio-based or recycled alternatives to petroleum-based plastics. We're using these alternatives in a number of components—for example, the speaker, keyboard, and trackpad enclosures of iMac Pro are made with 60 percent recycled plastic. And the fan assembly is made with 26 percent bio-based plastic.



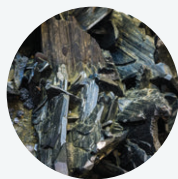
**Rare earth elements.** These elements include neodymium, praseodymium, and dysprosium, which are used in magnets for audio applications, in cameras, and in haptics technology. Traditional recyclers don't typically recover rare earth elements, because they are often in small magnets that are embedded in a number of different components within iPhone. Daisy retrieves those components. So we're now investing in new technologies to recover the material from those components so they can be used again.




**Steel.** We use stainless steel in the enclosure construction of iPhone X and some Apple Watch models. Stainless steel is a highly recyclable material, and we're working with our suppliers to increase the recycled content in the stainless steel that we source.



**Tin.\*** There is an existing market supply of recycled tin, but we wanted to make sure it meets our quality standards. So in 2017 we proved that we could use 100 percent recycled tin for the solder on the main logic board (where the majority of tin is found) of iPhone 6s. Since then, we've expanded to other products: We're now specifying 100 percent recycled tin for the solder on the main logic board of iPhone 7, iPhone 7 Plus, iPhone 8, and iPhone 8 Plus.\*\* But to truly close the loop, we want to recover as much tin as we're using—and make sure the tin is recycled responsibly and put back into the world's supply. Unfortunately, tin is not recovered by all electronics recyclers. So we're prioritizing responsibly operated recyclers that recover tin, in addition to the copper and precious metals, from the main logic boards retrieved by Daisy.



**Tungsten.\*** Tungsten is a key material used in our Taptic Engine and other consumer electronics that enable devices to vibrate. The availability of recycled tungsten varies by geography and by supplier, and the tungsten in our products is currently lost to shredding in traditional recycling processes. So Daisy retrieves the alert module and allows us to send it to speciality recyclers who recover tungsten.

\* Apple is committed to the responsible sourcing of materials for our products. We identify and map both regulated and unregulated materials in our products deep in the supply chain. For the second year in a row, 100 percent of our identified tin, tantalum, tungsten, gold, and cobalt smelters and refiners participated in independent third-party audits. We go beyond what is required by law, including by publishing smelter lists, to meet and exceed internationally accepted due diligence standards and help protect the people in our supply chain. [Download Apple's Conflict Minerals Report.](#) 

\*\*The recycled tin we're transitioning to has been verified by a third party to be 100 percent recycled.

## Packaging

# We're using more recycled and responsibly sourced materials in our packaging.



Read more about our paper and packaging strategy. [Download PDF](#)

Forests provide wood fiber for the paper in our product packaging. They also clean our air, purify our water, and provide wildlife habitat. We look for ways to use more recycled and responsibly sourced paper, to create technologies that use paper more efficiently, and to find alternatives to plastic. In fiscal year 2017, 100 percent of the paper in our packaging was from responsibly managed forests, controlled wood, or recycled sources. We're replacing some plastic components with materials like bamboo fiber and bagasse, a by-product of sugarcane. And we've reached our goal to protect and create enough sustainably managed forests around the world to cover our current paper use and produce fiber for generations. The results are more beautiful than ever—for our packaging and for the planet.

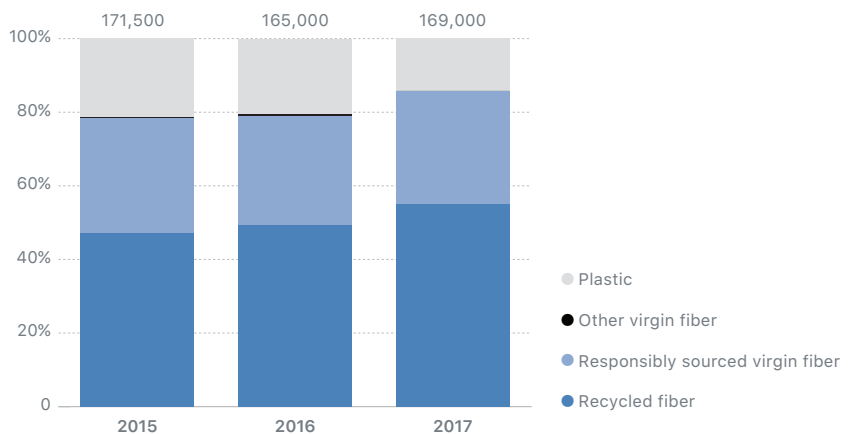


The U.S. retail packaging of the iMac Pro contains 78 percent less plastic than the similarly sized 27-inch iMac with Retina 5K display, and contains 85 percent recycled content.

## Reducing our plastic use.

In fiscal year 2017, U.S. product packaging used on average 29 percent less plastic than in 2016, made possible by replacing plastic with responsibly sourced and recycled paper. For example, we've replaced the plastic EarPods case with a paper alternative. Starting with iPhone 7, iPad Pro, and the new iPad launched in March 2018, we changed the plastic tray in the packaging to an all molded fiber alternative. And we replaced the expanded polystyrene that protects iMac Pro during shipping with paper padding made from 100 percent recycled fiber.

## Plastic and fiber packaging footprint (metric tons)



In fiscal year 2017, our U.S. product packaging used on average 29 percent less plastic than in 2016. Recycled fiber now represents 64 percent of packaging fiber. And we are now sourcing 100 percent of the virgin fiber in our packaging from sustainably managed forests or controlled wood.

# 100%

All the fiber in our product packaging is now 100% responsibly sourced.

## Sourcing virgin paper responsibly.

Wherever possible, we use recycled paper. But when virgin paper is needed in our packaging, we require our suppliers to source it from sustainably managed forests or FSC controlled wood sources.<sup>17</sup> In 2017, all of our packaging suppliers sourced their paper responsibly. And we conduct regular audits to ensure their claims.

Our corporate office paper use—which includes printing paper, paper towels, and toilet paper—represented less than 2 percent of our total fiber footprint. In fiscal year 2017, approximately 80 percent of our corporate paper use was from recycled sources or sustainably managed forests. And in some of our offices in China, we're sourcing paper from one of the sustainably managed forests created in partnership with World Wildlife Fund (WWF).

## Protecting sustainable forests.

In addition to specifying that all of our virgin fiber be sourced responsibly, we also wanted to make sure we weren't diminishing the world's supply of responsible paper. So we set a goal to protect or create enough sustainably managed forests to cover all of our product packaging needs.<sup>18</sup> For the second consecutive year, production from our forest conservation projects exceeded the amount of virgin fiber we use in Apple's product packaging. As our paper demands grow and change, we will continue protecting and creating enough sustainably managed forests to cover all our packaging needs.



Sustainably managed forest,  
Brunswick County, North Carolina.

# 100%

We have protected or created enough responsibly managed forests to cover the 51,000 metric tons of virgin paper we used in our packaging in fiscal year 2017.

In partnership with The Conservation Fund, we've protected 36,000 acres of forest in the Eastern United States that are certified as sustainably managed. In Maine, we're protecting more than 32,400 acres in the Reed Forest, which includes critical wetlands and upland forest habitats that support a number of wildlife species in Maine's iconic North Woods. In North Carolina, we're protecting more than 3600 acres of pine and hardwood forest in Brunswick County along the southern coast of North Carolina. Apple and The Conservation Fund have donated a conservation easement for both properties. The conservation easements ensure the forests won't be developed or converted to other uses, and will continue to produce sustainable fiber and other wood products.

In 2015, we announced a five-year partnership with WWF to transition up to one million acres of forest, across southern provinces of China, into responsible management by 2020. WWF's work has three primary components:

- Increase responsible management of working forests in China—by creating up to 300,000 acres of FSC-certified forests, and up to 700,000 acres of forests under improved management.
- Improve China's policy framework to encourage responsible forest management.
- Establish long-term market incentives in China for responsibly sourced paper.

In just three years, we've surpassed our first objective by supporting 320,000 acres of forest to achieve FSC certification, and improving the management of an additional 430,000 acres of forest land in southern China. Altogether we've improved responsible management of 750,000 acres, or about 1170 square miles.

To address the project's second objective, in 2017, China's State Forestry Administration and WWF released the China Sustainable Plantation Guidelines, which will be used to identify opportunities for improved forest management on more than 7 million acres of forest land included in China's National Reserved Forestry Program.

And to create market incentives for responsibly sourced paper, WWF and the China Sustainable Paper Alliance continued to raise consumer awareness of the importance of responsible forest management. They launched a campaign that reached more than 20 million people through many events, media coverage, corporate engagement, and a celebrity spokesperson.

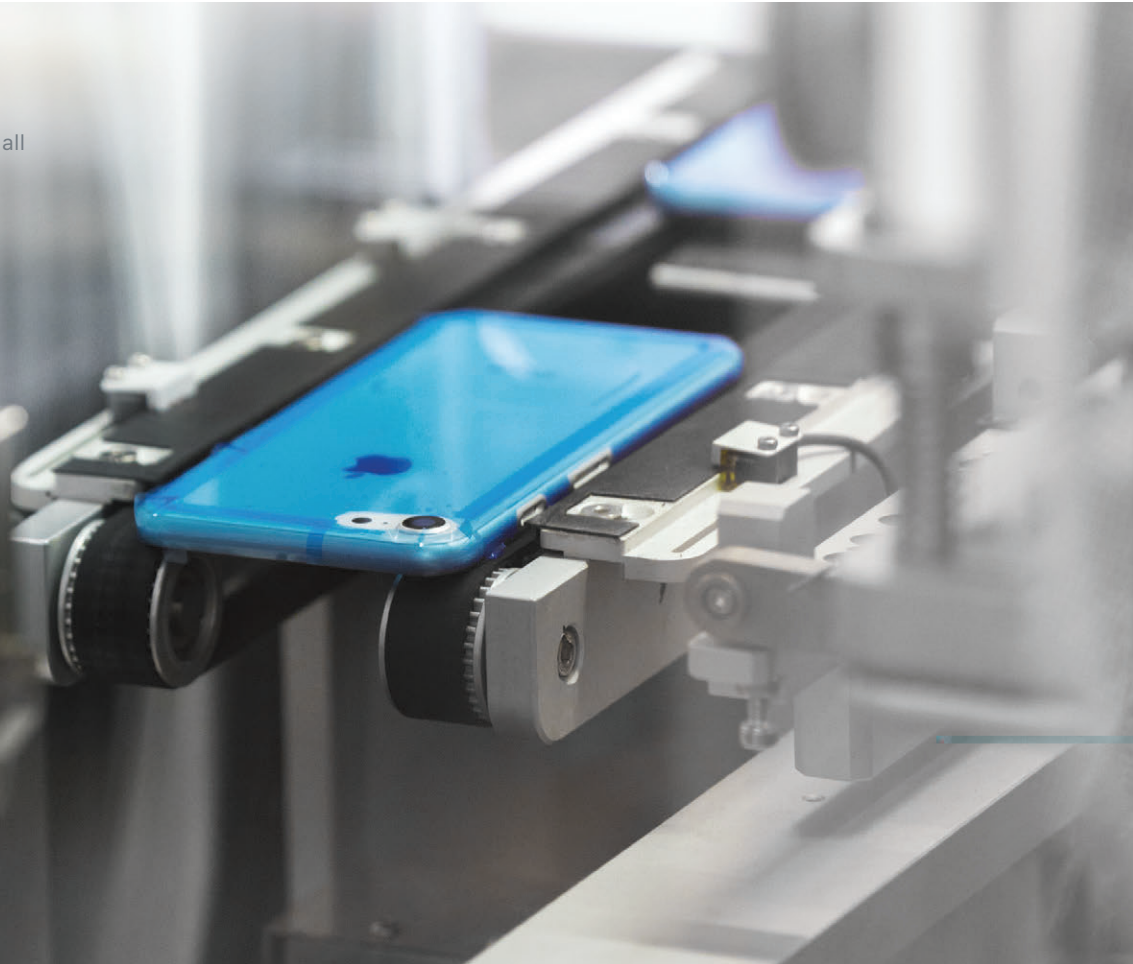
## Waste

# We're finding new ways to keep old materials out of landfills.

We're committed to making sure all the waste created by our own facilities and in our supply chain is reused, recycled, composted, or when necessary, converted into energy. Reaching this goal requires collaboration among multiple Apple teams, local governments, and specialty recyclers, but we've already seen great success. In 2015, our facility in Cork, Ireland, was the first outside North America to receive UL's Zero Waste to Landfill certification.<sup>19</sup> In addition, 22 supplier facilities—including all iPhone final assembly sites—have received UL's Zero Waste to Landfill certification, diverting more than 625,000 metric tons of waste from landfills since January 2015.

When first launching our Zero Waste Program for suppliers in 2015, we focused our efforts on final assembly sites in China, where most in-process packaging waste was being generated in our supply chain. Since those facilities have all achieved Zero Waste to Landfill certification, we've expanded our efforts to include more upstream suppliers. To date, we've engaged 71 supplier sites. To help our suppliers divert all waste from landfills, Apple provides necessary tools and guidance, including the services of experts in sustainable waste management.

In 2017, 22 supplier facilities were certified as Zero Waste, including all our iPhone final assembly sites.



# 71%

We diverted from landfill about 71 percent of waste across all of Apple's facilities, including our retail stores.

At our corporate offices and retail stores, we're creating robust recycling and composting programs to minimize the environmental impact of the waste we produce. In fiscal year 2017, we generated 53,800 metric tons of waste, of which we diverted from landfill about 71 percent through recycling and composting. We continue to find ways to reduce the waste we send to landfill—like expanding composting at our corporate campuses and pursuing a zero waste effort at over 500 retail stores and at our headquarters in Santa Clara Valley, which includes more than 200 buildings.

Apple disposes of hazardous waste responsibly. We complete regular audits of the Transportation, Storage, and Disposal Facilities (TSDF), where hazardous waste is ultimately sent to be treated, recycled, or incinerated. Only facilities we audit and approve are allowed to accept and treat the hazardous waste Apple generates. We take this commitment seriously—if the TSDFs do not meet our strict standards for environment, health, safety, and waste management protocols, we switch facilities.

While we have a disassembly solution for nine models of iPhone, we also want to make sure other electronic devices stay out of landfills so that the resources they contain can be reused. So we've developed recycling collection events, take-back initiatives, and efforts like Apple GiveBack that make it easier to return old Apple devices to Apple. We're also working with recyclers around the world, whose facilities we hold to rigorous standards of environmental compliance, health and safety, and social responsibility.

## Water

### **We hold ourselves accountable for every drop of water we use.**

Water is essential to all life. We need it to drink, to grow our food, and to maintain natural ecosystems throughout the planet. And though water is a renewable resource, its scarcity—often exacerbated by climate change—makes it precious in many parts of the world. So we hold ourselves accountable for the water we use, whether at our corporate offices, our data centers and retail stores, or in our suppliers' facilities around the globe.

# 13.6 billion

Since 2013, we've helped our suppliers save more than 13.6 billion gallons of water—enough to provide every person on the planet with almost 30 glasses of water.

## Supplier water use.

We're focused on the water used by suppliers to make our products. In 2013, we established the Clean Water Program to help our suppliers conserve water and prevent water pollution. We put a special emphasis on working with suppliers with high water usage and in water stressed regions, as well as makers of components that our life cycle water assessments have identified as particularly water-intensive.

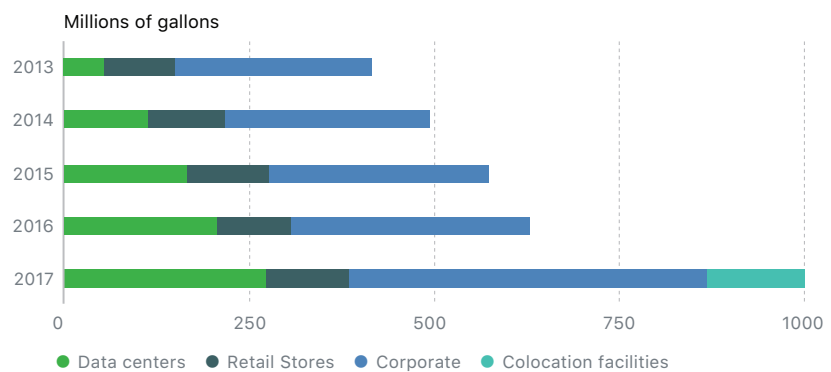
Through employee training, baseline assessments, performance evaluations, and technical support, we helped our suppliers conserve more than 5.1 billion gallons of water in 2017 alone, increasing average water reuse to 37 percent across 106 facilities. And since many of our suppliers also build components for other companies, we're reducing the water footprint of non-Apple products too.

## Corporate water use.

At our offices, data centers, and retail stores across the world, we monitor our cooling, landscaping, and sanitation water use so we can develop targeted ways to conserve water. In fiscal year 2017, Apple used about 1 billion gallons of water directly, a 59 percent increase over the previous year. This increase was driven by extraordinary growth in our data center services, research and development activities, and temporary water uses like new construction, and establishment of mature trees at Apple Park. These temporary water uses represented 80 million gallons—nearly 10 percent of our water footprint. In addition, we have expanded our water footprint to include colocation facilities and distribution centers for the first time, which together amount to 159 million gallons of water, or 16 percent of our total footprint.

### Water use at Apple facilities

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



Starting in 2017, we're including as part of Apple's footprint, water use at distribution centers and colocation facilities.

## Our water strategy.

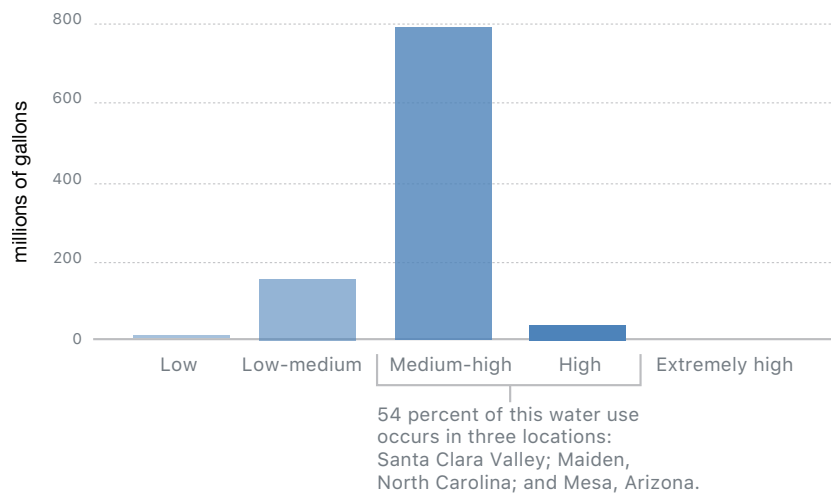
Our risk-based water strategy focuses on understanding watershed context, prioritizing areas of high water risk and use, and recognizing that each location requires its own solution.

## Prioritizing our efforts.

We want to focus where our efforts matter the most and can have the largest positive impact. So we map our global water use against water quality, quantity, and regulatory factors to understand which regions have an elevated risk,<sup>20</sup> then prioritize those locations based on how much water we're using.

## Corporate water use by level of risk

We mapped our water use to different levels of water risk (as defined by WRI's Aqueduct tool) across the world to understand where we should be focusing our conservation efforts. Water risk takes into consideration indicators such as water scarcity, business risk, and habitat and livelihood impact to the basins in which we operate.<sup>21</sup>



## Using water efficiently.

We work to minimize the water we use, especially in areas of elevated water risk. When siting a new facility, we consider overall watershed risk—including quantity, quality, and impact to the community—as a factor in our core due diligence process. We regularly install sub-meters to monitor and manage our water use, and reuse water wherever possible. At our corporate offices in Santa Clara Valley, our landscape efficiency program now integrates remote soil moisture sensors and rotating-head nozzles to reduce water use by 500,000 gallons. At our data centers in Prineville, Oregon, and Reno, Nevada, our design and operations teams have been piloting innovative mineral removal media in the cooling systems that will reduce our cooling water discharge by up to 30 percent. We are continuing to invest in new cooling technologies to reduce data center water use. In our retail business, redesigned back-of-house space includes low-flow fixtures anticipated to deliver up to 30 percent water savings compared with our previous design. Over 25 stores have been built with this new design.



# 24 million

We used 24 million gallons of recycled water and captured rainwater in 2017.

### **Identifying alternative sources.**

Once we have minimized our water use, we look to alternative sources to help reduce freshwater withdrawals, including recycled water, reclaimed water, and rainwater harvesting. At our headquarters in Santa Clara Valley, we helped extend the City of Sunnyvale's recycled water system to our new Apple Park campus and to another new campus set to open in mid-2018. Between both campuses, use of this recycled water will replace over 30 million gallons of potable freshwater. We are also capturing rainwater for cooling, irrigation, and construction needs at our Maiden data center, and for our corporate offices in Cork, Ireland; Austin, Texas; and Yokohama Japan.

### **Pursuing water stewardship.**

We're looking to restore water resources in the most critical regions in which we operate. For example, our Southern California retail stores make up the majority of our highly stressed water use in retail. Though our new back-of-house design will minimize water use, we still face risk from poor overall health of the watershed. So we partnered with Bonneville Environmental Foundation (BEF) to help fund WAYS Park, a project led by Heal the Bay in South Los Angeles. The park will collect and filter stormwater runoff from 9 acres surrounding the site—delivering water quality benefits and groundwater recharge to the Los Angeles River Watershed, as well as recreational benefits to an underserved community.

## **Green Buildings**

### **Designing our buildings with the planet in mind.**

We want our commitment to the environment to show in everything we do—not just in our products, but at the offices where our employees work, in the services that our customers use, and in the spaces where our customers shop. We actively apply green building principles to all of our office, data center, and retail store projects. This means we're creating these spaces to be environmentally responsible and use resources efficiently. For most projects, we are able to meet the U.S. Green Building Council's LEED Gold requirements, and sometimes LEED Platinum—the highest level.

Whether we're building a new facility or renovating an already occupied one, we also think about enhancements that improve the general well being of our employees—such as inviting outdoor spaces. In addition, we proactively provide a high percentage of EV charging stations to all our corporate campuses, offer a comprehensive commute program, and utilize green cleaning and pest control products.

Apple Park—our new headquarters in Cupertino—is the latest example of this commitment. The building is on track to be the largest LEED Platinum-certified office building in North America. It's powered by 100 percent renewable energy, 75 percent of which is generated onsite by a 17-megawatt rooftop solar installation and 4 megawatts of baseload biogas fuel cells. Any additional energy required is drawn from the nearby California Flats Solar Project. When the building has less use—on weekends, for example—it will generate renewable energy that's delivered to the public grid. Over 80 percent of the new campus is open space with more than 9000 drought-tolerant trees. Most are oak, and many are shade and fruit trees.

At our retail stores, we also apply green building principles. Our new back-of-house design is anticipated to reduce our water use by 30 percent and our energy load by 40 percent. And whenever possible, we're bringing the outside in, through mixed-mode natural ventilation, and biophilic design, in addition to installing rooftop solar systems where conditions allow.

We've planted more than 9000 drought-resistant trees at our new campus in Cupertino. We selected many tree varieties native to the area as well as others that could thrive in a range of climate change scenarios.



Safer Materials

# Safer to make. And to use.

We lead the industry in reducing or eliminating the harmful substances commonly used in electronics. Through our rigorous process of design, testing, and analysis, we're constantly evolving our products and how we make them. So the materials we use are safer for the environment, the people who make our products, and the people who use them.



## Our Approach

# Design, manufacture, test. Repeat.

To help protect people and the planet, we set strict standards for the materials used in our devices—in many cases going far beyond what’s required by law. The evaluation process begins early in the design and manufacturing phases. If replacements for hazardous chemicals aren’t readily available, we work with our suppliers to find substitutions, or explore how to eliminate the need for that substance. When we test replacements, we look for formulations that meet our environmental standards without compromising performance. And, of course, the end product must still live up to the design standards you expect from Apple.

### Safer materials assurance process

Through extensive testing, research, and toxicological assessments, we design products to be safe. And then we continue to evaluate products while they’re under-going product development and after they’re released to make sure they stay safe.



## Validation and Toxicology

# We run our own environmental testing lab.

We built our own Environmental Testing Lab, where our chemists and toxicologists look for any potentially harmful substances. Since 2006, we have expanded it to more than 30 times its original size, and have regularly updated it with state-of-the-art equipment—like an inductively coupled plasma mass spectrometer, a liquid chromatography mass spectrometer, and a laser-induced breakdown spectrometer similar to the one used by the Mars rover. We’ve even manufactured artificial sweat to simulate human exposure, and to evaluate the safety of our materials that come into contact with skin.



We screen our materials with comprehensive risk assessment tools, including GreenScreen®, which evaluates substances against 18 different hazards, including carcinogens, mutagens, and endocrine disruptors.

To understand the safety of our materials more comprehensively, we started our Full Material Disclosure (FMD) program to identify all the substances in all the parts in all our products. So far, we've collected the composition of more than 25,000 individual components out of the 50,000 present in our products, and we get data on more parts every day. We've also collected FMDs covering over half of the mass of iPhone 8, iPhone 8 Plus, and iPhone X. We're prioritizing materials with the greatest risks, such as those used in high quantities or those with the greatest human exposure.

We apply our most rigorous controls to the materials that are in prolonged skin contact. Our toxicologists review results from our testing and use FMDs to generate comprehensive hazard and risk assessments including GreenScreen®, which considers 18 different criteria to help us understand the materials' effect on people's health and on the environment. Only materials that pass our rigorous review process are accepted for our products.

Since we built our own Environmental Testing Lab in 2006, we've grown it to over 30 times its original size.



## Worker Safety

# High safety standards for the people who make our products.

We also work to protect the health and safety of the people who work in our supply chain. The standards we set for our suppliers go far beyond what's required by law, like our Regulated Substances Specification (RSS) list, which identifies the toxic chemicals we limit or prohibit in our manufacturing processes and products.

We launched a Chemical Management Program in 2014 to help suppliers develop a comprehensive approach to managing chemicals safely. The program has grown to 113 participating supplier facilities, and focuses on shifting to safer chemicals and improving general safety, awareness, and training.

To better understand the opportunities for greener alternatives, in 2017 we mapped the chemicals used in our final assembly facilities and evaluated all control measures, such as ventilation, personal protective equipment, and worker training programs. The mapping resulted in the identification of harmful substances from cleaners at final assembly sites. Hazardous chemicals such as methanol, xylene, cyclohexane, acetone, and methyl ethyl ketone were replaced with safer alternatives including ethanol, isopropyl alcohol, glycerol, and water. We're continuing to work with our suppliers to help them better manage chemicals used in manufacturing.

# 100%

At all of our final assembly facilities in 2017, 100 percent of all process chemicals complied with Apple's Regulated Substances Specification.

Final assembly facility in Shanghai, China.



### Looking for toxins.

Laser-Induced Breakdown Spectroscopy is one process we use to analyze the materials that go into our products and detect certain harmful substances, such as beryllium.



### Updating the lab with state-of-the-art equipment.

With the addition of gas and liquid chromatography mass spectrometry instruments, we can screen for even more substances of concern that aren't explicitly targeted in our standard material evaluation process.



### Ensuring the safety of Apple Watch.

We test all our products, and place special attention on materials that come in contact with skin. In our nickel leach testing on Apple Watch, we place different components in jars of artificial sweat to ensure the nickel in the stainless steel alloy stays where it belongs.



## Eliminating Toxins

# The worst toxins and what we've done about them.

We're continually evaluating the materials used in products. When we identify toxins, we reduce them, remove them, or develop new materials that are safer. These efforts also remove toxins from our manufacturing and recycling processes, which protects the people who make and take apart our products and keeps pollutants out of the land, air, and water.



### **Beryllium**

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



### **Mercury**

Eliminated 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.<sup>22</sup>



### **Arsenic**

Eliminated from display glass since 2008. Arsenic was traditionally used in glass.<sup>23</sup>



### **PVC and phthalates**

Replaced with safer thermoplastic elastomers.<sup>24</sup> 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.<sup>25</sup>



## External Engagement

### **We can do a lot. But we can't do it alone.**

We want insights and ideas from those who share our commitment to removing toxins. So we formed our own Green Chemistry Advisory Board, made up of some of the world's leading toxicologists, researchers, and academics. The board helps us identify innovative ways to minimize or eliminate toxins from our supply chain. We also invite experts from around the world to meet with leaders at Apple. Together, we focus on eliminating toxins at each stage of our process, while sharing our learnings through Green America's Clean Electronics Production Network. And we seek out the best ideas and insights from key NGOs to help us make our products and processes even safer.

Better Together

# Leading and listening in equal measure.

A single company cannot solve the world's challenges alone. So Apple engages across sectors, listens to diverse perspectives, and shares the latest research to identify solutions.

In this past year, we've continued our focus on inspiring others, influencing public policy, and helping to improve global outcomes. We've deepened our engagement with well-respected organizations, collaborated with peer organizations, publicly shared our vision and our journey, and supported legislative efforts through advocacy.



## More partnerships. More progress.

We engage with industry, sustainability, and cross-sector organizations to share knowledge while learning from subject-matter experts in strategic areas. We prioritize associations that share our values, passion, and deeply held belief that companies can make a difference.

Great relationships are built over time. So we have renewed our commitments to Ceres, Corporate Eco Forum, the World Business Council for Sustainable Development (WBCSD), the GreenBiz Executive Network, and the Paulson Institute, among others. We are continuing our memberships in organizations whose work aligns with our three priority areas:

- **Climate change.** To support our significant investments in renewable energy, we've continued to work with Advanced Energy Economy (AEE), RE100, and We Mean Business. In 2017, we joined several new organizations, including the Hawthorn Club to support executive women in the renewable energy industry and the Business Environmental Leadership Council of the Center for Climate and Energy Solutions (C2ES). We also joined the Green Electricity Consumption Cooperative as a Board Member Company to support the use of voluntary renewable energy certificates in China.
- **Resources.** Our work on creating closed-loop material supply chains is backed by our memberships with the Ellen MacArthur Foundation and the Aluminum Stewardship Initiative.
- **Safer materials.** We're members of the ChemSec Business Group, where we work with like-minded companies across a diversity of sectors to refine our knowledge of safer materials. And we were founding members of Green America's Clean Electronics Production Network. In 2017, we joined the Green Chemistry and Commerce Council (GC3) to advance the application of green chemistry in product design and supply chains.

## Collaborating for joint success.

We've continued to work with cross-sector companies, researchers, suppliers, thought leaders, and technical experts to forge new paths, build unique solutions, and inspire others to continue their efforts.


We are building relationships with key academic institutions worldwide—like with Tsinghua University's School of Economics and Management in Beijing, where we are funding a \$3 million endowed chair professorship based on Responsible Innovation. We also collaborated with Tsinghua for a second year on an App Innovation Contest and a Green Innovators program, which focus on identifying creative solutions to environmental challenges, governance, and public administration through entrepreneurship.

In 2016, we partnered with app developers and customers across the globe to create Apps for Earth, an initiative that generated over \$8 million to support World Wildlife Fund's global environmental projects. As of November 2017, World Wildlife Fund had invested approximately \$6.5 million of funds raised, focusing on environmental projects in seven key areas:

- Conservation of coastal riches
- Combating climate change
- Preserving forests
- Ensuring sustainable food sources
- Providing safe and secure water
- Saving sea turtles and tigers
- Harmonizing people, nature, and wildlife

We continue to meet with our own Green Chemistry Advisory Board, made up of some of the world's leading toxicologists, researchers, and academics. The board helps us identify innovative ways to minimize or eliminate toxins from our supply chain. We also invite experts from around the world to meet with leaders at Apple. Together, we focus on eliminating toxins at each stage of our process.

In 2017, we invited key stakeholders to participate in small closed-door roundtables in Europe, the United States, and China to obtain feedback on Apple's closed-loop ambition and our current approach. Attendees included a range of academics, NGOs, industry leaders, and other companies.

A photograph of Lisa Jackson, Apple's Chief Environmental Officer, speaking at a conference. She is wearing a dark blazer over a white blouse and is holding a microphone. She is gesturing with her left hand while speaking. To her left, another woman is partially visible, holding a microphone and a clipboard, appearing to be conducting an interview. The background is dark with some blurred lights.

At the 2017 Women's Forum for the Economy and Society in Paris, Lisa Jackson discussed Apple's global impact through environmental leadership and how our values drive our business.

## Showing what we do. Sharing what we know.

We want to share our vision and our work, so we can make a difference well beyond Apple's walls. To increase our impact, over the last year our team presented at several notable conferences, meetings, and events, including:

- 2017 Sustainable Brands conference, where we outlined our ambition to create closed-loop material supply chains.
- The Columbia University Global Energy Summit in New York City; Washington Post Live—A World in Balance: Solutions for Sustainability; and the eighth annual Clean Energy Ministerial (CEM8). At these events, we demonstrated how business has the power to influence renewable energy markets.
- Ceres Investor Summit at the United Nations, where we underlined the importance of business action and clean energy investment.
- TechCrunch Disrupt 2017 conference, where we announced that Apple is 100 percent renewable in Japan, setting the example for other tech industry leaders.
- GreenBiz VERGE 2017 conference, where we urged the business community to take strong action to protect the environment.
- 2017 Forest Stewardship Council's General Assembly, where we detailed our efforts to reduce our packaging paper footprint.
- 2017 G20 Resource Efficiency Workshop, where we presented on Apple's efforts to reduce dependence on finite resources.

In addition, we published a number of papers to offer insight into how we're innovating on environmental challenges. These include a white paper about the work we are doing to source paper responsibly and a collaboration with RE100 about our supplier clean energy program.

## Speaking up for stronger policies.

We believe it's important to defend the best ideas and to amplify our beliefs. And to speak out when our voice will have a powerful impact:

- In June 2017, Apple urged the White House to remain in the Paris climate agreement, to retain American leadership, and to take meaningful action on climate change.
- In November 2017, Apple joined a number of other companies urging the government of Vietnam to make regulatory changes allowing companies to procure renewable energy through direct power purchase agreements.
- In January 2018, Apple filed comments to the Federal Energy Regulatory Commission, urging it not to finalize a rulemaking that would subsidize fossil fuels, which would limit the ability of renewables to compete in the electricity market. FERC chose not to finalize that rule.
- In February 2018, Apple filed comments with the Japanese government, calling for the development of a robust and verifiable renewable energy trading system that would help accelerate the deployment of renewable generation in Japan.
- And in April 2018, we filed individual comments to the U.S. Environmental Protection Agency, urging it not to repeal the Clean Power Plan because of its importance in reducing emissions in the United States.

## Appendix A

# Apple's Operations: Environmental Data

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**Scopes 1 and 2 Carbon Emissions Breakdown (Page 50)**

**Fiscal Year 2017 Natural Gas and Electricity Use (Page 51)**

# Facilities Environmental Performance Indicators

The following table summarizes environmental performance indicators relating to Apple's global facilities, including our data centers, corporate offices, and our 500 retail stores, together occupied by 123,000 Apple employees.<sup>1</sup>

	KPI	Unit	Fiscal Year					
			2017	2016	2015	2014	2013	2012
Greenhouse Gas Emissions	<b>Scope 1</b>	metric tons CO <sub>2</sub> e	<b>42,860</b>	<b>34,400</b>	<b>28,100</b>	<b>28,490</b>	<b>29,300</b>	<b>21,220</b>
	Natural gas, diesel, propane <sup>2</sup>		34,560	27,000	19,360 <sup>3</sup>	20,710	22,090	14,300
	Fleet vehicles		8300	7400	8740	7780	7210	6920
	Process emissions <sup>4</sup>		2540	—	—	—	—	—
	<b>Scope 2<sup>5</sup></b>		<b>36,250</b>	<b>41,000</b>	<b>42,460</b>	<b>63,210</b>	<b>91,510</b>	<b>139,160</b>
	<b>Scope 3<sup>6</sup></b>		<b>293,440</b>	<b>303,910</b>	<b>312,910</b>	<b>259,130</b>	<b>225,630</b>	<b>202,060</b>
	Business travel		121,000	117,550	139,940	110,940	90,948	85,090
	Employee commute <sup>7</sup>		172,970	186,360	172,970	148,190	134,685	116,970
<b>Total facilities emissions (Scopes 1, 2, 3)</b>			<b>372,550</b>	<b>379,310</b>	<b>383,470</b>	<b>350,830</b>	<b>346,440</b>	<b>362,440</b>
Energy Use	<b>Electricity</b>	million kWh	<b>1832</b>	<b>1419</b>	<b>996</b>	<b>839</b>	<b>708</b>	<b>608*</b>
	U.S.		1536	1157	831	702	590	—
	International		296	262	166	137	118	—
	<b>Natural gas</b>	million btu	<b>1,225,210</b>	<b>974,570</b>	<b>851,660</b>	<b>922,860</b>	<b>764,550</b>	<b>304,000</b>
	U.S.		1,127,550	901,950	794,830	840,490	676,630	240,230
	International		97,660	72,620	56,830	82,370	87,920	63,770
Energy Efficiency	<b>Electricity saved as a result of energy efficiency measures (cumulative since 2011)<sup>9</sup></b>	kWh	<b>69,989,660</b>	<b>55,288,800</b>	<b>37,875,000</b>	<b>31,225,000</b>	<b>26,241,600</b>	<b>11,354,200</b>
	<b>Natural gas saved as a result of energy efficiency measures (cumulative since 2011)<sup>9</sup></b>	million btu	<b>2,453,410</b>	<b>2,228,477</b>	<b>1,676,735</b>	<b>1,431,215</b>	<b>1,238,291</b>	<b>548,508</b>
Renewable Energy	<b>Renewable energy sourcing (calendar year)<sup>10</sup></b>	%	<b>97</b>	<b>96</b>	<b>93</b>	<b>87</b>	<b>73</b>	<b>60</b>
	<b>Emissions avoided as a result of renewable energy sourcing (scopes 1 and 2)</b>	metric tons CO <sub>2</sub> e	<b>625,000</b>	<b>569,000</b>	<b>362,000</b>	<b>283,000</b>	<b>214,000</b>	<b>118,000</b>
Water Use <sup>11</sup>	<b>Total</b>	million gallons	<b>1000</b>	<b>630</b>	<b>573</b>	<b>494</b>	<b>430</b>	<b>345</b>
	Data centers		410	207	166	113	69	57
	Retail		110	99	111	103	94	71
	Corporate		480	324	296	278	267	217
Waste Generation <sup>12</sup>	Landfilled	pounds	31,595,200	21,618,850	13,110,880	6,833,000	5,923,810	4,850,160
	Recycled		68,509,300	28,198,560	19,599,570	14,621,940	15,866,650	11,464,020
	Composted		14,567,500	13,737,320	3,006,170	—	—	—
	Hazardous waste		3,342,700	2,287,320	1,002,300	508,040	70,550	123,460
	Waste to energy		645,000	—	—	—	—	—
	<b>Landfill diversion rate</b>		<b>%</b>	<b>71</b>	<b>66</b>	<b>63</b>	<b>68</b>	<b>73</b>

Apple's fiscal year is the 52- or 53-week period that ends on the last Saturday of September.

<sup>1</sup> As reported in Apple's Form 10-K Annual Report filed with the SEC for FY2017.

<sup>2</sup> Starting in FY2016, Scope 1 emissions include diesel use in emergency backup generators and propane gas use in corporate offices.

<sup>3</sup> In FY2015, we adjusted our methodology to better reflect locations where natural gas is used. We estimate natural gas usage in offices and retail stores where we are not billed based on usage (e.g., leased office space or retail stores within malls). This more accurate methodology resulted in a decrease in emissions in FY2015.

<sup>4</sup> Emissions from R&D processes. We started tracking these emissions in FY2017.

<sup>5</sup> We've updated our FY2016 colocation facilities footprint to reflect more accurately Apple's operational boundaries. Per the WRI Greenhouse Gas Protocol, we've removed from our Scope 2 calculations those emissions associated with colocation facility cooling and building operations. This energy use, however, is still covered by renewable energy. As a result, these effective Scope 3 emissions from this energy use was 550 metric tons CO<sub>2</sub>e in FY2016, and 500 metric tons in FY2017.

<sup>6</sup> In FY2017, we started calculating Scope 3 emissions not listed above. These include electricity transmission and distribution losses (22,300 metric tons CO<sub>2</sub>e) and lifecycle emissions associated with renewable energy (46,400 metric tons CO<sub>2</sub>e).

<sup>7</sup> We adjusted our methodology for FY2017 to take into account Apple's "At Home Advisors" Program, where employees work remotely.

<sup>8</sup> Only total electricity usage data was available for FY2012.

<sup>9</sup> Because energy efficiency measures have lasting benefits, energy efficiency savings are calculated cumulatively since 2011. All efficiency measures are retired based on their effective useful lifetime as documented by the California Energy Commission.

<sup>10</sup> We calculate our progress toward 100 percent renewable energy on a calendar year basis. Beginning January 1, 2018, 100 percent of the electricity we use to power our global facilities is sourced from renewable energy.

<sup>11</sup> Beginning in FY2017, "Data Centers" includes water use at colocation facilities, and "Corporate" includes water use at Apple distribution centers.

<sup>12</sup> Beginning in FY2017, we're including waste from Apple's distribution centers. Prior to FY2015, composted quantities were reported as part of the "recycled" figure. Beginning in FY2017, waste processed in "Waste to Energy" facilities is reported separately.



# Product Environmental Performance Indicators

The following table summarizes the environmental performance indicators relating to Apple's products—including the life cycle greenhouse gas emissions associated with the manufacturing, transportation, use, and end-of-life processing of our products. In fiscal year 2017, we sold 216,756,000 iPhone, 43,753,000 iPad, and 19,251,000 Mac devices.<sup>1</sup>

We also publish individual product environmental reports for all of our products. These are available at [www.apple.com/environment/reports](http://www.apple.com/environment/reports).

Fiscal Year	2017	2016	2015
<b>Scope 3 - Life cycle greenhouse gas emissions (metric tons CO<sub>2</sub>e)<sup>2</sup></b>	<b>27,100,000</b>	<b>29,200,000</b>	<b>38,000,000</b>
Manufacturing	21,100,000	22,800,000	29,600,000
Product transportation	1,200,000	1,200,000	1,300,000
Product use	4,700,000	4,900,000	6,600,000
End of Life <sup>3</sup>	100,000	300,000	500,000
<b>Packaging fiber footprint (metric tons)</b>	<b>145,000</b>	<b>129,000</b>	<b>133,000</b>
Recycled fiber	65%	62%	60%
Responsibly sourced virgin fiber	35%	38%	40%
Other virgin fiber	—	<1%	<1%
<b>Packaging plastics footprint (metric tons)</b>	<b>24,000</b>	<b>34,000</b>	<b>36,000</b>
<b>Average power use (kWh/year)</b>	<b>7.2</b>	<b>7</b>	<b>8.4</b>
<b>Safer materials</b>			
Arsenic <sup>4</sup>	Removed from glass by 2008		
PVC <sup>5</sup>	PVC-free AC power cord available in all regions except India and South Korea		
Beryllium	Eliminated from all new product designs. Beryllium is found in copper alloys used to make connectors and springs		
Mercury	Eliminated in display 2009		
Lead <sup>6</sup>	Phased out of display glass and solder in 2006		
Brominated flame retardants (BFRs) <sup>7</sup>	Eliminated from thousands of parts since 2008		

<sup>1</sup> As reported in Apple's Form 10-K Annual Report filed with the SEC for FY2017.

<sup>2</sup> We have been calculating the life cycle greenhouse gas emissions of our products since 2007. Over time, we have greatly refined our model to include more Apple-specific data instead of industry averages. We made significant modeling changes in FY2016 to improve how we calculate emissions from the integrated circuits in Apple products, which resulted in a decrease in manufacturing emissions. And we make systematic changes each year to reflect changes in global electricity grids. Scope 3 emissions associated with employee commute and business travel are included in the Facilities Environmental Performance Indicators table.

<sup>3</sup> Carbon emissions associated with our products' end of life decreased in FY2017, because of changes in methodology to more accurately reflect disposal and recycling practices.

<sup>4</sup> Arsenic is present in minute quantities in some semiconductor devices.

<sup>5</sup> Every Apple product is free of PVC and phthalates with the exception of power cords in India and South Korea, where we continue to seek government approval for our PVC and phthalates replacement.

<sup>6</sup> 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.

<sup>7</sup> While Apple's phaseout covers the vast majority of products and components, recently acquired Beedit products and some older Apple product designs may not be fully BFR-free and PVC-free.

## Overview of Apple's product life cycle carbon assessment (LCA) methodology

Apple uses five steps when conducting a product LCA.

- 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, packaging, and units that are repaired and replaced through AppleCare.
- 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 and watchOS devices. Most Apple products last longer and are 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.
- 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.
- To model recycling, we use material composition data on our products and cover the treatment steps carried out by the recycler to obtain metal, plastic, and glass material streams. Subsequent processing and remelting steps are not included, as these are considered stages of production and not end-of-life processing.
- After we collect data about production, use, transport, and recycling, 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, are also accounted for. Combining product-specific data with emission data in our LCA tool allows us to compile detailed results for greenhouse gas emissions as they relate to the product. The data and modeling approaches are checked for quality and accuracy by the Fraunhofer Institute in Germany.

## Scopes 1 and 2 Carbon Emissions Breakdown (metric tons CO<sub>2</sub>e)

Fiscal Year	2017 <sup>1</sup>		2016		2015	
Location	Scope 1	Scope 2	Scope 1	Scope 2	Scope 1	Scope 2
<b>Corporate</b>	<b>25,430</b>	<b>33,290</b>	<b>20,537</b>	<b>30,408</b>	<b>15,415</b>	<b>19,564</b>
Cupertino, CA	20,580	0	17,121	0	13,248	0
Elk Grove, CA	530	0	397	0	369	0
Austin, TX	330	0	248	0	233	0
Other U.S.	1160	0	883	0	121	0
Cork, Ireland	710	0	780	0	892	0
Singapore	90	0	65	0	0	3767
China	220	0	38	0	117	2201
Other International	1810	33,290	1005	30,408	435	13,596
<b>Data centers</b>	<b>4210</b>	<b>1520</b>	<b>2738</b>	<b>1621</b>	<b>13</b>	<b>0</b>
Maiden, NC	150	0	126	0	0	0
Newark, CA	70	0	139	0	0	0
Prineville, OR	950	0	1077	0	13	0
Reno, NV	1530	0	713	0	0	0
Mesa, AZ	1510	0	683	0	—	—
Viborg, Denmark		0	—	—	—	—
Colocation facilities (U.S.) <sup>2</sup>		0		0		
Colocation facilities (International) <sup>2</sup>		1520		1621		
<b>Retail stores</b>	<b>4920</b>	<b>1440</b>	<b>3679</b>	<b>8924</b>	<b>3800</b>	<b>22,893</b>
Domestic (U.S.)	2490	0	1597	0	2269	0
International	2430	1440	2082	8924	1531	22,893
<b>Business fleet</b>	<b>8299</b>	<b>—</b>	<b>7370</b>	<b>—</b>	<b>8744</b>	<b>—</b>
<b>Process emissions<sup>3</sup></b>	<b>2538</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>—</b>	<b>—</b>
<b>Totals</b>	<b>45,397</b>	<b>36,250</b>	<b>34,324</b>	<b>40,953</b>	<b>27,972</b>	<b>42,457</b>

Fiscal Year	2014		2013		2012	
Location	Scope 1	Scope 2	Scope 1	Scope 2	Scope 1	Scope 2
<b>Corporate</b>	<b>15,335</b>	<b>21,555</b>	<b>13,727</b>	<b>17,503</b>	<b>11,343</b>	<b>48,215</b>
Cupertino, CA	12,929	0	10,747	0	9,132	25,450
Elk Grove, CA	411	0	509	0	560	0
Austin, TX	148	0	83	0	59	0
Other U.S.	115	0	337	0	237	4265
Cork, Ireland	1000	0	743	0	715	0
Singapore	51	6852	50	5826	32	4946
China	385	8577	390	7490	—	1049
Other International	296	6126	868	4187	609	12,505
<b>Data centers</b>	<b>18</b>	<b>0</b>	<b>2201</b>	<b>0</b>	<b>146</b>	<b>7664</b>
Maiden, NC	0	0	2201	0	146	0
Newark, CA	0	0	0	0	0	7664
Prineville, OR	18	0	0	0	0	0
Reno, NV	0	0	0	0	0	0
<b>Retail stores</b>	<b>5355</b>	<b>41,658</b>	<b>6158</b>	<b>74,002</b>	<b>2812</b>	<b>83,285</b>
Domestic (U.S.)	2812	11,036	3548	44,606	787	—
International	2543	30,662	2610	29,397	2025	—
<b>Business fleet</b>	<b>7778</b>	<b>—</b>	<b>7214</b>	<b>—</b>	<b>6923</b>	<b>—</b>
<b>Totals</b>	<b>28,486</b>	<b>63,213</b>	<b>29,300</b>	<b>91,505</b>	<b>21,224</b>	<b>139,164</b>

— = Energy source not yet online.

Scope 1 emissions result from natural gas use in buildings, and gasoline use for fleet vehicles. As is typical, these emissions are tracked separately from our 100% renewable energy claim. Starting in FY2016, Scope 1 emissions capture diesel use in emergency backup generators and propane gas use in corporate offices. Scope 1 emissions are calculated using emissions factors from EPA clean energy website <https://www.epa.gov/climateleadership/center-corporate-climate-leadership-ghg-emission-factors-hub>.

Scope 2 emissions result from electricity use for Apple's facilities, calculated using a market-based approach, following the WRI Greenhouse Gas Protocol.

<sup>1</sup> Apple also calculates what our emissions would have been had we not taken action to supply new, clean renewable energy to our facilities. If we remove the emissions reduction benefits of our renewable energy program, then our Scope 1 emissions in FY2017 would have been 70,780 metric tons CO<sub>2</sub>e and our Scope 2 emissions would have been 589,000 CO<sub>2</sub>e for our corporate operations, data centers, and retail stores. In FY2017, combustion of biogas for our fuel cells resulted in 36,220 metric tons of direct CO<sub>2</sub> emissions. These emissions are not counted in Apple's footprint because they would have occurred naturally even if we had not combusted the biogas.

<sup>2</sup> In FY2016, we began tracking electricity used at colocation facilities as part of Apple's footprint. We've updated our FY2016 colocation facilities footprint to reflect more accurately Apple's operational boundaries. Per the WRI Greenhouse Gas Protocol, we've removed from our Scope 2 calculations those emissions associated with colocation facility cooling and building operations. This energy use, however, is still covered by renewable energy. As a result, these Scope 3 effective emissions from this energy use was 550 metric tons CO<sub>2</sub>e in FY2016, and 500 metric tons in FY2017.

<sup>3</sup> Emissions from R&D processes.

# Fiscal Year 2017 Natural Gas and Electricity Use

The chart below provides a detailed breakdown of fiscal year 2017 energy use, which is used to calculate our carbon emissions.

Fiscal Year 2017				
Location	Natural Gas		Electricity	
	Total Gas (mmBTU)	Renewable Biogas (mmBTU)	Total Electricity (million kWh)	Renewable Electricity (million kWh)
<b>Corporate</b>	<b>556,970</b>	<b>85,990</b>	<b>544</b>	<b>488</b>
Cupertino, CA	467,280	85,990	305	305
Elk Grove, CA	9930	0	15	15
Austin, TX	6180	0	56	56
Other U.S.	21,750	0	19	19
Cork, Ireland	13,420	0	13	13
Singapore	540	0	19	19
China	4070	0	24	24
Other International	33,800	0	93	37
<b>Data centers</b>	<b>575,600</b>	<b>575,040</b>	<b>1106</b>	<b>1103</b>
Maiden, NC	575,040	575,040	273	273
Newark, CA	0	0	118	118
Prineville, OR	520	0	195	195
Reno, NV	0	0	186	186
Mesa, AZ	40	0	45	45
Viborg, Denmark	—	—	<1	<1
Colocation Facilities (USA) <sup>1</sup>	N/A	N/A	228	228
Colocation Facilities (International) <sup>1</sup>	N/A	N/A	61	58
<b>Retail stores</b>	<b>92,600</b>	<b>0</b>	<b>182</b>	<b>179</b>
Domestic (U.S.)	46,800	0	96	96
International	45,800	0	86	83
<b>Totals</b>	<b>1,225,170</b>	<b>661,030</b>	<b>1832</b>	<b>1770</b>
<b>Percent Renewable<sup>2</sup></b>		<b>54%</b>		<b>97%</b>

— Data not tracked

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

<sup>1</sup> We've updated our FY2016 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.

<sup>2</sup> We calculate our progress toward 100 percent renewable energy on a calendar year basis. In calendar year 2017, 97 percent of the electricity used at our global facilities was powered by renewable energy. Beginning January 1, 2018, we are at 100 percent.

## Appendix B

# Data Center Energy Supplement

Apple's data center presence continues to grow—since April 2017, we announced a new U.S. data center in Iowa, a second data center in Denmark, and two new data centers in China.

Each Apple data center has unique design features that reflect the climate and other aspects of its specific site. All of our data centers operate on 100 percent renewable energy and power billions of iMessages, answers from Siri, and song downloads from iTunes. This means that no matter how much data the facilities handle, there is a zero greenhouse gas emissions impact from their electricity use. These data centers use renewable energy sources like solar, wind, biogas fuel cells, and low-impact hydro power from onsite and locally obtained resources.

### **Maiden, North Carolina**

Between 2011 and 2015, we installed 68 megawatts of Apple-created projects: two 20-megawatt solar arrays, an 18-megawatt solar array, and 10 megawatts of biogas fuel cells. In 2015, we partnered with the local utility, Duke Energy, to help build five solar PV projects through Duke Energy's Green Source Rider program. These solar PV projects, which started coming online in late 2015, 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 projects have a combined peak capacity of 20 megawatts. In 2017, we also made long-term commitments to five more solar PV projects in North Carolina, for an additional 86 megawatts of clean energy. All told, in fiscal year 2017, the Maiden data center was supported by projects that generated 273 million kilowatt-hours of renewable energy, which is equivalent to the energy used by 20,663 North Carolina homes.<sup>26</sup>



Among Maiden’s energy efficiency features is the 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 turned off more than 75 percent of the time.

Maiden, North Carolina—100% renewable since opening June 2010			
273 million kWh energy use in fiscal year 2017			
Duke Energy Default Grid Mix		Apple Actual Renewable Energy Use	
Nuclear	51%	Apple’s Solar PV Projects	42%
Coal	33%	Apple’s Biogas Fuel Cells	27%
Other	16%	Duke Green Source Rider (100% solar PV)	12%
Renewable	<1%	NC GreenPower (100% solar PV)	19%
<b>2017 Default Emissions (mtons CO<sub>2</sub>e/year)</b>	<b>100,480</b>	<b>2017 Effective Emissions (mtons CO<sub>2</sub>e/year)</b>	<b>0</b>
<i>From Duke Energy Carolinas 2015 Statistical Supplement generation data</i>		<i>Actual fiscal year 2017 energy data</i>	

### Newark, California

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’re acquiring this energy directly from the wholesale market through California’s Direct Access program. Late in 2017, Apple’s 130-megawatt California Flats solar project in Monterey County, California, 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 2017, the Newark data center was supported by projects that generated 118 million kilowatt-hours of renewable energy, which is equivalent to the energy used by 17,976 California homes.<sup>26</sup>



Newark, California—100% renewable since opening January 2013			
118 million kWh energy use in fiscal year 2017			
Pacific Gas & Electric Default Grid Mix		Apple Actual Renewable Energy Use	
Natural Gas	17%	Bundled Grid (mostly wind)	91%
Nuclear	24%	Grid (mostly wind)	9%
Other/Unspecified	26%		
Renewable	33%		
<b>2017 Default Emissions (mtons CO<sub>2</sub>e/year)</b>	<b>23,300</b>	<b>2017 Effective Emissions (mtons CO<sub>2</sub>e/year)</b>	<b>0</b>
<i>www.energy.ca.gov/pcl/labels/2016_labels/Pacific_Gas_and_Electric.pdf (From September 2017)</i>		<i>Actual fiscal year 2017 energy data</i>	

## Prineville, Oregon

To support our Prineville data center, we recently signed a 200-megawatt power purchase agreement for a new Oregon wind farm, the Montague Wind Power Project, set to come online by the end of 2019. This is our first Apple-created wind project. And it's our largest project to date, producing over 560 million kilowatt-hours of clean, renewable energy a year.

Additionally, we executed a power purchase agreement for the 56-megawatt Solar Star Oregon II PV array located just a few miles from our data center, which came online and began supporting the data center in 2017. The project produces 140 million kilowatt-hours of renewable energy a year. To strengthen the connection between Apple and these projects, we use Oregon's Direct Access program to schedule 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. These micro-hydro projects generate 12 million kilowatt-hours of renewable energy a year.

Supplementing these projects, and ensuring we remain 100 percent renewable all the time, we executed a long-term purchase agreement with Cypress Creek Renewables for all environmental attributes from a 50-megawatt portfolio of six solar arrays in Oregon.

In fiscal year 2017, the Prineville data center was supported by projects that generated 195 million kilowatt-hours of renewable energy, which is equivalent to the energy used by 17,916 Oregon homes.<sup>26</sup>



Wind + Low-impact hydro

### Prineville, Oregon—100% renewable since opening May 2012

#### 195 million kWh energy use in fiscal year 2017

Pacific Power Default Grid Mix		Apple Actual Renewable Energy Use	
Coal	62%	Apple's Micro-Hydro Projects	<1%
Natural Gas	17%	Oregon Wind (via Direct Access)	99.9%
Other	6%		
Renewable	15%		
<b>2017 Default Emissions (mtons CO<sub>2</sub>e/year)</b>	<b>57,980</b>	<b>2017 Effective Emissions (mtons CO<sub>2</sub>e/year)</b>	<b>0</b>

[www.pacificpower.net/content/dam/pacific\\_power/doc/About\\_Us/Rates\\_Regulation/Oregon/11536-9\\_PP\\_ORLabelingInsert\\_LrgBiz\\_F.pdf](http://www.pacificpower.net/content/dam/pacific_power/doc/About_Us/Rates_Regulation/Oregon/11536-9_PP_ORLabelingInsert_LrgBiz_F.pdf)

Actual fiscal year 2017 energy data

## Reno, Nevada

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 we created a partnership with the local utility, NV Energy, to develop our first renewable project: the Fort Churchill Solar PV 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 PV project uses a new kind of photovoltaic panel with curved mirrors that concentrate sunlight. The 20-megawatt array has an annual production capacity of over 43 million kilowatt-hours of clean, renewable energy.

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 that does not require the customer to fund project development up-front. Thanks to this new option, the Nevada Green Rider, in 2015 we announced our second Nevada solar array: a 50-megawatt project called Boulder II. This project came online in 2017, producing 137 million kilowatt-hours of renewable energy a year.

In 2017 and early 2018, we used the green energy option two more times. Our third Nevada solar array is a 200-megawatt project called Techren Solar—Apple's largest solar array to date—estimated to produce over 540 million kilowatt-hours of clean, renewable energy a year. And our fourth Nevada solar array is the 50-megawatt Turquoise Nevada project producing 110 million kilowatt-hours a year.

In fiscal year 2017, the Reno data center was supported by projects that generated 186 million kilowatt-hours of renewable energy, which is equivalent to the energy used by 16,756 Nevada homes.<sup>26</sup>



Solar

### Reno, Nevada—100% renewable since opening December 2012

#### 186 million kWh energy use in fiscal year 2017

NV Energy—North Default Grid Mix		Apple Actual Renewable Energy Use	
Natural Gas	52%	Apple's Solar PV Projects	99.7%
Coal	22%	Other Solar PV (PPA)	0.3%
Other	3%		
Renewable	23%		

<b>2017 Default Emissions (mtons CO<sub>2</sub>e/year)</b>	<b>45,820</b>	<b>2017 Effective Emissions (mtons CO<sub>2</sub>e/year)</b>	<b>0</b>
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[www.nvenergy.com/bill\\_inserts/2017/Power\\_Content\\_Insert\\_NVE-North\\_2017-01.pdf](http://www.nvenergy.com/bill_inserts/2017/Power_Content_Insert_NVE-North_2017-01.pdf)

Actual fiscal year 2017 energy data

## Mesa, Arizona

Our newest data center, our global command center in Mesa, Arizona, came online in 2016. To support this facility, we partnered with the local utility, the Salt River Project, to build the 50-megawatt Bonnybrooke solar array, which became operational in December 2016. This project produces over 147 million kilowatt-hours of clean, renewable energy a year, which more than fully matches the energy used by the data center.

In fiscal year 2017, the Mesa data center was supported by 45 million kilowatt-hours of renewable energy, which is equivalent to the energy used by 3,640 Arizona homes.<sup>26</sup>



### Mesa Arizona—100% renewable since opening March 2017\*

#### 45 million kWh energy use in fiscal year 2017

Salt River Project (SRP) Default Grid Mix		Apple Actual Renewable Energy Use	
Coal	53%	Apple's Solar PV Project	93%
Nuclear	18%	SRP Solar PV Purchase	7%
Natural Gas / Other	17%		
Renewable	12%		

<b>2017 Default Emissions (mtons CO<sub>2</sub>e/year)</b>	<b>21,630</b>	<b>2017 Effective Emissions (mtons CO<sub>2</sub>e/year)</b>	<b>0</b>
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[www.srpnet.com/about/stations/pdfx/2014irp.pdf](http://www.srpnet.com/about/stations/pdfx/2014irp.pdf)

Actual fiscal year 2017 energy data

\*Apple took operational control of the building in October 2015 and converted it to a data center that began servicing customers in March 2017

## Viborg, Denmark

We're currently constructing a new data center running on 100 percent renewable energy in Denmark's central Jutland region. Due to its proximity to one of Denmark's largest electrical substations, the data center won't require backup generators, which typically run on diesel and require periodic testing and burning of fuel.



Denmark has a long tradition of biomass energy generation from agricultural waste products. Apple is partnering with Aarhus University (Viborg campus) to co-develop an agricultural waste biomass project. Methane from the biomass digester reaction will be used to create renewable electricity for our data center. Much of the agricultural waste going into the digester will come from local farms in a mutually beneficial relationship. They bring us their agriculture waste material to use as feedstock for the digester, and we give them the nutrient-rich by-product of the digestion process, which they can apply to their fields.



Wind

Viborg, Denmark—100% renewable (currently in construction)			
37,000 kWh energy use in fiscal year 2017			
Energinet Default Grid Mix		Apple Actual Renewable Energy Use	
Natural Gas	8%	Utility Wind Purchase	100%
Coal	28%	Apple's Wind Project	pending
Other / Unspecified	2%		
Renewable	62%		
<b>2017 Default Emissions (mtons CO<sub>2</sub>e/year)</b>	<b>7</b>	<b>2017 Effective Emissions (mtons CO<sub>2</sub>e/year)</b>	<b>0</b>
<small><a href="http://www.aib-net.org/documents/103816/176792/AIB_2016_Residual_Mix_Results.pdf/6b49295b-ad99-a189-579e-877449778f62">www.aib-net.org/documents/103816/176792/AIB_2016_Residual_Mix_Results.pdf/6b49295b-ad99-a189-579e-877449778f62</a></small>		<small>Actual fiscal year 2017 energy data</small>	

### 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. Over 99 percent of our power for colocation facilities is 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. And we will keep working with the colocation suppliers to get to 100 percent.

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.

Beyond the use of our own data centers and colocation facilities, we also use third-party computing services to support some of our on-demand cloud storage-based services. We encourage these suppliers to adopt a 100 percent renewable energy strategy for their energy use.

## Energy Use and Emissions at Apple's Colocation Facilities

	Total Energy Use (kWh)	Renewable Energy (kWh)	Default Utility Emissions <sup>1</sup> (metric tons CO <sub>2</sub> e)	Apple's Emissions— Including Renewable Energy <sup>2</sup> (metric tons CO <sub>2</sub> e)	Percent Renewable Energy <sup>3</sup>
<b>FY2011</b>	42,500	0	10	10	<b>0%</b>
<b>FY2012</b>	38,552,300	1,471,680	17,200	16,500	<b>4%</b>
<b>FY2013</b>	79,462,900	46,966,900	31,800	14,500	<b>59%</b>
<b>FY2014</b>	108,659,700	88,553,400	44,300	11,000	<b>81%</b>
<b>FY2015</b>	142,615,000	121,086,100	60,500	12,700	<b>85%</b>
<b>FY2016<sup>4</sup></b>	145,520,900	143,083,200	66,300	1,600	<b>98%</b>
<b>FY2017</b>	289,195,800	286,378,100	125,600	1,500	<b>99%</b>

<sup>1</sup> 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.

<sup>2</sup> Apple's greenhouse gas emissions are calculated using the World Resources Institute Greenhouse Gas Protocol methodology for calculating market-based emissions.

<sup>3</sup> We calculate our progress toward our 100 percent renewable energy goal on a calendar year basis. In calendar year 2017, 99% of the electricity used at our colocation facilities was powered by renewable energy. Beginning January 2018, it is at 100%.

<sup>4</sup> Over the past two 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. This energy use, however, is still covered by renewable energy.

## Regional Energy Use at Apple's Colocation Facilities (Fiscal Year 2017)

	Total Energy Use (kWh)	Renewable Energy (kWh)	Percent Renewable Energy*
<b>U.S.</b>	228,114,700	228,014,600	100%
<b>Europe</b>	23,355,300	20,637,700	88%
<b>APAC</b>	37,725,800	37,725,800	100%
<b>FY2017 Total</b>	<b>289,195,800</b>	<b>286,378,100</b>	<b>99%</b>

\*We calculate our progress toward our 100 percent renewable energy goal on a calendar year basis. In calendar year 2017, 99% of the electricity used at our colocation facilities was source with renewable energy. Beginning January 2018, it is at 100%.

## Appendix C

# Assurance and Review Statements

**Bureau Veritas: Corporate energy, carbon, waste, and water data  
(Pages 60–62)**

**Fraunhofer Institute: Product life cycle carbon footprint  
(Pages 63–66)**

**Bureau Veritas: Supplier clean energy program  
(Pages 67–69)**

**Fraunhofer Institute: Comprehensive fiber footprint  
(Pages 70–71)**

**Fraunhofer Institute: Packaging plastic footprint  
(Pages 72–74)**

# BUREAU VERITAS NORTH AMERICA

## INDEPENDENT ASSURANCE STATEMENT



### Introduction and objectives of work

Bureau Veritas North America, Inc. (BVNA) was engaged by Apple, Inc. (Apple) to conduct an independent assurance of select environmental data reported in its 2017 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. BVNA was not involved in the collection of the information or the drafting of the Report.

### Scope of Work

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

- Assurance of select environmental data and information included in the Report for the fiscal year 2017 reporting period (September 25, 2016 through September 30, 2017), 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

### Methodology

BVNA undertook the following activities:

1. Site visits to Apple facilities in Culver City, California; Maiden, North Carolina; London, United Kingdom; Taipei, Taiwan; and Tokyo, Japan.
2. Visit to 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.

Our work was conducted against Bureau Veritas' standard procedures and guidelines for external Verification of Sustainability Reports, based on current best practice in independent assurance.



Bureau Veritas procedures are based on principles and methods described in the International Standard on Assurance Engagements (ISAE) 3000.

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

BVNA verified the following indicators for Apple’s Fiscal Year 2017 reporting period (September 25, 2016 through September 30, 2017):

Parameter	Quantity	Units	Boundary/ Protocol
Natural Gas Consumption:	12.3	Million Therms	Worldwide occupied properties / Apple Internal Protocol
Electricity Consumption:	1,832	Million kilowatt hours (mkWh)	Worldwide occupied properties / Apple Internal Protocol
Renewable Energy	1,772	Million kilowatt hours (mkWh)	Worldwide / Invoiced quantities & self-generated
Scope 1 GHG Emissions	45,400	metric tons of carbon dioxide equivalent (tCO <sub>2</sub> e)	Worldwide occupied properties / WRI/WBCSD GHG Protocol
Scope 2 GHG Emissions (Location-Based)	650,600	tCO <sub>2</sub> e	Worldwide occupied properties / WRI/WBCSD GHG Protocol
Scope 2 GHG Emissions (Market-Based)	36,200	tCO <sub>2</sub> e	Worldwide occupied properties / WRI/WBCSD GHG Protocol
Scope 3 GHG Emissions – Business Travel	121,000	tCO <sub>2</sub> e	Worldwide occupied properties / WRI/WBCSD GHG Protocol Value Chain (Scope 3)
Scope 3 GHG Emissions – Employee Commute	172,000	tCO <sub>2</sub> e	Worldwide occupied properties / WRI/WBCSD GHG Protocol Value Chain (Scope 3)
Water Withdrawal	1,000	Million gallons	Worldwide occupied properties / Apple Internal Protocol
Trash disposed in Landfill	14,300	Metric tonnes	Worldwide occupied properties / Apple Internal Protocol
Hazardous Waste (Regulated waste)	1,500	Metric tonnes	Worldwide occupied properties / Apple Internal Protocol
Recycled Material (Removal by recycling contractor)	31,000	Metric tonnes	Worldwide occupied properties / Apple Internal Protocol
Composted Material	6,600	Metric tonnes	Worldwide occupied properties / Apple Internal Protocol
Waste to Energy	293	Metric tonnes	Worldwide occupied properties / Apple Internal Protocol
Paper	1,100	Metric tonnes	Worldwide occupied properties / Apple Internal Protocol



## Our Conclusion

Based on the assurance process and procedures conducted, 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; 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, impartiality and competence

BVNA is an independent professional services company that specializes in Quality, Health, Safety, Social and Environmental management with over 180 years history in providing independent assurance services, and an annual 2017 revenue of \$4.6 billion Euros.

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

BVNA has implemented a Code of Ethics across the business to maintain high ethical standards among staff in their day-to-day business activities.

The assurance team has extensive experience in conducting assurance over environmental, social, ethical and health and safety information, systems and processes, has over 20 years combined experience in this field and an excellent understanding of BVNA standard methodology for the Assurance of Sustainability Reports.

### Attestation:

Trevor A. Donaghu, Lead Verifier  
Technical Director, Climate Change Services  
Sustainability and Climate Change Services  
Bureau Veritas North America, Inc.

April 6, 2018

David Reilly, Technical Reviewer  
Senior Project Manager  
Sustainability and Climate Change Services  
Bureau Veritas North America, Inc.

## Letter of Assurance

### Comprehensive Carbon Footprint – Scope 3: Product related Carbon Footprint for Fiscal Year 2017

Fraunhofer IZM reviewed Apple's scope 3 carbon footprint data related to the products manufactured and sold by Apple Inc. in fiscal year 2017.

#### 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 2017. 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 (close to 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
<b>2017</b>	<b>21.14</b>	<b>1.21</b>	<b>4.73</b>	<b>0.04</b>
	[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: million metric tons carbon dioxide equivalents*

Including a reported value of 0.34 million metric tons CO<sub>2</sub>e for facilities (out of scope of this verification), total comprehensive carbon footprint is reported to be 27.45 million metric tons CO<sub>2</sub>e.

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 in the course of this 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 FY2017, including accessories and including AppleCare, Apple's extended warranty and technical support plans for their devices.



- Regional distribution of sold units and country specific allocation per product to major sell-in countries
- Product specific data on transportation including breakdown of air and sea shipment
- Life cycle GHG emissions for all products, differentiating the actual product configurations (i.e. memory capacity)
- Calculation methodology for the comprehensive carbon footprint and methodological changes implemented in 2017
- The total carbon footprint – scope 3 for the fiscal year 2017
- 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 2017 data regarding sales figures, manufacturing, transportation).

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 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

Since the FY2016 Carbon Footprint review in early 2017 6 recent product LCA studies have been reviewed successfully against ISO 14040/44. These LCAs and LCAs reviewed in early

2017 cover product segments MacBook Pro, Apple Watch, iPad, and iPhone. These recently reviewed LCA studies cover products which represent in total 45,7% of the total scope 3 carbon footprint. Representatives of other product segments (iPod, MacBook, iMac, Mac Pro, Mac Mini, Airport Express / Airport Extreme, Apple TV, 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 73,5% of the total scope 3 carbon footprint.

End-of-life models were updated this year to better reflect actual recycling and disposal of packaging materials and products. The reduced carbon footprint of end-of-life processes compared to former fiscal years is largely due to this improved modelling approach.

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

## 4 Conclusions

Apple' 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.

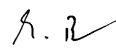
For all product LCA calculations, where exact data was missing, the principle of a worst-case approach has been followed and results have been calculated with rather conservative estimates.

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 29, 2018



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Fraunhofer IZM  
Dept. Environmental and  
Reliability Engineering



- Marina Proske -  
Fraunhofer IZM  
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# BUREAU VERITAS NORTH AMERICA

## INDEPENDENT ASSURANCE STATEMENT



### Introduction and objectives of work

Bureau Veritas North America, Inc. (BVNA) was engaged by Apple, Inc. (Apple) to conduct an independent assurance of its Supplier Clean Energy Program data reported in its 2017 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. BVNA was not involved in the collection of the information or the drafting of the Report.

### Scope of Work

Apple requested BVNA 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 2017 reporting period (September 25, 2016 through September 30, 2017), 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

### Methodology

BVNA undertook the following activities:

1. 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.

Our work was conducted against Bureau Veritas' standard procedures and guidelines for external Verification of Sustainability Reports, based on current best practice in independent assurance. Bureau Veritas procedures are based on principles and methods described in the International Standard on Assurance Engagements (ISAE) 3000.



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

### Our Findings

BVNA verified the following indicators for Apple’s Fiscal Year 2017 reporting period (September 25, 2016 through September 30, 2017):

Parameter	Quantity	Units	Boundary/ Protocol
Clean Energy Use	1.88	Million megawatt hours (mMWh)	Apple suppliers / Apple Internal Protocol
Avoided GHG Emissions	1.55	Million metric tons of carbon dioxide equivalent (MMtCO <sub>2</sub> e)	Apple suppliers / Apple Internal Protocol
Operational Capacity	1,154	Megawatts (MWac)	Apple suppliers / Apple Internal Protocol

### Our Conclusion

Based on the assurance process and procedures conducted, there is no evidence that the assertions for Clean Energy Consumption, Avoided GHG Emissions, and Operational Capacity shown above:

- Are not materially correct;
- Are not a fair representation of the stated information; and
- Have not been prepared in accordance with Apple’s stated protocols for their Clean Energy Program.

It is our opinion that Apple has established appropriate systems for the collection, aggregation and analysis of quantitative data for determination of the above indicators for the stated period and boundaries.

### Statement of independence, impartiality and competence

BVNA is an independent professional services company that specializes in Quality, Health, Safety, Social and Environmental management with over 180 years history in providing independent assurance services, and an annual 2017 revenue of \$4.6 billion Euros.

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

BVNA has implemented a Code of Ethics across the business to maintain high ethical standards among staff in their day-to-day business activities.



Apple, Inc.

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The assurance team has extensive experience in conducting assurance over environmental, social, ethical and health and safety information, systems and processes, has over 20 years combined experience in this field and an excellent understanding of BVNA standard methodology for the Assurance of Sustainability Reports.

**Attestation:**

Trevor A. Donaghu, Lead Verifier  
Technical Director, Climate Change Services  
Sustainability and Climate Change Services  
Bureau Veritas North America, Inc.

April 6, 2018

David Reilly, Technical Reviewer  
Senior Project Manager  
Sustainability and Climate Change Services  
Bureau Veritas North America, Inc.

# 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 2017.

### 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 annual fiber footprint of Apple products shipped in fiscal year 2017 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 comprehensive fiber footprint includes Apple’s fiber usage from products, corporate, and retail operations. The comprehensive fiber footprint tracks the total amount of wood, bamboo, and bagasse fiber, both virgin and recycled, that Apple uses in packaging (“Packaging Fiber”), and other paper products such as retail bags, photo books and non-product related corporate use (“Corporate Fiber”).

Apple obtains and analyses supplier-specific data for each product line and sums up these figures for the entire company using sell-in numbers. The output is a total fiber footprint.

Data reported by Apple is as follows:

		Total Fiber	Virgin Fiber	Recycled Fiber
2017	Packaging Fiber	145,000	51,000	94,000
	Corporate Fiber	3,000	1,000	2,000
	<b>Total</b>	<b>148,000</b>	<b>52,000</b>	<b>96,000</b>
		[metric tons fiber]	[metric tons fiber]	[metric tons fiber]

The review of the comprehensive 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

All results and figures reviewed for fiscal year 2017 are plausible.

## 2 Reviewed Data and Findings

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

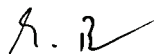
- Calculation methodology for the comprehensive fiber footprint
- Sales data for FY2017, including accessories
- Aggregated fiber data for all products and the total comprehensive fiber footprint for the fiscal year 2017

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

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 and related evidence was provided where needed.

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

Berlin, April 5, 2018



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



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

## Review Statement

### Packaging Plastic Footprint

Fraunhofer IZM reviewed Apple’s packaging plastic footprint data related to packaging plastic usage from products and retail operations in fiscal year 2017.

#### 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 annual packaging plastic footprint of Apple products shipped in fiscal year 2017 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 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. The output is a total packaging plastic footprint.

The review of the 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:

	<b>Total Plastic</b>
<b>2017</b>	<b>24,000</b> [metric tons plastic]



The two main drivers for the plastic packaging footprint are HIPS (high-impact polystyrene) and adhesives.

All results and figures reviewed for fiscal year 2017 are plausible.

## 2 Reviewed Data and Findings

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

- Calculation methodology for the packaging plastic footprint
- Sales data for FY2017, including accessories
- Selected product and supplier specific data on packaging materials and production yields
- Aggregated packaging plastic data for all products and the total packaging plastic footprint for the fiscal year 2017

The methodology paper provided by Apple (Packaging Plastic Footprint at Apple – Methodology Description – V1.0) on March 2, 2018, is considered a sound and appropriate guidance for determining the packaging plastic footprint. Where appropriate, this approach follows methodological principles applied for state-of-the-art Life Cycle Assessments.

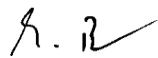
This review comprises a check of packaging plastic data for selected products (iPhone, iPad, MacBook). For Beats products, it was explained which products were assessed in detail and for which products representative data was used.

Plausibility of some data has been questioned and discussed with Apple in detail. Corrections were made accordingly. Similarly, scope for the packaging plastic and fibre footprint have been discussed. Including ink use of photobooks in future footprints is suggested for consistency between plastic and fibre footprint, although the impact on the overall packaging plastic footprint is expected to be low.

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 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, April 6, 2018



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Fraunhofer IZM  
Dept. Environmental and  
Reliability Engineering



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Fraunhofer IZM  
Dept. Environmental and  
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## Appendix D

# Environmental Health and Safety Policy Statement

### Mission Statement

Apple Inc. is committed to protecting the environment, health, and safety of our employees, customers, and the global communities where we operate.

We recognize that by integrating sound environmental, health, and safety 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 environmental, health and safety management systems and in the environmental quality of our products, processes, and services.

### Guiding Principles

- Meet or exceed all applicable environmental, health and safety requirements. We will evaluate our EHS performance by monitoring ongoing performance results and through periodic management reviews.
- Where laws and regulations do not provide adequate controls, we will adopt our own standards to protect human health and the environment.
- Support and promote sound scientific principles and fiscally responsible public policy that enhance environmental quality, health and safety.
- Advocate the adoption of prudent environmental, health and safety principles and practices by our contractors, vendors, and suppliers.
- Communicate environmental, health, and safety policies and programs to Apple employees and stakeholders.
- Design, manage and operate our facilities to maximize safety, promote energy efficiency, and protect the environment.
- 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.
- Ensure that all employees are aware of their role and responsibility to fulfill and sustain Apple's environmental, health and safety management systems and policy.

Luca Maestri  
Senior Vice President and CFO  
January 2018

#### Report Notes:

- This report is published annually and covers fiscal year 2017 activities, unless otherwise noted.
- This report addresses environmental impacts and activities at Apple-owned 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).

<sup>1</sup> The CPU, SOC, DRAM, and memory (NAND) make up the bulk of the integrated circuit emissions.

<sup>2</sup> "Boards and flexes" refers to bare printed circuit boards and flexible printed circuits.

<sup>3</sup> Integrated circuits, aluminum, bare boards and flexes, display, and onboard electronics make up 88 percent of manufacturing emissions. The remaining 12 percent ("Other") include final assembly facilities, battery cells, steel, glass, plastic, packaging, and other materials (such as copper). These are listed in order of their contribution.

<sup>4</sup> "Onboard electronics" includes capacitors, resistors, transistors, diodes, and other electronic components soldered to bare board and flexes, other than the integrated circuits.

<sup>5</sup> Active: active charging of the battery for iOS devices; active use of the product for all other products.

<sup>6</sup> Idle: macOS and AirPort products that are awake, but non-active.

<sup>7</sup> Sleep: maintenance charge of the battery for iOS devices; sleep mode for all other products.

<sup>8</sup> Greenhouse gas equivalencies calculated using the U.S. EPA Greenhouse Gas Equivalencies Calculator: [www.epa.gov/energy/greenhouse-gas-equivalencies-calculator](http://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator).

<sup>9</sup> Includes new renewable energy commitments that are part of Apple's clean energy program, as well as clean energy use purchases suppliers have made independently.

<sup>10</sup> Compared to early 2015 13-inch MacBook Pro with Retina display.

<sup>11</sup> Based on sales weighted averages.

<sup>12</sup> Calculation assumes one full charge per day, using the US Energy Information Administration average electricity cost in the US for January, 2018.

<sup>13</sup> Based on typical energy consumption calculations from Energy Star Program Requirements for Computers Version 6.1.

<sup>14</sup> Compared to a conventional, single-converter power supply design. iMac Pro incorporates a high-efficiency, dual-converter power supply design.

<sup>15</sup> Based on the average power consumed by A19 LED bulbs listed on the ENERGY STAR Certified Light Bulbs Version 2.0 registry as of March 16, 2018. Average power use across geographic locations is approximately 9 watts.

<sup>16</sup> Compared to early 2015 13-inch MacBook Pro with Retina display. Includes retail and shipping box for U.S. configurations.

<sup>17</sup> For more details on FSC Controlled Wood standards, see Forest Stewardship Council. "FSC Controlled Wood." 2017. <https://ic.fsc.org/en/what-is-fsc-certification/controlled-wood>.

<sup>18</sup> 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.

<sup>19</sup> To achieve a Zero Waste to Landfill validation against the UL 2799 standard, a factory must divert 100 percent of its waste from landfills, with a maximum of 10 percent sent to a waste-to-energy facility.

<sup>20</sup> As defined by the WRI Aqueduct tool. We consider "elevated risks" to include levels medium-high and above.

<sup>21</sup> Source: World Resources Institute (WRI) Aqueduct, [www.wri.org/our-work/project/aqueduct](http://www.wri.org/our-work/project/aqueduct).

<sup>22</sup> 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.

<sup>23</sup> Arsenic is present in minuscule quantities in some semiconductor devices.

<sup>24</sup> Every Apple product is free of PVC and phthalates with the exception of power cords in India and South Korea, where we continue to seek government approval for our PVC and phthalates replacement.

<sup>25</sup> While Apple's phaseout covers the vast majority of products and components, recently acquired Beedit products and some older Apple product designs may not be fully BFR-free and PVC-free.

<sup>26</sup> Carbon emissions equivalences calculated using U.S. Energy Information Administration, 2016 data: [www.eia.gov/electricity/sales\\_revenue\\_price/pdf/table5\\_a.pdf](http://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf).