Google

Realizing a carbon-free future
Google's Third Decade of Climate Action

SEPTEMBER 2020

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The Decisive Decade

For Google, sustainability has been a core value since our founding in 1998.

By the end of our first decade, in 2007, we were the first major company to be carbon neutral in our operations. At the end of our second decade, we became the largest corporate purchaser of renewable energy in the world and the first major company to match 100% of our operations' annual electricity consumption with renewable energy for three years in a row.

Our third decade of climate action will be our most ambitious yet.

We are committed to operating on carbon-free energy and aim to get there by 2030.

We are working toward sourcing 24/7 carbon-free energy for all of our data centers and campuses around the world. This means that we will evolve from *matching* our annual energy consumption with renewable energy to sourcing *round-the-clock* carbon-free energy. By 2030 we aim to run our business on carbon-free energy everywhere, at all times.

This is our biggest sustainability moonshot yet, with enormous practical and technical complexity. We are the first major company to make a commitment to source 24/7 carbon-free energy for our operations, and we aim to be the first to achieve it.

We know that no company, no matter how ambitious, can solve a challenge like climate change alone. That's why we are committed to action far beyond our own operations, by creating tools and investing in technologies to **help build a carbon-free future, for everyone.**

This may seem like a bold vision for a company to set. But, as Larry and Sergey wrote in our very first founders' letter, "Google is not a conventional company. We do not intend to become one."

Today, it's more important than ever to go beyond business as usual. The United Nations Framework Convention on Climate Change (UNFCCC)'s 2015 Paris Agreement states that humanity must "keep global temperature rise this century well below 2°C above pre-industrial levels." Google remains unwavering in our commitment to the Paris Agreement, because climate scientists are clear: we have until 2030 to chart a sustainable course for our planet, or face the worst consequences of climate change.

Meeting this challenge will require rapid decarbonization across society in only 10 years, from individuals, businesses, cities, and nations.

At Google, we have always viewed a challenge as an opportunity to be helpful and to make things better for everyone. Climate change is no different.

Across the world, nine of Google's core products have more than one billion monthly active users each. Millions of partners use our cloud technology and other Google services. We are humbled by this unique opportunity to enable universal action and offer individuals and organizations the information and solutions they need to create a sustainable future.

Building Together

As we launch this strategy, the communities that Google serves across the world are working to combat and recover from a global pandemic.

How we reduce carbon emissions must support that recovery. The development of carbon-free economies can boost economic growth, create jobs, reduce energy costs, and improve human health and welfare. This has been proven true over the last decades and has never been needed more than now.

We know that environmental impacts do not affect all equally. Communities already facing other socio-economic injustices and poor infrastructure disproportionately bear the brunt of severe

air pollution and extreme weather damage. Carbon-free solutions must be available to everyone, communities should be meaningfully engaged, and the benefits of decarbonization should be shared.

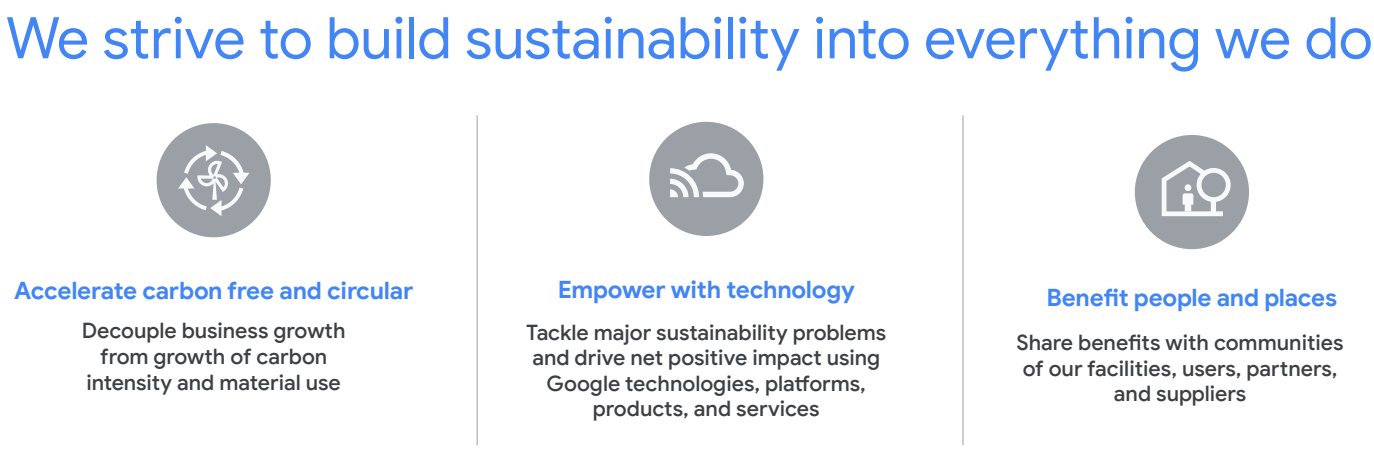
The world is at a crossroads, and at Google, we choose to accelerate action and progress toward a carbon-free world, for everyone.

Activating our Ambition

Google's mission is to organize the world's information and make it universally accessible and useful. Our five-year Sustainability Strategy (Figure 1) already identifies 'empowering with technology' as one of our three strategic priorities.

FIG. 1

Five-year sustainability strategy overview



Our pathway to carbon free by 2030 starts with our own operations. We will steadily advance toward our goal, while maintaining our current operational carbon neutrality commitment. We will test and iterate new technologies and sustainable tools at Google, then offer

them to our partners in businesses, communities, and governments. There are also tools and information we can provide to our users, and our goal is to find new ways our products can help people make more sustainable choices.

We are targeting our efforts where Google's technology, knowledge, and influence can make the greatest impact, building on the learnings and achievements from our first two decades of climate action.

Our new commitments:

Leading at Google	Supporting Partners	Enabling Everyone
1. Operate on carbon-free energy 24/7 by 2030. **2.** Immediately eliminate all our legacy carbon emissions. **3.** Deploy $5.75 billion in sustainability bonds. **4.** Enable 5 GW of new carbon-free energy in manufacturing regions by 2030.	**5.** Help over 500 cities or local governments to reduce 1 gigaton of carbon emissions annually by 2030 and beyond. **6.** Remove carbon from the atmosphere with science-based tree planting and support the global restoration movement. **7.** Support nonprofits and social enterprises by launching a €10 million Google.org Impact Challenge on Climate. **8.** Scale up Artificial Intelligence and Machine Learning efficiency solutions for buildings, data centers, and facilities.	**9.** Offer 1 billion people new ways to live more sustainably by 2022 via our core products.

Carbon emission equivalencies have been calculated using the EPA Greenhouse Gas Equivalencies Calculator.

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Leading at Google

When it comes to sustainability at Google, we aim to lead by example, which is why we've always started with how we operate our business. This is both our responsibility and also the best way to innovate, create value, iterate solutions, and then share our practices with others.

Where We've Been

- **Carbon neutral since 2007**

  In our first decade, we became the first major carbon neutral company. Since 2007, everyone using our products has been able to do so safe in the knowledge that our data centers have caused net zero carbon emissions for our planet. For 13 years, we have not wavered in that commitment, and we're proud to have maintained carbon neutral operations. Our approach focused on three key levers: driving energy efficiency, procuring renewable energy, and purchasing high-quality carbon offsets for all the emissions that we can't yet eliminate, like employee travel and commuting.

- **100% renewable energy since 2017**

  We are the largest corporate purchaser of renewable energy in the world, and the only company of our size to match 100% of our annual operational electricity consumption with renewable energy for three consecutive years (2017—2019) (Figure 2).

- **Cleanest, most energy-efficient hyperscale cloud services in the industry**

  Because of our continued energy efficiency efforts, a Google data center is, on average, twice as energy efficient as a typical enterprise data center. Compared to five years ago, we now deliver around seven times as much computing power with the same amount of electrical power. This, paired with matching

100% of our electricity with renewable energy since 2017 and our carbon neutral commitment, makes our hyperscale cloud the cleanest in the industry.

- **Leading on sustainable workplaces**

  We have 13 million square feet of LEED-certified office spaces. We're also working to mitigate carbon emissions related to business travel and commuting, and promoting the use of electric vehicles and bicycles. In 2018, by using Google shuttles in the San Francisco Bay Area, we saved 40,000+ metric tons of carbon dioxide emissions—equivalent to taking 8,760 cars off the road every work day.

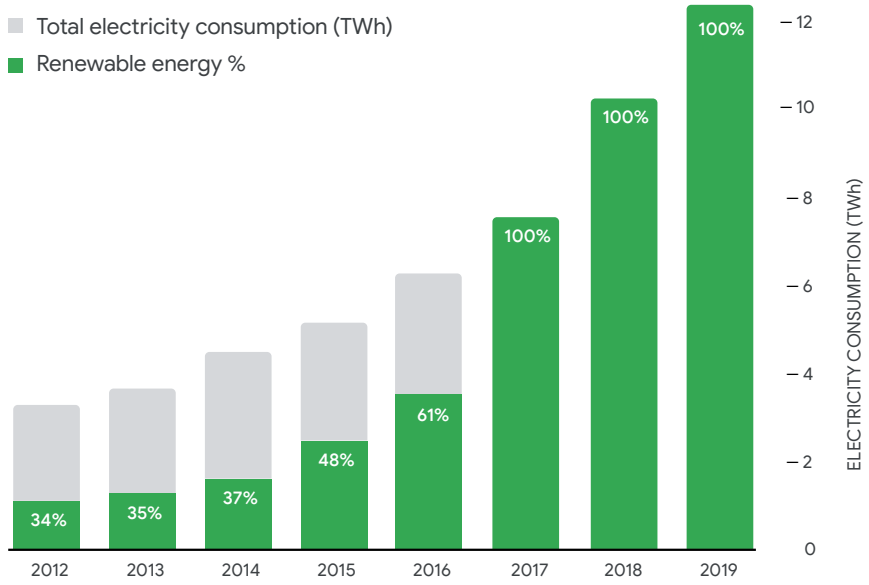
- **Investing in renewable energy around the world**

  Since 2010, Google has made commitments to invest nearly $2.7 billion in renewable energy projects with an expected total combined capacity of approximately 4.6 GW.

  Most recently, our investments have focused on working toward a world where everyone has access to renewable energy, including our suppliers and their communities. We are committed to investing $150 million in our key manufacturing regions. This investment commitment, with our partners, aims to catalyze roughly $1.5 billion of new capital into renewable energy. With these investments, we expect to help generate renewable energy that's equivalent to the amount of electricity used to manufacture all of our Google consumer hardware products.

FIG. 2

Renewable energy purchasing compared with total electricity use (2012—2019)



Where We're Going

We're proud of our achievements over the last two decades, and these successes spur our most ambitious decade yet: to decarbonize energy grids, neutralize our legacy carbon, and advance new solutions for our own operations, our partners, and wider society.

Our new commitments:

1. Operate on carbon-free energy 24/7 by 2030.	**2.** Immediately eliminate all our legacy carbon emissions.	**3.** Deploy $5.75 billion in sustainability bonds.	**4.** Enable 5 GW of new carbon-free energy in manufacturing regions by 2030.

Google

1. **Operate on carbon-free energy 24/7 by 2030**

   Addressing climate change requires fully decarbonizing every electric grid on the planet, as soon as possible. We aim to be at the forefront of this change, and that's why we set a first-of-its-kind target to achieve 24/7 carbon-free energy by 2030.

   Sourcing round-the-clock clean energy is a far more ambitious and challenging goal than the traditional approach of matching electricity use annually with renewable energy purchases. Every Google data center and campus is connected to a regional power grid, just like any other electricity consumer is, and the power mix in every region where we operate currently includes both carbon-free (e.g. wind, solar, or nuclear) and carbon-based (e.g. coal, gas, or oil) resources. Since 2017, we've achieved 100% RE by purchasing enough renewable energy to match our entire worldwide electricity use each year. However, some of the electricity we use in certain places, at certain times, still results in carbon emissions because, put simply, the wind doesn't always blow and the sun doesn't always shine. That's why 100% RE matching was just the beginning; an important step on a longer journey to an even more ambitious end goal.

   With 24/7 carbon-free energy, we're going far beyond offsetting carbon or matching our global electricity consumption with renewable energy; we're working to decarbonize our electricity supply *entirely.* This is the next (and final) step in the decarbonization of our direct electricity use. We know how complex and challenging it will be to achieve this goal, and it will require different strategies in different regions. In general, across the globe, we'll need to take on one of the toughest questions in energy today: how can we bridge the gap between intermittent renewable technologies like wind and solar power and the 24/7 energy demands of the digital economy? By 2030, we will solve this problem for our operations—every hour of every day.

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Our 24/7 Carbon-Free Energy priorities:

Decarbonize our operations

Every year, Google answers trillions of search queries. Every minute, people upload over 500 hours of YouTube videos. Our mission to organize the world's information demands significant processing power—which requires energy. **Our mission won't change, but the way we deliver on it must.**

Build the carbon-free energy economy

Driving more carbon-free energy will create thousands of jobs and positively impact the economy in regions where Google operates. **By driving scale and helping to bring down technology costs, we can make clean energy more affordable for more people.**

Focus on local procurement and hourly matching

We strive to source clean energy in every grid where we operate and optimize our consumption to achieve 24/7 carbon-free energy. **The pace of progress and the technologies needed to achieve 24/7 carbon-free energy may look different from one region to another.**

Leverage Google technology

We will continue to develop and commercialize new software, such as Machine Learning tools and carbon-intelligent computing, that can help better match real-time carbon-free energy supply with energy demand. **New approaches can accelerate innovation in energy technologies and systems.**

Diversify our energy portfolio

We are integrating new technologies, such as battery storage, into our portfolio. We will also work to accelerate the deployment of next generation clean energy technologies. **A diverse portfolio of carbon-free technologies is key to meeting our target.**

Advocate for policy changes to decarbonize electricity grids

We cannot achieve 24/7 carbon-free energy alone. We are working with industry partners, utilities, and policymakers to accelerate the transition to decarbonized electricity grids. **Ultimately, we envision a future in which everyone, everywhere, has access to affordable 24/7 carbon-free energy.**

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2. **Immediately eliminate all of our legacy carbon emissions**

   In 2007, we committed to carbon neutrality. We've met that commitment every year since by procuring high-quality carbon offsets.

   However, Google began operating in 1998, nine years before we first became carbon neutral. For those early years, we were a much smaller company, but we often reflect back on how formative this time was for our future. That history deserves to be included in our ambition to be the world's first carbon-free company.

   Therefore, as of September 14, 2020, we have neutralized our entire legacy carbon footprint since our founding.

   For this additional neutrality, we procured high-quality carbon offsets and applied the same methodology used over the last 13 years.

   Google is now the first major company to be carbon neutral for its entire operating history.

3. **Deploy $5.75 billion in sustainability bonds**

   In August 2020, we issued $5.75 billion in sustainability bonds, the largest green bond or sustainability bond by any company in history.

   Our sustainability bonds will support investment in both environmental and social initiatives including energy efficiency, clean energy, green buildings, clean transportation, circular economy and design, affordable housing, commitment to racial equity, and support for small businesses and COVID-19 response.

   We believe that these investments benefit our communities, employees, and stakeholders, and are an important part of fulfilling our mission and goal of creating value over the long term.

   Sustainability bonds are an emerging asset class and we hope our transaction will help accelerate this new market. We're encouraged that investor demand for our bonds was so strong that they were significantly oversubscribed.

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4. **Enable 5 GW of new carbon-free energy in manufacturing regions by 2030**

   Google works directly with more than 2,000 suppliers in more than 70 countries. The electricity grids in many of the countries where our suppliers operate lack sufficient carbon-free energy capacity to support rapidly growing demand and may even face energy shortages affecting not just manufacturing, but also the communities and livelihoods of the people in these regions.

   Our long-term vision is that all of our suppliers, direct and indirect, and their communities have access to reliable, cost-effective carbon-free energy; but we can only get there through significant global investment in new wind, solar, and other clean energy capacity as well as more robust grid systems.

   That's why Google has committed to invest in and deploy 5 GW of new clean energy across our key supply chain regions (this includes our previous commitments of renewable energy in our key manufacturing regions). This will result in global emissions avoidance equivalent to taking more than one million cars off the road each year.

   Investment is a scalable approach to drive system-level change, grid decarbonization, and enable greater access to carbon-free energy. This is especially impactful in markets where credible carbon-free energy procurement mechanisms do not exist and there is a shortage of available capital. Our 5 GW commitment is expected to result in more than $5 billion of investment in new wind, solar, and other clean energy and enabling technologies, driving sustainability benefits for everyone.

   Of course, bringing new carbon-free energy online is only one piece of the puzzle. We're committed to directly reducing our own footprint by supporting our suppliers' transition to carbon-free energy for their operations and adopting energy efficiency measures drawing on Google's expertise in the areas

of predictive analytics and Machine Learning, including helping them schedule energy-intensive activities and drive further energy efficiency across their operations. We expect that all these efforts will result in a significant reduction of our suppliers' greenhouse gas emissions.

Focus on: Data Centers

With the ongoing digitization of systems, computing capacity in data centers around the world has increased five times between 2010 and 2018. The good news is that energy use for this computing is staying nearly flat.

Some speculated that data centers might match the carbon emissions of automobiles. This hasn't been the case. Although computing output from data centers has increased exponentially by over 500%, the amount of energy used by data centers only increased by 6% over the same period, between 2010 and 2018. This is due to rapidly falling energy intensity (kilowatt-hours per gigabyte [kWh/GB]) of cloud computing and networks, which has halved every two years since 2000 and almost outpaced the growth in usage. So, while data centers consumed about 1% of global electricity use in 2010, eight years later that percentage remains nearly unchanged.

At Google we have always worked to build the world's most energy-efficient computing network by squeezing more out of every watt of power we consume. For example, we utilize Machine Learning developed in collaboration with DeepMind to analyze and control our data center cooling systems. Machine Learning is excellent at identifying and optimizing for energy savings across millions of data points from thousands of sensors.

Today, on average, a Google data center is twice as energy efficient as a typical enterprise data center, delivering seven times the computing power per watt than it did five years ago. Our power usage effectiveness (PUE) has stayed at or below 1.12 since 2013, compared to the 2019 industry average of 1.67 PUE.

This makes our data centers some of the most high-performing, secure, reliable, and efficient in the world.

To help improve the energy efficiency of our industry and beyond, we now offer the same Machine Learning efficiency technology to our partners to enable them to uncover savings in data centers and other energy-intensive buildings.

PUE is a standard industry ratio that compares the amount of noncomputing overhead energy (used for things like cooling and power distribution) to the amount of energy used to power IT equipment. A PUE of 2.0 means that for every watt of IT power, an additional watt is consumed to cool and distribute power to the IT equipment. A PUE closer to 1.0 means nearly all the energy is used for computing.

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Supporting Partners

Our carbon-free ambitions reach far beyond Google's own operations. Business and policy makers across the world play a deciding role in climate action. That's why, for more than a decade, we have offered solutions to support our partners' carbon goals and initiatives.

Where We've Been

- **Enabling carbon-free cities**

  Over 70% of global carbon emissions come from cities, which is why mayors across the world have pledged climate action and better air quality for their citizens.

How we have enabled climate action by cities:

Our Environmental Insights Explorer (EIE), created in collaboration with the Global Covenant of Mayors for Climate and Energy (GCoM), is an online and freely accessible tool based on proprietary Google data that has enabled over 100 cities to measure emissions, set reduction goals, and take informed action. EIE helps reduce the time and money spent on conducting emission measurement so that cities can accelerate climate action planning. Today, we're seeing several local governments like Kyoto, Japan; Houston and Dallas, Texas; and Orange County, Florida in the US use EIE, to support bold climate action plans and renewable energy targets.	To further accelerate climate action, last year, we committed $4 million in Google.org funding to create the ICLEI Action Fund to help nonprofits and civil society use data to drive climate action. Organizations across Europe, Mexico, and South America submitted proposals. Grantees include the Centre for Sustainable Energy in Birmingham which will establish an open-source, citywide energy dataset, along with tools to model decarbonization options for buildings in the city and other interventions. In Hamburg, HafenCity University will incorporate data from the Environmental Insights Explorer and other sources into a tool to help the City of Hamburg identify spaces and districts that can be used as urban testbeds for prototyping energy innovations.	Google has mapped air quality at street level in cities for over seven years, using specially equipped Street View cars in cities like Oakland, Copenhagen, and London. By providing cities with this information, we're helping make the invisible visible and accelerating critical efforts to transition to healthier, more sustainable urban environments.

- **Improving data for forests**

  First prototyped in 2009, Google Earth Engine is a platform that has transformed the practice of forest monitoring, enabling conservationists to raise awareness of deforestation with accurate and timely alerts. By offering free support to tropical nations and partnering with Global Forest Watch, Earth Engine has revealed previously unknown deforestation hotspots in near real time. This work provides insights to international climate convening, supports affected communities, and helps corporations measure up to their sustainability promises.

- **Reduced environmental impact through cloud**

  Google Cloud provides organizations with infrastructure, platform capabilities, and industry-specific solutions to run their business. As the pace of digital transformation has accelerated, organizations are migrating infrastructure and applications to the cloud to achieve cost efficiencies, improve performance, and reduce environmental impact. As a result of our long-standing commitments to sustainability, our Google Cloud customers benefit from zero operational carbon footprint associated with running their workloads on our infrastructure. For customers like Etsy, Spotify, and PayPal, migrating to Google Cloud helps accelerate progress toward their own sustainability targets.

  For organizations working to improve the environmental impact of their operations, Google Cloud technologies can help them innovate. For instance, Carrefour created a new solution with BigQuery to analyze product demand at grocers and optimize supply to reduce food waste. At the Zoological Society of London, which monitors biodiversity in over 50 countries across the globe, teams are using Cloud AutoML to analyze camera trap images and make faster decisions on conservation efforts. Gringgo Trash Tech, a start-up tackling urban waste and ocean plastic in Asia, built their mobile application using Google Cloud to help collectors identify and value trash for pickup. These are just a few examples of the many organizations leveraging Google Cloud technology to do more for the planet.

Where We're Going

Google organizes information to help optimize systems and processes, measure progress, and bring clarity and accountability through transparency. These abilities are particularly powerful in solving four key aspects of a carbon-free future:

- Shifting complex infrastructure systems within cities to be carbon free.
- Optimizing nature's proven capacity to act as a carbon sink.
- Accelerating technology-driven climate innovation, especially at universities and nonprofits.
- Radically accelerating efficiency-driven emission reductions in buildings.

Our new commitments:

5. Help over 500 cities or local governments to reduce 1 gigaton of carbon emissions annually by 2030 and beyond.	**6.** Remove carbon from the atmosphere with science-based tree planting and support the global restoration movement.	**7.** Support nonprofits and social enterprises by launching a €10 million Google.org Impact Challenge on Climate.	**8.** Scale up Artificial Intelligence and Machine Learning efficiency solutions for buildings, data centers, and facilities.

5. Help over 500 cities or local governments to reduce 1 gigaton of carbon emissions annually by 2030 and beyond

City leaders and mayors across the world are setting ambitious renewable energy targets and are charting a course to green recovery. As part of our next decade of action, Google will help over 500 cities/local governments reduce 1 gigaton (Gt) of

carbon emissions annually by 2030 and beyond—equivalent to the annual carbon emissions of a country the size of Japan (home to 126 million people).

We will expand our city data coverage globally and provide robust and trustworthy information to both help measure citywide emissions and map pathways to a carbon-free future.

Accelerating emissions reductions by 2030 will require cities to make ambitious climate action plans and set bold renewable energy targets. It also demands shifting technical and financial resources from planning to implementation. At Google, we commit to supporting cities around the world as they make these bold changes.

Our next steps in partnering with cities:

Empower city partners with insights

To kick off our next decade of climate action, we're launching data for over 3,000 local governments (including over a thousand EMEA localities) within the Environmental Insights Explorer (EIE). We will enable more cities to measure and mitigate building and transport emissions, create renewable energy programs and policies, and enable green jobs. We're also going to establish new global partnerships with GCoM, ICLEI, and Ironbark Sustainability to integrate EIE data into existing leading climate tools to reduce the time and costs for cities to create their climate action plans. We are committed to scaling these insights and extending partnerships over the next decade.

Support local government climate action planning and implementation

We aim for our data to spur renewable energy deployment, help cities set solar goals, implement programs and incentives, and spur workforce development. According to our solar potential mapping analysis, hundreds of cities have the capacity potential to become the world's leading 'gigawatt cities'. Realizing even a portion of this potential would chart the course for a low-carbon economy leading to jobs and opportunities in the solar industry.

Google data will also catalyze a carbon-free transport future by helping cities accelerate pathways to reduce vehicle miles traveled. Cities can use data to optimize 'mode-shifting' toward low- or no-carbon alternatives such as bikes, encourage electric vehicle adoption, and plan infrastructure for the future.

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6. **Remove carbon from the atmosphere with science-based tree planting and support the global restoration movement**

   Protecting existing natural ecosystems, such as forests, is one of the most cost-effective and reliable ways to sequester carbon. However, we also need to restore degraded ecosystems and forests. Simply planting a tree is not the end goal. Species and site selection, planting configurations, land management, and long-term monitoring all need to be properly designed and managed for trees to reach maturity, restore ecosystems, and permanently store carbon. That's why we are launching a science-based reforestation program, starting with planting on degraded lands in California, Texas, Spain, and Australia.

   And, as we invest in our own data-driven tree-planting projects, we also commit to helping others do the same. As a first step, Google is supporting the Crowther Lab at ETH Zurich to develop a global restoration platform in collaboration with a wide network of environmental organizations and scientists.

   The global restoration movement must no longer be limited by access and accuracy in ecological data. Our investments will work with the latest ecological models, and the outcomes will be fed back into open data models. This will allow others to benefit from this knowledge and will further improve accuracy over time.

   To further support this work, we pledge $1 million in funding from Google.org to develop tools that will help increase the likelihood of success for ecosystem restoration projects around the world.

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Focus on: Green jobs

Reaching a carbon-free future for humanity will require a great deal of work: building new infrastructure, increasing energy efficiency, restoring nature, and inventing new solutions for billions of people.

These jobs are needed more than ever as economies around the world combat and recover from the COVID-19 pandemic. We are committed to help make these employment opportunities a reality. As the Mayor of Houston, Sylvester Turner, says: "*The City of Houston partnered with Google using Environment Insights Explorer and estimated Houston's solar potential to be 5 million MWh from local rooftop and community solar projects per year by 2050. This gives us the potential to create more than a thousand jobs and help us reach our goal of making Houston carbon neutral by 2050 and a leader in the global energy transition. Besides cost savings, a key benefit of the Houston Climate Action Plan is workforce development, which is much needed as we enable economic recovery during the pandemic.*"

Many aspects of our carbon-free plan will directly and indirectly enable new jobs, for example:

- We estimate that our commitment to 24/7 carbon-free energy and our investment in our key manufacturing regions will directly generate over 20,000 new jobs in clean energy construction and operations globally by 2025.
- We are partnering with SolarPower Europe to offer introductory courses through Grow with Google in Europe.
- In our work on Environmental Insights Explorer, we will continue to partner with local governments setting ambitious renewable energy programs designed to spur local workforce development.
- Our reforestation program will create job diversity in rural areas with roles for nursery workers, drone mappers, ecologists, foresters, agriculture workers, planting crews, negotiators, and program managers.

In addition to job creation from Google's own commitments and investments, we will seek to support job creation through our programs and partners.

7. **Support nonprofits and social enterprises by launching a €10 million Google.org Impact Challenge on Climate**

   Nonprofits, civil society organizations, and universities will play a critical role in mitigating the impacts of climate change and improving communities' resilience to its effects.

   As countries across Europe continue to respond to the economic and health impacts of COVID-19, there is a clear opportunity for a green recovery. To support these efforts, we will launch a Google.org Impact Challenge on Climate, with an open call for grant applications. We commit €10 million to fund bold ideas that aim to use technology to accelerate Europe's progress toward a

greener, more resilient future. Selected organizations may receive up to €2 million in funding and customized support from the Google for Startups Accelerator to help bring their ideas to life.

We are seeking ideas that address increased access to or use of renewable energy, decarbonization of transportation, improvements to air quality, natural resource planning and protection, and circular economy and design.

We will prioritize the projects which clearly articulate the potential additional benefits of their positive impact on climate change, such as job creation and retention, improved health outcomes, and environmental justice.

Focus on: Policy for a Carbon-Free Future

Climate change is one of the most urgent and critical collective challenges facing the world today. The COVID-19 pandemic has taught us how important robust collective action is to address a global threat. As the world looks to rebuild for the future, we know that strong public policy action is critical to creating prosperous, equitable, and resilient carbon-free economies around the world.

At Google, we support public policies that:

- Strengthen global climate action efforts through the Paris Agreement, G20, and other multilateral fora to enhance international cooperation on climate.
- Establish emissions reduction targets and technology-neutral pathways to achieve a carbon-free economy in line with the Intergovernmental Panel on Climate Change (IPCC) guidance and scientific consensus.
- Use competitive, interconnected energy markets to empower consumers and speed up the transition to a clean economy.
- Accelerate the development and deployment of next generation low-carbon technology, including harnessing digital technologies like Artificial Intelligence and Machine Learning.
- Ensure that the clean energy economy provides economic growth for all, spurs a new generation of green jobs, benefits the communities most impacted by a changing climate, and leaves no one behind in the transition.

Europe specifically has long been a leader in championing forward-thinking clean energy and climate policies that create economic opportunity while reducing emissions. Europe's commitment to clean growth has never been stronger, with the European economic recovery focused squarely on digital and green transformations. Enshrined in the European Green Deal, we applaud Europe's leadership and ambition to create the world's first carbon-neutral continent.

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8. **Scale up Artificial Intelligence and Machine Learning efficiency solutions for buildings, data centers, and facilities**

   Machine Learning reduced the energy used for cooling of Google data centers by 30%. Now, Google Cloud and DeepMind have developed an Industrial Adaptive Controls platform to deliver Machine Learning-enabled energy savings on a global scale, by autonomously controlling Heating, Ventilation, and Air Conditioning (HVAC) systems in commercial buildings, data centers, and industrial facilities.

   We will make these solutions available to the largest industrial enterprises and Building Management software providers. These software providers collectively make up nearly 60% of the global large commercial building footprint and each of these enterprises manages tens to hundreds of thousands of commercial buildings. By helping to optimize their HVAC operations through Artificial Intelligence, we can improve their own efforts to reduce their energy and carbon impact.

Focus on: Environmental and Social Impact

Over the past decades, too many people have struggled to access the benefits of environmental improvements. The burdens of air pollution and other negative environmental impacts are also disproportionately placed on underserved communities and there is growing evidence that catastrophic weather events hit the poorest people the hardest.

At Google, we will strive to ensure that our carbon strategy will always consider the impact on those who need the social and economic benefits of a carbon-free future the most.

Our work to date has included:

- Equipping over 50 of our Street View vehicles with air pollution sensors in order to measure street-by-street air quality. As we extend this project, we will offer transparency to the communities most affected and offer solutions to cities to reduce the burden of air pollution on already underserved communities.
- Utilizing AI to develop flood forecasting models in India (where 20% of extreme flood-related fatalities occur). This data has been incorporated into Google Public Alerts. In 2017, we activated SOS Alerts in more than 200 crisis situations, in addition to tens of thousands of Google Public Alerts, which have been viewed more than 1.5 billion times.
- In the United States, some families spend between 20% and 50% of their income on home energy bills. The Power Project provides energy savings to those families struggling with high energy costs and has reached 2,100 communities to raise awareness of the gap in access to affordable home energy.

We believe that Google has a key role to play in enabling partners to use our technology to improve everyone's lives. We will continue to listen to the insights and needs of people across the world in order to enable a carbon-free future, for everyone.

Google

Enabling Everyone

Our core products of Android, Chrome, Gmail, Google Drive, Google Maps, Google Play, Search, Photos, and YouTube each have over one billion monthly active users.

This gives us a unique opportunity to support everyone to live in more sustainable ways. Today, millions of people are already doing so, from creating and viewing how-to videos on YouTube that make it easy to repair and reuse instead of throwing away, to using Google Maps to get around with bike shares and public transit.

We will continue to improve our products to enable everyone to connect with the right tools, information, and guidance to live more sustainably.

Where We've Been

- **Nest thermostats enable energy savings**

  Nest thermostat owners have saved over 50 billion kWh of energy—that's enough energy to light up the planet for five days and amounts to $3 billion in energy bill savings. On average the Nest thermostat saves 10% to 12% on heating and 15% on cooling in American homes. Based on typical energy costs, we've estimated average savings of $131 to $145 a year per household.

- **Alternative low-carbon transit routes through Google Maps**

  Google Maps provides more than one billion kilometers (621 million miles) of alternative, low-carbon transit options each day. Additionally, electric vehicle charging stations are integrated directly into Google Maps globally, as well as bike sharing locations and availability in cities around the world.

- **Estimate home solar potential with Project Sunroof**

  Project Sunroof drives consumer awareness of the benefits of home solar. The service also makes it easy for interested homeowners to connect with solar providers in their area.

Since 2015, Project Sunroof has mapped more than 107 million rooftops in 21,500 cities around the world for their potential to save money and cut carbon.

- **Sustainability content on YouTube**

  YouTube has become a central platform for sustainability content spanning topics, countries, and languages. For example, videos with "sustainable fashion", "sustainable clothing", or "sustainable haul", in the title were viewed over 25 million times in 2019 alone. People are using the platform to take action: in 2019, #TeamTrees raised over 20 million dollars in a matter of months to meet its goal of planting 20 million trees.

Where We're Going

As we enter our third and most ambitious decade of climate action, we will build new, uniquely helpful ways to support our users in living more sustainably and join in the transition to a carbon-free world.

Our users are expressing a growing desire for more sustainable products and a growing appetite for information about how to live more sustainably. Google Trends analysis shows that shopping-related web searches including the term "sustainable" have risen tenfold globally over the past five years as a share of search traffic, while interest in electric cars has tripled in the same period. We believe our core mission of organizing the world's information has a key role to play in connecting people with sustainable choices for products and services.

For example, 2019 consumer research suggests that over half of global travelers are willing to pay more for products that demonstrate environmental responsibility, an increase from 40% in 2018. To support this demand, we now offer carbon emissions data, and the capability to sort flights by least carbon-intensive option in Google Flights in select European countries. This is powered by an emissions model that incorporates not only the route flown but also the aircraft model and seating configuration.

Google

Our aspiration is to help reduce the friction between good intentions and taking action, whether it's when deciding what to buy, how to travel, or even how to power homes.

Our new commitment:

9. Offer 1 billion people new ways to live more sustainably by 2022 via our core products.

Principles for our new and enhanced products and services:

Build features that connect individuals with information and sustainable options that will help them make informed choices and take environmental action in the aspects of their life that make the most sense for them.	Offer new functionality to highlight sustainable choices that are beneficial to everyone, in particular those that help all of us shift to a circular economy and enjoy the benefits of carbon-free energy.	Ensure that equity of access, user safety, and environmental justice are incorporated into new developments so that the carbon-free future truly is for everyone.

We will strive to measure and share the positive environmental impact facilitated by our core products, with the aim of inspiring further change and momentum toward collective action.

At Google, we're excited to work with our users to enable sustainable choices for a carbon-free world.

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A Carbon-Free Future for Everyone

Google's efforts to date have proven that partnerships, the power of digital technology, and human inventiveness can accelerate progress toward the carbon-free future that the planet needs.

We believe that changing the course on climate will take everyone. With a collective determination to act, this can be the decisive decade for climate action.

The next 10 years will provide the springboard for further progress, and a carbon-free future for everyone.