Industry incentives create greener crypto mining

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In the wake of a new White House report on the climate implications of energy-hogging cryptocurrency mining, Cornell Engineering research suggests that providing green policy incentives for carbon capture and renewable energy should help such mining operations reduce their carbon footprints.

The Cornell study, "Mining Bitcoins with Carbon Capture and Renewable Energy for Carbon Neutrality Across States in the U.S.," was published Sept. 14 in *Energy & Environmental Science*.

The carbon impact of cryptocurrency faces increasing energy scrutiny and was examined in a White House report, "Climate and Energy Implications of Crypto-Assets in the United States," published Sept. 8 by the White House Office of Science and Technology Policy. This report is a result of President Joe Biden's Executive Order 14067 (March 2022)—"Ensuring Responsible Development of Digital Assets."

"Bitcoin mining's thirst for energy and the problematic, associated carbon emissions have raised concerns across the globe," said senior author Fengqi You, the Roxanne E. and Michael J. Zak Professor in Energy Systems Engineering.

"Whether you like it or not, there is a market. Crypto is here," said You, a senior faculty fellow at the Cornell Atkinson Center for Sustainability. "Since the market for cryptocurrency is growing, how can we better use science to inform energy and climate policy? How can we encourage the industry to practice environmental, social and governance-type management and to run their mining operation in a more sustainable way? That's the key."

Crypto-asset transaction validation—done through consensus mechanisms such as "proof of work," used by the Bitcoin and Ethereum blockchains—requires massive amounts of electricity. Total global electricity usage for cryptocurrency mining assets is between 120 billion and 240 billion kilowatt-hours per year—a range that exceeds the total annual electricity usage of large countries, such as Australia and Argentina, according to the White House report.

The Cornell study shows that states with a large share of renewable

energy in the electrical grid and lower electricity prices could mitigate the environmental damage that cryptocurrency brings.

In the United States, if federal and state policies balance economic development, strengthen environmental protection and offer incentives for direct carbon capture from the air and eco-friendly mining, then cryptocurrency becomes more sustainable.

"Mining cryptocurrency is like mining precious metals," he said. "The deeper underground you go, the harder it is to extract. For cryptocurrency, it takes more time to validate now than before."

In a technical-economic environmental analysis contained in the paper, the Cornell group examined all 50 states on the feasibility of cryptocurrency mining operations. Among states with crypto-mining operations, Vermont, Maine, Washington, Idaho and New Hampshire emitted the least carbon dioxide, while Delaware, West Virginia, Rhode Island and Kentucky produced the most.

Economically speaking, Hawaii, Rhode Island, Alaska, Connecticut, West Virginia and Kentucky performed the worst, while Washington was the most profitable state, followed by Vermont (with nearly all green energy) and New York (which has a lot of hydropower and is working toward all-green energy).

"The study finds that states with lower electricity prices typically have a higher penetration of renewable energy on the power grid," You said. "If you're running a cryptocurrency mining operation and you pick a place that has a lower electricity price, it is likely to use cleaner electricity to mine the bitcoin.

"Greener technology is coming," he said. "We are developing renewable energy systems to support the sustainable development of this industry,

promote economics and support climate actions."

More information: Haider Niaz et al, Mining bitcoins with carbon capture and renewable energy for carbon neutrality across states in the USA, *Energy & Environmental Science* (2022). DOI: 10.1039/D1EE03804D

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