United States Senate

WASHINGTON, DC 20510

June 14, 2022

Office of Science and Technology Policy
Executive Office of the President
Eisenhower Executive Office Building
1650 Pennsylvania Avenue
Washington, D.C. 20504

Dear Dr. Nelson,

We appreciate the opportunity to comment on the Office of Science and Technology Policy's Request for Information (RFI) on the Climate and Energy Implications of Digital Assets. As noted in the RFI, addressing the climate crisis is a key priority for policymakers. We applaud the administration's commitment to meeting our nationally determined contribution (NDC) under the Paris Agreement to reduce emissions by at least 50 percent by 2030 and thereby mitigate the worst effects of climate change. In order to do so, we must consider the carbon footprint of emerging technologies and work proactively to mitigate their emissions.

The continued use of proof-of-work cryptomining directly threatens the United States' ability to meet its climate goals. In preparing this comment, our staff interviewed over a dozen experts in computational science and other relevant fields. Based on these conversations and additional research, we feel confident in stating up front that we have been unable to ascertain a single climate benefit from cryptocurrencies. While we can estimate the emissions from cryptomining, these estimates are hindered by cryptomining companies' failure to disclose their energy usage and sources. In this letter, we discuss the growing energy consumption of proof-of-work cryptocurrencies and their negative effects on retail and consumer electricity prices. We recommend that the United States restrict energy use for cryptomining to verified new, zero carbon sources and to increase transparency on energy usage.

Energy Consumption

Proof-of-work mining is an increasingly energy-intensive process and is used by the two largest cryptocurrencies by market capitalization, Bitcoin and Ethereum. "Miners" are given rewards in the form of coins based on "proof-of-work," or demonstration of resources put towards solving increasingly difficult computing problems. The annual global electricity consumption associated with mining Bitcoin and Ethereum is estimated to be around 300 TWh[1], which is comparable to the consumption of the United Kingdom.[2] After China's ban on cryptomining in 2021, cryptomining operations moved to other jurisdictions, and carbon emissions are estimated to have increased by 17%.[3] In order to provide an idea of the size of these emissions, it is estimated that the carbon emissions associated with Bitcoin mining in 2021 negated the global emissions

[1] https://digiconomist.net/ethereum-energy-consumption and https://digiconomist.net/bitcoin-energy-consumption accessed May, 2022.
[2] https://www.eia.gov/international/data/world/electricity/electricity-consumption

reductions from the uptake of electric vehicles.[4] If nothing changes, and cryptocurrency mining continues to increase, we run the risk that the emissions associated with this mining negate our transition to a clean energy future.

The United States is now the most popular country for cryptomining. The Cambridge Bitcoin Electricity Consumption Index, which is based on voluntary disclosures from four mining pools representing less than half of the network's activity, now estimates that 35% of global mining is in the United States compared with 4% in August 2020.[5]

The need for inexpensive, reliable energy to power cryptomining facilities had led to the revival of fossil fuel plants, making it harder to reach our climate goals. In one case, a coal-fired power plant located in Dresden, New York was slated for closure, but was then purchased and converted to natural gas which now powers Bitcoin mining.[6] A draft report by the New York State Climate Action Council, a committee that was established to develop a scoping plan and recommendations that are to be incorporated into the state energy plan, states that using fossil fuels and the additional electricity load to power cryptomining "could make it more difficult to meet [New York State's] Climate Act's zero carbon electricity requirement by 2040."[7]

Cryptomining also increases the stress on the electricity grid. Cryptocurrency boosters typically argue that cryptocurrency mining rigs, the computing system used for mining, can be considered a battery and help stabilize the grid. This is a deeply flawed analogy in that a true battery stores and releases energy rather than increasing the demand on the grid itself. In Texas, the Electric Reliability Council of Texas (ERCOT) introduced a new interim large load interconnection process[8] for new load interconnection requests, mainly applicable to cryptominers seeking to bring their facilities online before Bitcoin halves the reward value for mining in 2024. ERCOT expects electricity demand to increase by 6 GW, the equivalent of powering every home in Houston, within the next 12 to 15 months.[9] They've received inquiries from cryptominers seeking to join the grid whose projects would consume 17 GW by 2026, or the equivalent of two and a half New York Cities. While some cryptocurrency mining operations have started to enroll in flexible load programs, agreeing to curtail operations as directed by ERCOT, this does not address the burden of significant additional load on an already stressed grid.

Inadequate transparency

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[3] de Vries, Alex and Gallersdorfer, Ulrich, and Klaaßen, Lena and Stoll, Christian, "Revisiting Bitcoin's carbon footprint," *Joule* 6 (3) 498-502

[4] de Vries, Alex and Gallersdorfer, Ulrich, and Klaaßen, Lena and Stoll, Christian. 2021. "The true costs of digital currencies: Exploring impact beyond energy use." *One Earth* 786-789.

[5] https://ccaf.io/cbeci/mining_map

[6] Grist, "This power plant stopped burning fossil fuels. Then Bitcoin came along," Jessica McKenzie, May 06, 2021, https://grist.org/technology/bitcoin-greenidge-seneca-lake-cryptocurrency/.; The Chronicle-Express, "Power plant to add data center," John Christensen, July 31, 2019, https://www.chronicleexpress.com/story/news/2019/07/31/power-plant-to-add-data/4575073007/.

[7] https://climate.ny.gov/Our-Climate-Act/Draft-Scoping-Plan

[8] https://www.ercot.com/calendar/event?id=1649295264273

[9] https://techxplore.com/news/2022-04-crypto-miners-electricity-texas-equal.html

Cryptocurrency mining companies currently do not disclose detailed information about their energy usage, inhibiting a thorough assessment of their carbon footprint. While the Bitcoin Mining Council's reports emphasize their use of renewables, as of Q4 2021, the Council does not represent a majority of global mining efforts.[10] The April 2022 Intergovernmental Panel on Climate Change Sixth Assessment Working Group III underscores "considerable uncertainty exists surrounding the energy use" and "while it is clear that the energy requirements of global Bitcoin mining have grown significantly since 2017, recent literature indicates a wide range of estimates for 2020 (47 TWh to 125 TWh) due to data gaps and differences in modelling approaches."[11] The Cambridge Center for Alternative Finance relies on voluntary disclosures from four mining groups. This includes Foundry USA, which provides some public data but represent less than 20% of the estimated hashrate, a measure of the computational power per second, in the United States.

While it is in the interest of cryptominers to brand themselves as "green" and "eco-friendly" in appealing to a broader consumer base, these claims cannot be verified due to lack of transparency that characterizes most cryptocurrency mining companies. They are also at odds with abundant anecdotal evidence suggesting that many cryptocurrency mining operations in the U.S. and overseas are powered by electricity produced from combusting fossil fuels. For example, Sierra Club researchers could not find any cryptomining contracts for renewable energy, instead the publicly available documents were all for carbon intensive energy sources.[12]

Effects on consumer and retail rates

The increased electricity demand associated with cryptocurrency mining is already negatively affecting consumers, who must pay higher energy prices. Following the arrival of cryptomining operations in upstate New York, small businesses and local residents paid $79 million and $165 million extra annually for electricity, respectively.[13] Although local governments could generate some increased tax revenue from cryptocurrency mining operations, this increased revenue only equals 15% of the increased electricity costs to local businesses and residents. Moreover, some state and local governments are providing tax incentives to lure cryptocurrency mining operations. For example, tax incentives could cost Kentucky taxpayers $9 million annually in foregone revenue.[14]

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[10] https://bitcoinminingcouncil.com/wp-content/uploads/2022/01/2022.01.18-BMC-Q4-2021.pdf

[11] https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_FullReport.pdf

[12] Data compiled by Sierra Club https://twitter.com/J_I_Fisher/status/1524059668745625602?s=20&t=cIwSRbJJvSDOCH0PV5w9Gg; Appendix to Sierra Club comments to OSTP, May 9, 2022

[13] Benetton, Matteo and Compiani, Giovanni and Morse, Adair, When Cryptomining Comes to Town: High Electricity-Use Spillovers to the Local Economy (May 14, 2021). Available at SSRN: https://ssrn.com/abstract=3779720 or http://dx.doi.org/10.2139/ssrn.3779720

[14] Coal to crypto: The gold rush bringing bitcoin miners to Kentucky by Avi Asher-Schapiro, Thomson Reuters Foundation, https://www.reuters.com/article/usa-bitcoin-environment/update-1-insight-coal-to-crypto-the-gold-rush-bringing-bitcoin-miners-to-kentucky-idUKL5N2VO4WT

While cryptocurrency mining companies promise jobs, these benefits have not manifested.[15] In January 2022, Fitch Ratings Inc., one of the "Big Three" credit rating systems, stated that cryptocurrency mining operations "typically bring in very little additional economic benefits…to a local economy."[16]

Outlook and policy recommendations

Proof-of-work cryptocurrencies' reliance on carbon intensive energy sources is a global problem. Miners can simply move to a different jurisdiction to avoid a particular country's regulations. As illustrated by the consequences of China's ban, some of these displaced cryptocurrency mining operations may wind up being powered by more carbon intensive sources of electricity. At the same time, our electricity grid and local communities are already facing significant negative consequences from cryptocurrency mining operations.

Alternative validation mechanisms, including proof-of-stake, are estimated to greatly reduce the energy consumption of cryptocurrency. While many newer cryptocurrencies are using proof-of-stake, proof-of-work cryptocurrencies still dominate the marketplace. There may be technical challenges in adapting a cryptocurrency's codebase to a new validation mechanism cannot be underestimated.[17] Ethereum's transition to proof-of-stake has been promised for over six years, and in April 2022, it was again delayed by several months.[18] Bitcoin has made no indication it has serious plans to do so and mining groups consider the energy consumption is "a feature" that "produce[s] valuable attributes."[19] There is uncertainty in relying on an oft-promised and long-delayed transition to proof-of-stake to address the climate impacts of cryptocurrency and the United States should pursue policy in the near term.

To mitigate the negative environmental effects of proof-of-work mining, the United States should implement policies that drastically reduce if not eliminate emissions from this sector and require transparency from this sector. There are several options to achieve this goal, and we urge you to consider all of them. For example, the federal government could establish a national registry of United States-based cryptomining plants. It could mandate increased transparency and regular disclosures from all cryptomining facilities with respect to their energy sources, emissions, and metering agreements with local utilities. Another option would be to introduce energy efficiency standard for cryptomining facilities. The United States could direct all domestic cryptomining operations be powered exclusively by verified new, zero-carbon sources of energy or solely rely on excess renewables from extant sources, and partner with other nations to do the same. Engaging with Regional Transmission Operators/Independent System Operators,

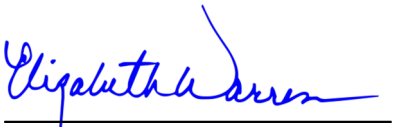
[15] Ibid.
[16] https://www.fitchratings.com/research/us-public-finance/crypto-mining-poses-challenges-to-public-power-utilities-24-01-2022
[17] https://www.businessinsider.com/greenpeace-chris-larsen-bitcoin-mining-campaign-crypto-community-outlook-falsehoods-2022-3
[18] https://cointelegraph.com/news/ethereum-merge-a-few-months-after-june-dev-clears-up-what-s-going-on
[19] Witness Testimony House Committee on Energy and Commerce (January 20, 2022) https://energycommerce.house.gov/sites/democrats.energycommerce.house.gov/files/documents/Witness_Testimony_Brooks_OI_2022.01.20_0.pdf

local public utility companies, and electricity providers to minimize cryptomining's repercussions on the electrical grid should be explored.

We thank OSTP for their attention to this matter and look forward to your next steps.

Sincerely,

Sheldon Whitehouse
United States Senator



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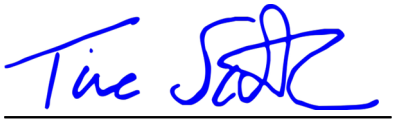
United States Senator



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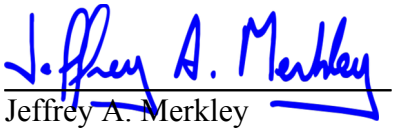

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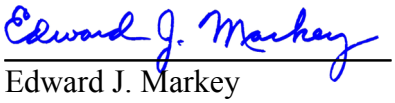

Edward J. Markey
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