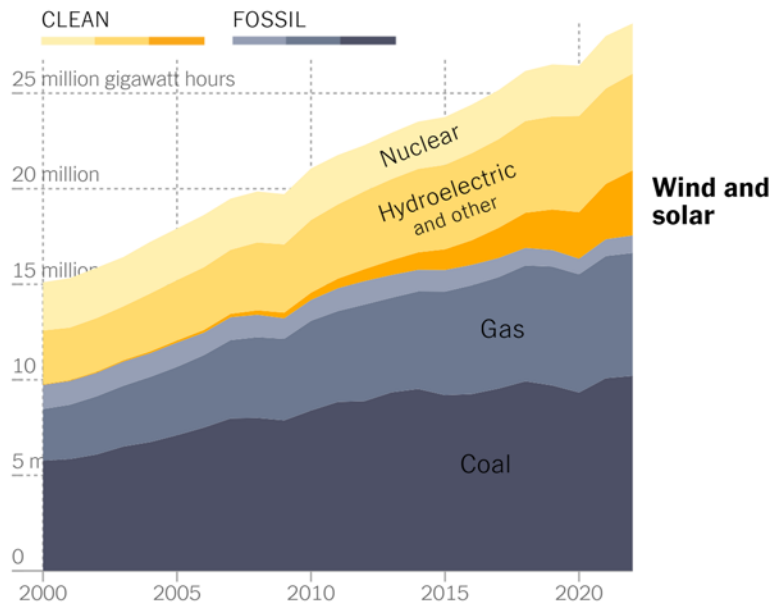


**World electricity generation**

# How Electricity Is Changing, Country by Country

By Nadja Popovich Nov. 20, 2023

Carbon-free electricity has never been more plentiful. Wind and solar power have taken off over the past two decades, faster than experts ever expected. But it hasn't yet been enough to halt the rise of coal- and gas-burning generation.

That's because global demand for electricity has grown even faster than clean energy, leaving fossil fuels to fill the gap.

The dynamic has pushed up carbon emissions from the power sector at a time when scientists say they need to be falling — and fast — to avoid dangerous levels of global warming.

## Where Fossil-Fueled Power Is Still Growing Today

### TREND OVER LAST DECADE

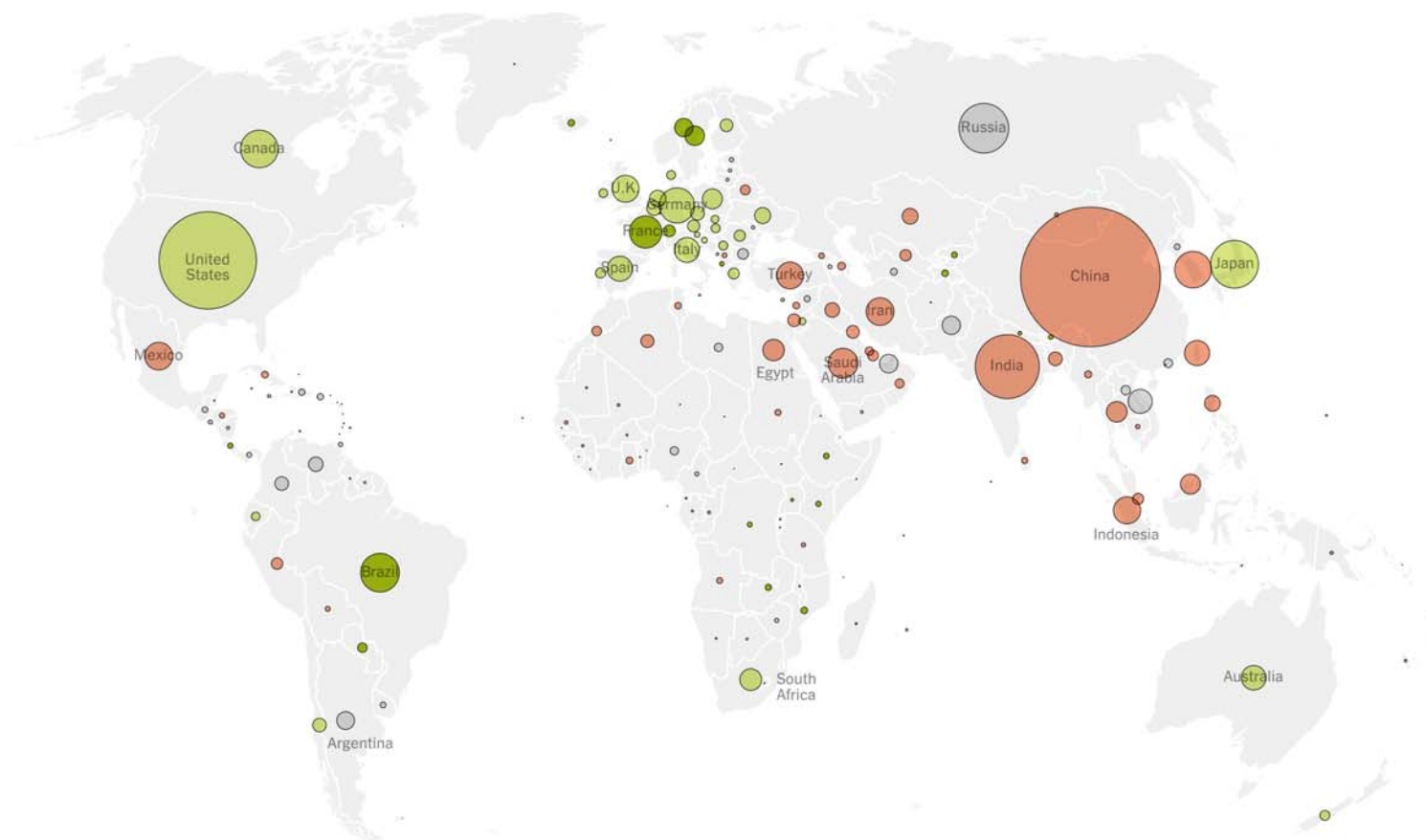
Mostly clean already

Declining fossil power

Plateau or other trend

Rising fossil power

Circles are sized by the amount of total power generated by each country in 2021-22.



Note: Total generation data is shown through 2022 for the countries that have power generation data available through that year. For others, data is shown through 2021. More information on how the categories were determined can be found at the bottom of this page.

Much of the rising power demand has come from rapidly-developing countries like China and India, where new coal plants are still coming online alongside wind and solar farms to power meteoric economic growth. But many industrialized nations are also not moving away from fossil fuels fast enough to meet their stated climate change goals.

Even on today's trajectory, many experts expect that fossil-fueled power will peak globally in the next few years. It's already falling in major economies like the United States and Europe, and analysts expect China, by far the world's largest power producer, to begin reducing coal-fired generation soon.

The world's climate future will depend, in large part, on what happens next.

Experts broadly agree that keeping global temperature rise to “well below” 2 degrees Celsius, the world’s self-imposed climate goal — and ideally as low as 1.5 degrees — will require peaking and then rapidly reducing fossil-fueled power, in favor of carbon-free sources, like wind and solar. (The world has already warmed about 1.2 degrees since preindustrial times.)

“The big question,” said Dave Jones, an electricity analyst at Ember, a London-based think tank, is whether countries can increase the pace of renewable energy deployment so that they’re not just bringing down power sector emissions slowly, but “actually enabling deep and rapid carbon dioxide emissions cuts.”

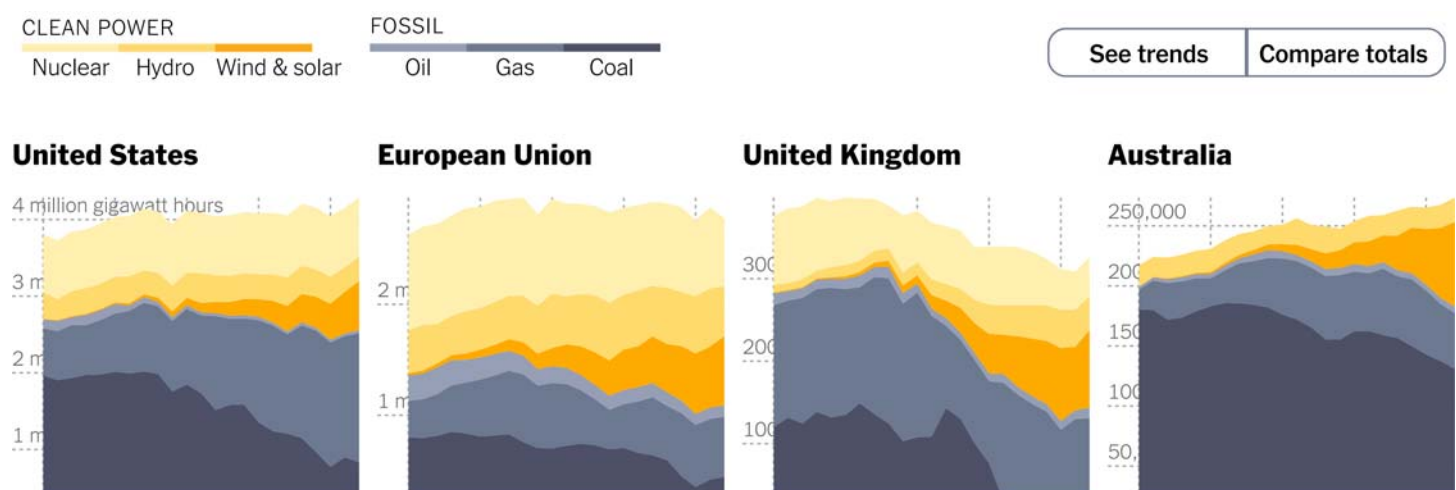
That question will take center stage at a global climate summit later this month.

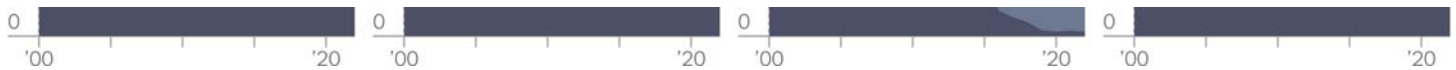
The stakes are enormous.

The power sector is already the world’s single biggest source of planet-warming emissions. And plans to decarbonize many other parts of the global economy — like transportation, buildings and industry — also rely on plugging in to cleaner power.

How electricity generation has changed in recent decades for the world’s major power producers, both rich countries and rapidly-developing ones, helps explain today’s global picture and underscores the climate challenges ahead.

## Falling Fossil Fuels





In the United States and much of Europe, fossil-fueled power generation has been declining for years, especially coal. It has even started to fall in coal-reliant Australia.

The rapid growth of renewable energy has played a major role.

Wind turbines and solar panels generated 22 percent of the European Union's electricity last year, up from less than 1 percent two decades ago. The United States made 15 percent of its electricity from wind and solar energy last year, which is slightly more than the global average.

The boom of cheap renewable power helped replace coal-fired generation in Europe. In the United States, natural gas — which pollutes less than coal when burned, but still warms the climate — played a key role in coal's decline, alongside quickly-growing wind and solar.

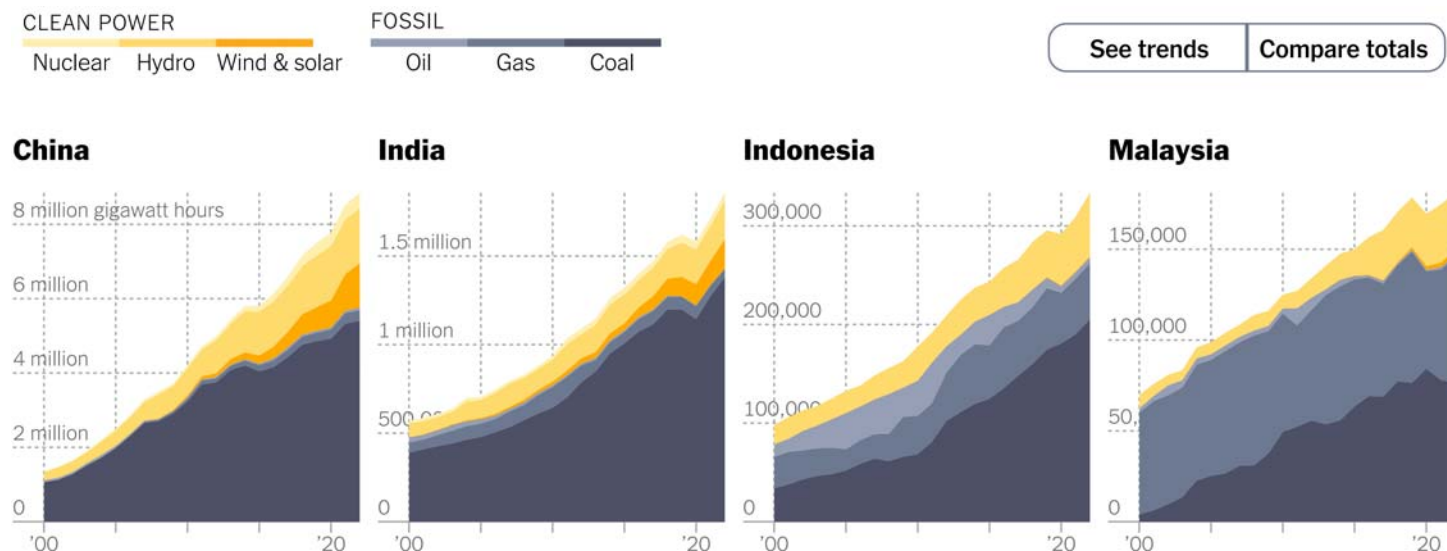
Lower overall electricity demand also contributed to the decline of fossil-fueled power.

Electricity use grew rapidly in rich countries like the United States and many European nations during the previous century, but started to plateau or even decline in the 2000s largely thanks to improved energy efficiency, as well as the outsourcing of heavy industries.

Yet neither the United States' nor the European Union's trajectories are currently on track to meet the world's ambitious 1.5 degree Celsius climate goal. Both major power producers recently passed legislation aimed at ramping up renewable energy, but growing economic headwinds and other challenges threaten to slow down their transitions, even as energy experts say they need to accelerate.



## Growth Through Coal



The trend so far looks very different in countries with rapidly growing economies — nowhere more so than in China.

China overtook the United States as the world's single largest power producer in 2010, and now makes nearly a third of the world's electricity. (The country's per person electricity generation is still much lower than America's.)

For decades, the country's soaring power demand was fulfilled largely by coal, the most polluting fossil fuel. Coal-fired generation continued to grow, though at a slower pace, even as China significantly expanded carbon-free power in recent years, especially wind and solar.

Now, China's power sector is getting close to a turning point.

Energy analysts expect carbon-free power to grow enough in the next few years to start pushing out coal-fired electricity here, too. And because of the country's outsize share of the global total, peak coal power in China will likely be a global one.

How quickly coal power and related emissions will decline after that peak is less clear. In a recent agreement with the United States, China said it would speed up renewable energy deployment to "accelerate the substitution for coal, oil and gas generation" and

agreed to pursue “meaningful” power-sector emissions cuts over the next decade. But whether it will stop approving new coal plants remains to be seen.



## What Is COP28? And Other Questions About the Big U.N. Climate Summit

Diplomats and leaders will gather in Dubai for United Nations climate talks. Here are some key facts.

Nov. 20, 2023

Coal continues to dominate electricity generation in other rapidly-developing countries, many of them in Asia, as well.

India, the world’s most populous nation, has set strong renewable energy targets, but officials say the country still needs coal to develop its economy and provide reliable, affordable power to millions of people. Indonesia, meanwhile, said it could phase out coal power by 2040 if it gets enough financial help from rich countries to build out cleaner energy.

Financing wind and solar projects remains a challenge for developing countries, said Faran Rana, an associate program officer at the International Renewable Energy Agency. “When you look at lifecycle costs, renewables are by far more cost-competitive than any fossil-fueled generation,” he said. “But the upfront cost is a barrier.”

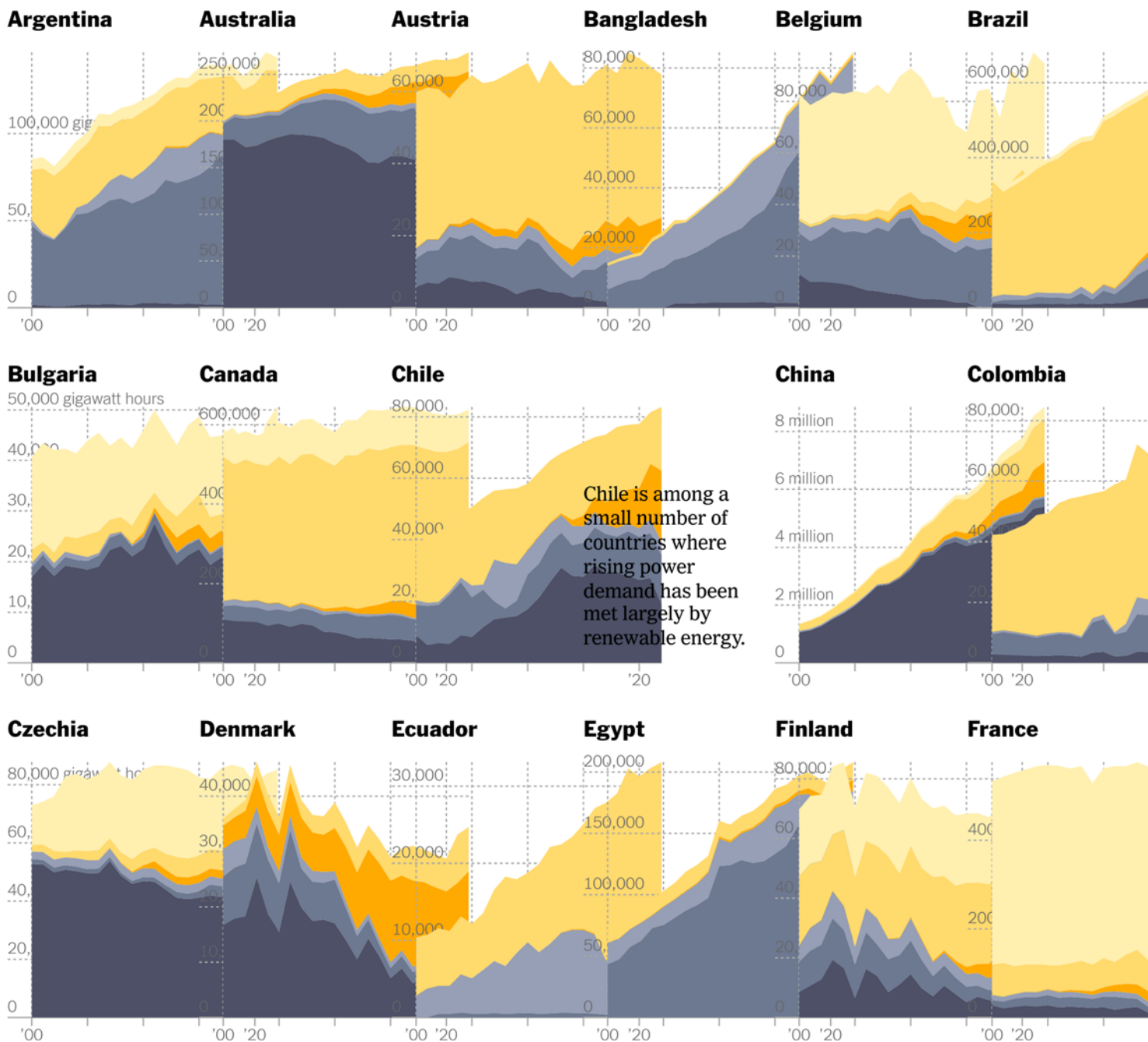
Millions of people around the world also continue to go without access to any form of electricity.

While major global challenges remain, said Nancy Haegel, a researcher at the United States’ National Renewable Energy Laboratory, the rapid growth of solar and wind generation so far shows that “this transition is doable and it’s well under way.”

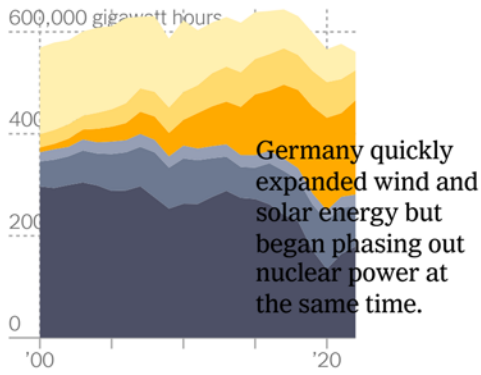
## Every Country Tells a Story

Explore trends among the world's top power-producing countries, in alphabetical order, below.

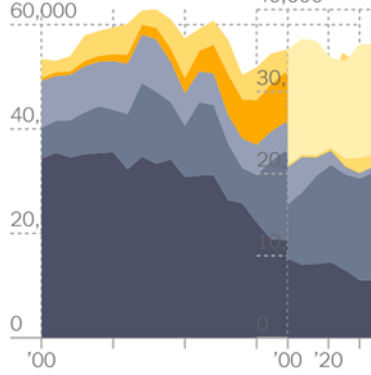
Note: These charts show countries on their own scale, making it easier to see individual trends and power mixes. You can swap the view to "compare totals" to see which countries play an outsized role. The top 60 power-producing countries with data available through 2022 are shown.



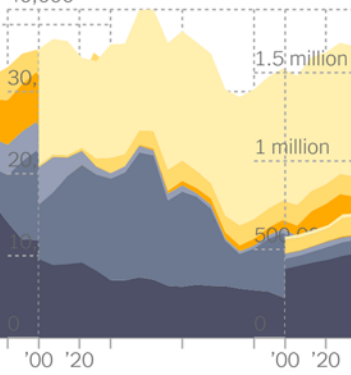
## Germany



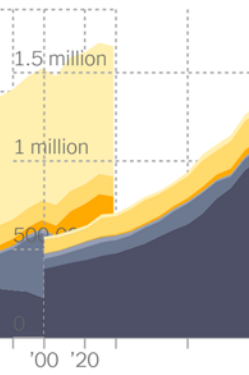
## Greece



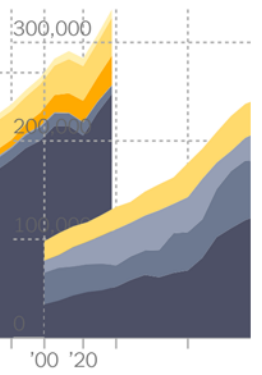
## Hungary



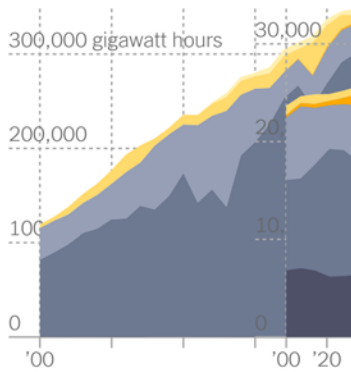
## India



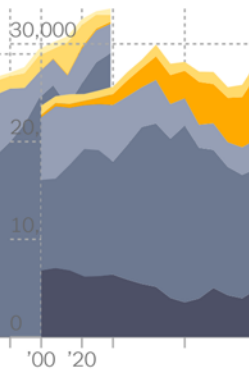
## Indonesia



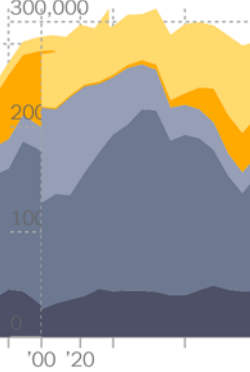
## Iran



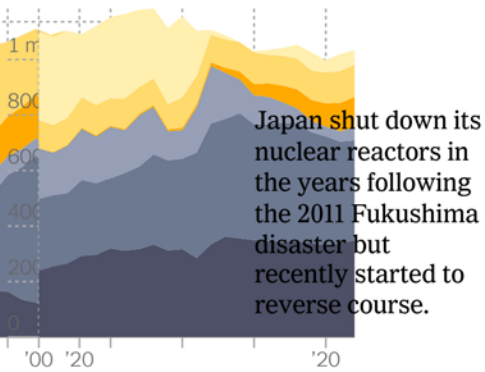
## Ireland



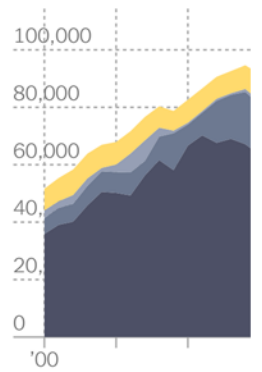
## Italy



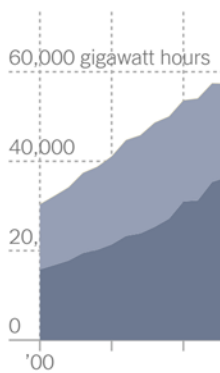
## Japan



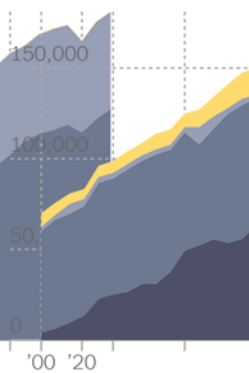
## Kazakhstan



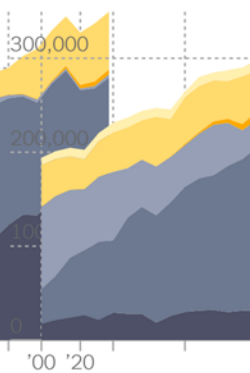
## Kuwait



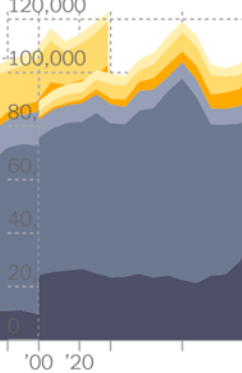
## Malaysia



## Mexico



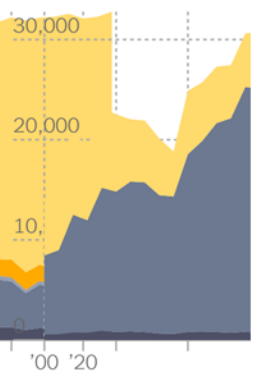
## Netherlands



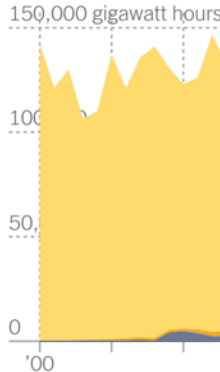
## New Zealand



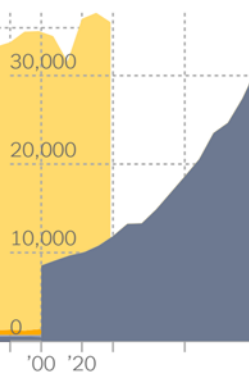
## Nigeria



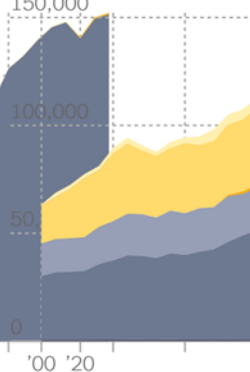
## Norway



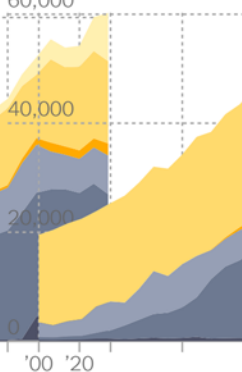
## Oman



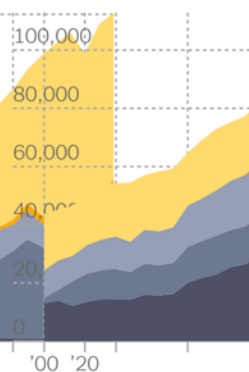
## Pakistan



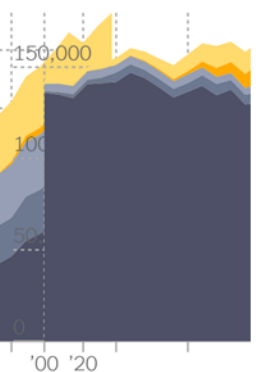
## Peru



## Philippines



## Poland



## Portugal



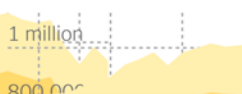
## Qatar



## Romania



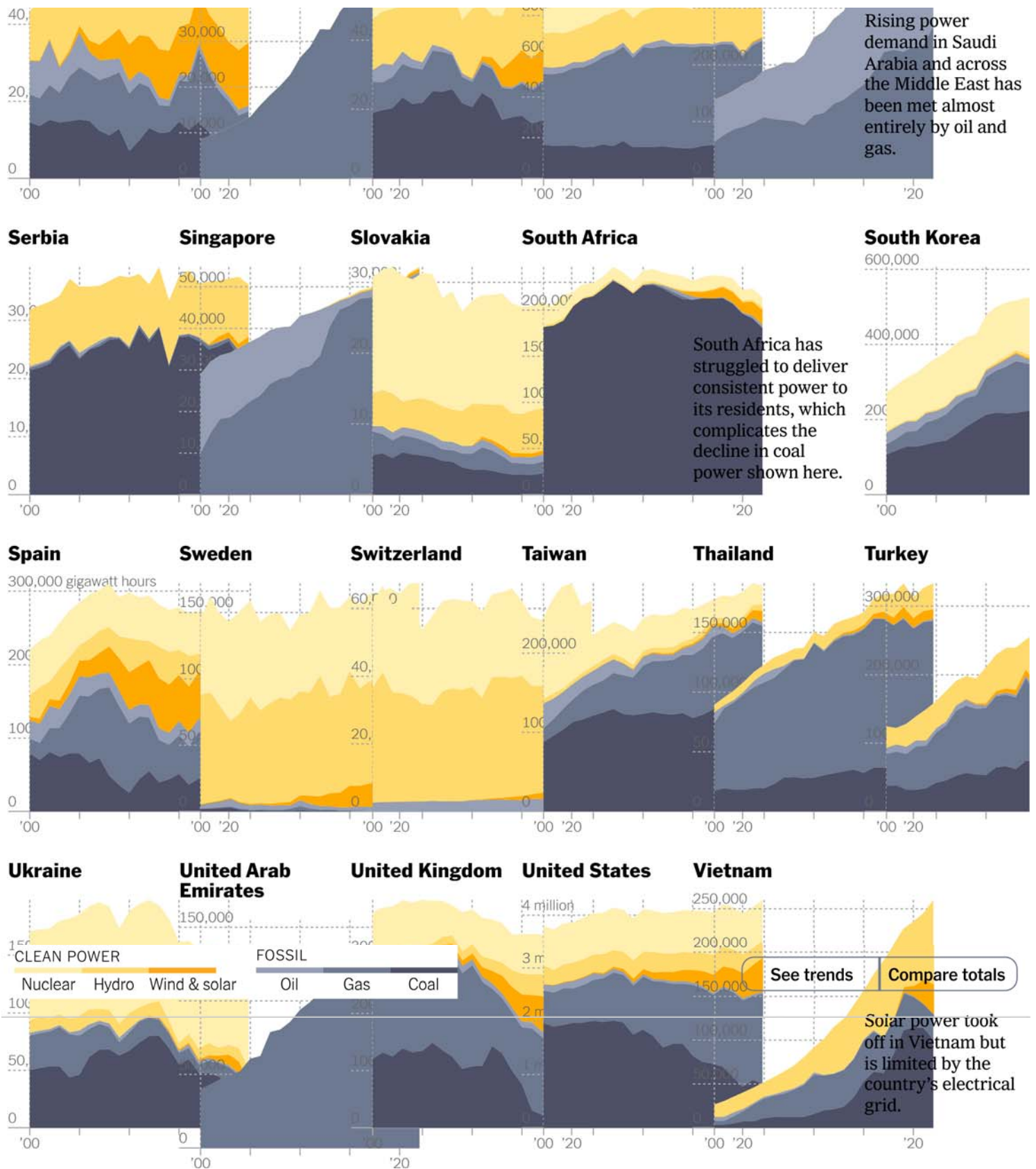
## Russia



## Saudi Arabia







### Data Sources and Notes

All of the charts and the map are based on electricity generation data from Ember. The data shown here reflects power generated within a country's borders and does not include imports or exports, which can play a large role in many countries. The data includes rooftop solar generation that is connected to the grid, but not solar generation for personal use that is not connected to the grid ("behind the meter"). Data for 2022 is estimated. More detail on Ember's methodology can be found [here](#).

In the charts, the hydroelectric category includes generation from other renewable sources of power besides wind and solar, but in most cases hydro dominates the category. Similarly, the oil category includes generation from other remaining fossil fuels.

In the map, countries are categorized as having "mostly clean" electricity generation if less than 15 percent of their generation came from fossil fuel sources in the latest available year. Countries are categorized as having "declining fossil power" if fossil-fueled generation reached a maximum at least five years ago and then declined, and if the trend was not solely attributable to a fall in demand. Countries where fossil-fueled generation was flat in recent years and ones where a reliable trend could not be identified are categorized under "plateau or other trend," along with several other patterns that do not clearly fit into the other categories. "Rising fossil power" countries have not yet reached a peak in fossil-fueled power generation.

Additional development by Michael Keller and Aatish Bhatia.