



# Google and AES innovate the next frontier in clean energy with first-of-its-kind 24/7 carbon-free energy solution

In September 2020, Google announced its world-leading goal to operate on 100% carbon-free energy at all times by 2030. However, Google set this goal knowing that a 24/7 carbon-free energy solution, where every hour of every day is generated from carbon-free sources, didn't yet exist. AES and Google partnered together to develop a first-of-its-kind 24/7 carbon-free energy solution, and AES committed to supply Google's Virginia data center campus with time-matched carbon-free energy for at least 90% of all hours. In the process, AES and Google advanced the leadership standard in corporate sustainability and created a roadmap for other organizations to 24/7 carbon-free energy.

## Google's world-leading goal

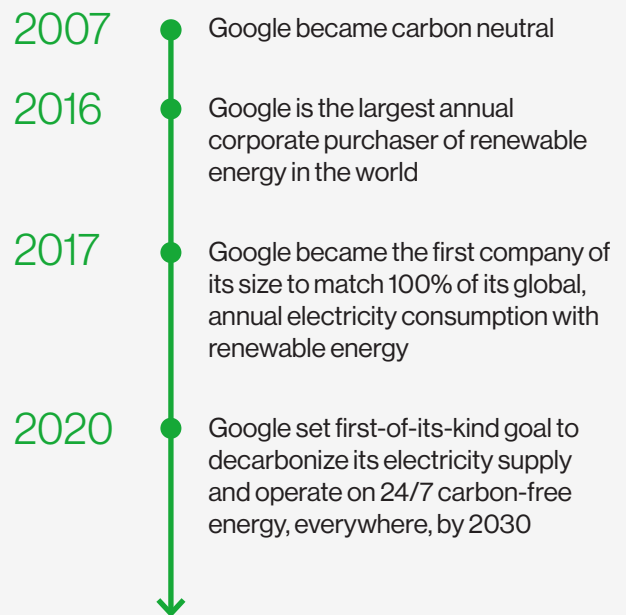
Google was the first major company to become carbon-neutral in 2007. Fast forward a decade, Google achieved its 100% renewable energy goal in 2017 through clean energy purchases from sources like solar and wind to match its global annual energy consumption, but they knew that when they achieved this goal, it wasn't the final milestone in their clean energy journey.

Despite being the world's largest corporate renewable energy purchaser, Google's facilities were still reliant on carbon-based power when the sun wasn't shining or the wind wasn't blowing. This means that even though Google had purchased 100% renewable energy on an annual basis, the electricity they used on an hourly basis was matched with regional, carbon-free sources just 61% of the time.<sup>1</sup>

To become truly sourced by 100% clean energy, Google needed a 24/7 carbon-free energy solution to run their operations - every hour of every day.

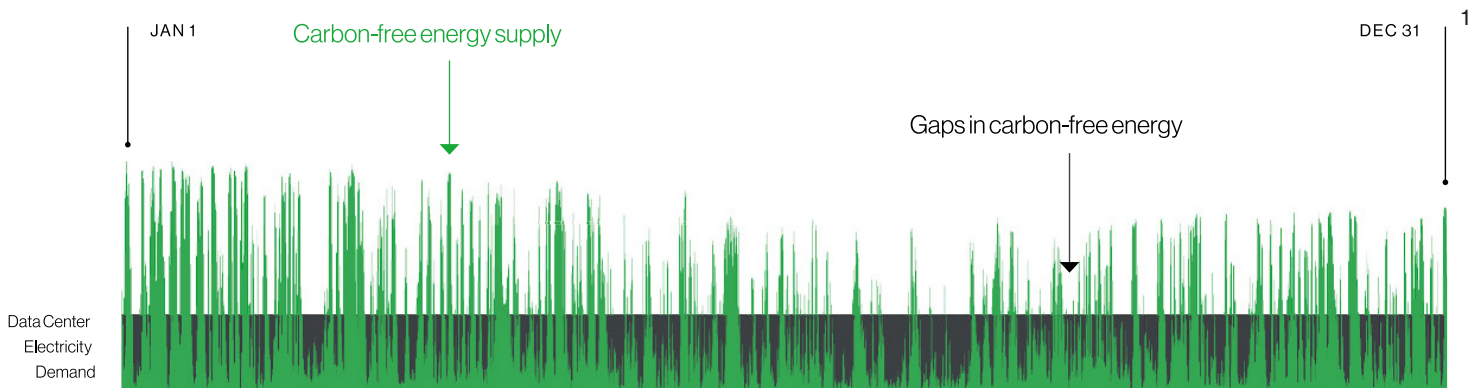
That's why, in 2020, Google set a first-of-its-kind goal to decarbonize its electricity supply and operate on 24/7 carbon-free energy, everywhere, by 2030.

## Google's sustainability leadership



1. "24/7 by 2030: Realizing a Carbon-free Future," Google, September 2020.

# Why do we need 24/7 carbon-free energy?

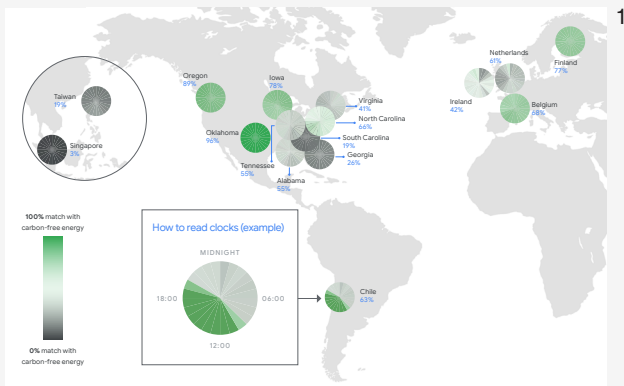


1. "24/7 by 2030: Realizing a Carbon-free Future," Google, September 2020.

In this example from Google, you can see that while Google buys large amounts of wind and solar power (symbolized by green spikes), these resources are variable, meaning that their data centers still sometimes rely on carbon-based resources. To create a carbon-free grid, Google needed a 24/7 carbon-free energy solution that matched the energy demands of their data centers with clean energy generation on an hourly basis.

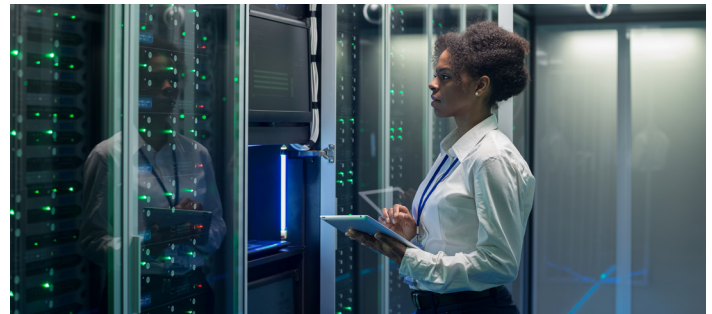


Operating on 24/7 carbon-free energy by 2030.



1. "24/7 by 2030: Realizing a Carbon-free Future," Google, September 2020.

Even though Google had purchased 100% renewable energy on an annual basis, its global data centers were being matched with carbon-free energy anywhere from 3% to 96% of the time. <sup>1</sup>



## Why data centers?

100%

Google matched 100% of the annual electricity used by global operations with renewable energy, amounting to more than 12 million megawatt-hours (MWh) of energy in 2019 alone—more electricity than the state of Maine uses annually. <sup>2</sup>



1%

Data centers account for approximately 1% of the world's electricity use. <sup>3</sup>

2. "Google Environmental Report 2020," Google, December 2020.

3. Eric Masanet et al., "Recalibrating Global Data Center Energy-Use Estimates," Science, February 28, 2020.



# Why AES and Google **partnered** together

Google had been managing its power procurement for years, and doing it successfully - meeting their clean energy goals at a groundbreaking pace. However, because of their ambitious sustainability goals, they wanted a partner that could co-create a new innovative product that would achieve their world-leading goal of 24/7 carbon-free energy while also reducing the risk and administrative burden they were currently taking on in their energy procurement process.



## Four **challenges** we needed to **solve**

We needed to develop a 24/7 carbon-free energy solution that incorporated a mechanism to deliver renewable generation at the right time and place to match the demand of Google's data centers with the load generation profile of renewables on an hourly basis. The added challenge was that we also needed to meet Google's four main objectives to simplify how they met their ambitious sustainability goals and business goals, truly eliminate carbon emissions and create a more sustainable grid.

### 1. Reduce complexity

Entering into multiple PPAs with multiple developers in multiple markets is transactionally expensive and difficult to track and report. To solve this problem, we simplified the contracting process and created a standard to measure their renewable energy use on an hourly basis.

### 2. Shift energy procurement and management responsibilities

Google recognized early on that sustainable energy was critical to delivering on its mission to organize the world's information and make it universally accessible and useful. They also recognized that managing their energy required a lot of time, resources and administrative burden. Our solution provides a structure that allows AES to take on some of the responsibilities of sourcing and managing their 24/7 generation portfolio.

### 3. Create new renewable additionality

Google had a unique requirement that this solution needed to bring new clean energy, as opposed to procuring renewable energy from existing projects, to further contribute to a decarbonized grid.

### 4. Create a sustainable and more equitable grid

At times when the share of renewable energy in a region reaches high percentages, grid operators may need to halt renewable energy production in order to keep the grid balanced during times of overproduction. We needed to add new renewables that correlated time and location with Google's load profile so that our resources weren't being curtailed (or thrown away), which promotes a more balanced, resilient grid.

# Together, we co-created a first-of-its-kind 24/7 carbon-free energy solution

To serve Google's Virginia data centers, AES procured more than 500-megawatts (MW) of wind, solar, hydro and energy storage projects from a combination of third party developers and AES-owned projects. We sized and contracted the portfolio to meet the 90% carbon-free guarantee in the most cost-efficient manner.



## How did we do it?

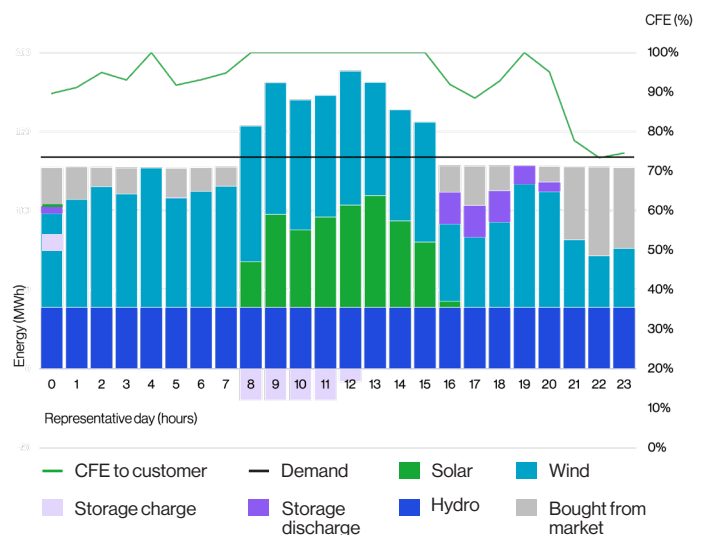
Behind the scenes, we built a portfolio optimization tool to ensure that we are delivering the optimal combination of renewable technologies to Google. We analyzed thousands of hypothetical portfolios and new renewable energy and storage projects within the same regional grid as Google's load. This detailed analysis ensured that the portfolio minimized cost and risk while maximizing the carbon-free energy.

This structure required managing both the market operations of scheduling and dispatching load and resources as well as managing the significant market and commodity risks required to shape variable generation into a fixed price, load matched supply. We bear the risk of under and over generation by purchasing and selling into the electricity market on an hourly basis as needed, while Google simply pays for their load at a stable \$/megawatt-hour price.

To simplify Google's energy procurement management process and reduce market risk at a competitive price, AES will perform many of Google's market-interfacing roles for its Virginia data centers. Through the 10-year supply contract, we will not only become the sole supplier of the Virginia data centers' renewable energy needs on an annual basis but will also ensure that the energy powering those data centers will be 90% carbon-free when measured on an hourly basis. Google's load and generation will always be in balance.

This solution means that Google can focus on their core business while AES assumes responsibility for every aspect of Google's energy management process in Virginia to ensure a carbon-free energy supply.

24/7 carbon-free energy can **avoid materially more carbon emissions** in the grid compared to single-technology renewable energy.



By combining a diverse set of carbon-free energy resources and a battery that can shift generation across hours, AES crafted a portfolio that is closely tied to Google's load to guarantee its data centers are being powered by carbon-free energy 90% of the time.

Our partnership with Google to deliver 24/7 carbon-free energy has world-changing implications.

Today, hundreds of companies around the world have committed to meeting 100% of their electricity needs with renewable sources. With this 24/7 carbon-free energy product, we demonstrated a clear roadmap for organizations to realize their clean energy goals in a way that minimizes risk, increases simplicity and ensures that their carbon-free energy is helping the grid, not hurting it. Together, we're working to empower other leaders to transition to 24/7 carbon-free energy and creating a path toward a net-zero future.



Together with AES, a carbon-free future is within reach.  
Learn more at [www.aes.com/247](http://www.aes.com/247).