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About this report

Google's 2022 Environmental Report features data, performance highlights, and progress against our targets from our 2021 fiscal year (January 1 to December 31, 2021). It also mentions notable targets set in 2022.

This report outlines how we're driving positive environmental impact throughout our business in five key ways: designing efficient data centers, advancing carbon-free energy, creating sustainable workplaces, building better devices and services, and empowering users with technology.

For more information about our sustainability strategy, see Google's [Sustainability](#) website and [sustainability reports](#) page. For more information about our overall corporate responsibility initiatives, see Google's [commitments](#), as well as [sustainability and related information](#). For more information about our business, see the [About Google](#) and [Alphabet Investor Relations](#) websites.

Our approach

We believe that every business has the opportunity and obligation to protect our planet. Sustainability is one of our core values at Google, and we strive to build sustainability into everything we do.

We've been a leader on sustainability and climate change since Google's founding over 20 years ago. These are some of our key achievements over the past two decades:

2007: We became the first major company to be carbon neutral for our operations.

2017: We became the first major company to match 100% of our annual electricity use with renewable energy, which we've achieved for five consecutive years.

2020: We issued \$5.75 billion in sustainability bonds—the largest sustainability or green bond issuance by any company in history at the time.

2021: We matched 66% of our data center electricity use with regional carbon-free sources, on an hourly basis.

Our sustainability strategy is focused on three key pillars: accelerating the transition to carbon-free energy and a circular economy, empowering everyone with technology, and benefiting the people and places where we operate (see Figure 1).

Figure 1

SUSTAINABILITY STRATEGY OVERVIEW

We strive to build sustainability into everything we do



Accelerate carbon-free and circular

Decouple business growth from the growth of carbon intensity and material use



Empower with technology

Tackle major sustainability problems and drive net-positive impact using Google technologies, platforms, products, and services



Benefit people and places

Share benefits with the communities of our facilities, users, partners, and suppliers

Accelerating carbon-free and circular

To accelerate the transition to a carbon-free and circular economy, in 2020, we launched our [third decade of climate action](#), and we're now working toward a new set of ambitious goals. By 2030, we aim to:

Achieve [net-zero emissions](#) across all of our operations and value chain, including our consumer hardware products

Become the first major company to run on [carbon-free energy](#) 24 hours a day, seven days a week, 365 days a year

Enable 5 gigawatts of new carbon-free energy through investments in our key manufacturing regions

Help more than 500 cities and local governments reduce an aggregate of 1 gigaton of carbon emissions annually

We also aim to maximize the [reuse of finite resources](#) across our operations, products, and supply chains and to enable others to do the same.

As part of our goal to achieve net-zero emissions across all of our operations and value chain by 2030, we aim to reduce the majority of our emissions (versus our 2019 baseline) before 2030 and plan to invest in nature-based and technology-based carbon removal solutions to neutralize our remaining emissions. We know this will be a challenging journey and we expect our progress toward this goal to be nonlinear. While our total GHG emissions increased from 2020 to 2021, we're committed to achieving GHG reductions throughout our operations and value chain.

Empowering everyone with technology

To empower everyone with technology, we've committed to help 1 billion people make more sustainable choices by the end of 2022 through our core products. We introduced eco-friendly routing in Google Maps, [new features](#) to book flights or purchase appliances that have lower carbon footprints, and Nest Renew, a program to support clean energy from home. And when people come to Google Search with questions about climate change, we show information from authoritative sources like the United Nations.

Benefiting people and places

To benefit the people and places where we operate, we've set goals to replenish [more water than we consume](#) by 2030 and to support water security in communities where we operate. We're focused on three areas: enhancing our stewardship of water resources across Google offices and data centers; replenishing our water use and improving watershed health and ecosystems in water-stressed communities; and sharing technology and tools that help everyone predict, prevent, and recover from water stress.

At Google, we remain steadfast in our [commitment to sustainability](#), and we'll continue to lead and encourage others to join us in improving the health of our planet. We're proud of what we've achieved so far, and we're energized to help move the world closer to a more sustainable and carbon-free future for all.

Performance highlights

The following section provides a snapshot of our performance as of the end of 2021—demonstrating how we’re strengthening our business by reducing the environmental impact of our operations and working to empower people everywhere to live more sustainably.

For a more complete overview of our performance over time, see the [environmental data table](#).

DESIGNING EFFICIENT DATA CENTERS

Energy

GHG emissions

2x
as energy efficient

On average, a Google data center is twice as energy efficient as a typical enterprise data center.¹

5x
as much computing power

Compared with five years ago, we now deliver around five times as much computing power with the same amount of electrical power.

1.10
average annual PUE

In 2021, the average annual PUE² for our global fleet of data centers was 1.10, compared with the industry average of 1.57³—meaning that Google data centers use about six times less overhead energy.

0
operational GHG emissions after compensations

Whether someone is using Google at home or as part of an organization running Google Cloud or Google Workspace, all products in our Cloud are carbon neutral—meaning that the operational GHG emissions associated with running workloads on our infrastructure have been reduced through procurement of renewable energy and any residual emissions have been compensated for with high-quality carbon credits.⁴

Waste

78%
of waste diverted

In 2021, we diverted 78% of waste from our global data center operations away from landfills.

27%
of components refurbished

In 2021, 27% of components used for server upgrades were refurbished inventory.

4.9million
components resold

In 2021, we resold more than 4.9 million components into the secondary market for reuse by other organizations.

ADVANCING CARBON-FREE ENERGY

Energy

Investment

7_{GW} of renewable energy

From 2010 to 2021, we signed more than 60 agreements totaling more than 7 GW of renewable energy. Over that period, we've committed approximately \$6 billion to purchase clean energy from wind and solar projects globally through 2040.⁵

100% renewable energy

In 2021, we matched 100% of the electricity consumption of our operations with renewable energy purchases for the fifth consecutive year.

73 million MWh of renewable energy

Over the past decade, Google purchased more renewable energy than any other company.⁶ From 2010 to 2021, we purchased a total of more than 73 million MWh of renewable energy through PPAs, via on-site generation, and from the electric grids where our facilities are located.⁷

\$3.3 billion in investment commitments

From 2010 to 2021, we made commitments to invest nearly \$3.3 billion in renewable energy projects with an expected combined capacity of approximately 8.7 GW. These targeted investments go beyond our purchases of renewable energy for our own operational footprint.

GHG emissions

65% cumulative GHG emissions reduction

From 2011 to 2021, our renewable energy purchasing resulted in a cumulative 65% reduction in our Scope 1 and Scope 2 emissions, as compared with a business-as-usual scenario in which we didn't procure renewable energy via PPAs.

81% decrease in carbon intensity

From 2011 to 2021, our carbon intensity per unit of revenue decreased by 81%.

15 years of carbon neutrality

Google has been carbon neutral for our operations since 2007. Because of our purchases of renewable energy and procurement of high-quality carbon credits, we have compensated for all our operational GHG emissions.

CREATING SUSTAINABLE WORKPLACES

Certifications

18 million ft² LEED-certified

From 2009 to 2021, over 1.7 million m² (18 million ft²) of Google office facilities achieved LEED certification.

26% LEED Platinum

26% of our LEED-certified square footage has achieved a Platinum rating and 60% a Gold rating.

64% landfill diversion

In 2021, we reached a 64% landfill diversion rate for waste from our offices globally.

15 acres of native habitat on our Bay Area campuses

From 2014 to 2021, we restored and created 15 acres of native habitat on our Bay Area campuses to support wildlife and our communities.

Commuting

4,000 EV charging ports at our offices

We have nearly 4,000 EV charging ports at our offices in the United States and Canada.

BUILDING BETTER DEVICES AND SERVICES

GHG emissions

100%
of shipments are
carbon neutral

All shipments of Google consumer hardware products to and from direct customers are carbon neutral and have been since 2019.⁸

Energy

86 billion kWh
of energy savings

From 2011 to 2021, Nest thermostats helped customers cumulatively save more than 86 billion kWh of energy—enough to power all of San Francisco's electricity consumption for over 17 years.

21 billion kWh
of energy savings

In 2021 alone, Nest thermostats helped customers save more than 21 billion kWh of energy—more energy than Google used in 2021.

10%–15%
energy savings

On average, Nest thermostats have proven energy savings of 10%–12% for heating and 15% for cooling,⁹ which means they can pay for themselves in under two years.¹⁰

Materials

100%
of Nest and Pixel devices
contain recycled materials

All Nest and Pixel devices launched since 2020 include recycled materials.¹¹

100%
recycled aluminum
in the housing of the
Pixel 6 and Pixel 6 Pro

Pixel 6 and Pixel 6 Pro are designed with recycled aluminum to reduce their carbon footprint. The aluminum in the housing is 100% recycled content.¹²

Waste

100%
of countries with
take-back programs

In 2021, we offered our take-back program in all countries where we ship Google consumer hardware products, allowing customers to responsibly recycle old and unused devices for free—whether made by Google or not.

EMPOWERING USERS WITH TECHNOLOGY

Products

1 billion km
of transit results
on Google Maps

Google Maps provides, on average, more than 1 billion kilometers' (621 million miles') worth of transit results per day, helping to limit carbon emissions by giving people access to mass transit options, bike routes, and traffic information.

200,000
EV charging locations
on Google Maps

By the end of 2021, Google Maps contained nearly 200,000 EV charging locations globally.

42,000
cities and regions
on Environmental
Insights Explorer

By the end of 2021, nearly 42,000 cities and regions worldwide were covered by the Environmental Insights Explorer, a tool that empowers city planners and policymakers with actionable data to help reduce global emissions.

52 petabytes
of freely available
geospatial data

Earth Engine has enabled tens of thousands of active users around the world to easily analyze over 52 petabytes¹³ of freely available geospatial information, resulting in a deeper understanding of the planet.

Programs

€10 million
Google.org Impact
Challenge on Climate

In 2021, 11 organizations across Europe were selected to receive Google.org funding via the Impact Challenge on Climate, which provided €10 million to fund bold ideas that use technology to accelerate Europe's progress toward a greener, more resilient future.

Progress against targets

As a data-driven company, we believe it is critical to regularly track progress toward our commitments and share updates with our stakeholders. The following section provides an overview of our 2021 progress toward our various environmental targets.

For a more complete overview of our performance over time, see the [environmental data table](#).

DESIGNING EFFICIENT DATA CENTERS			
Target	Deadline	2021 progress	Status
Energy			
Maintain or improve average annual fleet-wide PUE across Google data centers year over year.	2021 (Annual)	In 2021, the average annual PUE for our global fleet of data centers was 1.10. Since 2012, our average annual fleet-wide PUE has stayed at or below 1.12, even as demand for our products has dramatically risen.	●
Certifications			
Maintain ISO 50001 energy management system certification for Google-owned data centers that meet certain operational milestones.	2021 (Annual)	In 2021, we maintained our ISO 50001 certification for our operational European data centers. We were the first major internet company to achieve a multi-site energy management system certification to ISO 50001, which we first attained in 2013.	●
Waste			
Achieve Zero Waste to Landfill for our global data center operations.	Not applicable	In 2021, our global landfill diversion rate for data center operations was 78%.	◐
Water			
Replenish 120% of the water we consume, on average, across our offices and data centers, and help restore and improve the quality of water and health of ecosystems in the communities where we operate.	2030	We're working toward this target. By the end of 2021, we had supported 13 water stewardship projects spanning 10 river basins where we operate and/or source water. Examples of these projects include wetland restoration, rainwater harvesting, and land conservation.	◐

● Achieved ◐ In progress ◑ Missed

ADVANCING CARBON-FREE ENERGY

Target	Deadline	2021 progress	Status
Energy			
Match 100% of the electricity consumption of our operations with renewable energy purchases.	2021 (Annual)	In 2021, we purchased enough renewable energy, from sources such as wind and solar, to match 100% of the electricity consumption of our data centers and offices. We were the first company of our size to reach this milestone back in 2017, and we've achieved it for five consecutive years. ¹⁴	●
Operate on carbon-free energy 24/7 by 2030.	2030	In 2021, on an hourly basis, 66% of our data center electricity use was matched with regional carbon-free sources. ¹⁵	◐
Enable 5 GW of new carbon-free energy through investments in our key manufacturing regions by 2030.	2030	We're working toward this target.	◐
GHG emissions			
Achieve net-zero emissions across all of our operations and value chain, including our consumer hardware products, by 2030.	2030	We're working toward this target. We aim to reduce the majority of our emissions (versus our 2019 baseline) before 2030 and plan to invest in nature-based and technology-based carbon removal solutions to neutralize our remaining emissions.	◐
Maintain carbon neutrality for our operations.	2021 (Annual)	In 2021, we purchased enough renewable energy and high-quality carbon credits to compensate for all our operational GHG emissions. Google has been carbon neutral for our operations since 2007—for 15 consecutive years. ¹⁶	●

CREATING SUSTAINABLE WORKPLACES

Target	Deadline	2021 progress	Status
Commuting			
Reduce single-occupancy vehicle commuting at our Bay Area headquarters ¹⁷ to 45% of workers commuting on any given day.	Not applicable	We're working toward this target.	◐
Provide EV charging stations for 10% of total parking spaces at our Bay Area headquarters.	Not applicable	Of the total parking spaces at our Bay Area headquarters, more than 7% were designated EV parking spaces with charging stations in 2021.	◐
Certifications			
Pursue the ILFI Living Building Challenge Certification for our Charleston East and Bay View campuses—two of Google's first ground-up development projects at our Bay Area headquarters.	2023	At our Charleston East campus, we're working to achieve the Living Building Challenge Materials Petal (which includes Red List Free materials and net-zero waste), and at our Bay View campus, we're working to achieve the Living Building Challenge Water Petal (which includes net-positive water use).	◐
Food waste			
Reduce food waste per Googler by 50% by 2025.	2025	This target was set in 2022.	◐
Send zero food waste to the landfill by 2025.	2025	This target was set in 2022.	◐

● Achieved ◐ In progress ◑ Missed

BUILDING BETTER DEVICES AND SERVICES

Target	Deadline	2021 progress ¹⁸	Status
GHG emissions			
Publish product environmental reports for 100% of new flagship consumer hardware products. ¹⁹	2021 (Annual)	We published product environmental reports for each of our flagship Nest and Pixel products that launched in 2021.	●
Materials			
Use recycled or renewable material in at least 50% of plastic used across our consumer hardware product portfolio by 2025. ²⁰	2025	In 2021, we used recycled content across numerous plastic parts in Nest and Pixel products. ²¹	◐
Eliminate plastic from packaging and make packaging 100% recyclable by 2025.	2025	In 2021, we designed Nest and Pixel packaging to minimize the use of plastic. The retail packaging for the Pixel 6, Pixel 6 Pro, and Pixel 5a (5G) use 98% paper- and fiber-based materials.	◐
Include recycled materials in 100% of Google consumer hardware products launching in 2022 and every year after.	2022	We met this target early. All Nest and Pixel devices launched since 2020 include recycled materials. ²²	●
Waste			
Achieve UL 2799 Zero Waste to Landfill certification at all final assembly consumer hardware manufacturing sites by 2022.	2022	In 2021, we achieved certification to the UL 2799 Zero Waste to Landfill certification standard for several final assembly manufacturing sites.	◐

EMPOWERING USERS WITH TECHNOLOGY

Target	Deadline	2021 progress	Status
Tools			
Help more than 500 cities and local governments globally reduce an aggregate of 1 gigaton of carbon emissions annually by 2030.	2030	In 2021, over 40 cities used the Environmental Insights Explorer tool in their climate action planning or for monitoring city climate targets.	◐
Products			
Help 1 billion people make more sustainable choices through our core products by 2022.	2022	We're working toward this target. In 2021, we shared several new ways people can use Google products—such as Google Flights, Google Maps, Google Search, and Google Shopping—to make more sustainable choices.	◐

● Achieved ◐ In progress ◑ Missed