Unused renewable energy an option for powering NFT trade, finds new research

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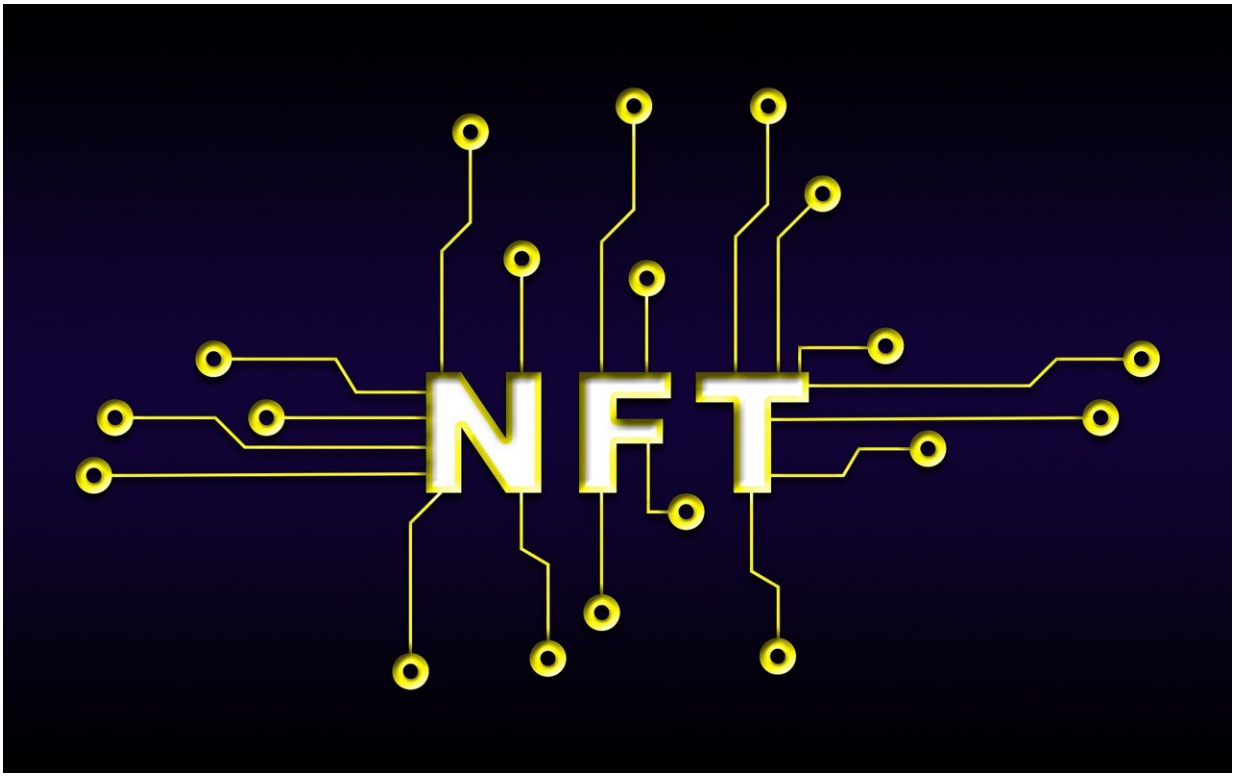

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Unused solar, wind, and hydroelectric power in the U.S. could support the exponential growth of transactions involving non-fungible tokens (NFTs), Cornell Engineering researchers have found.

Fengqi You, the Roxanne E. and Michael J. Zak Professor in Energy Systems Engineering in Cornell Engineering, is corresponding author of "Climate Concerns and the Future of Non-Fungible Tokens: Leveraging Environmental Benefits of the Ethereum Merge," which published July 10 in *Proceedings of the National Academy of Sciences*. You's co-author is Apoorv Lal, graduate student in chemical and biomolecular engineering and a member of the You Research Group.

Processing of NFT transactions, which has increased fourfold over the past five years, was once highly energy-intensive but has been made more sustainable with a recent switch to a more energy-efficient algorithm. But those savings, the researchers said, will be largely offset by the anticipated boom in yearly NFT activity.

Excess renewable energy, due to lack of storage capability, forces grid operators to curtail production. You's idea would put that unused energy-production potential to good use.

"It's the same idea as a car sitting in someone's garage," You said. "If it's not being driven, they could lend it to someone for carsharing. In our case, wind, solar and hydro power sources that aren't being utilized could be used to do something good."

"Of course, this would be up to the industry and policymakers," he said, "but technology-wise, we show it's very feasible because these power sources are there already."

Their key finding: The increased NFT processing activity could be powered, in part, from un- or underutilized existing power sources. Fifty megawatts of potential hydropower from existing U.S. dams that are not currently used to generate power, or a 15% utilization of wind and solar energy that can't currently be used or stored from sources in Texas, could be used to power an exponential increase in NFT transactions.

Blockchain technologies, including NFT transactions, offer a high level of security in a variety of applications, but the energy required to process each transaction is problematic in a warming world.

"In the beginning, people only cared about the usefulness of these applications," Lal said. "But then they started to realize the energy and climate impacts, because the crux of all these applications is the utilization of massive amounts of energy."

Without any efforts to make NFT transaction processing more sustainable, the authors wrote, their annual emissions will reach an equivalent of 0.37 megatons of carbon dioxide—close to the CO_2 emissions from 1 million single-trip flights for a passenger from New York to London.

In September of 2022, the Ethereum blockchain responded to the call for more sustainable trading by switching from an energy-intensive proof of work (PoW) algorithm to a proof of stake (PoS) consensus mechanism, which requires less computing power. Energy consumption decreased drastically following the switch, known as the Ethereum Merge.

Still, the authors wrote, an exponential rise in recorded NFT transactions would translate to more validators operating on the network. Toward the end of this decade, energy consumed by an exponential increase in NFT transactions could be equivalent to that of 100,000 U.S. households.

So even with significantly less energy consumption for individual NFT transactions, the cumulative effect of increased numbers of validators operating on fossil fuel-dominant grids will lead to a further rise in the associated carbon debt.

"By the end of this decade," You said, "the carbon produced by NFT

transactions may be roughly equivalent to that produced in one year by a 600-megawatt coal-fired power plant."

The authors evaluated two hydroelectric energy carriers—green hydrogen and green ammonia (more energy-dense than hydrogen)—for their viability, noting that their cost savings are influenced by multiple factors, including transportation distances and the utilization levels of available renewable energy sources.

Retrofitting these existing power sources could be challenging, the authors said, but would still be good for energy carriers and the planet.

"NFT processing is very power-hungry," You said, "so this turns out to be a good way to take advantage of these curtailments."

You is a senior faculty fellow of the Cornell Atkinson Center for Sustainability and co-director of Cornell University AI for Science Institute.

More information: Apoorv Lal et al, Climate concerns and the future of nonfungible tokens: Leveraging environmental benefits of the Ethereum Merge, *Proceedings of the National Academy of Sciences* (2023). DOI: 10.1073/pnas.2303109120

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