



Carbon-free Energy Performance at Google Data Centers (2021)

Introduction

When we announced our goal of operating on 24/7 carbon-free energy by 2030, we set out to be transparent about our progress, barriers, and obstacles we encounter, and useful lessons that might support others in decarbonizing their organizations. We believe that open access to data and insights is critical to accelerating economy-wide decarbonization and, in that spirit, we started sharing our annual, overall carbon-free energy (CFE) performance for every region, starting with our [2020 data](#), as well as our [methodology](#) for calculating it.

As we noted last year, comparing our CFE data from year to year reveals some interesting trends and fluctuations, reflecting the complex interplay between new CFE projects coming online, changes in energy supply and demand within regional grids, and significant growth in demand for Google services around the world. We expect that these annual fluctuations will continue and progress will be uneven from year to year, but our global and regional CFE percentages will trend steadily upwards as we approach our 2030 target.

Highlights from 2021

- Globally, 66% of the electricity use at Google data centers was matched with carbon-free energy on an hourly basis, 5% higher in 2019 but 1% lower in 2020. We [expected](#) this fluctuation: in 2020, we brought a large number of CFE projects online, leading to a large jump in our 2020 CFE % and thus a high baseline for calculating changes between 2020 and 2021.
- The largest regional increases in Google CFE between 2020 and 2021 were in Chile (4%) and PJM (4%), both driven mainly by the scaling up of new Google-contracted CFE projects, including a major new [wind farm](#) in Chile. The largest increase in grid CFE was in Belgium (10%), where a significant uptick in local nuclear power generation helped Google CFE exceed 80%.
- Declines in Google CFE had two main drivers. First, we saw decreased production from some existing Google CFE projects due to weather-related fluctuations in solar and wind generation. Second, we saw flat or declining grid CFE in the majority of our operating regions, for example Finland, Denmark, and the Northwest and Eastern U.S.
- The declines in 2021 grid CFE underscore the need for more ambitious action to expand grid CFE, including [new policies](#). Achieving global decarbonization targets will require rapid and sustained growth in grid CFE everywhere, even as electricity demand grows due to the electrification of transport, heating, and industry.

Ultimately, 24/7 carbon-free energy is about operating on carbon-free energy everywhere and at all times. As we noted last year, we continue to advance progress toward this goal by developing new technologies, scaling new transaction models, and advocating for stronger clean energy policies at the local, regional, and global levels. We remain confident in our long-term trajectory toward 24/7 carbon-free energy, and we will continue to share our progress along the way.

REGIONAL GRID	LOCATION OF DATA CENTER(S)	2021 GRID CFE %	2021 GOOGLE CFE %
Energy Market Authority of Singapore	Singapore	3%	4%
Taiwan Power Company, Taiwan	Changhua County	17%	17%
Elia, Belgium	St. Ghislain	74%	82%
EirGrid, Ireland	Dublin	46%	46%
Energinet, Denmark	Fredericia	81%	89%
Fingrid, Finland	Hamina	79%	91%
Tennet, Netherlands	Eemshaven	35%	53%
Sistema Interconectado Central, Chile	Quilicura	43%	69%
Midcontinent Independent System Operator (MISO), U.S.	Council Bluffs, IA	33%	97%
Southwest Power Pool (SPP), U.S.	Mayes County, OK	46%	88%
Pennsylvania, Jersey, Maryland Power Pool (PJM), U.S.	Loudoun County, VA New Albany, OH	40%	67%
South Carolina Public Service Authority (Santee Cooper), U.S.	Berkeley County, SC	25%	25%
Southern Company (SOCO), U.S.	Douglas County, GA	29%	42%
Tennessee Valley Authority (TVA), U.S.	Jackson County, AL Montgomery County, TN	54%	68%
Duke Energy Carolinas (DEC), U.S.	Lenoir, NC	60%	65%
Bonneville Power Administration (BPA), U.S.	The Dalles, OR	88%	88%
Electric Reliability Council of Texas (ERCOT), U.S.	Midlothian, TX	40%	40%
Nevada Energy (NVE), U.S.	Henderson, NV	21%	21%

Note: Our carbon-free energy (CFE) percentage measures the degree to which our electricity consumption on a given regional grid is matched with CFE on an hourly basis. This is calculated using both CFE under contract by Google as well as CFE coming from the overall grid mix. CFE coming from the overall grid mix is based on data obtained from a third-party, ElectricityMap, and has not been assured.