bloomberg.com

The U.S. Will Need a Lot of Land for a Zero-Carbon Economy

Dave Merrill

3-4 minutes

At his international climate summit last week, President Joe Biden vowed to cut U.S. greenhouse gas emissions in half by 2030. The goal will require sweeping changes in the power generation, transportation and manufacturing sectors. It will also require a tremendous amount of land.

Wind farms, solar installations and other forms of clean power take up far more space on a per-watt basis than their fossil-fuel-burning brethren. A 200-megawatt wind farm, for instance, might require spreading turbines over 19 square miles (49 square kilometres). A natural-gas power plant with that same generating capacity could fit onto a single city block.

Achieving Biden's goal will require aggressively building

more wind and solar farms, in many cases combined with giant batteries. To fulfill his vision of an emission-free grid by 2035, the U.S. needs to increase its carbon-free capacity by at least 150%. Expanding wind and solar by 10% annually until 2030 would require a chunk of land equal to the state of South Dakota, according to Bloomberg and Princeton University estimates. By 2050, when Biden wants the entire economy to be carbon free, the U.S. will need up to four additional South Dakotas to develop enough clean power to run all the electric vehicles, factories and more.

Power Densities: Renewables Need More Space

Land area needed to power a flat-screen TV, by energy source

Sources: Leiden University, John van Zalk, Paul Behrens
Note: Assumes 100-watt television operating year-round

To be clear, Biden's plan doesn't need to entirely rest on wind and solar. Nuclear energy, which requires far less space, is also emission free. Same for

hydroelectric power. Plus, wind farms can be installed at sea. Solar panels work wonderfully on rooftops. And plenty of companies are placing bets that fossil-fuel plants can be retrofitted to burn hydrogen or equipped with systems to capture their carbon dioxide emissions.

But no matter how you slice it, the U.S. will need to dedicate more land to producing power in an emissions-free future. Here's how researchers at Princeton University's Net-Zero America project estimate it can be done.

Today, the U.S. Uses 81 Million Acres to Power Its Economy

Note: Liquid biofuels map depicts soy and corn farming. One dot equals 10,000 crop acres. About one-third of the nation's corn and soy crops are used for biofuels.

Right now, the current U.S. energy sector requires about 81 million acres (33 million hectares) of land. That estimate includes not only energy sources fueling the electric grid, but also transportation, home-heating and manufacturing.

Energy Land-Use Framework

Note: Wind's direct footprint includes only turbine bases and access roads. See methodology below for complete accounting of land-use estimates.

Two-thirds of America's total energy footprint is devoted to transportation fuels produced from agricultural crops, primarily corn grown for ethanol. It requires more land than all other power sources combined but provides just 5% of the nation's energy, making it the most land-intensive major fuel source.