



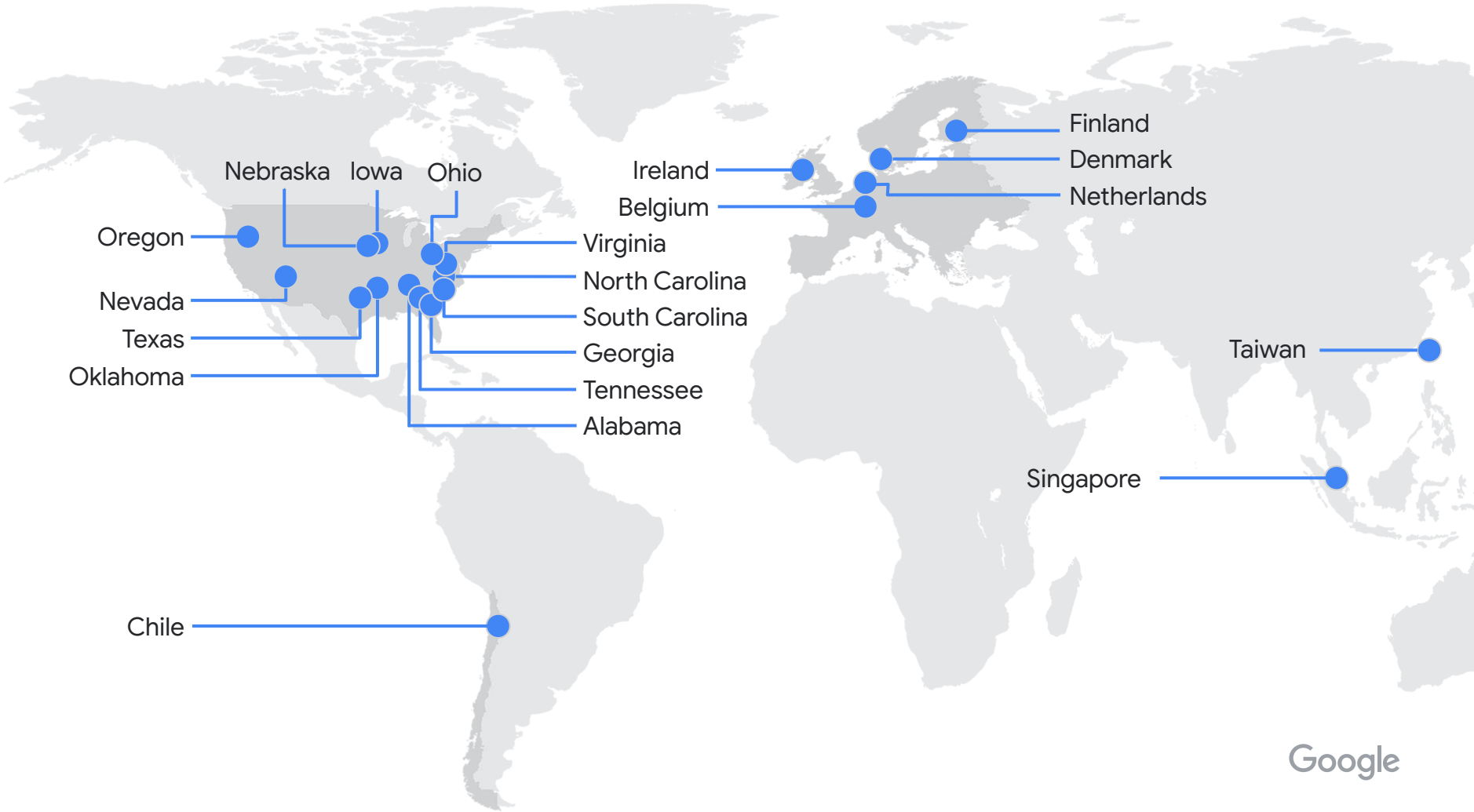
Google

# Google's Path to 24/7 Carbon-Free Energy

Re-Scandinavia  
June 17th, 2021



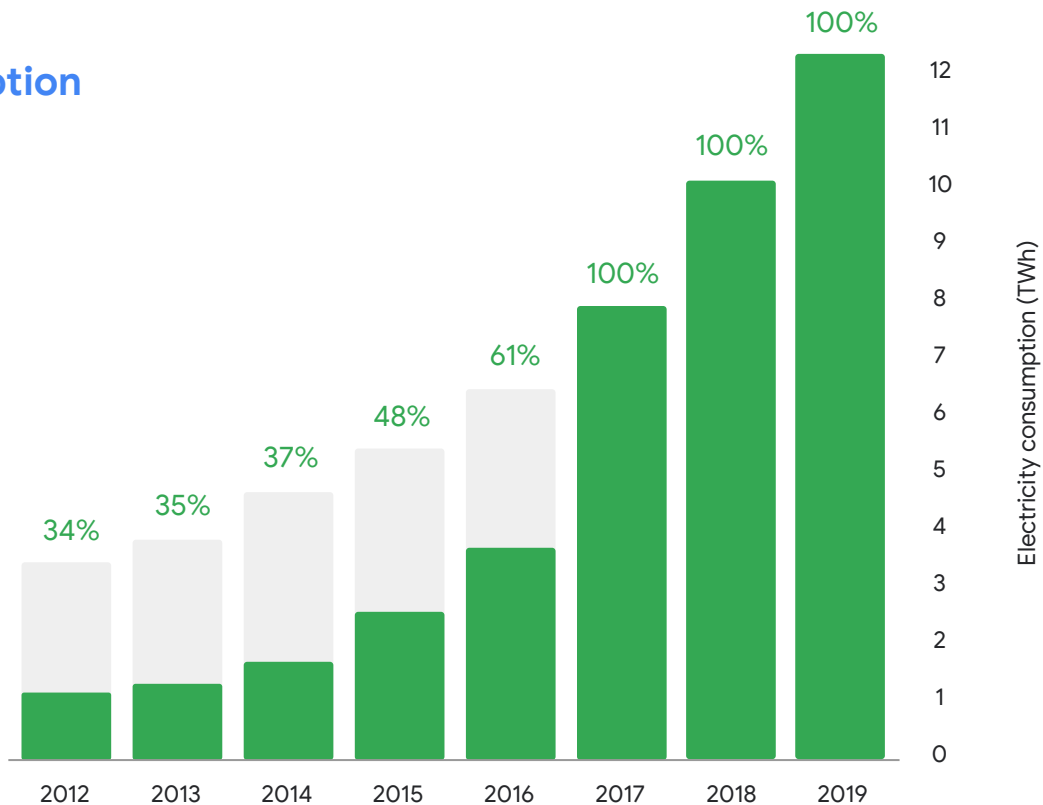
Google



## Google's annual electricity consumption

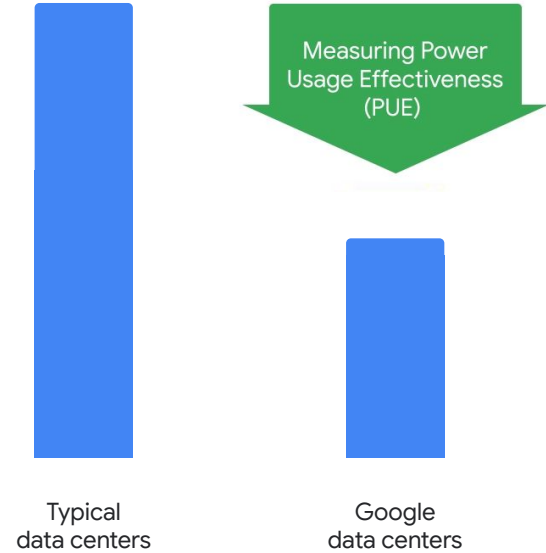
Demand for our services is growing every year, driving continued growth in our energy use

- Total electricity consumption
- Renewable energy



## Efficiency

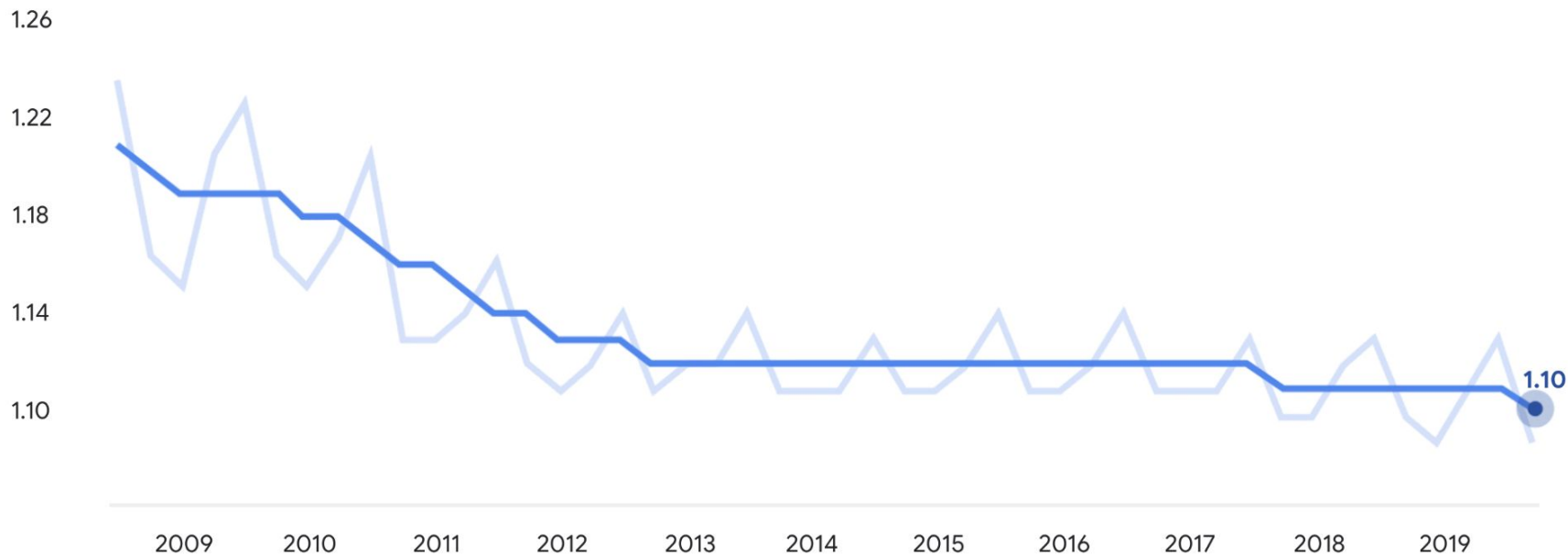
Google data centers use **50%** less energy than a typical data center



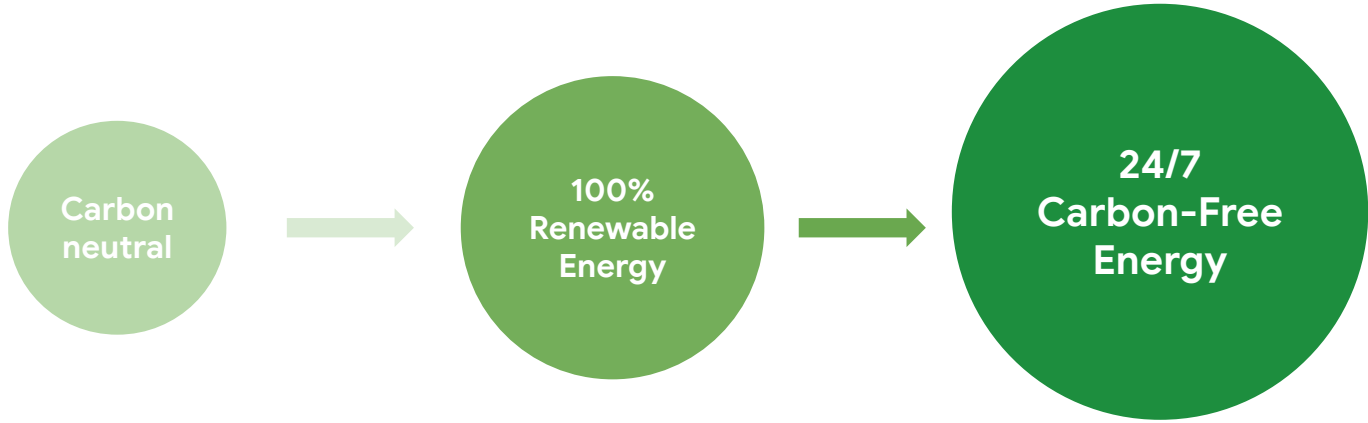
# Average PUE for all data centers

\*Industry average PUE: **1.67**

Quarterly PUE Trailing 12-month PUE



# Our clean energy journey



Since 2007  
Carbon Neutral



*Offset as much carbon as  
we generated*

Since 2017  
100% Renewable Energy



*Matched 100% of our annual  
electricity consumption with  
renewable energy*

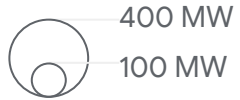
24/7 Carbon-Free Energy



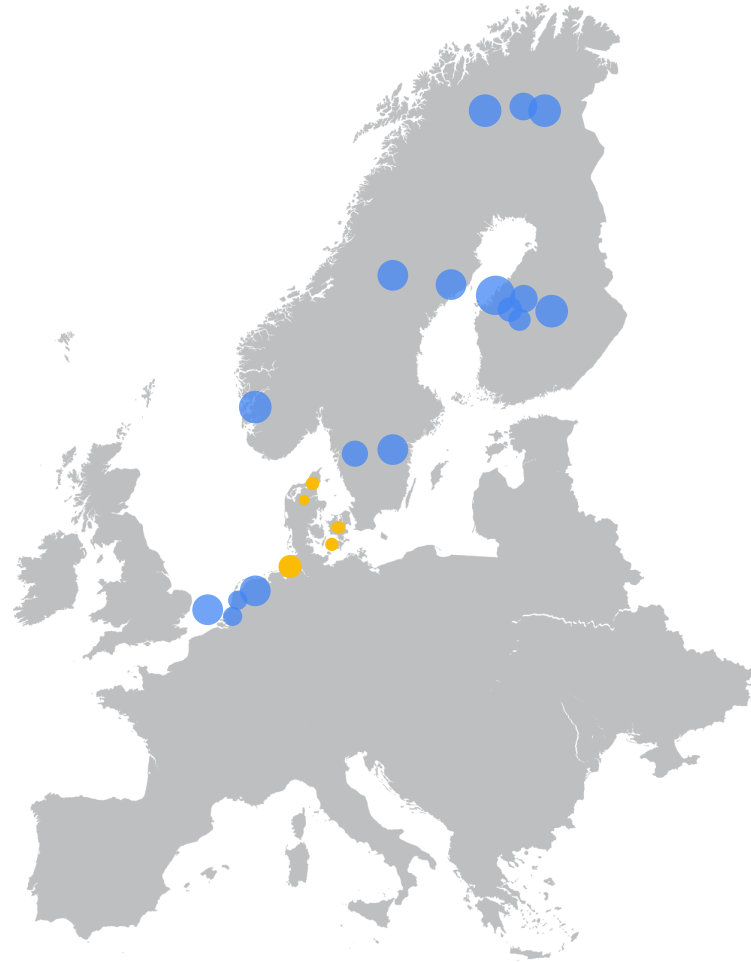
*Round-the-clock clean energy  
at every data center around  
the world*

## Renewable Energy in Europe

24 projects  
1,692 MW



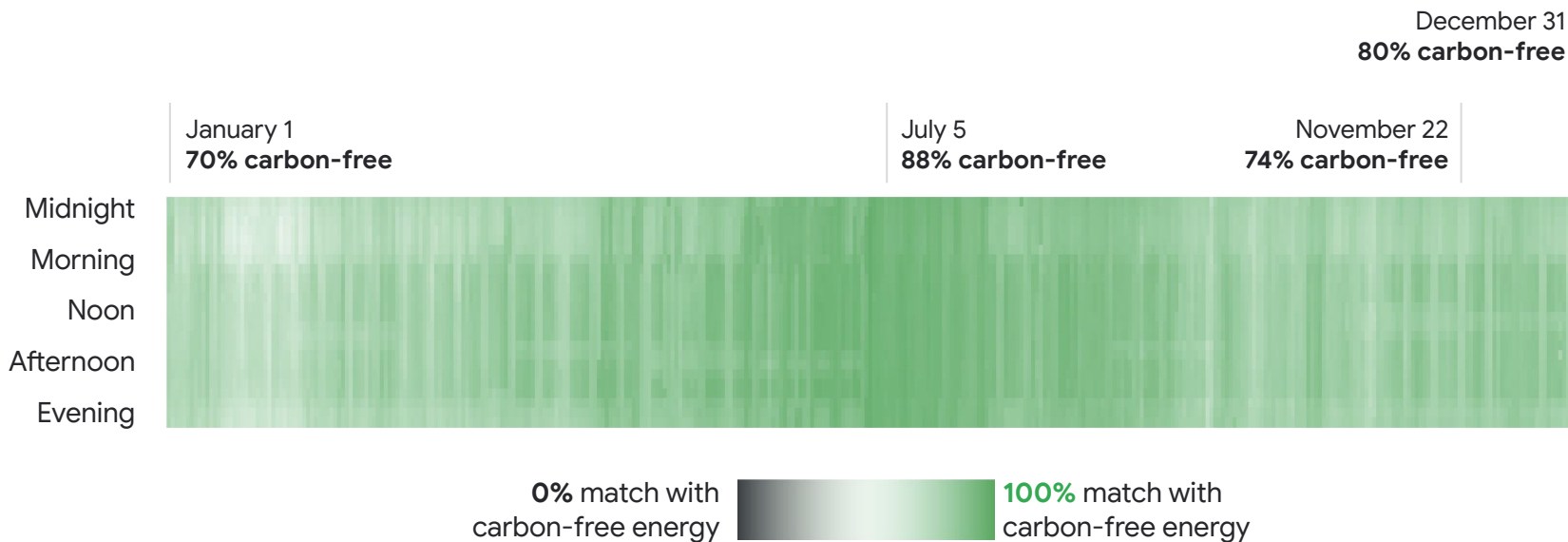
● Wind ● Solar



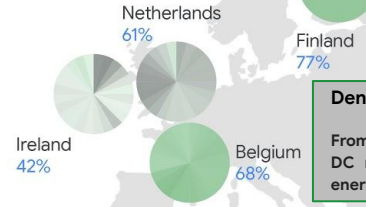
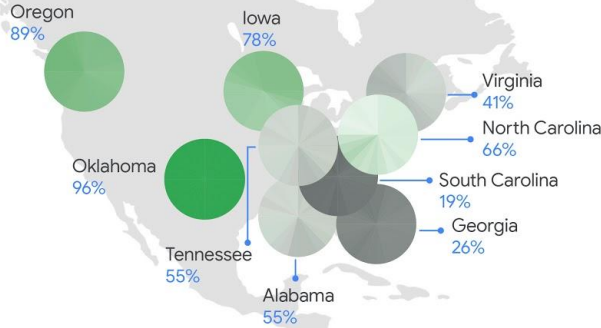


# Every hour of electricity use at Finland data center

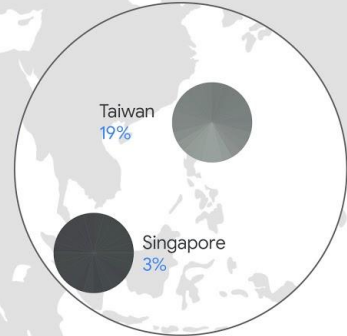
77% of our Finland data center's electricity use was matched on an hourly basis with carbon-free sources



# Where we stand currently



**Denmark**  
From the beginning of operation, Fredericia DC matched with **over 90%** carbon-free energy on an hourly basis

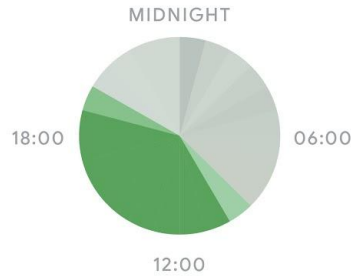


100% match with carbon-free energy



0% match with carbon-free energy

## How to read clocks (example)



Globally, performance currently varies across sites; our global **hourly** clean energy average is **61%**

# Our Third Decade of Climate Action:

## 24/7 Carbon-Free Energy by 2030

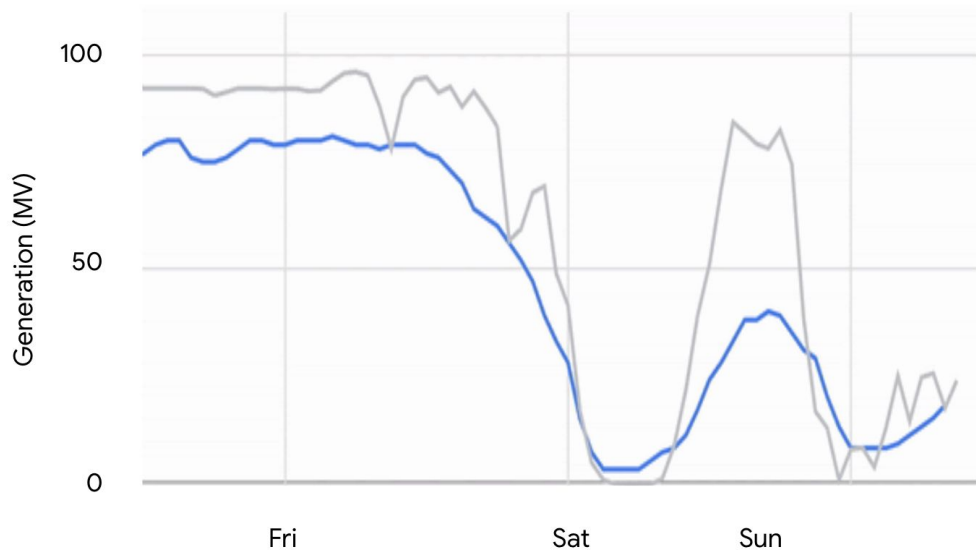
- **Transactions:** Buy more and different types of clean energy deployed locally
- **Policy:** Advocating for policy changes to decarbonize electricity grids
- **Technology:** Accelerate energy technology innovation



## Technology for renewables

The DeepMind system uses a neural network to predict wind power output **36 hours** ahead

- Predicted
- Actual



# Carbon-intelligent load-shifting

Reducing data center carbon footprints by shifting flexible compute tasks across locations is a progression of our first step in carbon-aware computing to shift compute across time





Thank you

Google