Exhibit A

Who Pays for Bitcoin Mining?

Electricity Ratepayers, Bitcoin Users, and Everybody Else

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Abstract:

Contrary to industry claims, I have shown elsewhere that a rising Bitcoin price and improved and more cost-effective Bitcoin mining machines will lead to ever-increasing electricity consumption and environmental costs. The very nature of Proof-of-Work mining sets up a Bitcoin mining arms race, with electricity the ammunition, while the vast revenue mining creates is an incentive to develop more powerful single purpose machines. This process is wasteful, in electricity and e-waste. It is also costly to the economy, even compared to the billions of dollars it generates for Bitcoin miners. I show that for every dollar of mining profits, more than six dollars of costs are imposed on our economy. These costs are from the burden heavily subsidized industrial power miners divert to themselves that ratepayers must ultimately pay, the greater dependence on costly and environmentally damaging peaker plants kept online or recommissioned to support mining, and even in the dilution of Bitcoin itself as more coin is minted. What once aspired to be the coin that would allow inexpensive banking and transacting for the masses has become incredibly inefficient, with hidden costs causing the average cost of each transaction to exceed $500, once all the various costs are included. These hidden costs, especially when compared to the $0.44 cost of the average debit card transaction, has pushed Bitcoin out of reach of all but a few speculators and those whose business demands its anonymity.

Who Pays for Bitcoin Mining? – Electricity Ratepayers, Bitcoin Users, and Everybody Else

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Satoshi Nakamoto had a vision to employ the blockchain to bring almost costless transactions to the masses who cannot afford traditional banks. Digital coins show great promise to streamline and memorialize events, such as transfers of digital coins and Non-Fungible Tokens (NFTs), tracking of movement of goods and services, or documentation of loans, investments, voting, airplane tickets, medical records, or myriad other applications. These records can be private or public, and protected from corruption or manipulation forever by raising the cost of any such corruption, either by committing a disproportionally high cost in electricity, or by insuring against such manipulations through collateral of some sort. The most notorious instrument and method is the Bitcoin Protocol, which employs Proof-of-Work and immense electricity consumption to protect against manipulation of transfers of Bitcoin. Rather than some alternative insurance against transaction manipulation, by using electricity purchases to up the ante of blockchain corruption, Bitcoin processing is inherently resource-intensive and wasteful. I show that other electricity users, Bitcoin holders, and the economy as a whole bear six times the amount of Bitcoin mining profits, based on New York State data, in ratepayer burden on mining subsidies, environmental costs, and Bitcoin dilution. In addition, each Bitcoin transaction costs over $500, compared to $0.44 for a typical bank debit transaction.

These economic inefficiencies are almost entirely unique to Bitcoin. As Ethereum moves to Proof of Stake, Bitcoin will represent most all Proof of Work mining activity, and hence almost all energy consumption in the sector. The U.S. is already the dominant host of miners in an industry that consumes more power than Sweden. I show in my research that the unique algorithm Bitcoin employs causes energy consumption to rise continuously in lockstep with the Bitcoin price, and will rise even faster if the cost and energy efficiency of miners or access to cheap power improves.

Commentators and researchers express grave concern for the effect of Proof of Work mining on resources and the environment. For instance, Schinckus et al (2019) note increased recognition of the carbon footprint and energy consumption of Bitcoin mining. Perhaps the most publicized study is Mora et al (2018), who assert that, should Bitcoin continue its current trend and experience the same growth as other innovations, it could generate sufficient electricity consumption to help push the planet beyond the two-degree Celsius temperature increase that accelerates global warming.

Some have argued that less expensive and sustainable energy sources, or improved Bitcoin mining efficiency will mitigate these dismal prophecies. For instance, Kohler et al (2019) outline the geographical differences in carbon footprints from Bitcoin mining globally to conclude greenhouse gas emissions can be reduced if mining moves to regions with a greater mix of sustainable energy.

Mir (2020) assert that improvements in Bitcoin mining efficiency has stemmed the energy intensiveness of mining, but do not describe how such enhancements reduce costs. They do correctly note that other blockchain authentication methods do not suffer the resource consumption problems of Proof-of-Work mining. Truby (2018) adds to the discussion by acknowledging the environmental threats arising from Bitcoin mining, and by proposing public policy to alleviate these

negative externalities that occur as an artifact of Proof-of-Work mining. They recommend such policies as profits taxes, facilities registration and mining taxes, improved carbon markets, and mandated emissions caps.

Authors recognize international challenges to such public policy. Newbery (2021) notes that the China mining crackdown resulted in a dramatic expansion of the share of Bitcoin mining in the United States, which now represents 35% of global Proof-of-Work mining. She observed "If overall energy consumption increases in a particular state because of mining, it could push other industries to use more non-renewable energy."

Few have measured the monetary consequences of mining on others. Most significantly, Benetton et al (2021) calculated that New York State ratepayers paid $244 million more in 2019 in electricity because of Bitcoin mining, and extrapolate to costs imposed across the United States of $1 billion annually. Goodkind et al (2020) calculate the environmental costs, and conclude that, for every $1 of Bitcoin mined, $0.49 is also generated in climate and health damages in the U.S.

I augment Benetton (2021) by demonstrating how other electricity consumers ultimately pay much more for Bitcoin mining. In doing so, I show why Benetton's estimates likely significantly underprice the burden paid by others in support of Bitcoin mining. These include a shifted burden on electricity costs in replacement electricity that covers not only Bitcoin mining energy consumption but also the profits generated in the industry. In addition, the electricity costs and profits arising from Bitcoin mining are also paid directly by holders of Bitcoin, as speculators and transactors. Finally, I also demonstrate that these costs will trend upward as a share of the increase in the price of Bitcoin, and document how greenhouse gas emissions will rise over the decade.

The Model:

Read (2022b) recently produced a theoretical model and then verified empirically that showed why electricity consumption to memorialize Bitcoin transactions, and in turn earn a reward of Bitcoin, rises proportionally with the price of Bitcoin. I showed that a 1% increase in Bitcoin rewards results in a .73% increase in electricity consumption. Bitcoin rewards increase if the price of Bitcoin rises by at least 17.3% annually to compensate for declining block rewards, which it has consistently over its lifetime. There is also a strong likelihood that the Bitcoin Protocol may soon adopt a transaction fee approach to maintain the profitability of mining indefinitely into the future. Hence, increased electricity consumption will likely continue and possibly even accelerate in the next decade.

The inherent weakness of the Bitcoin mining protocol is actually quite simple once one understands two aspects of Proof-of-Work mining. First, as we acknowledged earlier, every protocol requires some method to compensate those who ensure the blockchain is not corrupted. Methods other than Proof-of-Work require some sort of a collateral stake to insure a blockchain is not manipulated. Only in Proof-of-Work is the stake an amount of energy used to perform the mining by employing millions of mining machines worldwide, in the case of Bitcoin.

The second ingredient is that anyone can mine Bitcoin if they have the requisite mining machine and access to abundant electricity, an Internet connection, and the ability to quickly dissipate the heat that the electricity consumption generates. These miners can be rented or purchased. Should

they be purchased, healthy resale markets exist and the miners themselves can often be paid by less than a year's worth of profits. Hence, capital is relatively inexpensive, as are labor and facilities costs.

Under these conditions, Bitcoin mining is characterized by the economic model of perfect competition and free entry. A miner that is just able to cover these costs is called the "marginal miner", and the electricity cost that makes such a marginal miner just profitable I label as c*. One can easily calculate such a break-even electricity cost using a variety of Bitcoin mining calculators on the Internet, or by application of the following formula from Read (2022b):

$$\textit{Cutoff energy cost } c^* = bP_0Q_0e^{(g-f)t}/M^*,$$

where c* is the breakeven electricity cost in dollars per kilowatt-hour, b is the number of blocks mined every hour (six in the case of Bitcoin), $P_0Q_0e^{(g-f)}$ is the path of mining rewards over time based on the initial price and reward quantity P_0 and Q_0, and (g-f) is the rate of increase of the Bitcoin price over the reward decline over time t. Finally, M* is the number of kilowatts of power devoted to mining from representative mining machines.

This equation represents the free-entry condition of the industry. The resulting break-even electricity cost c* that results in zero gross mining profits also reveals to us the nature of Bitcoin net profits. Mining results in positive profits if a mining farm can obtain electricity at a cost c less than the breakeven cost c*. In the case of the ubiquitous Antminer S9 machine that represents a plurality of all miners, this breakeven cost c* is currently just under $0.10 per kilowatt-hour. An operator who secures energy below that level is able to earn a positive profit. A state-of-the-art S19 XP Hydro can mine profitably with electricity at $0.32/kwh. In mining the electricity cost is the operative currency.

Benetton (2021) notes correctly that any such demand for electricity results in greater electricity demand overall within an electricity production industry that economists label quite inelastic. Such industries require a relatively large price increase to accommodate increased demand. For instance, Benetton report a price elasticity of .14, which means the electricity price increases to all ratepayers by .14% for every one percent rise in the price of Bitcoin because the resulting greater electricity demand requires the employment of more expensive power on the spectrum of low cost to high cost. In the next figure I show the spectrum of energy sources, from new and relatively low cost, but capital intensive, forms such as wind, solar, and geothermal energy, compared to the low capital intensity, but high variable cost forms of natural gas, coal-fired, and "peaker" natural gas plants employed only when quick new electricity must be brought online. Note that these latter fossil-fueled plants also generate significant greenhouse gas emissions, mostly in the form of carbon dioxide.

Figure 1 below shows the ranking of production of electricity by price on the vertical axis and the quantity the United States produces on the horizontal axis, including a modest carbon tax. I also show the cutoff electricity price of $.10 per kilowatt-hour, above which mining on the most common machines is no longer profitable. Finally, I denote by the vertical rectangle an estimate of approximately 130 terawatt-hours devoted to Bitcoin mining. The width of this rectangle is for illustrative purposes only, but represents the approximate global rate of Bitcoin mining consumption worldwide, of which the greatest share is now in the United States.

Currently in the United States, our marginal producers of electricity is either peak natural gas plants that are turned on and off as demand warrants, and coal-fired power plants that are kept online to meet growing demand. Let us assume that Bitcoin farms are able to divert some of the cheapest and sustainable electricity production to their use. The total cost of such power generation is denoted by A in the diagram. In this simple model, since mining profits are derived by obtaining power at a rate lower than the miner profitability cutoff c*, those that can divert power at the industrial rate to mining receive a profit of $0.046 per kilowatt-hour diverted to mining. The resulting subsidy of $0.112 over the rate that residents and businesses pay is almost twice the profit miners receive. It is this subsidized cost plus profits that exhaust the reward offered miners, and hence acts as a credible commitment the network makes to ensure it is not corrupted by coalitions of miners that would sacrifice these costs for the returns in double-spending their accounts within one block.

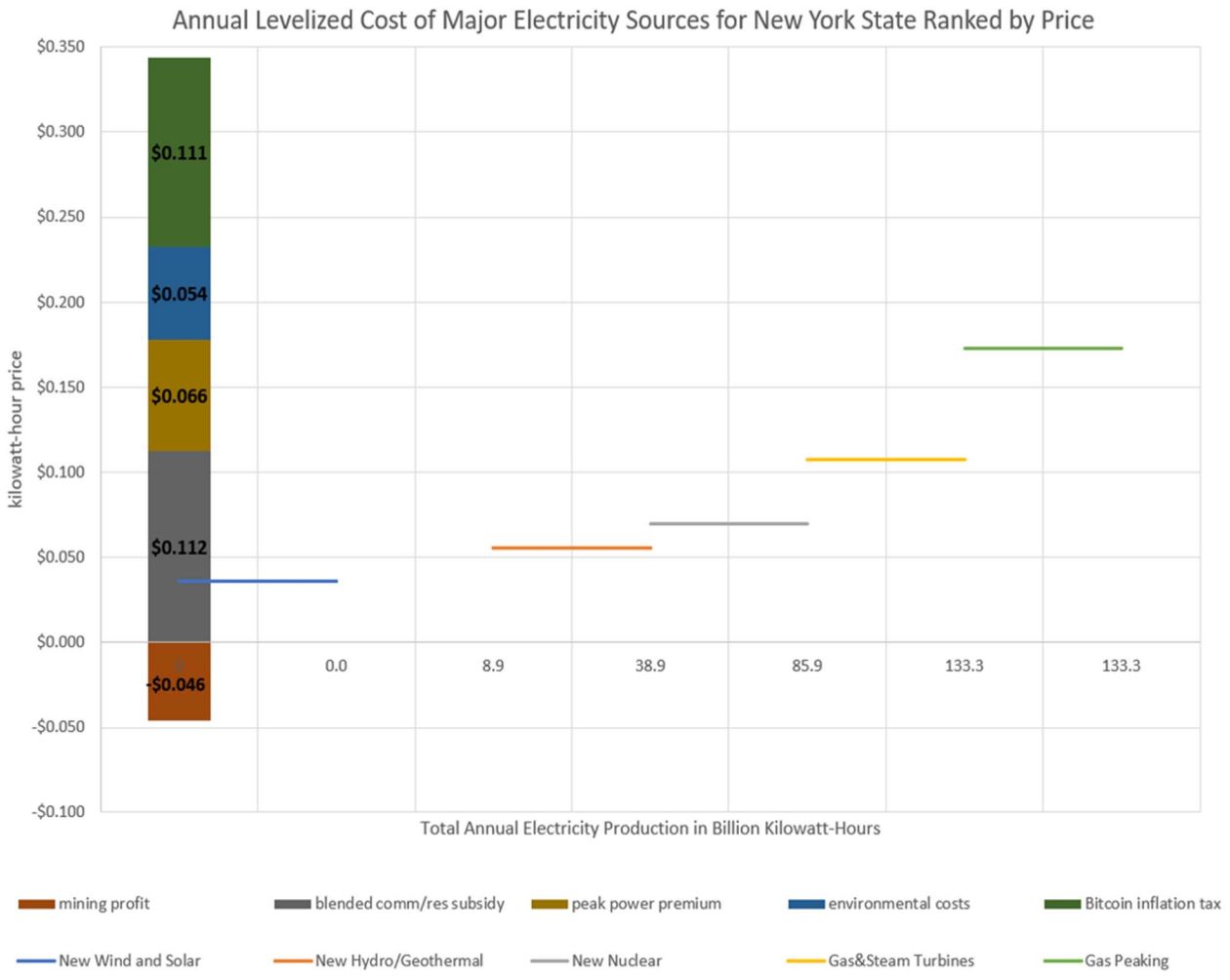

Figure 1. Ranking of Bitcoin Mining and Energy Costs for various power sources in New York State

As Figure 1 shows, so long as the marginal cost of electricity is greater than the cost miners pay for electricity, other ratepayers will always be subsidizing their operation and covering their profits. New York electricity ratepayers pay the subsidies offered Bitcoin miners through higher rates. As figure 1 shows, for every $.046 per kilowatt-hour consumed in profits, the difference between the blended

residential/commercial power rate and the industrial rate offered miners is $0.112. In addition, since additional system demand must be accommodated at the margin typically with natural gas peaker plants, ratepayers must cover these overruns of another $0.066.[1] Goodkind (2021) calculates environmental and health costs of $0.054 for every dollar of Bitcoin mined, which adds another $0.054, while the additional coin mined dilutes value of Bitcoin holders by $0.111. In sum, others pay $0.343 for every $0.046 of profits miners garner, or $6.52 for every $1 in Bitcoin mining profits.

I can also use this methodology to determine the carbon footprint of Bitcoin mining. It is frequently claimed that Bitcoin miners divert to their use sustainable forms of power such as wind and solar. However, if that diversion then requires other consumers of electricity to be diverted to marginal electricity sources such as natural gas and coal, then Bitcoin's gain in clean power is the industry's loss in then relying on fossil fuels that would otherwise not be needed. Hence, we must measure the carbon footprint of mining not based on the power source miners divert to themselves, but the sources we must use to replace the power they diverted. In most all regions, coal and natural gas are the marginal sources of power, and hence we must look at their carbon footprints for an equivalent amount of power diverted to Bitcoin mining.

A couple of groups produce estimates of energy consumption in Bitcoin mining. The Cambridge Bitcoin Electricity Consumption Index makes a conservative estimate of energy consumption by assuming that the total mining processing power is first generated by the existing stock of the most efficient miners available, and then is rounded off by remaining miners of lesser efficiency but which may nonetheless be profitable if their electricity cost is sufficiently low. Their estimate is that the mining industry consumes 136.5 terawatt-hours annually, which is equivalent to the annual electricity consumption of Sweden.[2]

A second research group called Digiconomist was founded by Alex De Vries, an expert in banking and in cryptocurrency. His group publishes an estimated and best case Bitcoin Energy Consumption Index based on the processing power of mining machines and also on the processors most likely to be operating at a given time. They also publish and update carbon footprint measures that correspond to their estimates.[3]

Globally, approximately 8,500 coal-fired power plants generate 9,440 terawatt-hours of electricity annually. Their 40% share of global electricity production creates an estimated 10.1 gigatonnes of carbon dioxide emissions annually.[4] A simple calculation then reveals that 136.5 terawatt-hours of electricity production from coal creates 146 million metric tonnes of carbon dioxide each year.

These results assume that there are sufficient mechanisms to move and store power. If such is not the case, investments are needed to combine solar power with batteries, with pumped hydro storage, with throttling of hydroelectricity generation or nuclear power generation. Inadequacies in the electric grid can be solved with technological improvements. Bitcoin mining is not that solution.

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[1] Lazard estimates peaker power costs of $.175/kwh based on a natural gas price of $3.45/MMBTU, while the current price has risen to about $10.00/MMBTU at wholesale, and higher for delivered industrial natural gas.

[2] https://ccaf.io/cbeci/index, retrieved March 18, 2022.

[3] https://digiconomist.net/bitcoin-energy-consumption, accessed March 29, 2022.

[4] https://www.iea.org/reports/global-energy-co2-status-report-2019/emissions, accessed February 13, 2022.

Next, I look at the energy outlook for the mining industry. I take industry consenses on the expected price of Bitcoin to the year 2030 and the adjustments in Bitcoin rewards to miners in 2024 and 2028 to estimate mining electricity demand by 2030, based on results from Read (2022c) that document the relationship between rewards and energy demand and on the Cambridge and Digiconomist estimates of total electricity demand at the end of 2021.

Figure 2 superimposes on the industry estimates of the Bitcoin price and the resulting Bitcoin reward that includes reward halving on the left vertical axis, and the corresponding trend in electricity consumption on the right hand vertical axis from 2020 to 2030 using both the Digiconomist and the more conservative Cambridge electricity consumption indices. The 30% upward trend in the Bitcoin reward over the period corresponds to a 30% increase in energy consumption, with a peak energy consumption globally of 284 TWh by 2027.

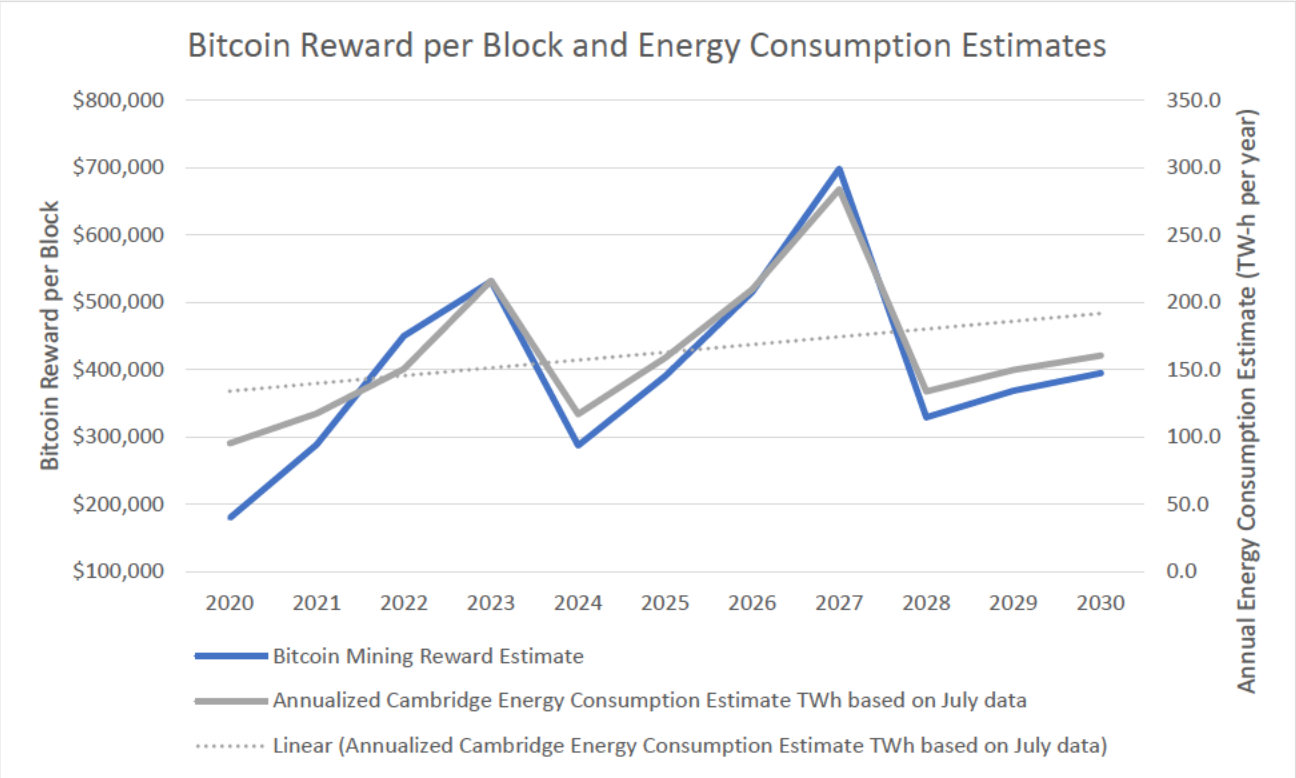

Figure 2 – Projections of Bitcoin Energy Consumption.

The increase represents the equivalent of an additional 12 coal power plants by 2030 from the increased consumption of 43.1 terawatt-hours of electricity and 42 million additional metric tonnes of greenhouse gas emissions yearly. It also increases electronic waste (e-waste) over the decade.

Some in industry suggest that the increase in electricity consumption will be mitigated by improvements in miner efficiency. Over the past six years, the processing power of miners have improved by a factor of ten, while their electricity consumption per unit has risen by a factor of less than 2.5. This translates into an improvement in miner energy efficiency for a unit of processing power by a factor of four. Yet, electricity consumption continues to rise in lock-step with miner rewards and the price of Bitcoin.

The reason why improvements in miner technology and in the electricity consumption per unit of processing power continues to worsen electricity consumption is that there is an arms race in miner technology, with three major companies competing to produce increasingly efficient miners. Intel is also entering the fray with a promise of a faster miner at half the cost.[5] Mining capital costs continue to improve dramatically. Yet, electricity consumption does not decline. In fact, as miner costs fall, there is even less competition for a share of the revenue mining can generate. This means that electricity can exhaust an even larger share of miner revenue. Free entry of miners continues to then demand more electricity so that rewards continue to be devoted to electricity and profit. Hence, the analysis above remains accurate despite the innovations. In the miner arms race, electricity continues to be the ammunition.

Consider a simple example that demonstrates why technological improvements do not reduce energy consumption. Assume the market is in equilibrium and a free firmware update allows every miner to process twice as many hashes per unit of electricity. Intuition at first would suggest the industry can then slash electricity consumption by one half. However, note that a Prisoner's Dilemma exists. No miner could be as profitable if it does not avail itself of the update. But, once all update, the network would be able to do the requisite calculations for each block in half the time. Since the Bitcoin Protocol adjusts the difficulty factor to find a solution to the blockchain only once every ten minutes, that halving of processing time quickly results in an increase in the difficulty factor by an equal amount so that the doubled processing power is just sufficient to mine one block every ten minutes.

This counterintuitive example for why improved efficiency is simply gobbled up by an explosion in the number of miners and hence no reduction in electricity hinges upon the nature of Proof-of-Work. The reward to miners must be consumed in costs, primarily electricity, and some profit for those who have an electricity cost advantage over others. In fact, if miners become cheaper such that they can pay for themselves quicker, that then translates into even more miners and hence greater electricity consumption. In other words, miner improvements can actually translate into greater electricity intensity, not less. Similarly, if electricity costs fall, the result is the consumption of more electricity as well, to ensure total electricity costs exhaust much of the Bitcoin mining reward and continue to act as the deterrent from a rogue theft of transactions in a block. Proof-of-Work mining is inherently wasteful by design. And other electricity users pay for profits of miners and for the expense of more costly power sources if less expensive power is diverted to mining.

One additional group also pays for mining. The block reward, which is currently approximately $300,000 every ten minutes, is a tax all those who hold Bitcoin pay. The total value of all outstanding Bitcoin does not change if some new Bitcoin is minted, just like the value of a company does not change if it performs a stock split. Bitcoin rewards can be likened to such a stock dividend that occurs. If a stock splits two for one, each stock is simply half as valuable as before. When

[5] Senior Intel Vice President Raja Koduri stated "We are mindful that some blockchains require an enormous amount of computing power, which unfortunately translates to an immense amount of energy. Our customers are asking for scalable and sustainable solutions, which is why we are focusing our efforts on realizing the full potential of blockchain by developing the most energy-efficient computing technologies at scale." https://www.intel.com/content/www/us/en/newsroom/opinion/thoughts-blockchain-custom-compute-group.html, retrieved February 20, 2022.

Bitcoin generates rewards at a rate of about $15 Billion per year, it is diverting $15 Billion of value from existing Bitcoin owners to miners. With a market capitalization on March 29, 2022 of $897 Billion, the shift in income by Bitcoin dilution is 1.7%. Bitcoin rewards act as an inflation that increases the number of coin without increasing market value, and hence reduces the value of each coin by the same amount. In other words, Bitcoin holders pay for both the profits and electricity of Bitcoin mining, for a total loss of $15 Billion per year.

These results are a product of Proof-of-Work that demands the intensive use of an expensive factor of production to produce a strong financial disincentive to one considering hijacking a block of transactions by commandeering the processing power (and expense) of the network. Fortunately, as Ether, the next largest Proof-of-Work digital coin, adopts the Ethereum 2.0 protocol and replaces Proof-of-Work with Proof-of-Stake mining, Bitcoin will be the only major coin using Proof-of-Work. It will command 94% of the value of all Proof-of-Work coins and will be 50 times larger than the next largest coin. There will be, in essence, only one major coin that will use the resource-intensive Proof-of-Work authentication method. That good news is balanced by the bad news that it still remains by far the largest digital coin in the sector by market capitalization. Also, since its design requires the majority of mining nodes to agree to any change in its protocol, it is also the least likely to reform in the ways more environmentally sensitive digital coins have evolved.

Those heavily invested in the profits this Proof-of-Work sector supports are not only loathe to change. They also wish to divert the discussion from this inconvenient truth. For instance, mining firms and their associations often claim they only purchase sustainable power, without acknowledging their purchases push the rest of us toward unsustainable fossil-fueled power. They argue that they only purchase stranded power, such as wind or solar that the grid cannot handle. The solution to this problem is better siting and storage, not unnecessary mining. Similarly, an improved natural gas pipeline system or an acceleration of mandates to cap methane emissions at oil and gas wells is superior to the use of generators to tap those methane sources to fuel Bitcoin mining. To shift emissions from methane to carbon dioxide does not solve the long term greenhouse gas emissions problems that we must solve to meet our treaty obligations under climate change protocols.

Another claim is that miners purchase carbon offsets. The carbon offset market is riddled with inefficiencies and fraud. Only true sequestration or carbon conversion to other non-emitting products are effective in reducing atmospheric carbon dioxide. The current price for true carbon capture is many orders of magnitude higher than carbon offsets miners claim to purchase.

The final claim articulated more of late is that Bitcoin mining act as some sort of battery that can allow the grid to better match supply and demand. They argue that their voluntary participation in load shedding that miners often offer to alleviate excess grid demand allows utilities to avoid using dirtier and more expensive power during high load events. The miners fail to note that they are paid to participate in such a program and they avoid involuntary brownouts by participating. They also fail to note that demand would not have been so high to need shedding in the first place had their mining not contributed to demand. For example, Mike Levitt, the Chief Executive Officer of Core Scientific. a Bitcoin mine allocated about 500 megawatts of power, claimed that “We have arrangements with the communities and utilities wherein; when the grid needs it, we will down

power…Our industry really can quite legitimately, effectively and uniquely release energy utilization to the grid; it's almost as if we're acting as a battery."[6]

These examples of greenwashing are particularly problematic since China's once dominant carbon footprint from mining has recently shifted to the United States once China realized it could no longer afford to keep building coal power plants as more hydroelectric power was diverted to Bitcoin mining. We see that the lax regulatory environment in the United States has now made it the largest Bitcoin miner in the world. In addition, a crackdown of mining in Kazakhstan in late 2021 is resulting in an increased migration of their activity toward the United States. Mining activity worldwide, as reported by Statistica, in August of 2021 is:[7]

USA	Kazakhstan	Russia	Canada	China	Other
35.40%	18.10%	11.23%	9.55%	0%	25.72%

With a number of states either overtly or by regulatory omission now attracting Bitcoin mining, the United States seems destined to represent the majority of Bitcoin mining globally. Foundry USA collects data on the states currently attracting mining in the U.S:[8]

New York	Kentucky	Georgia	Texas	Nebraska	Other
19.9%	18.7%	17.3%	14.0%	10.4%	19.7%

Admittedly, the results are counterintuitive. Other electricity ratepayers pay for both the profits of the Bitcoin mining industry and for the subsidy miners receive by purchasing power at preferable rates and forcing ratepayers toward the least efficient and dirtiest power sources. Also, the electricity costs and profits of mining are borne a second time by holders of Bitcoin themselves as a diversion of a share of their value to miners. Finally, if electricity is transportable, new demand anywhere results in maintenance or expansion of our worst power sources, in expense and greenhouse gas emissions. These costs us all and to Bitcoin holders are a totally unnecessary price to pay.

In summary, while most cryptocurrency mining use environmentally benign methods to authenticate transactions, Bitcoin stands out in a number of ways. With Ether, the number two coin, transitioning to Proof of Stake, Bitcoin represents 95% of all energy-intensive mining by market capitalization, and almost all the energy usage. The price of Bitcoin continues to increase and so does its energy usage. On any grid that employs fossil-fueled power plants, this means that states will be forced to keep online or bring back online fossil-fueled power plants at precisely a time when our nation and other countries are committed to reducing our carbon footprint. Not only is this excess, equivalent to the total electricity consumption of Sweden, growing and shall grow dramatically should Bitcoin price predictions prevail, but the profits that these Bitcoin mining entrepreneurs garner come at a far higher price to us all, in higher electricity costs, greater reliance on peaker plants, health and environmental costs, and even the dilution of value to existing Bitcoin holders as supply expands with additional mining. None of these consequences are necessary or affordable.

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[6] https://www.coindesk.com/business/2022/03/25/greener-bitcoin-mining-could-be-chinas-trillion-dollar-present-to-the-us/, accessed March 26, 2022.

[7] https://www.statista.com/statistics/1200477/bitcoin-mining-by-country/, accessed March 7, 2022.

[8] https://www.cnbc.com/2021/10/09/war-to-attract-bitcoin-miners-pits-texas-against-new-york-kentucky.html, retrieved March 7, 2022.

References:

Benetton, Matteo, Compiani, Giovanni and Adair Morse (2021), "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.

Goodkind, Andrew L, Jones, Benjamin A., and Robert P. Berrens (2020), "Cryptodamages: Monetary Value Estimates of the Air Pollution and Human Health Impacts of Cryptocurrency Mining," Energy Research and Social Science, Vol. 59, pp. 3-8.

Kohler, Susanne, and Massimo Pizzol (2019), "Life Cycle Assessment of Bitcoin Mining," Environmental Science and Technology, 53, pp. 13598-13606.

Lazard, "Levelized Cost of Energy Production," https://www.lazard.com/perspective/levelized-cost-of-energy-levelized-cost-of-storage-and-levelized-cost-of-hydrogen/, accessed April 1, 2022.

Mir, Usama (2020), "Bitcoin and its Energy Usage: Existing Approaches, Important Opinions, Current Trends, and Future Challenges," KSII Transactions on Internet and Information Systems, Vol. 14., No. 8, August.

Mora, C., Rollins, R.L., Taladay, K. (2018), "Bitcoin emissions alone could push global warming above 2°C. Nature Clim Change 8, 931–933 (2018). https://doi.org/10.1038/s41558-018-0321-8

Newbery, Emma (2021), "U.S. is Now the Biggest Bitcoin Miner in the World. Should We Be Happy?" The Ascent, October 17, 2021, https://www.fool.com/the-ascent/cryptocurrency/articles/us-is-now-the-biggest-bitcoin-miner-in-the-world-should-we-be-happy/ , retrieved February 28, 2022.

Read, Colin (2022a), "The Inevitability of Escalating Energy Usage for Popular Cryptocurrencies, and Other Dimensions of Cryptocurrency Risk, forthcoming in the International Journal Risk and Contingency Management,

Read, Colin (2022b), The Bitcoin Dilemma -The Inevitability of Increasing Energy Consumption in the Cryptocurrency Mining Arms Race, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4061464

Read, Colin (2022c), "The Bitcoin Dilemma," forthcoming in Palgrave MacMillan Press, NY.

Schinckus, Christophe, Canh Phuc Nguyen, and Felicia Chong Hui Ling (2019), "Crypto-currencies Trading and Energy Consumption," International Journal of Energy Economics and Policy, 10(3), pp. 355-364.

Truby, J. (2018), "Decarbonizing Bitcoin: Law and Policy Choices for Reducing the Energy Consumption of Blockchain Technologies and Digital Currencies," Energy Res. Social Sci., 44, pp. 399-410.

Exhibit B

BUFFALO NIAGARA WATERKEEPER®
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May 9, 2022

VIA ELECTRONIC SUBMISSION ONLY

Office of Science & Technology Policy
Eisenhower Executive Office Building
725 17th Street NW, Washington, DC 20500
DigitalAssestsRFI@ostp.eop.gov

RE: Request for Information on the Energy and Climate Implications of Digital Assets.

Thank you for the opportunity to provide comments on the Request for Information ("RFI") on the Energy and Climate Implications of Digital Assets (87 Fed. Reg. 17,105). Please accept these state-specific comments for New York on behalf of Buffalo Niagara Waterkeeper.

Buffalo Niagara Waterkeeper (BNW) is a regional 501(c)(3) non-profit organization whose jurisdiction includes the entire Niagara River watershed and nearshore areas of Lake Erie and Lake Ontario. Our mission is to protect and restore our water and the health of our surrounding ecosystems and community and to connect our community to the water. We provide these comments on behalf of our constituents who reside in the Western New York area including the City of North Tonawanda.

The following comments pertain to topical comment areas: (2) Hardware; (3) Resources; (7) Likely future development of industry trajectory; (8) Implications for U.S. Policy and (9) Other information. The topic area number is included in the section titles below.

<u>What is cryptocurrency mining? (3)(7)(9)</u>

Proof of Work cryptocurrency mining uses many computers working simultaneously to solve the same mathematical equation, or puzzle. The first machine to solve the problem wins. The more machines working on the same puzzle, the greater the chances of profiting. To do this, cryptocurrency operators search for areas with cheap power sources or power plants that are not operating at full capacity to install mining machines. Researchers at Cambridge found that bitcoin globally, uses as much energy as some countries like Belgium or the Netherlands. Another formally published study found that bitcoin emissions alone could push global warming above 2°C. Notably, there are other, less resource intensive, types of cryptocurrency mining.[1]

[1] https://www.theguardian.com/technology/2022/mar/29/bitcoin-reduce-energy-consumption-climate-groups?CMP=Share_AndroidApp_Other

Cryptocurrency in New York (2)(3)(7)(9)

Cryptocurrency mining companies are attracted to New York State due to the presence of inexpensive energy from the Niagara River and St. Lawrence River Hydropower projects and increasingly to take advantage of underutilized fossil fuel power facilities. An April 26, 2021 letter sent to Governor Cuomo by the environmental law group, Earthjustice, and the Atlantic Chapter of the Sierra Club warned that **nearly 30 upstate New York power plants could be converted** to run full-time as data centers, with catastrophic consequences for statewide CO2-equivalent emissions.

Over the past two legislative sessions, New Yorkers have pushed for a moratorium on cryptocurrency mining until the environmental and public health effects could be studied but have failed to pass this legislation [A.7389-C/S.6486-D].

Simultaneously, New York State has had at least two cryptocurrency mining operations open with detrimental environmental effects:

(1) Seneca Lake: Greenidge Generation located on the shores of Seneca Lake, the largest of New York's finger lakes, brought a coal fired power plant, converted to natural gas, back online solely to mine for cryptocurrency. The plant intakes 139 million gallons of water and discharges 135 million gallons daily. The discharged water can be as hot as 108 degrees in the summer and 86 degrees in winter, according to permit documents.

(2) Fortistar: In the City of North Tonawanda, located north of Buffalo, New York in Niagara County. A Canadian-owned company is bringing a minimally operational natural gas fired power plant back to full capacity. The plant that was operating at a minuscule 3-20% of capacity since 1994 will now be running at full capacity, 24 hours a day, 365 days per year, for the sole purpose of cryptocurrency mining. As noted in the concurrently submitted Earth Justice letter on this matter, "if the plant operates every day at full capacity, the potential emissions from the facility will sharply increase to 339,068 tons of CO2 per year a nearly 3,000% increase in its CO2 emissions while also significantly increasing emissions of nitrous oxide, particulate matter, carbon monoxide, and volatile organic compounds."

Operating this plant not only raises concerns about the effects of air pollution on surrounding residents, but also after assurance from the company that the noise would not affect the surrounding residential neighborhood, the Developer is now seeking to install a 26-foot wall to trying to abate the consistent noise plaguing the neighbors. Currently, the company is awaiting permits to utilize the power plant for personal use yet have built shipping container towers filled with servers and are operating off old existing permits. While the company awaits permit renewal from the state of New York, needed to operate, they are opearting using power from the grid.

> Located adjacent to the Niagara River Area of Concern, the U.S. federal government has spent tens of millions of dollars cleaning up the toxic legacy that previous industry left behind in this community. Now, as the Niagara River communities begin to recover, a new industrial threat has emerged, bringing a new suite of negative environmental impacts on these same communities that have already suffered 100 years of industrial abuse.

The specific kinds of environmental hazards associated with these industries are outlined below. The following information is indicative of the types of harm that could be encountered with all crypto mining facilities verified by local experiences.

Energy Use and Emissions (3)

Proof-of-Work cryptocurrency mining uses enormous amounts of energy to power the computers needed to conduct business. The resulting emissions will undermine the national climate mitigation goal of reaching net-zero greenhouse gas emissions no later than 2050. The cumulative impact of this type of business model could go unnoticed as these individual enterprises operate privately, off the electric grid. By not supplying power to the grid for public consumption, these companies are able to evade state and federal oversight of cryptocurrency mining operations. Specifically in New York, because many miners are generating power for private use, thus operating "behind the meter" they are also undermining New York State's Climate Leadership and Community Protection Act (CLCPA) requirement, that by 2030, 70% of grid electricity must be from renewable sources. Expanding coal or gas plants to burn more fossil fuels in the middle of a climate crisis will exacerbate the problem for nothing more than private gain.

Water Use (3)

In addition, power plants use more water than any other industry. With billions of gallons of water being used each day to produce electricity, thermoelectric power plants have been the largest water users in the country since 1965. Most of the water used in thermoelectric power generation is for cooling and condensing the steam at power plants. Repowering fossil fuel power plants for cryptocurrency mining will have a negative impact on water resources by depleting quantities for private energy generation. Moreover, the water that is returned is superheated. (See above fact from Seneca Lake). This detrimental environmental effect results in ecosystem harm, fish kills, and in turn disrupts the tourism and fishing industry. All with no public benefit from the electric generation.

Electronic Waste (2)

The very nature of bitcoin mining requires intense computing and as the computers used for mining become obsolete, it generates e-waste. University at Buffalo Professor Jim Berry, describes ASIC (Application Specific Integrated Circuits) as "so specialized that as they become obsolete, they cannot be repurposed for another task… Computer components contain hazardous materials such as lead and mercury and must be treated as a hazardous waste and

managed accordingly." Industries are already struggling with a global chip shortage. In addition to producing large amounts of e- waste, rapidly cycling through millions of cryptocurrency mining devices may further disrupt the global supply chain for other electronic devices.

Zoning (9)

Municipal zoning codes don't adequately address the cryptocurrency industry. Pollution comes in many forms, and it takes time for regulations to catch up with emerging environmental issues, such as greenhouse gas emissions and noise levels associated with bitcoin mining operations. In fact, these types of operations are increasingly deemed an incompatible land use when located next to residential neighborhoods but have been able to operate by taking advantage of an area's industrial past. Relying on the industrial heritage of an area will likely lead to a disproportionate impact on environmental justice areas.

Noise levels (9)

Continual operation of power plants contributes excessive noise pollution into the surrounding community. These high noise levels 24 hours a day, every day, can have detrimental health impacts. Communities in the state can attest to their experience with significant increase in noise pollution attributed to bitcoin operations. In the Fortistar case, after assurance that noise would not affect this surrounding residential neighborhood, the developer, Digihost, is now seeking a variance to install a 26-foot wall in an effort to abate the consistent noise plaguing neighbors. According to residents along Seneca Lake, the noise from the constant hum of computer servers travels across the lakes causing a constant disruption lakewide.

Lack of Transparency and Local Difficulties During Public Process (9)

In Buffalo Niagara Waterkeeper's experience with local cryptocurrency mining facilities, we have observed extremely flawed processes associated with the proper review, permitting processes, and public involvement. Small municipalities don't have the expertise or resources to properly and objectively review these types of proposals. Some may view it as an opportunity for new technology and community improvement, however the developers and owners are not transparent about the downsides of these operations as outlined above. When former power generating facilities are transformed into mining facilities, we have seen them latch onto the existing permits (occupancy, air, water, etc.) of the previous operations. With new ownership and an entirely new use, these facilities should have to obtain new permits. In contrast, no public comment or notification is currently required for these facilities in New York State, and communities have had these facilities open in their neighborhoods without knowing about the direct impacts of noise and air pollution that they will be subjected to.

Conclusion

BNW supports the United States commitment to the climate crisis and thanks the Office of Science and Technology for seeking comment on this important issue. Our direct personal experience with the cryptocurrency mining industry had displayed a disregard for

environmental protections, community impact, and a backstepping toward climate goals. Cryptocurrency mining will continue to emit CO2 and other noxious substances regulated under the Clear Air Act into the air. It puts an undue burden on surrounding neighborhoods and their quiet enjoyment of their homes with noise pollution. Moreover, repowering fossil fuel plants for private gain provides no public benefit. This practice takes a step back to the time when water resources were destroyed by industry and saddles the public with the responsibility to mitigate negative environmental impacts such as superheated waters, hypoxia, harmful algal blooms, and loss of fish and wildlife habitat.

Respectfully submitted,

Jill Jedlicka,
Executive Director
Buffalo Niagara Waterkeeper

es;mv

Exhibit C

May 9, 2022

VIA ELECTRONIC SUBMISSION
Office of Science & Technology Policy
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725 17th Street NW, Washington, DC 20500
DigitalAssetsRFI@ostp.eop.gov

Re: The Energy and Climate Implications of Digital Assets in New York State

Thank you for the opportunity to provide comments on the Request for Information ("RFI") on the Energy and Climate Implications of Digital Assets. 87 Fed. Reg. 17,105 (Mar. 25, 2022). Please accept these state-specific comments for New York on behalf of the undersigned organizations.

We appreciate the Biden Administration's efforts to combat the climate crisis and advance environmental justice by cutting U.S. greenhouse gas pollution at least 50% by 2030 and having a net-zero emissions economy by 2050. However, as the RFI notes, these efforts will be imperiled by the climate, energy, and environmental challenges from digital assets that rely on proof-of-work consensus mechanisms. Tremendous amounts of fossil-fuel-powered energy in the U.S. following the ban on crypto-mining in China in September 2021 now threaten the achievement of climate and energy commitments.[1]

1. Proof-of-work Cryptocurrency or "Digital Asset" Mining Uses an Enormous Amount of Electricity.

Proof-of-work cryptocurrency mining consumes massive amounts of electricity.[2] Bitcoin's electricity consumption alone increased more than threefold between the beginning of 2019 and May 2021.[3] Estimates of Bitcoin's global energy use are approximately 152 tera-watt hour ("TWh").[4] In comparison, the entire state of New York used approximately 150 TWh in 2020.[5] Due to this enormous amount of electricity use, Bitcoin's annual global greenhouse gas emissions have been estimated by some at between roughly 60 to 100 million tons of carbon dioxide ("CO_2"), though this is most likely an underestimate given the exponential growth of mining in recent years.[6] Further, a recent congressional memo estimates that the annual emissions from Bitcoin and Ethereum are equal to roughly 15.5 million car tailpipes per year.[7] Although it is difficult to forecast emissions in coming years given the rapid growth of proof-of-work cryptocurrency mining in the United States after China's ban in September 2021, academics estimate that "cryptocurrency's energy usage will rise another 30% by the end of the decade—producing an additional 32.5 million metric tons of carbon dioxide a year."[8]

2. Climate and Energy Impacts from Proof-of-work Mining in New York State.

The climate and energy impacts of proof-of-work cryptocurrency mining in New York and throughout the United States are staggering and increasing every day.[9] Following China's ban on proof-of-work mining in September 2021, the U.S. is now the largest proof-of-work mining location in the world, accounting for more than one-third of the global market.[10] New York is home to approximately 20% of the country's proof-of-work cryptocurrency mining operations.[11]

As the map below shows, [12] there are many operating and proposed large-scale cryptocurrency mining operations in upstate New York.

As detailed below, New York is also at the frontline of several local fights against proof-of-work cryptocurrency mining operations that burn fossil fuels and which threaten local health, local ecosystems, local economies,[13] and prevent the State from meeting its statutory climate and clean energy goals. But this cannot be a town-by-town or even a state-by-state fight: the consequences of inaction and disparate action are too severe. An increased use of fossil-fueled electricity has terrible consequences for climate, for air and water pollution, and is unconscionable during a climate crisis.[14]

3. Lack of Reliable and Specific Information on Proof-of-work Mining Operations.

Unfortunately, there is very little transparency in this largely unregulated, energy-intensive wild-west industry. Many operations can operate as of right now under existing laws, regulations, and permits with no additional oversight. Mining operations can negotiate private contracts with merchant generators or utilities for discounted rates. Proof-of-work mining operations vary greatly in size and are often ever-expanding. Given the unregulated nature of crypto mining, it is notoriously difficult to determine how much energy a particular entity is using, what fuel source the mining operation relies on, or estimate how much a particular entity is mining in general. Without a standardized methodology to collect data to properly estimate energy consumption from cryptocurrency mining, estimates will continue to vary widely. Without accurate information, it is nearly impossible for communities, local groups, and interested residents to understand the impact a mining operation can have on the community. Despite what little we know about mining operations, what we do know for certain is that the expansion of crypto currency mining in the United States increases air and water pollution, strains the electrical grid, and increases electricity rates of local residents.

4. Proof-of-work Mining Increases the Operations of Fossil Fueled Power Plants.

Companies and private-equity firms have invested significantly in proof-of-work mining facilities in New York and throughout the U.S.[15] We frequently hear from the Bitcoin community about the merits of financial decentralization, but the reality does not seem to bear that utopian dream out.[16] Because of the immense amount of capital needed to purchase enough application-specific integrated circuit ("ASIC") miners[17] to competitively mine bitcoin, there are fewer miners today compared to even a few years ago.[18] In 2021, before China banned mining, a whitepaper published by the National Bureau of Economic

Research found that the top 10% of crypto miners control 90% of mining and just 0.1% (about 50 miners) control close to 50% of all mining—which directly translates to "ownership" of Bitcoin.[19] It has been surmised that the concentration of mining wealth is even more pronounced in the U.S. today.[20]

In New York, those entities are resurrecting and extending the life of old, inefficient, fossil-fueled power plants to mine proof-of-work cryptocurrency—translating to significant greenhouse gas emissions. Unfortunately, that increase in fossil-fueled electricity has dire consequences for the climate, air and water pollution, and communities that live in the shadow of fossil fuel plants. Two upstate New York power plants in particular tell a worrying story:

In North Tonawanda, New York, just outside Buffalo, is the fossil gas Fortistar North Tonawanda ("FNT") power plant where a new owner intends to convert the little-used 60 megawatt ("MW") gas turbine facility to mine proof-of-work cryptocurrency 24/7, 365 days per year. Over the past five years the FNT plant operated at 2–13% capacity factor emitting relatively small amounts of CO_2, nitrogen oxide ("NO_x"), and other harmful air pollutants.[21] If the plant operates every day at full capacity, the potential emissions from the facility will sharply increase to 339,068 tons of CO_2 per year—a nearly **3,000%** increase in its CO_2 emissions—while also significantly increasing emissions of NO_x, particulate matter, carbon monoxide, and volatile organic compounds.[22] This signficant increase in air pollution will spew into several nearby environmental justice areas.[23]

In addition, increased operation of the power plant significantly increases clean water intake and discharge of hot water. The FNT facility plans to use 500,000 gallons of water per day for cooling purposes, which will discharge to the local wastewater treatment plant. That will account for approximately 12% of the City of North Tonawanda's current total water usage.[24] This significant additional thermal discharge comes at a time when the city can least afford it. The North Tonawanda water treatment plant recently discovered that it needs $3 million in emergency repairs and $30 million for long term repairs.[25]

In another instance, on the western shores of Seneca Lake, amongst the productive vineyards and farms of the Finger Lakes, is the Greenidge Generating Station. Like FNT, in recent years Greenidge was operating infrequently[26] and is now operating 24/7/365 to mine cryptocurrency. In 2020, the Greenidge CFO stated "[w]ithout the crypto mining operation, we would not be running most of the time."[27] Indeed for six years, the plant did not operate at all.[28] The Greenidge facility emissions history tells the story:

Year	Days of Operation[29]	Approx. Annual Capacity Factor[30]	CO2 (tons/ year)	No. of Miners	Fuel source
2009	267	~34%	455,795	0	Coal
2010	358	~65%	599,105	0	Coal
2011[31]	77	~10%	113,357	0	Coal
2012	0	0%	0	0	*none*
2013	0	0%	0	0	*none*
2014	0	0%	0	0	*none*
2015	0	0%	0	0	*none*
2016	0	0%	0	0	*none*
2017	135	~17%	124,009	0	Gas
2018	147	~19%	119,304	0	Gas
2019[32]	48	~6%	39,406	0	Gas
2020	**343**	**~42%**	**228,303**	**6,900 miners[33]**	**Gas**
2021	353	~51%	278,846	15,300 miners[34]	Gas
2022	Every day	Increasing	91,530 (for 01/01–03/31/2022)[35]	32,500 miners[36]	Gas

The Greenidge plant also discharges hot water from the plant, but here the plant owners are permitted to discharge 134 million gallons of water daily into a nearby trout stream at temperatures of *up to 108 degrees Fahrenheit*.[37] This thermal pollution endangers the Keuka Outlet and Seneca Lake—impacting health and wildlife habitability, including but not limited to potential harmful algal blooms, migration and loss of biodiversity, oxygen depletion, direct thermal shock, and changes in dissolved oxygen.

As high-profile as they are, the conversion of Greenidge Generating Station and Fortistar North Tonawanda from low-capacity plants to 24 hours-a-day, 7 days-a-week, 365 days-a-year mining operations are just two examples of how a low-capacity power plant can ramp up operations to increase their profits at the expense of local air and water pollution and increasing greenhouse gas emissions that accelerate the impending climate crisis. Indeed, Senator Kirsten Gillibrand stated in her September 8, 2021 letter to the EPA that "the potential consequences of the plant's Bitcoin mining operations and the effect on local emissions and air quality" are significant and require full assessment.[38] Senator Schumer also recently "urged the Environmental Protection Agency (EPA) to exercise its oversight powers under the Title V Clean Air Act and Clean Water Act and closely review Greenidge Generation Plant's permit renewal application" because "[t]he EPA and NYSDEC regulate such plants to keep these negative impacts on our health and the environment to a minimum, while maximizing the public good" and "[t]his increase in emissions may bring profits to the plant's owners, but it does not provide the same pub[l]ic good to the surrounding community…."[39]

Notably, as New York and the U.S. transition to renewable energy resources, there will be an increasing number of fossil fuel power plants that operate less frequently. Evaluation of the New York Independent System Operator's ("NYISO") 2021 Load and Capacity Data spreadsheet identifies a potential 22,891 MW capacity from fossil fueled power plants operating at less than 30% capacity factor—all of which, under current lack of regulations, could be utilized for proof-of Work mining operations.[40] Indeed, a March 2021 opinion piece in the Albany Times Union,[41] penned the President and CEO of the Independent Power Producers of New York titled "There's a Role for Natural Gas in the Renewable Energy Future" foreshadowed such a turn, describing Greenidge's transition to crypto mining as a "model for innovation."

5. Proof-of-work Mining Places a Large New Load on the NYS Electric Grid.

At a recent NYS Environmental Conservation budget hearing, when asked about the potential impact of the escalating cryptocurrency mining activity in upstate NY on the state's energy grid, the NYS Energy Research and Development Authority ("NYSERDA") President Doreen Harris stated, "There could be a very significant impact on NY load resulting from cryptocurrency mining depending on the penetration of the resource."[42]

To our knowledge, there is no registry of proof-of-work mining facilities in New York State or anywhere in the U.S. Data on mining facilities in New York State in the below table are derived from various news stories, press releases, videos, Town Board minutes, etc. Based on the information we could locate, there are currently 13 proof-of-work mining facilities imposing at least a 576 MW load in New York State. Data on the number of mining rigs used at a given site was even harder to come by, but we were able to document approximately 88,000 mining rigs.[43] If these mining operations expand to the extent their literature suggests, by the fourth quarter of 2022, there could be up to 1,626 MW of proof-of-work mining operations in New York State.[44]

Table 1: Known Proof-of-work Mining Facilities Currently Operating in New York State

Mining Facility	MW	Electric Source	# Machines	Status
Coinmint NCDC Massena, Old Alcoa W	250 --> 435	NYPA, hydro	46,000 → 81,000	Operating @ 250; 185 request pending NYISO review
Greenidge LLC Coal → Gas power plant Seneca Lake, Dresden	25 – >100	Onsite Gas Generation Carbon offsets, 2MW solar proposed	17,300 →31,700	Operating @ 25MW, propose increase to 100MW. **Already 10x increase GHG emissions.** DEC air permit renewal pending 3/31/22
Fortistar (Digihost) Operating gas peaker plant N. Tonawanda	35 --> 55	Gas	9400	Proposal to convert pending PSC decision. DEC air permit renewal soon. Convert to RNG or Hydrogen? 14 containers @700 rigs each
Somerset, Lake Mariner Retired coal plant, Barker	0 - 250 --> 500	Hydro, grid mix		NYPA approved 90 MW hydro. Town approved; construction underway.
Cayuga, TeraWulf Retired coal plant Cayuga Lake, Lansing	0 --> 100	Hydro, grid mix		NYPA approved 2.5 MW hydro. Possible 100-200 MW solar? No active proposal w Town.
Wattum Niagara Falls area	5 –> 50	Hydro Grid mix		Operating 5MW now. Expand to 50MW in 2022.
Weitsman Owego	8 --> 115	Grid mix	2500 ->35,000	Operating 8 MW now. 100 more pending. Interconnection app?
Massena Containers	2 –> 20	Hydro Grid mix		Multiple. Town issued moratorium
Mechanicsville	4	Hydro		Operating.
US Bitcoin Niagara Falls	45	Hydro Grid mix	12,600	Operating. 18 containers@ old DuPont site in Niagara Falls x 700 rigs per container
Bit Digital / Blockfusion Niagara Falls	150	Hydro Grid mix		GM coal plant along Niagara River
Plattsburgh NCDC	10	Hydro Grid mix		
Digihost American Axle Buffalo	42	Hydro Grid Mix		
TOTAL	576 MW now 1336 – 1626 MW by Q4 2022		87,800 known	

To put the above cryptocurrency mining load in perspective, consider the following: For the year 2020, NYISO reports that NYS used 150,198 gigawatt hours ("GWh") electricity.[45] Thus, the 576 MW (5,046 GWh) load we have identified for active, known instances proof-of-work mining is 3.35% of NYS's 2020 energy use. If the proof-of-work mining expansion to 1,626 MW (14,244 GWh) by Q4 2022 occurs—this would be a whopping 9.5% of NYS's 2020 energy use.

6. Proof-of-work Cryptocurrency Mining Operations will Make it Harder to Achieve New York State Renewable Energy Goals.

Adding demand from proof-of-work cryptocurrency mining to the New York grid could increase capacity problems, especially downstate.[46] New York's Climate Leadership and Community Protection Act is one of the most ambitious climate laws in the country, committing the state to, among other things, 70% renewable electricity by 2030 as well as 40% reduction in greenhouse gas emissions.[47] In order to simultaneously meet these renewable energy targets while also rapidly electrifying the building and transportation sectors, the NYISO projects the need to install 15,000 MW new solar and 8,700 MW land-based wind by 2030.[48] This is a daunting task to accomplish in the next 8 years. The new solar farms will cover 90,000 acres, approximately 5 times the footprint of Manhattan; the wind farms will require erecting 2,200 turbines the size of the Statue of Liberty.[49] In addition, hundreds of miles of new transmission lines will need to be installed at a cost of tens of billions of dollars to convey this energy from upstate where the land is, to downstate where the load is.

Clearly allowing underutilized fossil fuel power plants to engage in proof-of-work mining of digital assets 24/7/365 would take NYS (and the country) in the wrong direction relative to meeting renewable energy and greenhouse gas reduction goals.

The difficulty of transitioning the added load from proof-of-work mining activities to renewable energy may not be as obvious, as one must understand that 100 MW energy drawn from the grid is not the same as installing 100 MW renewable resources. In New York State, solar has a capacity factor of approximately 14%,[50] meaning that one would need to install 100/0.14 = 714 MW solar to generate the equivalent of 100 MW grid power. Similarly, the capacity factor for wind in New York State at present is approximately 29%,[51] meaning that one would need to install 100/0.29 = 345 MW wind to produce 100 MW grid power. Applying these capacity factors to the current 576 MW proof-of-work cryptocurrency mining in New York State would mean adding an additional 4,144 MW (27%) solar to the 15,000 MW the NYISO indicated we need by 2030 and a whopping 11,614 MW (77% increase) to provide enough solar power to cover the 1,626 MW added proof-of-work mining load anticipated by Q4 of 2022. Alternatively, adding wind for 576 MW would entail adding 1,986 MW wind, at 4 MW per turbine, equal to adding another 496 turbines—a 23% increase over the 2,200 turbines already planned; to cover the 1,626 MW load anticipated by Q4 2022 would require an added 5607 MW wind, or 1,401 additional turbines by 2030—an increase of 64% over the NYISO planned build out. Studies are needed in order to understand what necessary additions would need to be made to the transmission system to provide interconnection and hosting to this added capacity.

As demonstrated by the forgoing calculations, satisfying the voracious appetite of proof-of-work mining with renewable energy while also meeting the state's ambitious renewable energy goals is simply not feasible. The inevitable result is that fossil-fueled power plants will need to continue operation in order to satisfy the added grid load from proof-of-work mining activities.

Further, as indicated in Table 1 above listing the current mining operations in the State, much of the current proof-of-work mining activity is taking place near Niagara Falls and the St. Lawrence River hydro plants. This means that the mining facilities are utilizing the State's only source of baseload

renewable energy, while not providing any additive renewable and storage resources to the grid to compensate.

Regional Transmission Organizations, Independent System Operators, and utilities around the nation are beginning to understand the impacts caused by proof-of-work cryptocurrency to their mandates to provide just, reasonable, and reliable electricity to homes and local businesses. NYISO needs to also take note of the large amounts of load coming onto the system and plan accordingly. Recently, the Electric Reliability Council of Texas ("ERCOT"), responding to worries that a flood of requests from crypto miners would drive up electricity demand and could ultimately overwhelm the grid, announced it will be instituting additional processes and requirements for new large-scale crypto miners to connect to the state's power grid.[52] On March 25, 2022, ERCOT released a notice[53] instructing utilities to submit studies on the impact of miners and other large users tapping the grid before they can get "approval to energize."[54]

7. Proof-of-work Cryptocurrency Mining Operations Could Displace Renewables Away from Residential and Commercial Uses as well as Hard-To-Decarbonize Industries.

Across the country, the cryptocurrency mining industry has been arguing that proof-of-work cryptocurrency mining could "stabilize" the grid. Grid experts are dubious. For example, a recent analysis by UC-Berkeley's Energy Institute at Haas found that "[a]dding demand will just make a grid tighter and increase capacity problems." And then the "the mining companies get paid for taking demand off the grid that they never would have put on the grid at those high prices anyway."[55]

The enormous amount of energy used by proof-of-work cryptocurrency mining also threatens to undo climate action to date and potentially makes it impossible to tackle the climate crisis since it diverts renewable energy sources from people that need it.

Contrary to proof-of-work cryptocurrency mining proponents, mining is not a catalyst for growth in clean energy. Clean energy is already cost-effective, efficient, and decentralized in comparison to dirty fossil fuel plants, even without the presence of cryptocurrency mining.

And in actuality, cryptocurrency mining companies are predominantly utilizing fossil fuel generation,[56] to mine for cryptocurrency. And even where clean, renewable energy technologies like solar or wind are being used to mine, many operations do not have commitments for renewable-only power supply and instead continue to mine when the sun is not shining nor the wind blowing, using the grid or natural gas. Further, considering how volatile the cryptocurrency market is and the fact that cryptocurrency mining companies come and go, there are serious implications for what happens when a cryptocurrency mining facility leaves the area and the economics of the renewable energy project means that it is unable to properly compete in an open market and potentially becomes stranded.

Crypto miners also often assert that they can spur renewable energy growth. But renewable energy costs are already low, [57] its growth exponential, and it does not need crypto mining operations to prop it up. Even if cryptocurrency mining companies only used excess renewable energy that would otherwise be curtailed, there are serious implications with wasting energy at a time when we need to be placing that energy in energy storage technologies for dispatch at peak usage times.

Building and transportation electrification will further increase demand on the grid, and green hydrogen proposals would also require copious amounts of zero-emissions energy. [58] Simply put, there is not enough clean energy in New York State to meet all that demand while supporting the extensive demands of proof-of-work cryptocurrency mining.

8. Electricity Prices for Local Residents and Business Spike When Proof-of-work Mining Moves Into Town.

Several New York localities have seen their local electricity prices rise when proof-of-work cryptocurrency miners move into town.

For example, in Plattsburgh, New York, residents' electricity bills increased 30% when a mining boom came to town a few years ago.[59] As a result, the New York Municipal Power Agency ("NYMPA"), an association of 36 municipal power authorities, petitioned the NYS Public Service Commission to prevent high-density load customers, specifically cryptocurrency companies, from requesting disproportionately large amounts of power, in some cases amounting to up to 33% of municipal utility's total load.[60] Concerns about electric rates, noise complaints, and unsightly server setups ultimately led Massena to issue a moratorium on crypto operations while public hearings are conducted to consider their continued impact in the small town.[61] Cryptocurrency companies that require high quantities of power increase bulk power supply costs with little to no capital investment in the local community. A recent study found that Plattsburgh residents and small businesses paid $244 million more in higher electric bills due to crypto's arrival.[62] After NYMPA increased rates for supplemental electricity used by high-density load customers, large-scale cryptocurrency data centers were forced to move from Plattsburgh to Massena, which is not a NYMPA member, as their costs increased over $1 million more than the year prior when they were allowed to buy market-rate electricity.[63]

Other parts of the country have and continue to face the same issues. For example, in eastern Washington, the Chelan County Public Utility District was overwhelmed by demand for cheap hydropower from crypto miners, and had to institute two moratoriums on new mining operations and a new rate structure to discourage miners from placing further strains on their grid.[64] Many cryptocurrency miners left the area because of the rate changes,[65] and when miners leave an area, there is a recurring concern across the country that they might "leav[e] ratepayers to cover the costs of upgrades that may no longer be needed."[66] For example, a congressional memo cited to a cryptocurrency mining operation in Washington state that declared bankruptcy in 2018, leaving more than $700,000 in unpaid utility and electricity bills.[67]

For a fuller discussion of the economic and ratepayer impacts on local residents and municipalities, we refer to the comments being simultaneously submitted by Dr. Colin Read.[68]

9. Electronic Waste From Proof-of-work Cryptocurrency Mining.

Proof-of-work mining results in enormous amounts of electronic waste which can cause significant harm to environmental and human health.[69] Globally, proof-of-work mining generates approximately 31 metric kilotonnes of e-waste every year, which is comparable to the e-waste produced by the whole country of the Netherlands.[70] The mining devices used for proof-of-work quickly go obsolete, often lasting less than two years.[71] Experts predict the waste will only increase as proof-of-work mining infrastructure becomes more powerful and increases in scale.[72] Much of this waste is sent to low-income communities who bear the harms of this toxic waste.[73]

10. Conclusion.

As crypto continues to grow, the associated surge in energy consumption to maintain proof-of-work cryptocurrency mining threatens to make the clean energy transition and meeting federal and state-level climate and environmental justice goals much more difficult, if not impossible. While the impacts of large-scale cryptocurrency operations have been most felt in small towns by local residents bearing the

brunt of local air and water pollution, as well as increased electricity costs, the consequences of allowing cryptocurrency mining operations to expand unmitigated are far too great to ignore.

This cannot be a town-by-town or even a state-by-state fight, but rather requires federal attention to address the ever-increasing public health and environmental threat that cryptocurrency mining poses. Without proper standards and the federal action, proof-of-work cryptocurrency mining will elongate the life of fossil fuels and divert renewable energy from where it's needed most to avert the worst of the climate crisis.

Thank you for the opportunity to provide comments concerning the impacts of proof-of-work cryptocurrency mining in New York State.

Respectfully submitted,

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[1] Amy Qin & Ephrat Livni, *China Cracks Down Harder on Cryptocurrency With New Ban*, The New York Times (Sept. 24, 2021), https://www nytimes.com/2021/09/24/business/china-cryptocurrency-bitcoin.html. The ban in China also created a proof-of-work crypto mining boom in Kazakhstan, which lead to civil unrest as the new, unexpected load overwhelmed the needs of ordinary people and local businesses. *See, e.g.*, Gian M. Volpicelli, *As Kazakhstan Descends Into Chas, Crypto Miners Are at a Loss*, Wired (Jan. 12, 2022), https://www.wired.com/story/kazakhstan-cryptocurrency-mining-unrest-energy/; Ephrat Livni, *Kazakhstan's huge Bitcoin mining industry is upended by unrest*, The New York Times (Jan. 6, 2022), https://www.nytimes.com/2022/01/06/business/kazakhstan-bitcoin-mining.html; MacKenzie Sigalos, *Kazakhstan's deadly protests hit bitcoin, as the world's second-biggest mining hub shuts down*, CNBC (Jan. 7, 2022), https://www.cnbc.com/2022/01/06/kazakhstan-bitcoin-mining-shuts-down-amid-fatal-protests.html.

[2] Jon Huang et al., *Bitcoin Uses More Elec. Than Many Countries. How is that Possible?*, The New York Times (Sept. 3, 2021), https://www nytimes.com/interactive/2021/09/03/climate/bitcoin-carbon-footprint-electricity.html.

[3] *Id.*; Brian Spegele & Caitlin Ostroff, *Bitcoin Miners Are Giving New Life to Old Fossil-Fuel Power Plants*, The Wall Street J. (May 21, 2021), https://www.wsj.com/articles/bitcoin-miners-are-giving-new-life-to-old-fossil-fuel-power-plants-11621594803.

[4] Bitcoin's network power demand is estimated to be in the range of 57.13 TWh to 343.75 TWh annually. *See* Univ. of Cambridge, Cambridge Bitcoin Elec. Consumption Index, https://ccaf.io/cbeci/index (last visited May 3, 2022).

[5] Statista, Leading states in elec. consumption in the United States in 2020 (2020), https://www.statista.com/statistics/560913/us-retail-electricity-consumption-by-major-state/; New York ISO ("NYISO"), *New York's Clean Energy Grid of the Future*, at 11–12 (2021), https://www.nyiso.com/documents/20142/2223020/2021-Power-Trends-Report.pdf/471a65f8-4f3a-59f9-4f8c-3d9f2754d7de.

[6] *See* Digiconomist, Bitcoin Energy Consumption Index (estimating Bitcoin's annual carbon footprint at 114.06 million metric tons of CO2, comparable to the carbon footprint of the Czech Republic), https://digiconomist.net/bitcoin-energy-consumption (last visited May 3, 2022); Forex Suggest, Global Impact of Crypto Trading (estimating that Bitcoin emits approximately 59 million metric tons of CO2 in 2020), https://forexsuggest.com/global-impact-of-crypto-trading/ (last visited May 3, 2022).

[7] Comm. on Energy and Com., Memorandum re: Hearing on 'Cleaning Up Cryptocurrency: The Energy Impacts of Blockchains,' at 5 (Jan. 17, 2022), https://energycommerce house.gov/sites/democrats.energycommerce house.gov/files/documents/Briefing%20Memo_OI%20Hearing_2022.01.20.pdf.

[8] Lois Parshley, *How Bitcoin mining devastated this New York town*, MIT Tech. Review (Apr. 18, 2022), https://www.technologyreview.com/2022/04/18/1049331/bitcoin-cryptocurrency-cryptomining-new-york/.

[9] Renee Cho, *Bitcoin's Impacts on Climate and the Env't*, Colum. Climate Sch. (Sept. 20, 2021), https://news.climate.columbia.edu/2021/09/20/bitcoins-impacts-on-climate-and-the-environment/.

[10] *See, e.g.*, Joe Tidy, *US leads Bitcoin mining as China ban takes effect*, BBC (Oct. 13, 2021), https://www.bbc.com/news/technology-58896545; *see also* Letters from Senator Elizabeth Warren et al. to Cryptominers (Jan. 27, 2022) (explaining that the United States' share of global Bitcoin mining increased from 4% in August 2019 to 35% in July 2021), https://www.warren.senate.gov/imo/media/doc/2022.01.27%20Letters%20to%20Cryptominers.pdf.

[11] MacKenzie Sigalos, *New York and Texas are winning the war to attract bitcoin miners*, CNBC (Oct. 9, 2021), https://www.cnbc.com/2021/10/09/war-to-attract-bitcoin-miners-pits-texas-against-new-york-kentucky html.

[12] Provided by Fractracker Alliance.

[13] Marissa Solomon, *Gillibrand Commits LIVE ON AIR to Visit FLX & Meet w/Residents on Climate Killing Cryptomining @ Greenidge*, Seneca Lake Guardian (Apr. 27, 2022) (e.g., pointing to the $3 billion agritourism economy, employing approximately 60,000 people in the Finger Lakes), http://readme.readmedia.com/Gillibrand-Commits-LIVE-ON-AIR-to-Visit-FLX-Meet-w-Residents-on-Climate-Killing-Cryptomining-Greenidge/18521058.

[14] Africa Renewal, *UN climate report: It's 'now or never' to limit global warming to 1.5 degrees*, UN News (Apr. 4, 2022), https://www.un.org/africarenewal/magazine/april-2022/un-climate-report-it%E2%80%99s-%E2%80%98now-or-never%E2%80%99-limit-global-warming-15-degrees.

[15] *See, e.g.*, *supra* note 8.

[16] Khristopher J. Brooks, *Bitcoin has its own 1% who control outsized share of wealth*, CBS News (Dec. 21, 2021), https://www.cbsnews.com/news/bitcoin-cryptocurrency-wealth-one-percent/.

[17] Paul Kim, *ASIC mining: Computers built specifically for mining cryptocurrency*, Insider (Mar. 16, 2022), https://www.businessinsider.com/personal-finance/asic-mining.

[18] Kristina Zucchi, *Is Bitcoin Mining Still Profitable?*, Investopedia (Mar.12, 2022), https://www.investopedia.com/articles/forex/051115/bitcoin-mining-still-profitable.asp.

[19] Igor Makarov & Antoinette Schoar, Blockchain Analysis of the Bitcoin Market, National Bureau of Economic Research, at 4 (Oct. 2021), Working Paper 29396 (note: this analysis was for the time period before China banned mining), https://www.nber.org/system/files/working_papers/w29396/w29396.pdf; *see also* Emily Graffeo, *Bitcoin Is Still Concentrated in a Few Hands, Study Finds*, Time (Oct. 25, 2021), https://time.com/6110392/bitcoin-ownership/. It is believed that the concentration of mining and wealth is even more stark in the U.S. today.

[20] Paul Vigna, *Bitcoin's 'One Percent' Controls Lion's Share of the Cryptocurrency's Wealth*, The Wall Street Journal (Dec. 20, 2021), https://www.wsj.com/articles/bitcoins-one-percent-controls-lions-share-of-the-cryptocurrencys-wealth-11639996204; Laurence Fletcher, Hedge funds expect to hold 7% of assets in crypto within five years, Financial Times (June 15, 2021), https://www.ft.com/content/4f8044bf-8f0f-46b4-9fb7-6d0eba723017; Khristoper Brooks, *Bitcoin has its own 1% who control outsized share of wealth*, CBS News (Dec. 21, 2021), https://www.cbsnews.com/news/bitcoin-cryptocurrency-wealth-one-percent/; Gregory Zuckerman, *Mainstream Hedge Funds Pour Billions of Dollars Into Crypto*, The Wall Street Journal (Mar. 9, 2022), https://www.wsj.com/articles/mainstream-hedge-funds-pour-billions-of-dollars-into-crypto-11646808223.

[21] Env't Prot. Agency ("EPA"), *Power Sector Emissions Data*, https://www.epa.gov/airmarkets/power-sector-emissions-data; EPA, Air Markets Program Data (filtering by Customized Data Queries > 'All Programs' > 'Emissions', 'Unit Level' > 'Facility Attributes' > 'Daily,' > 'Facility ID and Name': 'Fortistar North Tonawanda Inc' > 'Select All' under Emissions Unit), https://ampd.epa.gov/ampd/ (last visited May 5, 2022).

[22] Digihost Tech., Inc., *Title V and Title IV Permits Renewal Application, Fortistar North Tonawanda Cogeneration Facility*, at 5–6, 30 (Apr. 21, 2021).

[23] N.Y. State Dep't of Env't Conservation, *Potential Environmental Justice Area (PEJA) Communities*, ArcGIS (filtering results to display: PEJA, 15000US360290091074; Census Block Group 15000US360290091074; Census Block Group 15000US360630232003; and Census Block Group 15000US360630232003), https://www.arcgis.com/home/webmap/viewer.html?url=https://services6.arcgis.com/DZHaqZm9cxOD4CWM/ArcGIS/rest/services/Potential_Environmental_Justice_Area__PEJA__Communities/FeatureServer&source=sd; *see also* EPA, *EJSCREEN: EPA's Environmental Justice Screening and Mapping Tool* (According to EPA's EJScreen, the area around the FNT plant has a disproportionately high ozone index when compared to the New York average), https://ejscreen.epa.gov/mapper/.

[24] Digihost, *Full Environmental Assessment Form*, at 5 (Aug. 12, 2021), https://www.northtonawanda.org/documents/legal%20notice/fortistar%20amended%20seqr_2.pdf (the City's current usage averages 4 million gallons per day).

[25] Thomas J. Prohaska, *North Tonawanda asks for $30 million in emergency aid to repair sewer plant*, The Buffalo News (Mar. 12, 2022), https://buffalonews.com/news/local/government-and-politics/north-tonawanda-asks-for-30-million-in-emergency-aid-to-repair-sewer-plant/article_91b32598-a145-11ec-b35d-7314fe498fd0.html.

[26] After only a few years of operating as an electric generating facility, the facility's owners realized that there was not enough demand for electricity to make operating the facility profitable. Greenidge's CFO stated that rather than close the power plant, they decided to convert the facility to a Bitcoin mining operation. John Christensen, *Power Plant to Add Data Center*, The Chronicle-Express (July 31, 2019), https://web.archive.org/web/20190731061907/https:/www.chronicle-express.com/news/20190731/power-plant-to-add-data-center#expand.

[27] *Digital Assets: Greenidge Gen, Once a Coal Plant, Is Now a Profitable Crypto Miner*, DailyAlts (Aug. 19, 2020) https://dailyalts.com/digital-assets-greenidge-gen-once-a-coal-plant-is-now-a-profitable-crypto-miner/.

[28] EPA, *Power Sector Emissions Data*, https://www.epa.gov/airmarkets/power-sector-emissions-data; https://ampd.epa.gov/ampd/ (filtering by Customized Data Queries > 'All Programs' > 'Emissions', 'Unit Level' > 'Facility Attributes' > 'Daily,' 'Select All' under Emissions Unit), (last visited May 4, 2022). These numbers do not include upstream emissions. For a full recitation of the facts and issues concerning the air permit at Greenidge, please see the Comments from Seneca Lake Guardian, The Comm. to Preserve the Finger Lakes, Fossil Free Tompkins, Sierra Club, and Earthjustice in Opposition to the Draft Title V Air Permit for Greenidge Generating Station, located at 590 Plant Road, Dresden, New York 14441 (Permit ID: 8-5736-00004/00017) (Nov. 19, 2021), https://earthjustice.org/sites/default/files/files/2021-11-19_slg-cpfl-fft-sc-ej-comments-to-dec.pdf.

[29] Days with less than three hours of operation were not included.

[30] The annual capacity factor is a percentage measurement of actual generation in relation to potential maximum generation on an annual basis. For example, a generator with a 1 MW capacity operating at full capacity for a year (8,760 hours) would produce 8,760 megawatt-hours of electricity. The generator's annual capacity factor would be 100%. New York ISO, *New York's Clean Energy Grid of the Future*, Glossary at 49 (2021), https://www.nyiso.com/documents/20142/2223020/2021-Power-Trends-Report.pdf/471a65f8-4f3a-59f9-4f8c-3d9f2754d7de.

[31] Based on its emissions, it appears that the power plant operated for the three months of 2011 before going offline.

[32] The year before Greenidge changed the operations at the plant to begin mining.

[33] Greenidge Generation Holdings Inc., Sec. & Exch. Comm'n Form S-1, at 2 (Oct. 5, 2021), https://sec.report/Document/0001193125-21-291578/.

[34] *Id*. at 13.

[35] Projected annualized CO2 emissions for 2022, if no more miners are installed. *Id*.

[36] *Id*. at 3.

[37] N.Y. State Dep't of Env't Conservation, Water Withdrawal Permit, DEC Permit No. 8-5736-00004/00015 (effective 09/11/2017), https://treichlerlawoffice.com/water/greenidge/WaterPermit_Final_2017-09-11_.pdf; Seneca Lake Guardian, *Facts Matter: Greenidge Bitcoin Mining Expansion* (Mar. 10, 2021), https://senecalakeguardian.org/Facts-Matter-Greenidge-Bitcoin-Mining.

[38] Letter from Sen. Kirsten Gillibrand to EPA on Greenidge Bitcoin Plant Title V Permit (Sept. 8, 2021), https://www.gillibrand.senate.gov/imo/media/doc/Gillibrand%20Letter%20to%20EPA%20on%20Greenidge%20Bitcoin%20Plant%20Title%20V%20Permit%20-%20Updated.pdf.

[39] Sen. Charles E. Schumer, *Schumer Calls on EPA to Review Air Permit For Greenidge Power Plant Cryptocurrency Mining Facility*, Press Release (Oct. 12, 2021), https://www.schumer.senate.gov/newsroom/press-releases/citing-environmental-concerns-schumer-calls-on-epa-to-review-air-permit-for-greenidge-power-plant-cryptocurrency-mining-facility-senator-reveals-emisions-from-plant-have-recently-increased-tenfold-and-with-ownership-planning-to-expand-virtual-mining-operation-pollution-from-mining-will-only-increase.

[40] Provided by Fossil Free Tompkins (citing NYISO, *2021 Load and Capacity Data*, at 80 (Apr. 2021), https://www.nyiso.com/documents/20142/2226333/2021-Gold-Book-Final-Public.pdf/b08606d7-db88-c04b-b260-ab35c300ed64).

[41] Gavin Donohue, *There's a role for natural gas in the renewable-energy future*, Times Union (Mar. 2, 2021), https://www.timesunion.com/opinion/article/There-s-a-role-for-natural-gas-in-the-15993563.php.

[42] Seneca Lake Guardian, *Gov Hochul + DEC Punt Decision on Greenidge Generation Air Permits Again* (Mar. 31, 2022), https://www.senecalakeguardian.org/index.php?tray=content&tid=1SLGtop4&cid=1SLG141.

[43] Table 1:13 Proof-Of-Work Mining Facilities Currently Operating In New York State. Provided by Fossil Free Tompkins.

[44] *See id.*

[45] NYISO, *Delivering the Grid of the Future How Mkts. Support Climate & Pol'y Goals*, at slide 9, https://www.nyiso.com/documents/20142/2225523/How-Markets-Support-Climate-and-Policy-Goals.pdf (last visited May 3, 2022).

[46] Severin Borenstein, *Crypto Mining for a More Stable Grid?*, Energy Inst. at HAAS (Mar. 21, 2022), https://energyathaas.wordpress.com/2022/03/21/crypto-mining-for-a-more-stable-grid/.

[47] S.B. 6599, 2019–2022 Reg. Sess. (N.Y. 2019).

[48] NYISO, *2019 Congestion Assessment and Res. Integration Study*, at 5–6 (July 24, 2020), https://www.nyiso.com/documents/20142/2226108/2019-CARIS-Phase1-Report-Final.pdf/bcf0ab1a-eac2-0cc3-a2d6-6f374309e961.

[49] Fossil Free Tompkins, Webinar to League of Women Voters, at 48:45 (Jan 13, 202, https://www.youtube.com/watch?v=qIuMqn2ISA4.

[50] NYISO, *Power Trends 2020: The Vision for a Greener Grid*, at 18 (2020), https://www.nyiso.com/documents/20142/2223020/2020-Power-Trends-Report.pdf/dd91ce25-11fe-a14f-52c8-f1a9bd9085c2.

[51] *Id*.

[52] Naureen S. Malik, *Texas Grid's Review of Crypto Miners Connection May Take Months*, Bloomberg (Apr. 4, 2022), https://www.bloomberg.com/news/articles/2022-04-04/texas-grid-s-review-of-crypto-miners-connection-may-take-months.

[53] Notice from Notice_Operations@lists.ercot.com, to Interconnecting Market Participants, Subject: W-A032522-01 Interim Large Load Interconnection Process (Mar. 25, 2022), https://www.ercot.com/services/comm/mkt_notices/detail?id=fc84b65f-72fe-4704-9974-b52974cdb81e.

[54] Bloomberg Wire, *Texas now requiring crypto miners to seek 'approval to energize' before plugging into grid*, Dallas Morning News (Mar. 30, 2022), https://www.dallasnews.com/business/energy/2022/03/30/texas-now-requiring-crypto-miners-to-seek-approval-to-energize-before-plugging-into-grid/; Husch Blackwell LLP, *ERCOT Now Requires Cryptocurrency Miners to Provide Info. on their Impact to the Texas Power Grid*, JDSupra (Apr. 6, 2022), https://www.jdsupra.com/legalnews/ercot-now-requires-cryptocurrency-6065651/.

[55] Severin Borenstein, *Crypto Mining for a More Stable Grid?*, Energy Inst. at HAAS (Mar. 21, 2022), https://energyathaas.wordpress.com/2022/03/21/crypto-mining-for-a-more-stable-grid/ (emphasis added).

[56] While proponents of proof-of-work cryptocurrencies claim that mining makes use of excess renewable generation, thereby reducing curtailment and helping to financially support renewable power development, miners have largely relied on baseload power supplied primarily by fossil fuels. Smart Energy International, *Cryptocurrency mining and renewable energy: Friend or foe?* (May 25, 2021), https://www.smart-energy.com/renewable-energy/cryptocurrency-mining-and-renewable-energy-friend-or-foe/.

[57] According to a 2020 report by the International Energy Agency, solar power now offers the "cheapest electricity in history" with technology cheaper than coal and gas in most major countries, and an estimated 43% increase in solar output expected by 2040. Simon Evans, *Solar is now 'cheapest electricity in history', confirms IEA*, CarbonBrief (Oct. 13, 2020), https://www.carbonbrief.org/solar-is-now-cheapest-electricity-in-history-confirms-iea. Utility-scale solar and wind power costs have dropped 90% and 71% respectively in the last 10 years, now costing less than gas, geothermal, coal, or nuclear. Ula Chrobak, *Solar power got cheap. So why aren't we using it more?*, Popular Science (Oct. 8, 2021), https://www.popsci.com/story/environment/cheap-renewable-energy-vs-fossil-fuels/.

[58] The limited clean renewable energy is also needed for the green hydrogen buildout as presently envisioned by the Biden administration. For clean hydrogen power generation, there cannot be grey or blue hydrogen, only hydrogen powered entirely by renewable energy. *See, e.g.*, Dep't of Energy, *DOE Seeks Public Input on New Hydrogen Hubs, Clean Hydrogen Manufacturing Programs to Decarbonize Industry, Transportation Sectors and Provide Healthier Air for All* (Feb. 15, 2022), https://www.energy.gov/articles/doe-establishes-bipartisan-infrastructure-laws-95-billion-clean-hydrogen-initiatives; *see also* Sasan Saadat & Sara Gersen, *Reclaiming Hydrogen for a Renewable Future: Distinguishing Oil & Gas Industry Spin from Zero-Emission Solutions*, at 24–26, Earthjustice (2021), https://earthjustice.org/sites/default/files/files/hydrogen_earthjustice.pdf (citing Jeffrey Goldmeer et al., Hydrogen as a Fuel for Gas Turbines at 3–4, Gen. Elec. (2021)), https://www.ge.com/content/dam/gepower-new/global/en_US/downloads/gas-new-site/future-of-energy/hydrogen-fuel-for-gas-turbines-gea34979.pdf.

[59] Patrick McGeehan, *Bitcoin Miners Flock to New York's Remote Corners, but Get Chilly Reception*, The New York Times (Sept. 19, 2018), https://www.nytimes.com/2018/09/19/nyregion/bitcoin-mining-new-york-electricity html.

[60] Paul Ciampoli, *Public power can charge cryptocurrency firms higher rates: N.Y. PS, American Public Power Association* (Mar. 16, 2018), https://www.publicpower.org/periodical/article/public-power-can-charge-cryptocurrency-firms-higher-rates-ny-psc.

[61] Keith Benman, *Massena seeks public's input on cryptocurrency mining*, 7 News WWNYTV(Feb. 15, 2022), https://www.wwnytv.com/2022/02/15/massena-seeks-publics-input-cryptocurrency-mining/.

[62] Laura Counts, *Power-hungry cryptominers push up electricity costs for locals*, BerkeleyHass (Aug. 3, 2021), https://newsroom.haas.berkeley.edu/research/power-hungry-cryptominers-push-up-electricity-costs-for-locals/; Mateo Benetton et al., *When Cryptomining Comes to Town: High Electricity-Use Spillovers to the Local Economy*, SSRN (May 14, 2021), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3779720.

[63] McKenzie Delisle, *Mining operation moves out of city for winter*, Press-Republican (Nov. 11, 2019), https://www.pressrepublican.com/news/local_news/mining-operation-moves-out-of-city-for-winter/article_4c86c044-4e1e-5ad6-8e6d-0ad19b875e35.html.

[64] Steve Wright, *Testimony before the Subcommittee on Oversight and Investigations, Cleaning Up Cryptocurrency: The Energy Impacts of Blockchains*, at 2 (Jan. 20, 2022), https://energycommerce house.gov/sites/democrats.energycommerce house.gov/files/documents/Witness%20Testimony_Wright_OI_2022.01.20.pdf.

[65] *Id*; Corbin Hiar, *Crypto mining gulps power. Can it help renewable energy?*, E&E News (Jan. 21, 2022), https://subscriber.politicopro.com/article/eenews/2022/01/21/crypto-mining-gulps-power-can-it-help-renewable-energy-285435.

[66] Naureen S. Malik & Michael Smith, *Crypto Mania in Texas Risks New Costs and Strains on Shaky Grid*, Bloomberg (Mar. 15, 2022), https://www.bloomberg.com/news/articles/2022-03-15/crypto-mania-in-texas-risks-new-costs-and-strains-on-shaky-grid.

[67] Comm. on Energy & Com., Memorandum re Hearing on Cleaning Up Cryptocurrency: The Energy Impacts of Blockchains, at 9 (Jan. 17, 2022), https://energycommerce house.gov/sites/democrats.energycommerce house.gov/files/documents/Briefing%20Memo_OI%20Hearing_2022.01.20.pdf.

[68] State University of New York, Plattsburgh, Dr. Colin Read, Professor of Econ. & Finance, https://www.plattsburgh.edu/academics/schools/business-economics/economics-finance/faculty/read-colin.html (last visited May 4, 2022).

[69] *See* Megan Avakian, *E-waste: An Emerging Health Risk*, Nat'l Inst. of Env't Health Sci. (Feb. 2014), https://www.niehs nih.gov/research/programs/geh/geh_newsletter/2014/2/spotlight/ewaste_an_emerging_health_risk_.cfm; EPA, *Understanding e-waste* ("Without proper standards and enforcement, improper practices may result in public health and environmental concerns, even in countries where processing facilities exist."), https://www.epa.gov/international-cooperation/cleaning-electronic-waste-e-waste (last visited May 4, 2022).

[70] BBC, *Bitcoin mining producing tonnes of waste* (Sep. 20, 2021), https://www.bbc.com/news/technology-58572385; Alex de Vries & Christian Stoll, *Bitcoin's Growing E-waste Problem*, 175 Res., Conservation and Recycling 105901 (Dec. 2021), https://www.sciencedirect.com/science/article/pii/S0921344921005103; Digiconomist, *Bitcoin Electric Waste Monitor*, https://digiconomist net/Bitcoin-electronic-waste-monitor/ (last visited May 4, 2022).

[71] BBC, *Bitcoin Mining Produces Tons of Waste*, (Sep. 20, 2021), https://www.bbc.com/news/technology-58572385.

[72] Mark Peplow, *Bitcoin poses major electronic-waste problem*, Chem. & Eng'g News (Mar. 14, 2019), https://cen.acs.org/environment/sustainability/Bitcoin-poses-major-electronic-waste/97/i11.

[73] Peter Howson & Alex de Vries, *Preying on the poor? Opportunities and challenges for tackling the social and environmental threats of cryptocurrencies for vulnerable and low-income communities*, 84 Energy Research & Social Science 102394 (2022), https://www.sciencedirect.com/science/article/abs/pii/S2214629621004813.