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Clothilde V. Hewlett, Commissioner
Department of Financial Protection and Innovation, Legal Division
2101 Arena Boulevard
Sacramento, CA 95834

Re: Invitation for Comments – Crypto Asset-Related Financial Products and Services

Dear Commissioner Hewlett:

Natural Resources Defense Council (NRDC) is pleased to submit this response to the invitation of the Department of Financial Protection and Innovation (DFPI) to comment regarding crypto asset-related financial products and services. 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 and to protect individual business enterprises. 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 DFPI's interest in understanding the climate impacts of crypto asset-related financial products and services. Innovations in crypto assets have brought about a new dynamic in financial markets. Initially, proponents claimed that crypto assets would provide safe and affordable access to financial services for underserved and underbanked communities. Some still do. In reality, crypto assets have become an unregulated asset class used primarily for speculative trading. It is critical that policymakers ensure that crypto assets are created, maintained, and used in a responsible, equitable, and just manner.

Achieving California's 2045 economywide decarbonization goals is already challenging. California needs much more clean electricity than it currently produces to meet Senate Bill 100's goal of 100% zero carbon electric sales by 2045, and E.O. B-55-18's goal of economy wide decarbonization by 2045. California's renewable development rates need to triple to meet SB100's goals (source: p11 of SB100 summary report available here); the additional electrification of cars and buildings necessary to meet E.O. B-55-18 would require even more clean electricity development.

In our comments, we focus on four aspects of the crypto industry and the risks they can pose to California's climate goals:

- The energy consumption of proof-of-work is enormous and must shift to proof-of-stake.
- The physical components that run the protocols for crypto assets are major sources of e-waste.
- Communities lured in by the economic prospects of crypto mining often suffer adverse environmental and economic impacts with few benefits.
- The crypto industry's claims of positive energy or climate impacts are largely unproven.

Question 6. What steps should the DFPI take to address climate risks posed in the offering and provision of crypto asset-related financial products and services?

It is well documented that the energy consumption and carbon footprint of cryptocurrency, a form of crypto asset, is enormous. This impact will only increase as the global market for cryptocurrency is projected to reach $32 trillion USD by 2027.[1] At its peak, if Bitcoin were a country, it would rank 23rd in the world in energy consumption, at 204 terawatt hours, which is equivalent to the energy consumption of Thailand. Its carbon footprint, at 114 megatons of carbon dioxide (CO_2), was as large as that of the Czech Republic.[2] Similarly, at its peak, the Ethereum network consumed 105.46 terawatt hours per year and the carbon footprint of a single Ethereum transaction as of April 2022 was 144.45 kilograms of CO_2, which is the equivalent to the carbon footprint of 320,373 Visa transactions or 24,092 hours of watching YouTube.[3] Although the energy consumption of the industry has decreased due to a recent downward trend in prices, this does not mitigate or resolve its energy or carbon emission concerns.

The energy consumption and climate pollution of the crypto industry are large and will continue to grow at a time when it is critical that we reduce greenhouse gas emissions to keep average global temperatures from rising more than 1.5 C above pre-industrial levels. There are four main areas where we see crypto assets having an adverse impact on the climate and the environment: the enormous energy consumption of crypto mining operations due to use of the Proof of Work protocol, the massive amount of electronic waste that is produced as a result of these operations, the serious environmental impacts often suffered by local host communities of mining operations, and the unproven claims that these operations are good for the electric grid and the climate. Each of these areas is discussed in more detail below:

[1] "Cryptocurrency Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2022-2027." *Research and Markets,* Feb. 2022, researchandmarkets.com/reports/5546940/cryptocurrency-market-global-industry-trends.
[2] "Bitcoin Energy Consumption Index." *Digiconomist,* digiconomist.net/bitcoin-energy-consumption/.
[3] "Ethereum Energy Consumption Index – Ethereum Energy Consumption." *Digiconomist,* digiconomist.net/ethereum-energy-consumption/.

I. The energy consumption of the Proof of Work protocol is enormous and must shift to Proof of Stake

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.[4] In addition, research has shown that this energy consumption is directly correlated with the price of Bitcoin, suggesting that if cryptocurrency prices start rising again, more resources will be employed for mining and more energy will be consumed.[5]

If cryptocurrency mining is to become climate-friendly, the first step is to reduce the energy consumption of mining algorithms. Shifting from a PoW protocol to a Proof-of-Stake (PoS) protocol is projected to decrease energy consumption by 99.95%,[6] which is essential if the industry is to operate in an environmentally responsible manner and the fastest 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 protocol a climate-friendlier alternative for the crypto mining 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. Several popular cryptocurrencies such as Solana and Cardano already use PoS algorithms to validate transactions.

The second largest cryptocurrency by market capitalization, Ethereum, announced plans several years ago to migrate to a PoS protocol blockchain and began its formal migration 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 due to lobbying efforts and incumbency issues. Outside pressure must be put on miners to consider factors beyond economic benefits in order for the Bitcoin network to shift the mining algorithm from PoW to PoS. This could take the form of regulation to require transition to a less energy intensive algorithm.

[4] Blandin, Appolline, et al. "3rd Global Cryptoasset Benchmarking Study." Sept. 2020.
[5] De Vries, Alex. "Bitcoin boom: What Rising Prices Mean for the Network's Energy Consumption." *Science Direct, 17 March 2021,* sciencedirect.com/science/article/pii/S2542435121000830.
[6] Beekhuizen, Carl. "Ethereum's Energy Usage Will Soon Decrease By ~99.95%." *Ethereum.org*, 18 May 2021, blog.ethereum.org/2021/05/18/country-power-no-more/.

Meanwhile, the current and future energy consumption of the PoW algorithm is counter to both the Biden Administration's and California's ambitious and necessary greenhouse gas reduction goals. A universal shift to PoS is therefore critical as the industry is projected to grow at an annual rate of more than 58% from 2022 through 2027.[7]

II. The physical components that run the protocols for crypto assets are major sources of e-waste

The data centers which house the mining rigs are also a major concern. Because 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). However, 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. Because of the intense calculations stemming from the PoW algorithm, crypto mining causes an ASIC chip to run at extremely high temperatures 24/7, which severely impacts its life span. Research has shown that crypto mining generates approximately 30,700 metric tonnes (a metric tonne is 1,000 kilograms) of e-waste annually, the equivalent of the e-waste from the Netherlands.[8]

The chemicals that compose e-waste—including mercury, cadmium, and lead—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.[9] The U.S. generated over 6.9 million metric tonnes of e-waste in 2019 and crypto mining will only add to this environmental hazard.

Changing the mining algorithm and decreasing the overall energy consumption will directly reduce the number of ASIC chips used for calculations.

III. Communities lured in by the economic prospects of crypto mining often suffer adverse environmental and economic impacts with few benefits

Many rural communities are looking for ways to revitalize their local economies. At the same time, crypto mining companies are constantly searching for cheap electricity. As a result, access to cheap energy offered by many of these communities is a major incentive for companies to site

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[7] "Cryptocurrency Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2022-2027." *Research and Markets,* Feb. 2022, researchandmarkets.com/reports/5546940/cryptocurrency-market-global-industry-trends.

[8] "Bitcoin Mining Producing Tonnes of Waste." *BBC, 20 Sept. 2021*, bbc.com/news/technology-58572385.

[9] "The Global E-waste Monitor 2020 – Quantities, Flows, and the Circular Economy Potential." *United Nations Institute for Training and Research.* ewastemonitor.info/gem-2020/.

their operations in these communities, especially ones with favorable policies such as federally designated opportunity zones.

Crypto mining 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 ones, for the local community. While claims of better utilizing the grid and generation assets might make economic sense for vertically integrated utility companies, from a climate perspective, these crypto companies want more fossil fuel-powered energy, due to its lower cost, which runs counter to state, national, and global climate goals.

Furthermore, crypto mining data centers can create negative impacts 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, these operations drive huge spikes in energy demand that often cause electricity rates to skyrocket to the detriment of local residents and businesses, as occurred in Plattsburgh, NY. Coinmint, a crypto mining company, opened up mining facilities in Plattsburgh in 2017-2018. With the servers running 24 hours a day, residents' electricity bills increased by $30-$40 a month. In response, the town enacted a moratorium on mining for 18 months in 2018. The ultimate response to this spike in local energy costs was the passage by Plattsburgh 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.[10] However, the electricity prices for local residents are still higher than when the crypto mining 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.[11]

IV. The crypto industry's claims of positive energy or climate impacts are largely unproven

While it is encouraging to see an emerging trend of using renewable energy for mining, from a crypto mining perspective, renewables are an intermittent source of energy and mining requires a constant flow. This 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, crypto mining firms have started resurrecting stranded fossil fuel assets to power their operations, giving them easy access to

[10] De, Nikhilesh. "US City Mulls 18-Month Moratorium on Bitcoin Mining." *Coindesk*, 5 Mar. 2018, coindesk.com/markets/2018/03/06/us-city-mulls-18-month-moratorium-on-bitcoin-mining/.
[11] Counts, Laura. "Power-hungry Cryptominers Push Up Electricity Costs for Locals." *Berkeley Haas*, 3 Aug. 2021, newsroom.haas.berkeley.edu/research/power-hungry-cryptominers-push-up-electricity-costs-for-locals/.

cheap energy. A prominent example is the Greenidge Generation plant in Dresden, New York,[12] where an unprofitable natural gas plant decided to pivot and supply energy for crypto mining. 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. When Greenidge applied for their 2016 permit, they indicated that it would operate solely to provide power to the grid in a "peaking" capacity; however, since 2020, Greenidge has begun utilizing the energy it produces to power an on-site cryptocurrency mining operation. As a result, Greenidge's GHG emissions have increased considerably and will continue to increase going forward.[13] Moreover, an expansion in the plant's 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.[14]

Due to instances like Greenidge Generation, lawmakers in New York have passed 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."[15] Meanwhile, the bill also calls for a generic environmental impact statement directed to all crypto mining operations in the state. The legislation has passed the Senate and Assembly and is currently awaiting Governor Hochul's signature. In addition, in June 2022, the Department of Environmental Conservation denied the renewal of a key air permit for Greenidge,

Beyond reusing fossil fuel power plants, crypto mining 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). It's true that the California Independent System Operator (CAISO) reports that approximately 5% of utility scale solar production (link) was curtailed in 2020. However, consistent with the principle of estimating electricity and environmental impact of crypto mining against a well-constructed counterfactual, to use this curtailed electricity, new crypto mining assets would have to demonstrate that they either (1) matched their consumption with solar production that would

[12] Misdary, Rosemary. "A Bitcoin Mining Operation in the Finger Lakes Runs Up Against New York's Climate Law." *Gothamist, 17 Feb. 2022*, gothamist.com/news/bitcoin-mining-operation-finger-lakes-runs-against-new-yorks-climate-law.

[13] Elkin, Jacob. " New York Denies Air Quality Permit to a Cryptocurrency Mining Facility, Citing Sabin Center White Paper." *Columbia Climate School, 7 Jul. 2022*, news.climate.columbia.edu/2022/07/07/new-york-denies-air-quality-permit-to-a-cryptocurrency-mining-facility-citing-sabin-center-white-paper/

[14] Greenfield, Nicole. "Bitcoin Mining Is Bad for the Climate—and Local Communities Too." *NRDC*, 27 Apr. 2022, nrdc.org/stories/bitcoin-mining-bad-climate-and-local-communities-too.

[15] De, Nikhilesh. "New York State Assembly Passes Bill Blocking New Crypto Mines That Use Non-Renewable Power." *Coindesk*, 26 Apr. 2022, coindesk.com/policy/2022/04/27/new-york-state-assembly-passes-bill-blocking-new-cryto-mines-that-use-non-renewable-power/.

have otherwise been curtailed or (2) sign contracts to bring incremental storage online to store this excess solar and then use that amount of electricity for mining. Moreover, 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.

Another claim of the cryptocurrency industry is that cryptocurrencies increase the demand for renewable electricity sources. According to the International Energy Agency (IEA), the amount of electricity generated from renewables is set to increase more than 6% in 2022. The IEA 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."[16] This evidence demonstrates 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 the claim that using superfluous methane gas—such as methane generated from landfills—for mining Bitcoin is a better choice than flaring it, and the claim that mining Bitcoin could absorb wasted clean energy, do not hold up. It is true that using methane for productive purposes is better than flaring it. However, the real question is - what is the best use for excess energy generated through methane that would otherwise be flared? The answer isn't mining for bitcoin. California needs every net zero carbon resource, like captured methane, to generate electricity and decarbonize our economy. Moreover, 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 DFPI should consider all options, including mandatory adoption of the PoS methodology, to mitigate the threat to achieving our climate goals.

Any energy and environmental impact of a new crypto project needs to be calculated against the right counterfactual. I.e., how much electricity would be used, and how many carbon and air pollutant emissions would occur if the new crypto project did not exist. The difference between electricity consumption and grid-wide pollution between these two scenarios, the grid with and the grid without further crypto mining, is the net impact of new crypto mining in California. Any crypto electricity and carbon emissions claim must be validated using this methodology.

[16] "Electricity Market Report - July 2021." *International Energy* Agency, www.iea.org/reports/electricity-market-report-july-2021.

New crypto brought online should at minimum use an electricity mix that is clean enough to be compliant with the state's existing renewable portfolio standards (RPS) and SB 100's carbon reduction targets. And if crypto assets truly aim to be zero carbon, crypto miners should sign contracts to bring new renewable resources online, the output of these contracted renewable resources should match the total electricity consumption amount and time-varying electricity consumption profile of the crypto mining center. NRDC recommends that any new crypto asset in California be required to do exactly that.

Respectfully submitted,

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