# The Boom in ‘Green’ Energy

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## Can renewables replace fossil fuels?

Renewable energy sources like solar, wind, and hydroelectricity are already overtaking fossil fuels as the main source of power generation in some parts of the developed world. In 2019, 72 percent of power plant additions utilized renewables, according to the International Renewable Energy Agency (IRENA). For the first time, the European Union generated more electricity (38 percent) from renewables in 2020 than from fossil fuels (37 percent). The U.S. still relies heavily upon oil (37 percent), natural gas (32 percent), and coal (11 percent), but the country is on pace this year to generate more energy from renewables than from coal. Overall, renewables now account for roughly 11 percent of U.S. energy production — with about a quarter of that coming from wind power, two-fifths from biofuels and hydroelectricity, and a 10th from solar. Rapid growth in renewables is underway: In 2020, electricity producers installed 37 gigawatts of new solar and wind capacity, shattering the record of 17 GWs from 2016.

## What's driving the transformation?

Cost-effectiveness. Solar panel companies have been able to generate more power from each individual solar cell. This has led to vast reductions in price, so that solar and wind power now have surpassed coal — and even natural gas — as the cheapest forms of power generation. While the price of coal power largely remained the same from 2009 to 2019, the price of solar power fell by 89 percent and onshore wind power by 70 percent, according to Lazard. The U.K., Norway, and other countries now generate a large share of their electricity from offshore wind farms, and that potential also exists for the U.S., with seven states now studying how to set up arrays. The boom in renewables has another economic benefit: It has created hundreds of thousands of jobs: About 446,000 Americans worked in the solar and wind industries as of 2019 — more than double the 211,000 in coal mining and other methods of fossil-fuel extraction.

## Are emissions down?

While emissions are slowing in the Western world, global CO2 emissions have risen from nearly 32 billion tons in 2009 to almost 37 billion in 2019, according to the Global Carbon Project, as developing nations such as India and China modernize and produce more energy, mostly through fossil fuels. In 1990, 81 percent of the world's total energy consumption came from oil, gas, and coal. Last year, the figure was still 80 percent — and largely because of a global slowdown brought on by the pandemic.

## Why not?

Unlike fossil-fuel power plants, solar and wind power plants only generate electricity when the sun shines and the wind blows. The batteries needed to store power for cloudy days are improving rapidly but are still not cheap enough — or able to store power for long enough periods — to rely heavily on. A breakthrough in battery technology will be needed for solar and wind to become mainstays of electric grids. Geothermal energy, however, does not require battery storage and has enormous potential. The U.S. leads the world in geothermal electricity production, or the process of mining the heat from Earth's crust to produce electricity. Although it accounts for only 0.4 percent of total U.S. utility-scale electricity production, the technology could someday provide almost limitless amounts of power.

## Auto companies going electric

Automakers are betting that electric vehicles (EVs) are the future. The switch is being powered by improvements in the lithium-ion batteries that fuel these cars. In 2020, the average price of lithium-ion batteries fell to $137 per kilowatt-hour (kWh) — down 89 percent from 2010. Currently, EVs constitute only about 3 percent of the global auto market but falling battery-pack prices point to a much bigger future. President Biden has ordered his government to develop a plan to make its fleet of 645,000 vehicles go completely electric. General Motors recently announced that by 2035 it would make only EVs.