Dr. Alondra Nelson, Acting Director

Office of Science and Technology Policy
Executive Office of the President
1650 Pennsylvania Ave., NW
Washington, DC 20504

RFI Response: Climate Implications of Digital Assets

Dear Acting Director Nelson:

Natural Resources Defense Council (NRDC) is pleased to submit this response to the OSTP's RFI regarding the climate implications of digital assets. NRDC is an international nonprofit environmental organization with more than 3 million members and online activists. Since 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and environment. NRDC has offices in New York City, Washington D.C., Los Angeles, San Francisco, Chicago, Montana, and Beijing.

A critical component of fighting climate change is ensuring that government financial regulatory agencies are properly considering and accounting for climate risk in their decision making, regulations, and actions. Regulators must address climate change risk across their regulatory domains, both to protect the financial system as a whole—guarding against systemic or "macro prudential" risk--and to protect individual business enterprises—guarding against "micro prudential" risk. Through its finance and legal experts, NRDC remains engaged in financial regulation and views sensible financial regulation as an integral part of mitigating the disruptive consequences of climate change on the economy.

We appreciate the OSTP's interest in understanding the climate impacts of digital assets[i]. Innovations in digital assets have brought about a new dynamic in financial markets. Initially, proponents claimed that digital assets would provide safe and affordable access to financial services for underserved and underbanked communities. Some still do. In reality, though, digital assets have become an unregulated asset class used mostly for speculative trading. It is critical that policymakers ensure that digital assets are created, maintained, and used in a responsible, equitable, and just manner.

It is well documented that the energy consumption and carbon footprint of cryptocurrency, a form of digital asset, is enormous. This impact will only increase as the global market for cryptocurrency is

projected to reach $32 trillion USD by 2027[ii]. If Bitcoin were a country, it would rank 23rd in the world in energy consumption, at 204 terawatt hours (equivalent to Thailand). Its carbon footprint, at 114 megatons of carbon dioxide (CO2), is as large as that of the Czech Republic.[iii] The Ethereum network, while consuming less energy than Bitcoin, still consumes a considerable amount of energy, annualized at 105.46 terawatt hours per year. The carbon footprint of a single Ethereum transaction as of April 2022 was 144.45 kilograms of CO2, which is the equivalent to the carbon footprint of 320,373 VISA transactions or 24,092 hours of watching Youtube.[iv]

The energy consumption and climate pollution of the industry are large and growing, at a time when it is critical that we reduce greenhouse gas emissions to keep average global temperatures from rising more than 1.5C above pre-industrial levels. Our comments below address several of the questions that OSTP posed in its Federal Register notice.

1. Protocols: *Information on the climate impacts of the protocols used by digital assets.*

The central reason for the industry's intensive energy consumption is the Proof of Work (PoW) protocol used to mine cryptocurrencies. Mining is a competitive validation method that pits pools of miners against one another, with the pool of miners that expends the most computational effort receiving the highest probability of collecting the financial rewards. It is this protocol's computational intensity that results in PoW's consuming enormous amounts of energy. While the industry may aspire to power its operations from renewable energy, currently over 60% of this energy demand is supplied from fossil fuel generation[v]. In addition, research has shown that this energy consumption is directly correlated with the price of Bitcoin, suggesting that if cryptocurrency prices continue to rise, more resources will be employed for mining and more energy will be consumed.[vi]

If cryptocurrency mining is ever to become climate-friendly, the indispensable first step is to cut down the energy consumption of the mining algorithms. Shifting from a PoW protocol to a Proof-of-Stake (PoS) protocol is projected to decrease energy consumption by 99.95%,[vii] which is essential if the industry is to operate in an environmentally responsible manner and the most immediate way to reduce its carbon footprint.

PoS is a consensus protocol where instead of miners competing through computational power, miners are randomly selected to validate transactions, with the caveat that a miner must deposit at least 32 Ethereum coins to participate. The improvements in energy efficiency and reduction in hardware requirements make this proposal a climate-friendlier alternative for the cryptomining industry. Despite the ongoing development of other, less energy-intensive protocols the method with the most immediate impact would be to switch to a PoS mechanism.

The Ethereum blockchain has announced plans to migrate to its PoS protocol blockchain, beacon chain, this summer. In theory, this should put pressure on the Bitcoin network to do the same. To date, however, Bitcoin, which represents more than 40% of the market, has been unwilling to move away from the energy intensive PoW methodology due to the huge economic benefits miners receive for maintaining the status quo, and it is unclear whether this will change. There must be an incentive beyond economic benefits for the entire network to undertake the shift of the mining algorithm from PoW to PoS. This could take the form of regulation to require transition to a less energy intensive algorithm. Meanwhile, the current and future energy consumption of the PoW algorithm is counter to the Biden Administration's ambitious and necessary greenhouse gas reduction goals. A universal shift to PoS is therefore critical as the industry is projected to grow at a rate exceeding 58% annually from 2022 through 2027.[ii]

2. Hardware: *Information about the climate impacts from the physical components that run the protocols for digital assets.*

The data centers which house the mining rigs are a major concern. Data centers are well known to be energy inefficient and can cause pollution from coolants. Their servers run continuously and utilize less than 40% of their capacity.[viii] The International Energy Agency estimates that data centers consume 200-250 TWh of electricity annually worldwide, which is approximately 1% of the world's energy consumption.

As electricity is the largest variable financial cost for miners, they need efficient processors to minimize energy consumption. Thus, they use highly specialized chips called Application-specific Integrated Circuits (ASICs). But ASICs are so specialized that as they become obsolete, they cannot be repurposed or used for another type of algorithm. This specialized hardware only lasts on average 1.29 years due to the huge toll mining takes. Research has shown that cryptomining generates approximately 30,700 metric tonnes (a metric tonne is 1,000 kilograms, or about 10% more than the weight of a US ton) of e-waste annually, the equivalent of the e-waste from the Netherlands.[ix]

When China banned crypto mining, many Chinese mining companies shifted their efforts to Kazakhstan, which provided more lenient policies and cheap, coal-powered energy. However, as the mining industry's energy consumption increased, it began overloading the country's electricity grid and caused frequent blackouts, forcing Kazakhstan to scale back the industry's ability to operate there. Many of these companies have chosen to abandon their hardware in Kazakhstan, which has lax policies surrounding the recycling of e-waste.[x]

E-waste is the dark side of our technology in that the chemicals —among them mercury, cadmium, and lead— that allow our devices to function are highly toxic when consumed or absorbed into the bloodstream. Global e-waste is on a trajectory to reach almost 74 million metric tonnes while the global recycling rate of e-waste is only at 17.4%. In 2019, the world generated 53.6 million metric

tonnes of e-waste, and within the 82.6% of unrecycled e-waste was 55 metric tonnes of mercury that has either already been released into the environment or will be eventually.[xi] Currently, over half of U.S. states have laws on the books regulating the disposal of e-waste, but there is currently no federal law requiring it to be recycled or prohibiting it from being exported to developing countries.[xii] The US generated over 6.9 million metric tonnes of e-waste in 2019 and cryptomining will only add to this environmental hazard, one that could potentially poison communities across the world if the e-waste is not recycled properly.

3. Resources: *Information about the resources used to sustain and power digital assets.*

It is encouraging to see an emerging—although limited-- trend of using renewable energy for mining. Nevertheless, from a cryptomining perspective, renewables are an intermittent source of energy, and mining requires a constant flow, which is why many companies still choose fossil fuel-based energy over renewables. Moreover, there are more important uses for renewable energy that can directly support decarbonization.

Counter to the crypto industry's claim of going green, cryptomining firms have started reinitializing stranded fossil fuel assets to power their operations, giving them easy access to cheap energy. A prominent example is the Greenidge Generation plant in Dresden, New York,[xiii] where an unprofitable natural gas plant decided to pivot and supply fossil-based energy for cryptomining. Greenidge has so far installed more than 17,000 crypto mining rigs and plans to double that number to 32,500 by the end of 2022. The issue here is that the permits were issued without the proper consideration of the environmental consequences--air and water pollution caused by the plant-- and economic consequences--potential decrease in tourism revenue--to the local community. Moreover, the expansion in their operations would consume the same amount of energy every year as nearly 100,000 homes. And because of Greenidge's "behind the meter" status, which means it doesn't provide electricity to the public, the plant is able to skirt environmental regulations.[xiv]

Due to instances like Greenidge Generation, lawmakers in New York have advanced legislation to impose a two-year moratorium on issuing air permits for fossil fuel-powered facilities that provide energy for proof-of-work mining operations. More specifically, under the legislation, permits and renewals could not be issued to any "electric generating facility that utilizes a carbon-based fuel and that provides, in whole or in part, behind-the-meter electric energy consumed or utilized by cryptocurrency mining operations that use proof-of-work authentication methods to validate blockchain transactions." [xv]Meanwhile, the bill also calls for a generic environmental impact statement directed to all cryptomining operations in the state.

Beyond reusing fossil fuel power plants, cryptomining proponents also claim to be using power that would otherwise be lost to curtailment (generally, the inability to use wind or solar energy because of lack of sufficient demand or lack of transmission infrastructure). However, there are many solutions

to the curtailment problem that can directly support decarbonization and help achieve our climate goals, such as building electrification, electric vehicle load, long duration storage, cross country transmission, and hydrogen electrolysis.

4. *Economics:* Information about how the energy use of digital assets is affected by the value of, demand for, and supply of particular digital assets or their underlying infrastructure.

Many rural communities are looking for ways to revitalize their local economies. At the same time, cryptomining companies are constantly searching for cheap electricity, their largest variable cost. As a result, the cheaper energy offered by many of these communities is an incentive for companies to site their operations in these communities, especially ones with favorable policies such as federally designated opportunity zones.

Cryptomining companies have made numerous claims about how their operations will benefit local communities, such as bringing jobs and strengthening the electricity grid for local utility companies. However, these purported benefits are tenuous at best. Mining operations only require a handful of unskilled staff to maintain and thus do not provide many jobs, let alone high-quality jobs, for the local community. While claims of strengthening the grid might make economic sense for utility companies, from a climate perspective these crypto companies want more fossil fuel-powered energy, which runs counter to state, national, and global climate goals.

Furthermore, cryptomining data centers can create negative effects on local water ecosystems due to water heating, can potentially release toxic chemicals into the air, and can generate large amounts of e-waste. In addition, their operations drive huge spikes in energy demand that often cause electricity rates to skyrocket, to the detriment of local residents and businesses, as evidenced in Plattsburgh, NY, which enacted a moratorium on mining for 18 months in 2018.[xvi] The result was the passage of a tariff structure agreement that ensured that if the city had to purchase extra power on the spot market, the costs would be passed on to miners, not residential users. However, anecdotally, the electricity prices for local residents are still higher than when the cryptomining companies weren't operating in their community. A study concluded that cryptocurrency mining operations in upstate New York increase annual electric bills by $165 million for small businesses and $79 million for individuals with little to no local economic benefit.[xvii]

6. Potential energy or climate benefits: Information about how digital assets can potentially yield positive energy or climate impacts.

Currently, Klima DAO and Toucan use blockchain technology to keep a public record of transactions for carbon offsets. Prices paid for individual offsets would become publicly available for the first time

and they claim crypto could help clean up a messy market. They also believe that using crypto to buy out the cheapest carbon offsets would get rid of the low-quality projects generating such credits in order to increase the price of carbon offsets. While there are significant issues with the carbon offsets trading markets—for example, whether they deter businesses from dealing directly with their own carbon emissions, as well as operational issues such as whether they ensure that the reduction of carbon emissions produced by an offset is equivalent, in quantity, timeframe and duration, assurance of achievement, and additionality, to the emitted carbon sought to be offset, it questionable at best whether crypto or blockchain can contribute to solving them. First, the verification issues are independent of the trading platform, whether blockchain or conventional. Second, using crypto to buy out cheap credits for low quality projects does not clear them from the market unless the buyer does not resell the credit, but rather disposes of the credit without consideration. In fact, by reselling credits for low quality projects, the buyer is actually creating more demand for them. And if the buyer does wish to buy and dispose of credits for low quality projects, it can do that on existing non-crypto markets.[xviii].

Another claim of the cryptocurrency industry is that cryptocurrencies increase the demand for renewable electricity sources. The amount of electricity generated from renewables is set to increase more than 6% in 2022, according to the International Energy Agency (IEA). The Agency also projects that global electricity demand is set to grow by another 4% in 2022. However, the IEA states that "despite these rapid increases, renewables are expected to be able to serve only around half of the projected growth in global demand in 2021 and 2022[xix]." What this shows is that there is already ample demand for renewable sources of electricity and the current supply already cannot keep up with the growth in demand globally, even without additional uptake from the cryptocurrency industry.

Other claims such as using methane gas for mining Bitcoin is a "better" choice than flaring it, and mining Bitcoin could "absorb wasted clean energy," are both strawman arguments. Better alternatives like investing in energy efficiency, electrification, and clean renewable generation, can help resolve the core problem of emissions, the risk associated with extracting the fossil fuels, and energy waste in the first place.

In sum, to date crypto mining, particularly using the PoW methodology, has been a voracious user of energy, inconsistent with combatting climate change. Any benefits to climate or local communities, whether economic development or jobs, have been largely unproven. The OSTP should consider all options, including mandatory adoption of the PoS methodology, to mitigate the threat to achieving our climate goals.

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We thank the OSTP for its consideration of our comments. If we can be of any further assistance, please do not hesitate to contact us.

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