

August 30, 2023

SUBMITTED VIA FORM/EMAIL

Secretary
Securities and Exchange Commission
Division of Trading and Markets
100 F Street NE
Washington, DC 20549
rule-comments@sec.gov

Re: SR-NYSEARCA-2023-44

Thank you for the opportunity to provide input as the U.S. Securities and Exchange Commission (“SEC”) regarding the Notice of Filing of a Proposed Rule Change To List and Trade Shares of the Bitwise Bitcoin ETP Trust Under Nasdaq Rule 5711(d), Commodity-Based Trust Shares (“Notice of Filing”). We recently learned of the public comment period and apologize for this late submission. Earthjustice, Environmental Working Group, and Greenpeace together submit these comments with regard to the climate and energy impacts if the Notice of Filing is approved.

We write to highlight the compounding impact of the failure of many Bitcoin companies to disclose their energy sources or locations (see our Letter of June 17, 2022, attached as [Appendix A](#)) along with the ETF application pending before you. ETFs like the Notice of Filing will make the disclosure of significant climate change impacts even more murky.

Following China’s ban on proof-of-work cryptocurrency mining in September 2021, the U.S. now houses the most cryptocurrency mining operations in the world.¹ The Cambridge Center for Alternative Finance estimates that as of December 2021, 37.84% of global computational power utilized for Bitcoin is located in the United States.²

As cryptocurrencies continue to grow in number and usage,³ the associated surge in energy consumption for proof-of-work cryptocurrency mining makes the clean energy transition and meeting federal and state-level climate and environmental goals much more difficult. The amount of load estimated for cryptocurrency mining operations in the near term is staggering—in Texas alone, the amount of miners requesting new connection to that fragile grid is nearly 42 GW of electricity before 2027, enough electricity to power more than 8.3 million Texas homes

¹ See, e.g., BBC, *US leads Bitcoin mining as China ban takes effect* (Oct. 13, 2021), <https://www.bbc.com/news/technology-58896545>; see also Letter 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).

² Cambridge Center for Alternative Finance, *Cambridge Bitcoin Electricity Consumption Index: Bitcoin Mining Map*, https://ccaf.io/cbeci/mining_map.

³ Statista, *Overall cryptocurrency market capitalization per week from July 2010 to June 2022*, <https://www.statista.com/statistics/730876/cryptocurrency-maket-value/>.

during periods of peak demand.⁴ An industry-sponsored paper last year projected that under certain price assumptions, energy consumption for Bitcoin could septuple (7x) in just six years.⁵

At a time when the U.S. needs to rapidly decrease fossil fuel production and consumption⁶ to combat the climate crisis and carefully plan the future of the grid structure for an electrified society, proof-of-work cryptomining operations will instead (1) increase the combustion of fossil fuels, which directly cause toxic air and water pollution and exacerbate climate change, and (2) could destabilize the electric grid. Already, U.S.-based Bitcoin miners are responsible for between one quarter and up to forty-five percent of the global greenhouse gas (“GHG”) emissions caused by Bitcoin mining.⁷ The rapid increase of energy demand from proof-of-work cryptocurrency mining operations in the United States, much of it fossil fuel-based,⁸ conflicts directly with federal and state plans to reduce GHG emissions. In fact, in its recent report on the Mitigation of Climate Change, the Intergovernmental Panel on Climate Change’s (“IPCC”) specifically noted that “the energy requirements of cryptocurrencies is also a growing concern” and that digital currencies like Bitcoin are likely to “be a major global source of CO₂ if the electricity production is not decarbonised.”⁹ The industry’s extensive power usage presents a transition risk for proof-of-work cryptocurrency mining companies.

⁴ ERCOT, Large Load Interconnection Status (May 31, 2023), <https://www.ercot.com/files/docs/2023/05/31/LLI%20Queue%20Status%20Update%20-%202023-05-31.pdf>; ERCOT, Fact Sheet (Nov. 2021) <https://www.ercot.com/files/docs/2021/11/23/ERCOT%20Fact%20Sheet.pdf>; Naureen S. Malik, *Crypto Miners’ Electricity Use in Texas Would Equal Another Houston*, Bloomberg (Apr. 27, 2022), <https://www.bloomberg.com/news/articles/2022-04-27/crypto-miners-in-texas-will-need-more-power-than-houston>.

⁵ Nic Carter & Ross Stevens, *Bitcoin Net Zero* (Sept. 2021), <https://bit.ly/3LRoOG2>.

⁶ IPCC, *The evidence is clear: the time for action is now. We can halve emissions by 2030*. (Apr. 4, 2022) (quoting IPCC Working Group III Co-Chair Jim Skea, “It’s now or never, if we want to limit global warming to 1.5°C (2.7°F) . . . Without immediate and deep emissions reductions across all sectors, it will be impossible.”), <https://www.ipcc.ch/2022/04/04/ipcc-ar6-wgiii-pressrelease/>; Damian Carrington, *It’s over for fossil fuels: IPCC spells out what’s needed to avert climate disaster*, The Guardian (Apr. 4, 2022) <https://www.theguardian.com/environment/2022/apr/04/its-over-for-fossil-fuels-ipcc-spells-out-whats-needed-to-avert-climate-disaster> (quoting UN Secretary General, “Increasing fossil fuel production will only make matters worse . . . It is time to stop burning our planet, and start investing in the abundant renewable energy all around us.”); Lina Tran & Joseph Winters, *‘We are at a crossroads’: New IPCC report says it’s fossil fuels or our future*, Grist (Apr. 4, 2022), <https://grist.org/science/we-are-at-a-crossroads-new-ipcc-report-says-its-fossil-fuels-or-our-future/>.

⁷ Alex de Vries et al., *Revisiting Bitcoin’s Carbon Footprint*, 6 Joule 498 (2022), <https://www.sciencedirect.com/science/article/abs/pii/S2542435122000861>.

⁸ Since cryptocurrency mining requires a steady source of power, 24/7/365, miners seek cheap sources of electricity generated by burning coal and natural gas—often extending the life of fossil fuel sources of energy. See Alex de Vries et al., *Revisiting Bitcoin’s Carbon Footprint*, 6 Joule 498 (2022), <https://www.sciencedirect.com/science/article/abs/pii/S2542435122000861>. The electricity used to mine Bitcoin in 2020 resulted in almost 60 million tons of CO₂ emissions, according to one estimate. See ForexSuggest.com, *Global Impact of Crypto Trading*, <https://forexsuggest.com/global-impact-of-crypto-trading/>. Further, the CO₂ emissions from mining Ethereum and Bitcoin in 2021 equaled the tailpipe emissions of more than 15 million gas-powered cars. See Committee on Energy & Commerce, Memorandum, at 5 (Jan. 17, 2022), https://energycommerce.house.gov/sites/democrats.energycommerce.house.gov/files/documents/Briefing%20Memo_OI%20Hearing_2022.01.20.pdf.

⁹ IPCC, *Climate Change 2022: Mitigation of Climate Change* (Apr. 2022), https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_FullReport.pdf.

In addition to the medium-term and long-term demands on an energy system in need of rapid change, proof-of-work mining creates a more immediate and acute climate risk tied to legacy coal and gas plants. Proof-of-work mining companies are resurrecting otherwise uneconomic fossil-fueled power plants to mine proof-of-work cryptocurrencies. This occurs because cryptocurrency mining companies will pay above-market prices for those fossil-fueled plants. Keeping older, dirtier plants online as a source of low-cost energy for cryptocurrency mining severely hinders efforts to reduce GHG emissions while prolonging harmful impacts on local communities.

Nowhere in the Notice of Filing is climate risk, regulatory risk, transition risk, or the risks from inadequate (and sometimes misleading, see again Appendix A) disclosures by publicly-traded cryptomining companies discussed. There should be public disclosure of the many climate and energy risks of investing in any financial product tied to the price of Bitcoin. An increase in the price and trading of Bitcoin may increase the amount of computing power put towards mining, and as such, the greenhouse gas emissions and local pollution therefrom.¹⁰ The Scope 3 emissions discussed in Appendix A for mining pools and exchanges are similar for ETFs such as the Notice of Filing and we direct you to that discussion of significant Scope 3 emissions at pages 16-19.

We applaud the SEC's leadership on climate and appreciate the opportunity to provide these comments.

Sincerely,

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¹⁰ Qin, Meng, *et al*, *Are Energy Consumption and Carbon Emission Caused by Bitcoin? A Novel Time-Varying Technique*, 80 *Econ. Analysis & Policy*, 109-20 (2023). doi: 10.1016/j.eap.2023.08.004; Asumadu Sarkodie, *et al*, *Trade Volume Affects Bitcoin Energy Consumption & Carbon Footprint*, 48 *Finance Research Letters* 102977 (2022). doi: 10.1016/j.frl.2022.102977.

Appendix A

June 17, 2022

Submitted Via Email

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Securities and Exchange Commission
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**Re: *The Enhancement and Standardization of Climate-Related Disclosures for Investors*
Comments on the Proposed Rule Related to Publicly-Traded Proof-of-Work
Cryptocurrency Mining Companies, File Number S7-10-22**

Thank you for the opportunity to provide input as the U.S. Securities and Exchange Commission (“SEC”) seeks to address investors’ needs for more comprehensive and comparable disclosures with regard to climate risk. Earthjustice, Environmental Working Group, and Greenpeace together submit these comments on the SEC’s proposed rule with respect to the disclosures of publicly-traded proof-of-work cryptocurrency mining companies.

I. Examining the Inadequate and Inconsistent Climate-Related Disclosures from Energy Intensive Proof-of-Work Cryptocurrency Mining Companies Offers Insight into the Strengths and Weaknesses of Proposed Climate Disclosures Rule

As the world works to decarbonize the economy and its energy systems, information on the climate change impacts to corporate operations, the business impacts of regulatory approaches to addressing climate change, and corporate strategies for managing these risks are increasingly important to investment strategies.¹

Inadequate, inconsistent, and misleading disclosures harm both investors and communities. Current disclosure practices have proven inadequate for properly informing investors and the market.² Investors evaluating the climate-related financial risks in their existing portfolios and new investment opportunities cannot adequately do so based on existing disclosures.

While more robust climate disclosures are necessary across many industries, this failure is particularly noticeable for emerging and energy-intensive industries such as proof-of-work cryptocurrency mining. Proof-of-work cryptocurrency mining is the process by which powerful computers are used to solve complex puzzles to generate new cryptocurrency.³ Bitcoin is the

¹ Hana Vizcarra, *The Reasonable Investor and Climate-Related Information: Changing Expectations for Financial Disclosures*, 50 No. 2, *Env’t L. Rep.* 10106, 10106-10114 (2020), <https://papers.ssrn.com/abstract=3532484> (last visited Apr. 27, 2022).

² Madison Condon, *Market Myopia’s Climate Bubble*, 1 *Utah L. Rev.* 63, 63-126 (2021), <https://papers.ssrn.com/abstract=3782675> (last visited Apr. 27, 2022).

³ Coinbase, *What is “proof of work” or “proof of stake”?*, <https://www.coinbase.com/learn/crypto-basics/what-is-proof-of-work-or-proof-of-stake> (last visited June 14, 2022).

largest of proof-of-work cryptocurrencies in terms of market capitalization and energy usage. Following China's ban on proof-of-work cryptocurrency mining in September 2021, the U.S. now houses the most cryptocurrency mining operations in the world.⁴ The Cambridge Center for Alternative Finance estimates that as of December 2021, 37.84% of global computational power utilized for Bitcoin is located in the United States.⁵

As cryptocurrencies continue to grow in number and usage,⁶ the associated surge in energy consumption for proof-of-work cryptocurrency mining makes the clean energy transition and meeting federal and state-level climate and environmental goals much more difficult. The amount of load estimated for cryptocurrency mining operations in the near term is staggering—in Texas alone, the amount of miners requesting new interconnection to that fragile grid is roughly 17 gigawatts, or as the interim head of the Texas grid described it: “that’s about the equivalent of load of two-and-a-half New York Cities.”⁷ A recent industry-sponsored paper projects that under certain price assumptions, energy consumption for Bitcoin could septuple (7x) in just six years, rising to become 0.4% of all global primary energy consumption.⁸

At a time when the U.S. needs to rapidly decrease fossil fuel production and consumption⁹ to combat the climate crisis and carefully plan the future of the grid structure for an electrified society, proof-of-work operations will instead (1) increase the combustion of fossil fuels, which directly cause toxic air and water pollution and exacerbate climate change, and (2) could destabilize the electric grid. Already, U.S.-based Bitcoin miners are responsible for between one quarter and up to forty-five percent of the global greenhouse gas (“GHG”) emissions caused by Bitcoin mining.¹⁰ The rapid increase of energy demand from proof-of-work

⁴ See, e.g., BBC, *US leads Bitcoin mining as China ban takes effect* (Oct. 13, 2021), <https://www.bbc.com/news/technology-58896545>; see also Letter 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).

⁵ Cambridge Center for Alternative Finance, *Cambridge Bitcoin Electricity Consumption Index: Bitcoin Mining Map*, https://ccaf.io/cbeci/mining_map (last visited June 14, 2022).

⁶ Statista, *Overall cryptocurrency market capitalization per week from July 2010 to June 2022*, <https://www.statista.com/statistics/730876/cryptocurrency-maket-value/> (last visited June 14, 2022).

⁷ Naureen S. Malik, *Crypto Miners’ Electricity Use in Texas Would Equal Another Houston*, Bloomberg (Apr. 27, 2022), <https://www.bloomberg.com/news/articles/2022-04-27/crypto-miners-in-texas-will-need-more-power-than-houston>.

⁸ Nic Carter & Ross Stevens, *Bitcoin Net Zero* (Sept. 2021), <https://bit.ly/3LRoOG2>.

⁹ IPCC, *The evidence is clear: the time for action is now. We can halve emissions by 2030*. (Apr. 4, 2022) (quoting IPCC Working Group III Co-Chair Jim Skea, “It’s now or never, if we want to limit global warming to 1.5°C (2.7°F) . . . Without immediate and deep emissions reductions across all sectors, it will be impossible.”), <https://www.ipcc.ch/2022/04/04/ipcc-ar6-wgiii-pressrelease/>; Damian Carrington, *It’s over for fossil fuels: IPCC spells out what’s needed to avert climate disaster*, The Guardian (Apr. 4, 2022), <https://www.theguardian.com/environment/2022/apr/04/its-over-for-fossil-fuels-ipcc-spells-out-whats-needed-to-avert-climate-disaster> (quoting UN Secretary General, “Increasing fossil fuel production will only make matters worse . . . It is time to stop burning our planet, and start investing in the abundant renewable energy all around us.”); Lina Tran & Joseph Winters, *‘We are at a crossroads’: New IPCC report says it’s fossil fuels or our future*, Grist (Apr. 4, 2022), <https://grist.org/science/we-are-at-a-crossroads-new-ipcc-report-says-its-fossil-fuels-or-our-future/>.

¹⁰ Alex de Vries *et al.*, *Revisiting Bitcoin’s carbon footprint*, 6 *Joule* 498 (2022), <https://www.sciencedirect.com/science/article/abs/pii/S2542435122000861>.

cryptocurrency mining operations in the United States, much of it fossil fuel-based,¹¹ conflicts directly with federal and state plans to reduce GHG emissions. In fact, in its recent report on the Mitigation of Climate Change, the Intergovernmental Panel on Climate Change’s (“IPCC”) specifically noted that “the energy requirements of cryptocurrencies is also a growing concern” and that digital currencies like Bitcoin are likely to “be a major global source of CO₂ if the electricity production is not decarbonised.”¹² The industry’s extensive power usage presents a transition risk for proof-of-work cryptocurrency mining companies. Thus, clear and strong guidance from governing agencies like the SEC on how these major companies should disclose their power use, GHG emissions, and related financial risks is important for investors assessing the severity of a transition risk for a particular company.

In addition to the medium-term and long-term demands on an energy system in need of rapid change, proof-of-work mining creates a more immediate and acute climate risk tied to legacy coal and gas plants. Proof-of-work mining companies are resurrecting otherwise uneconomic fossil-fueled power plants to mine proof-of-work cryptocurrencies. This occurs because cryptocurrency mining companies will pay above-market prices for those fossil-fueled plants. As of early June 2022 (prior to this week’s market crash), the breakeven price of electricity that Bitcoin miners were willing to pay more than \$170 per MWh¹³ - far above the operating cost of just about any coal plant.¹⁴ Keeping older, dirtier plants online as a source of low-cost energy for cryptocurrency mining severely hinders efforts to reduce GHG emissions while prolonging harmful impacts on local communities. Several publicly-traded cryptocurrency

¹¹ Since cryptocurrency mining requires a steady source of power, 24/7/365, miners seek cheap sources of electricity generated by burning coal and natural gas—often extending the life of fossil fuel sources of energy. See Alex de Vries et al., *Revisiting Bitcoin’s carbon footprint*, 6 Joule 498 (2022), <https://www.sciencedirect.com/science/article/abs/pii/S2542435122000861>. The electricity used to mine Bitcoin in 2020 resulted in almost 60 million tons of CO₂ emissions, according to one estimate. See ForexSuggest.com, *Global Impact of Crypto Trading*, <https://forexsuggest.com/global-impact-of-crypto-trading/> (last visited June 14, 2022). Further, the CO₂ emissions from mining Ethereum and Bitcoin in 2021 equaled the tailpipe emissions of more than 15 million gas-powered cars. See Committee on Energy & Commerce, Memorandum, at 5 (Jan. 17, 2022), <https://energycommerce.house.gov/sites/democrats.energycommerce.house.gov/files/documents/Briefing%20Memo%20OI%20Hearing%202022.01.20.pdf>.

¹² IPCC, *Climate Change 2022: Mitigation of Climate Change* (Apr. 2022), https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_FullReport.pdf.

¹³ The breakeven energy price for Bitcoin mining is dependent on the prevailing trading price of the currency, the likelihood of any given processor successfully solving the cryptological puzzle (as expressed by the global “hashrate”), the reward for solving the puzzle, and the efficiency of the processors engaged in mining (as expressed by their power draw and processing speed). The processing speed of a mining rig is typically expressed in trillions of calculations (“terahashes”, or “TH”) per second. The Bitcoin price, global hashrate, reward factors, and network fees are commonly rolled up into an index called the “hashprice,” or expected revenue per day for each terahash per second of processing power. As of early June 2022 (prior to this week’s market crash), the hashprice, or expected profitability, was \$0.123/day per TH/s. <https://bitinfocharts.com/bitcoin/>. A new mining rig (proxy S19 Pro 110TH) has a power draw of 3,250 watts, and processing speed of 110 TH/s. The proxy rig could be expected to produce, on average in early June, a reward worth \$13.54/day (\$0.123 x 110), but draws 78 kWh/day (3,250W x 24hrs). On a marginal cost basis, this proxy rig could absorb electricity costs of \$174/MWh, and still break even. The price of Bitcoin as of the date of this letter is well below its peak price. At higher realized prices, Bitcoin miners could absorb far higher electricity prices.

¹⁴ U.S. Energy Information Administration, *Today in Energy: U.S. coal plant retirements linked to plants with higher operating costs* (Dec. 3, 2019), <https://www.eia.gov/todayinenergy/detail.php?id=42155>.

mining and energy companies engage in such operations, examples of which include but are not limited to:

- at least two waste-coal plants in Pennsylvania that have increased capacity, local air and water pollution levels,¹⁵ and GHG emissions since they were bought by Stronghold Digital Mining Inc. in 2021;¹⁶
- a coal-fired power plant in Montana operated by Marathon Digital Holdings Inc.¹⁷ that had previously filed for bankruptcy and was barely operating, and then began operating and polluting full-time;¹⁸
- two gas-fired power plants in upstate New York that, before crypto-currency mining, powered up only rarely during heat waves and cold snaps;¹⁹
- a coal-fired power plant in Indiana that had been set to retire in May 2023, until a cryptocurrency mining company extended the plant's life for at least an additional five years;²⁰ and
- cryptocurrency mining in Kentucky powered by a grid that is nearly 70% coal-powered.²¹

¹⁵ For example, sulfur dioxide emissions at Stronghold's Scrubgrass waste coal plant in 2021 were more than three times greater than 2020 emissions as calculated via EPA Clean Air Markets Division (CAMD) Air Markets Program Data (AMPD) (2022), <https://ampd.epa.gov/ampd>.

¹⁶ Stronghold Digital Mining, Inc., 2021 Form 10-K (2022), <https://www.sec.gov/ix?doc=/Archives/edgar/data/0001856028/000162828022007706/sdig-20211231.htm>;

¹⁷ Marathon Digital Holdings, Inc., 2021 Form 10-K (2022), <https://www.sec.gov/ix?doc=/Archives/edgar/data/0001507605/000149315222006446/form10-k.htm>; Tom Lutey, *Crypto miner plans to exit Hardin coal-fired power plant*, Billings Gazette (Apr. 6, 2022), https://billingsgazette.com/news/crypto-miner-plans-to-exit-hardin-coal-fired-power-plant/article_cd2ca444-929a-511d-913d-903fbc570498.html (announced that it would transition its operations at the coal plant in Montana to a gas plant in Texas).

¹⁸ In 2021 alone, the Big Horn Data Hub operated by Marathon Digital Holdings, at the Hardin Coal Plant in Montana, saw an increase in NOx emissions by 842%, SO₂ emissions by 508%, and CO₂ emissions by 850%, compared to the prior year. Because coal plants spew toxic air pollution and coal ash contamination, the neighboring Crow Indian Reservation is most disproportionately impacted by local environmental issues. Calculated via EPA CAMD AMPD, <https://ampd.epa.gov/ampd>.

¹⁹ One of the plants is Greenidge Generation Station, located on the western shores of Seneca Lake, among the productive vineyards and farms of the Finger Lakes. In its first year of mining operations, Greenidge operated seven-fold more than the year prior and its CO₂ emissions increased 479%. Calculated via EPA CAMD AMPD, <https://ampd.epa.gov/ampd>.

²⁰ Alex Brown, *Hallador Acquires Sullivan County Coal Plant*, Inside Indiana Business (Feb. 15, 2022), <https://www.insideindianabusiness.com/articles/hallador-acquires-sullivan-county-coal-plant>; Global Newswire, *AboutBit launches one of nation's largest cryptocurrency mining facilities* (May 11, 2022), <https://www.globenewswire.com/news-release/2022/05/11/2440883/0/en/AboutBit-launches-one-of-nation-s-largest-cryptocurrency-mining-facilities.html>. The tagline of AboutBit, the company resurrecting the Merom Generating Station, is "Earth Friendly Crypto." When asked if AboutBit's five-year power contract would keep a polluting coal plant open, AboutBit's co-founder Jay Chiang explicitly offered, "It's 100 percent correct." See Benjamin Storrow & Jael Holzman, *Cryptocurrency's climate conundrum*, E&E News (May 18, 2022), <https://www.eenews.net/articles/cryptocurrencys-climate-conundrum/>.

²¹ U.S. Energy Information Administration, *Kentucky: State Profile and Energy Estimates*, <https://www.eia.gov/state/?sid=KY> (last visited May 5, 2022).

Inadequate disclosures make it harder for investors to know not only direct carbon emissions impacts of cryptocurrency mining companies, but also how these public companies will adapt to decarbonization goals and policies, particularly in states like New York, Illinois, and other states with ambitious net-zero emissions targets enshrined in statute. Without such transparency, risks to investors increase as investments flow to industries or companies that would otherwise struggle to attract significant interest due to the risks of harm to local communities or of regulations designed to achieve state or federal climate goals.

As discussed in detail below, the SEC filings of thirty-three publicly-traded cryptocurrency mining companies²² show a wide variation among the filings as well as a lack of detailed energy and climate-related disclosures. Strengths and weaknesses of the proposed rule were reviewed as applied to proof-of-work cryptocurrency mining operations. The proof-of-work cryptocurrency mining industry is just one of many problem actors as it relates to clear and robust climate disclosures to investors, but it is an extremely fast-growing industry in the U.S. and thus is worth the careful evaluation detailed in these comments.

II. Survey of SEC Filings of Thirty-three Publicly-Traded Cryptocurrency Mining Companies Demonstrates Necessity of the Proposed Rule

After reviewing the SEC filings of thirty-three publicly-traded cryptocurrency mining companies, it is clear that there is an extremely wide variety of information contained among the companies' filings as well as a lack of detailed energy and climate-related disclosures.²³ This review displays the urgent need for SEC guidance on such disclosures. The primary filings reviewed are located in Appendix A.

While there appear to be efforts to improve measuring, tracking, and reporting their energy use and GHG emissions from some cryptocurrency mining companies,²⁴ these efforts are mostly being adopted by non-proof-of-work cryptocurrencies and are a far cry from the current practices of most publicly-traded proof-of-work cryptocurrency mining companies in their SEC filings to date.

Robust disclosures in this industry would have a big impact. For example, the *New York Times* has reported that almost 80% of all computing power on the Bitcoin network is owned by

²² The thirty-three publicly-traded cryptomining companies whose disclosures we reviewed are Adit EdTech Acquisition Corp. (ADEX), Applied Blockchain, Inc. (APLD), Argo Blockchain (ARBK), Bit Digital (BTBT), BIT Mining (BTCM), Bitdeer Technologies Group, Bitfarms (BITF), BitFuFu, BlockFi Inc., Blockware Mining, Inc., Canaan (CAN), Celsius Network LLC, Cipher Mining (CIFR), Cipher Mining (CIFR), Cleanspark, Inc. (CLSK), Core Scientific (CORZ), Galaxy Digital Inc (GLXY), Greenidge Generation Holdings (GREE), HashChain Technology Inc., HIVE Blockchain Technologies (HIVE), Horizon Kinetics, Hut 8 Mining Corp. (HUT), Iris Energy (IREN), Lancium Technologies Corp., Layer1 Technologies Inc., Luxxfolio Holdings, Inc. (LUXFF), Marathon Digital Holdings (MARA), Mawson Infrastructure Group (MIGI), MGT Capital Investments, Inc. (MGTI), Northern Data AG, Rhodium Enterprises (RHDM), Riot Blockchain (RIOT), Stronghold Digital Mining (SDIG), and Terawulf (WULF).

²³ See Appendix A for the SEC filings reviewed.

²⁴ See, e.g., Marc Johnson & Sahithi Pingali, *Guidance for Accounting and Reporting Electricity Use and Carbon Emissions from Cryptocurrency* (Dec. 15, 2021), <https://cryptoclimate.org/wp-content/uploads/2021/12/RMI-CIP-CCA-Guidance-Documentation-Dec15.pdf>.

seven mining pools.²⁵ Strengthening reporting obligations and improving transparency for the largest publicly-traded cryptocurrency mining operations is therefore likely to have significant and positive impacts for Bitcoin investors.

Climate and Energy-Related Information is Currently Inconsistently and Incomparably Reported

Of the thirty-three companies reviewed, seven of them have filed Form D exemptions,²⁶ which exempt them from more comprehensive registration. Thus, their SEC filings offer no relevant information on energy or climate impacts. So, this review focuses on the filings of the remaining twenty-six companies.

Four of these twenty-six companies do not include any information regarding the location, energy consumption, or fuel usage of the mining operations: namely, Canaan, HIVE Blockchain, Horizon Kinetics, and Northern Data AG.²⁷

The remaining companies include some disclosures, but many are incomplete, describing the *number* of mining machines or their hashrate but not their location or power source. For example, Riot Blockchain discloses the total number of cryptocurrency mining machines expected to be in use by the company by the end of 2022 (120,150 miners, utilizing approximately 370 megawatts (“MW”) of capacity in New York and Texas), but does not detail the fuel sources associated with the energy consumed by those machines. Such detail would at least partially convey the scope of emissions attached to this energy consumption.²⁸

Slightly more than half of the twenty-six non-exempted registrants do provide information related to the energy consumption of at least one of their mining operations. But this information is often partial or selective. For example, Iris Energy and Marathon Digital Holdings both enumerate several different facilities where they conduct cryptocurrency mining operations. Iris Energy claims to have 530 MW of data center capacity, split across three different facilities, but only discloses the capacity of one of those facilities, and it is only 30 MW.²⁹ Marathon Digital Holdings discusses three active and one planned facility, but only discloses the capacity of one of them—which happens to be the same facility at which Marathon Digital Holdings

²⁵ Jon Huang, Claire O’Neill, and Hiroko Tabuchi, *Bitcoin Uses More Electricity 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>.

²⁶ These are BlockFi Inc, Blockware Mining, Inc., Celsius Network LLC, HashChain Technology Inc., Lancium Technologies Corp, Layer1 Technologies Inc., and Luxxfolio Holdings, Inc.

²⁷ SEC Company Search, Canaan Inc., <https://www.sec.gov/edgar/browse/?CIK=1780652&owner=exclude>; SEC Company Search, HIVE Blockchain Technologies Ltd., <https://www.sec.gov/edgar/browse/?CIK=1720424&owner=exclude>; SEC Company Search, Horizon Kinetics LLC, <https://www.sec.gov/edgar/browse/?CIK=1519418>; SEC Company Search, Northern Data AG, <https://www.sec.gov/edgar/browse/?CIK=1863502>.

²⁸ Riot Blockchain, Inc., 2021 Form 10-K (2022), <https://www.sec.gov/ix?doc=/Archives/edgar/data/0001167419/000107997322000280/riot10k1221.htm>.

²⁹ Iris Energy Ltd., 2021 Form F-1 (2021), https://www.sec.gov/Archives/edgar/data/0001878848/000114036121037466/ny20000275x9_f1a.htm.

notes that it will be terminating all operations and redeploying its miners elsewhere by September 30, 2022.³⁰

Less than half of the non-exempted registrants clearly disclose their fuel source for the energy consumed by their mining operations, which makes it impossible to estimate GHG emissions. Instead, many companies either do not mention fuel source at all, or employ vague language in their filings to describe that their energy supply is “reliable, renewable” or has “high emissions free content.”³¹ These terms are undefined and do not provide the type of information investors need to evaluate the climate risks to these companies. The use of such vague terminology also raises concerns about “greenwashing” or otherwise misleading claims about the actual impact on the grid generation mix of the facility.³²

About half of the non-exempted registrants disclose information about power purchase agreements with local utilities. If those utilities file an integrated resource plan (“IRP”) or other public information about its generation,³³ that information can be used to help determine fuel mix when operations use energy from the grid. However, some, like Applied Blockchain, Inc. only include vague indication that they have “signed an energy services agreement with a utility to power this facility.”³⁴

Because cryptocurrency mining operations are expanding rapidly in the U.S. and there is no standardized reporting framework for these data, different companies report metrics like megawatt capacity over different temporal periods even when they are filing the same forms at the same time. For example, in their 2021 respective Form 10-K, Cipher Mining reports their capacity envisioned for the end of Q2 in 2023, while Core Scientific reports their capacity envisioned for the end of 2022.³⁵ This lack of temporal standardization makes it difficult for investors to compare parallel statistics across companies.

In addition, relevant information was disclosed inconsistently in various sections of filings. For example, for Iris Energy, the location of their mining facilities and total energy

³⁰ Marathon Digital Holdings, Inc., 2022 Form 10-Q (2022), <https://www.sec.gov/ix?doc=/Archives/edgar/data/0001507605/000149315222012398/form10-q.htm>.

³¹ Argo Blockchain plc., 2021 Form F-1 (2021), https://www.sec.gov/Archives/edgar/data/0001841675/000110465921136647/tm2130707-7_f1a.htm; Core Scientific, Inc., 2021 Form 10-K (2022), <https://www.sec.gov/ix?doc=/Archives/edgar/data/0001839341/000119312522088850/d268076d10k.htm>;

³² *See, e.g.*, 16 C.F.R. § 260.15 (“It is deceptive to misrepresent, directly or by implication, that a product or package is made with renewable energy or that a service uses renewable energy”).

³³ Where the power purchase agreement is with an electric cooperative or municipal utility not subject to either state or Federal Energy Regulatory Commission regulation, this information may be available only piecemeal or after-the-fact.

³⁴ Applied Blockchain, Inc., 2022 Form 10-Q (2022), <https://www.sec.gov/ix?doc=/Archives/edgar/data/0001144879/000162828022014389/apld-20220228.htm>.

³⁵ Cipher Mining, Inc., 2021 Form 10-K (2022), <https://www.sec.gov/ix?doc=/Archives/edgar/data/0001819989/000095017022002861/cifr-20211231.htm>; Core Scientific, Inc., 2021 Form 10-K (2022), <https://www.sec.gov/ix?doc=/Archives/edgar/data/0001839341/000119312522088850/d268076d10k.htm>;

consumption was noted in the Prospectus Summary of their Form F-1, whereas other companies disclose this information in their Business section.³⁶ Such patchwork information disclosures and reporting approaches make it difficult to compare the relative climate and energy impacts associated with different companies. Thus, we are glad that the proposed rule will require registrants to create an appropriately captioned, separate part of the registration statement or annual report for their climate disclosures. We believe this is appropriate and will allow for apples-to-apples comparison by investors.

Multiple Types of Information Are Necessary to Fully Account for Cryptocurrency Mining's Climate Impacts

We encourage the SEC to require the following disclosures so investors are able to understand the full magnitude of a proof-of-work cryptocurrency mining company's climate impacts and climate risk:

- The location of the company's mining operations, including state and county.
- Whether the mining operation obtains electricity through retail service, a power purchase agreement, and/or behind-the-meter generation.
 - Where the mining operation has entered into a power purchase agreement or receives electricity through retail service, the company should identify any additional infrastructure (both generation and transmission) constructed as a condition or part of the rate agreement.
- The fuel consumption of each of the company's mining operations, such as:
 - The amount of fuel consumed directly by a cryptocurrency mining operation that is co-located with an electric generating facility, if applicable.
 - The approximate volume of flared gas utilized to mine crypto currency, if applicable.
 - The fuel mix of the local grid that provides electricity to the cryptocurrency mining operation, if applicable.
 - Any power purchase agreements or utility offtake agreements of 25 MW or more with utilities in the area. The company should identify the fuel mix associated with the utility, regardless as to whether the mining operation is co-located with particular generation facilities, unless the power purchase agreement specifies behind-the-meter delivery from an identified generating facility.
- The "peak load" or maximum megawatts of energy consumed at one time by each of their cryptocurrency mining operations.
- Whether the power purchase agreement or retail rate class provides for interruptible load and, if so, the terms of that potential interruption.
- The specific type and quantity of application-specific integrated circuit ("ASICs"), Antminers, or other mining hardware used at each mining operation, which can help estimate energy consumption. This includes differentiation between mining hardware of

³⁶ Iris Energy Ltd. 2021 Form F-1 (2021), https://www.sec.gov/Archives/edgar/data/0001878848/000114036121037466/ny20000275x9_f1a.htm.

the same type but with different computing power (e.g., Antminer S17 (56Th) vs. Antminer S17 (53Th)).

- The expected life of this hardware, as incorporated into any depreciation calculation.
- The tonnage of electronic waste generated per year.
- Methods used to cool the facility, and the energy used for cooling operations.
- Whether the company is part of a mining pool (a group of cryptocurrency miners who team up to increase their chances of successfully mining cryptocurrency), and if so, the above-described information for that mining pool's facilities as well as the portion of the pool's load and waste attributable to the company.
- Whether the company utilizes a computing service provider or other intermediary to arrange the purchase of electricity or the construction of transmission infrastructure in lieu of owning hardware or entering into rate or power purchase agreements directly.
 - For example, mining companies that purchase electricity, physical space (with corresponding transmission access), and/or computing time from a service provider, such as Compute North should disclose the electricity arrangements made through such a third-party service provider which the company relies on for mining operations.

A standardized and consistent reporting framework provided by the SEC is imperative for investors to have reliable and comparable information regarding climate impacts. Without such guidance, registrants will continue to provide partial or potentially misleading information.

III. Scope 1 and 2 Emissions Disclosures are Imperative for Investors to Understand Crypto Impacts, and Attestation Reports Should Be Required

We applaud the SEC's proposed rule for necessitating disclosure of Scope 1 and Scope 2 GHG emissions in standard units of CO₂e for all registrants. With this rule in place, investors will be able to more clearly understand the emissions impacts of cryptocurrency mining companies that are both (a) co-located with dirty power plants to fuel their mining activities, as well as (b) those that use immense amounts of electricity from dirty electric grids.

It should also be noted that some energy sources that are often considered renewable still have GHG emissions. For example, hydropower is often associated with substantial GHG emissions from reservoir surface emissions and other sources.³⁷ Such emissions should be appropriately documented by registrants.

We agree that Scope 1 and 2 emissions should be reported separately from each other, as well as that any carbon offsets should be reported independently rather than factored into emissions reporting. As drafted in the proposed rule, attestation, attestation reports should be required as drafted in the proposed rule in order to maintain comparability across companies.

³⁷ Earthjustice, *Over One Hundred Twenty-Five Groups Petition EPA to Report GHG Emissions from Dams and Reservoirs* (Mar. 22, 2022), <https://earthjustice.org/news/press/2022/over-one-hundred-twenty-five-groups-petition-epa-to-report-ghg-emissions-from-hydropower-dams-reservoirs>.

This comparable GHG emissions reporting will provide investors with essential insights into the relative carbon impacts of all types of companies and will specifically help investors understand the relative climate impacts different cryptocurrency mining companies.

IV. Carbon Offsets or Renewable Energy Credits (“RECs”) Should be Disclosed in Detail, as Proposed, to Avoid Misleading Greenwashing

In response to a growing body of research and journalism describing the immense environmental and climate damage caused by energy-intensive cryptocurrency mining, some cryptocurrency companies and industry groups have promoted cryptocurrency as an environmentally friendly industry, either as a driver of renewables development or as “carbon neutral,” often through the use of carbon offsets. Without stronger disclosure requirements, however, there is little or no publicly available information for investors or the general public to assess the accuracy of these claims, or the degree to which such “carbon neutrality” is claimed on the basis of RECs³⁸ or other offsets.

For example, Greenidge Generation Holdings Inc., which mines Bitcoin by burning natural gas at a formerly retired power plant in upstate New York, currently claims climate neutrality via offsets.³⁹ In Montana, perhaps succumbing to public, community, and investor pressure and the prospect of complying with this rule, in early April 2022, Marathon Digital announced that it would transition away from its coal-fueled operation at Hardin.⁴⁰ However, it is possible that Hardin mining equipment will simply be moved, at least temporarily, near or at the gas-powered Wolf Hollow Generating Station in Texas, given Marathon’s relationship with Compute North in the area.⁴¹ Even with this announcement, Marathon’s own CEO Fred Thiel stated that the company is leaving the Big Horn Data Hub, and millions of dollars’ worth of infrastructure intact, “so another miner can come in right behind us with a minimal delay and then com[e] up to speed[.]”⁴²

Even where mining operations draw a portion of their electricity from a grid mix that includes solar and wind, many operations do not have commitments for renewable-only power

³⁸ Defined by the SEC in the proposed rule as “a credit or certificate representing each purchased megawatt-hour (1 MWh or 1000 kilowatt-hours) of renewable electricity generated and delivered to a registrant’s power grid.”

³⁹ Greenidge Generation, *Environmental Stewardship*, <https://greenidge.com/environmental-stewardship/> (last visited June 15, 2022).

⁴⁰ Tom Lutey, *Crypto miner plans to exit Hardin coal-fired power plant*, Billings Gazette (Apr. 6, 2022), https://billingsgazette.com/news/crypto-miner-plans-to-exit-hardin-coal-fired-power-plant/article_cd2ca444-929a-511d-913d-903fbc570498.html.

⁴¹ Dan Swinhoe, *Compute North breaks ground on 300MW data center in Granbury, Texas*, Data Center Dynamics (Apr. 12, 2022), <https://www.datacenterdynamics.com/en/news/compute-north-breaks-ground-on-300mw-data-center-in-granbury-texas/#:~:text=Compute%20North%20is%20building%20a,in%20Granbury,%20in%20Hook%20County>.

⁴² Kayla Desroches, *As crypto company departs Hardin, what’s next for the communities it leaves behind?*, Yellowstone Public Radio (Apr. 28, 2022), <https://www.ypradio.org/energy/2022-04-28/as-crypto-company-departs-hardin-whats-next-for-the-communities-it-leaves-behind>; Marathon Digital Holdings, *Our Facilities*, <https://marathondh.com/our-facilities/> (last visited June 10, 2022).

supply and instead continue to mine without regard to the renewable generation curve, using electricity from gas-fired plants when they are the primary generation resource.

We are not aware of any state-based energy efficiency standard or other restriction on carbon dioxide emissions that applies to the cryptocurrency industry. In the absence of enforceable regulation and the combination of rapidly increasing demand for computing power with a high break-even point for miners, there appears to be little incentive or enforcement for companies to follow through on such representations. One estimate even finds that actual use of renewable energy Bitcoin miners has fallen in recent years.⁴³ Voluntary, unenforceable “accords” are not binding on individual miners and rely on sometimes unverifiable and hard-to-measure offsets. As such, we are glad that the proposed rule necessitates detailed description of all carbon offsets and RECs used to achieve goals of “carbon neutrality” or emissions reductions targets and we believe that such disclosures are essential for ensuring industry claims of environmental stewardship and represent more than being unfulfilled promises designed to appease, and potentially mislead, risk-averse investors.

V. “Transition Risks” Should Be Comprehensively Disclosed, and the SEC Should Offer More Specific Guidance

As detailed in Section I, a GHG emissions disclosure is not the only type of information necessary for investors to be fully informed of the climate and energy impacts of cryptocurrency mining operations. We believe these kinds of impacts and risks fit under the category of transition risks as defined in the proposed rule, and that the SEC should provide more specific guidance to registrants as they evaluate such risks, even in cases where a cryptocurrency mining company’s operations are fully powered by zero-emissions energy. The vast quantity of energy necessary to power cryptocurrency mining operations have already led to various kinds of regulatory and reputational risks, and the wastes produced by such activities pose substantial risks in a climate change-conscious society. Investors should be so duly and comprehensively informed.

The proposed rule would define transition risks as “the actual or potential negative impacts on a registrant’s consolidated financial statements, business operations, or value chains attributable to regulatory, technological, and market changes to address the mitigation of, or adaptation to, climate-related risks.” Below we describe how such risks are already impacting cryptocurrency mining operations, and we propose metrics that companies should report to help inform investors of such risks.

There are Significant Regulatory and Reputational Risks Posed to Cryptocurrency Mining Companies Due to both Local Grid Impacts and Climate Change Considerations

Cryptocurrency Mining operations have impacted electricity rates and the ability of local grids to meet the needs of an increasingly electrified economy in the U.S. The huge energy demand associated with mining operations may require relatively small-scale utilities to rapidly build out infrastructure, or risk overtaxing those utilities’ existing generation and transmission

⁴³ Alex de Vries et al., *Revisiting Bitcoin’s carbon footprint*, 6 Joule 498 (2022), <https://www.sciencedirect.com/science/article/abs/pii/S2542435122000861>.

resources. One effect of rapid cryptocurrency mining electric load increases in certain areas has been to increase utility bills for existing customers and has created stranded asset risk associated with the cryptocurrency mining-prompted build-out, mining companies themselves face considerable risk as utilities adapt rate structures or impose moratoria on cryptocurrency mining operations to address these impacts. Companies must disclose the magnitude of their impact on local grids, so that investors can assess the risk that regulation aimed at protecting the grid will disrupt cryptocurrency mining companies' business model. To put it another way: Because cryptocurrency mining operations currently displace certain externalities associated with electricity production on to ratepayers and residential users, companies should be prepared to disclose the magnitude of these externalities in anticipation of the possibility that states, utilities, and/or local governments will impose regulations that force the company to internalize these risks.

In Nebraska, Compute North operates cryptocurrency mining facilities where power is supplied by the Nebraska Public Power District ("NPPD"). In 2020, NPPD spent \$17.6 million, or 18% of its capital budget for the year, constructing a transmission line and substation to allow the Compute North's campus to increase from 30 MW to 100 MW.⁴⁴ Retail electricity customers will subsidize the cost of installing this increased transmission capacity at the site through higher per-kWh rates than Compute North itself. In eastern Washington, the Chelan County Public Utility District was overwhelmed by demand for cheap hydropower from cryptocurrency miners, and had to institute two moratoria on new mining operations and a new rate structure to discourage miners from placing further strains on their grid.⁴⁵ Many cryptocurrency miners left the area because of the rate changes,⁴⁶ 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."⁴⁷ For example, a congressional memo cited to a circumstance of a cryptocurrency mining operation in Washington state that declared bankruptcy in 2018, leaving more than \$700,000 in unpaid utility and electricity bills.⁴⁸ Finally, in Plattsburgh, New York,

⁴⁴ Nebraska Public Power District, 2021 Financial Report at 6, <https://docs.nppd.com/2021FinancialReport.pdf>; Peter Maloney, *Bitcoin mining operation to add flexible load to NPPD's area*, American Public Power Association (March 17, 2021), <https://www.publicpower.org/periodical/article/bitcoin-mining-operation-add-flexible-load-nppds-area>.

⁴⁵ Steve Wright, *Testimony before the Subcommittee on Oversight and Investigations, House Energy and Commerce Committee Hearing: 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.

⁴⁶ *Id.* at 6; 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/cryptocurrency-mining-gulps-power-can-it-help-renewable-energy-285435>.

⁴⁷ 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>.

⁴⁸ U.S. House Committee on Energy & Commerce, Memorandum, at 9 (Jan. 17, 2022), https://energycommerce.house.gov/sites/democrats.energycommerce.house.gov/files/documents/Briefing%20Memo_OI%20Hearing_2022.01.20.pdf.

residents' electricity bills increased 30% when a mining boom came to town a few years ago.⁴⁹ As a result, the New York Municipal Power Agency (“NYMPA”), an association of thirty-six municipal power authorities, petitioned the New York State 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.⁵⁰ A recent study found that Plattsburgh residents and small businesses paid \$244 million more in higher electric bills due to crypto's arrival.⁵¹ After NYMPA increased rates for supplemental electricity used by high-density load customers, large-scale cryptocurrency data centers chose to move from Plattsburgh.⁵²

These examples demonstrate that investors should be informed of both the social impacts of mining operations under an environmental, social, and governmental (“ESG”) framework *and* the risks associated with a mining operation that absorbs a significant proportion of a utility's generation capacity, which may increase electricity rates. A rule requiring disclosures as to what percentage of a utility's total load a mining operation constitutes will help investors understand the magnitude of this risk.

The regulatory and reputational risks posed to cryptocurrency mining companies are not limited to these concerns about local grid impacts. Concerns about how the energy demand of cryptocurrency mining might hinder efforts to (1) address climate change and (2) transition to the renewable energy have led some governments to ban cryptocurrency mining completely.

Governments around the world (in addition to China) have banned cryptocurrency mining completely. In November 2021, the Swedish Financial Supervisory Authority and Environmental Protection Agency called for a ban on cryptocurrency mining over concerns that the use of renewable electricity for mining could delay the energy transition of essential services.⁵³ As society transitions to full electrification, grid reliability becomes essential, which has influenced several other recent regulatory bans on cryptocurrency mining. In Québec in 2018, the Canadian power company Hydro-Québec and the Québec Energy Board decided to impose a moratorium on new cryptocurrency mining operations, after a significant number of

⁴⁹ 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>.

⁵⁰ Paul Ciampoli, *Public power can charge cryptocurrency firms higher rates: N.Y. PSC*, American Public Power Association (Mar. 16, 2018), <https://www.publicpower.org/periodical/article/public-power-can-charge-cryptocurrency-firms-higher-rates-ny-psc>.

⁵¹ Laura Counts, *Power-hungry cryptominers push up electricity costs for locals*, Berkeley Hass (Aug. 3, 2021), <https://newsroom.haas.berkeley.edu/research/power-hungry-cryptominers-push-up-electricity-costs-for-locals/>; Matteo Benetton et al., *When Cryptomining Comes to Town: High Electricity-Use Spillovers to the Local Economy* (May 14, 2021), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3779720.

⁵² 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.

⁵³ Alex de Vries et al., *Revisiting Bitcoin's carbon footprint*, 6 Joule 498–502 (2022), <https://www.sciencedirect.com/science/article/abs/pii/S2542435122000861>.

applications threatened to destabilize the local grid.⁵⁴ And, more recently, in January 2021, Iran decided to confiscate mining equipment as the country suffered from outages blamed on cryptocurrency mining activities.⁵⁵ Again, these developments are indicative of the need to explain to investors in proof-of-work mining operations the risks of several types of regulation in the transition risks section of their climate disclosures.

Large quantities of cryptocurrency mining operations can impact grid stability and reliability, facts which are front of mind for Americans and investors across the country as grid operators have struggled to adequately and reliably provide power to customers in light of extreme weather and catastrophic events, which events will only worsen because of the climate crisis. For example, the enormous load being placed on the Electric Reliability Council of Texas (“ERCOT”) grid from proof-of-work mining will have significant impacts on electricity prices and on transmission and distribution infrastructure, which is already unstable—as evidenced most recently and tragically by the Texas Winter Storm in February 2021, in which at least 246 people lost their lives,⁵⁶ and millions of households were without power.⁵⁷ More than two out of three Texans lost electricity at some point during Winter Storm Uri, for an average of forty-two hours.⁵⁸ Cryptocurrency operations may increase strain on this grid. ERCOT estimates that proof-of-work cryptocurrency mining alone will account for 6 GWs of new demand over the next two years—with peak demand in 2022—7.7% higher than in 2021.⁵⁹ Recently, total power demand in ERCOT broke through 75,000 MW for the first time ever.⁶⁰

Because of this immense increase in load from proof-of-work cryptocurrency mining operations, ERCOT is instituting additional processes and requirements for new large-scale

⁵⁴ Alex de Vries, *Bitcoin boom: What rising prices mean for the network’s electricity consumption*, 5 Joule 509, 509–513 (2021), <https://www.sciencedirect.com/science/article/pii/S2542435121000830>.

⁵⁵ *Id.*

⁵⁶ Erica Proffer, *Here is why death totals from Winter Storm Uri may vary*, KVUE (Feb. 15, 2022), <https://www.kvue.com/article/weather/winter-storm/here-is-why-death-totals-from-winter-storm-uri-may-vary/269-f2bf277f-74d9-443b-ab2e-ff89f336f3ec>.

⁵⁷ Texas Tribune Staff, *Texas power outages: Nearly half the state experiencing water disruptions as power grid operator says it’s making progress*, The Texas Tribune (Feb. 18, 2021), <https://www.texastribune.org/2021/02/18/texas-winter-storm-power-outage-ercot/>; see also Mandi Cai et al., *How Texas’ power grid failed in 2021 — and who’s responsible for preventing a repeat*, The Texas Tribune (Feb. 15, 2022), <https://www.texastribune.org/2022/02/15/texas-power-grid-winter-storm-2021/>.

⁵⁸ Chris Stipes, *New Report Details Impact of Winter Storm Uri on Texans*, Univ. of Houston (Mar. 29, 2021), <https://uh.edu/news-events/stories/2021/march-2021/03292021-hobby-winter-storm.php>.

⁵⁹ Naureen S. Malik, *Crypto Miners’ Electricity Use in Texas Would Equal Another Houston*, Bloomberg (Apr. 27, 2022), <https://www.bloomberg.com/news/articles/2022-04-27/crypto-miners-in-texas-will-need-more-power-than-houston>; Michael Smith, *Texas Governor Eyes Bitcoin Mining to Fortify the Electric Grid*, Bloomberg Law (Jan. 27, 2022), <https://news.bloomberglaw.com/securities-law/texas-governor-eyes-bitcoin-mining-to-fortify-the-electric-grid>.

⁶⁰ Matthew Watkins, *Texas breaks power demand record during June heat wave*, The Texas Tribune (June 12, 2022), <https://www.texastribune.org/2022/06/12/texas-heat-wave-grid/>.

cryptocurrency miners to connect to the state's power grid.⁶¹ On March 25, 2022, ERCOT released a notice⁶² instructing utilities to submit studies on the impact of miners and other large users tapping the grid before they can get "approval to energize." ERCOT's new rule applies to both new projects and expansions as well as projects at the site of power generation and projects that do not have their own power generation: any project that will add twenty MW of demand on the site of a generator within the next two years, and any project that will add seventy-five MW of demand without its own power generation on site within the next two years, will have to undergo a review process.⁶³

Local officials are also sounding the alarm on grid instability that may be caused by cryptocurrency mining operations. For example, the City of Brenham (Texas) Planning and Zoning Committee said that the city's current power grid cannot sustain the amount of electricity required for large scale and commercial-like cryptocurrency mining set ups, thus necessitating the committee halting the approval of more mining setups.⁶⁴ Further, electric cooperatives and utilities across Texas are weighing requests from Bitcoin miners to connect to the grid, which would require millions of dollars in transmission upgrades and associated infrastructure. For example, the Rayburn County Electric Cooperative found that two of the crypto mines interested in connecting to the utility's service territory north and east of Dallas would each require as much as \$20 million to fortify power lines to and avoid blackouts and would consume enough electricity to power as many as 60,000 Texas homes. As explained in Bloomberg, "[u]tilities like Rayburn have to provide service to miners if it's technically feasible to do so, but upgrades to the grid threaten to drive up bills for consumers already shouldering price shocks for almost everything."⁶⁵

There is a possibility that a mining operation would be blamed for large additional loads on fragile electrical grids throughout the country, with the accompanying the reputational risk of a mining operation being identified as one of the causes of a capacity shortfall. These various grid stability considerations merit detailed discussion in the transition risk section of cryptocurrency mining company's transition risks sections.

⁶¹ 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>.

⁶² ERCOT, *Market Notice: re Interim Large Load Interconnection Process* (Mar. 25, 2022), https://www.ercot.com/services/comm/mkt_notices/detail?id=fc84b65f-72fe-4704-9974-b52974cdb81e.

⁶³ Bloomberg Wire, *Texas now requiring crypto miners to seek 'approval to energize' before plugging into grid*, The 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/>; Chris Reeder & Miguel Suazo, *ERCOT Now Requires Cryptocurrency Miners to Provide Information on Their Impact to the Texas Power Grid*, JDSupra (Apr. 6, 2022), <https://www.jdsupra.com/legalnews/ercot-now-requires-cryptocurrency-6065651/>.

⁶⁴ Morgan Riddell, *Brenham officials discuss cryptocurrency and their ability to sustain energy demands that come with it*, KBTX (Mar. 29, 2022), <https://www.kbtx.com/2022/03/29/brenham-officials-discuss-cryptocurrency-their-ability-sustain-energy-demands-that-come-with-it/>.

⁶⁵ 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>.

The current situation in Texas should serve as a warning sign about the risk that cryptocurrency mining operations pose to reliable and affordable electricity, which ultimately results in potential regulatory risks to the companies themselves. As more and more of these operations come online—and as the United States attempts to combat climate change by decarbonizing economy-wide by shutting down fossil fuel operations and drastically ramping up renewable energy deployment—the SEC and investors should scrutinize claims by cryptocurrency mining companies to that effect. Also of note, the deployment of clean energy is not currently constrained by a lack of investment, but by supply chain considerations, interconnection constraints, and siting limitations. Today, there are far more planned clean energy projects in interconnection queues than can be built rapidly, and all of that clean energy could be economically deployed today. New demand from cryptocurrency operations will draw on rapidly-deployed resources, such as fossil plants near retirement, or rapidly deployed “flare gas” mining operations sited near wellheads. Further, the volatility of the cryptocurrency market and the short life of many cryptocurrency mining companies have serious implications for what happens when an operation leaves the area. If a renewable energy project requires revenue from a crypto operation to be economically viable, the economics of that putative renewable energy project mean it is unable to properly compete in an open market and potentially becomes stranded.

Several Specific Metrics Could Help Investors Understand Transition Risks

Significant transition risks associated with cryptocurrency mining operations in the U.S., are largely due to the immense energy needs of the cryptocurrency mining industry. Thus, cryptocurrency mining companies should be required to disclose their overall energy consumption to investors. This way, even if a company is using electricity with a low carbon footprint, investors can still understand the relative potential transition risks due to energy consumption among cryptocurrency mining companies. In addition to energy usage, waste production and water consumption (for machine cooling purposes) may also lead to transition risks for the cryptocurrency mining industry. We are glad that the proposed rule requires water usage disclosures if assets are located in regions of high or extremely high water stress, and believe such disclosures are appropriate.

Finally, in line with the various grid stability concerns exemplified above, cryptocurrency mining companies should be required to discuss in full any power purchase agreements or utility offtake agreements of 25 MW or more with utilities in the area, considering these types of agreements often lead to retail electricity consumers providing indirect subsidies to the cryptocurrency mining industry and can lead to regulatory changes. The SEC should consider requiring the disclosure of these metrics as well as those already proposed in the rule to help investors quantitatively compare potential transition risks.

VI. Registered Companies Who Supply and Service Proof-of-Work Cryptocurrency Mining Companies Should Disclose Scope 3 Emissions

A robust services market has developed around cryptocurrency mining, including infrastructure and corporate entities that facilitate agglomeration of mining operations. We are glad these companies will be required to disclose their Scope 1 and 2 emissions, and believe in many cases their Scope 3 emissions will be material and thus should be disclosed.

In some cases, such as the Compute North agreement with NPPD, the primary counterparty to a utility is not the mining company itself, but a business that arranges electricity and computational infrastructure for miners.

Moreover, as Bitcoin mining has become more complex and complicated over time, cryptocurrency miners have had to team up to increase their chances of successfully solving a complex puzzle and adding to the blockchain, to then receive a reward in the form of Bitcoin. Thus, cryptocurrency miners opt-in to participate in a mining pool to maximize the ability to solve a puzzle and receive Bitcoin,⁶⁶ with Foundry USA being the largest in North America.⁶⁷ Indeed, most of the peer-reviewed, academic studies that attempt to calculate Bitcoin's carbon footprint, associated energy usage, and concentration of miners do so by utilizing data from mining pools.⁶⁸ These service providers and pools, if publicly-traded, should be subject to identical disclosures as the mining operations themselves (including those suggested in these comments), even if they are not direct owners of mined cryptocurrency.

Additionally, companies that *trade* (as opposed to mine) proof-of-work cryptocurrencies and exchanges that facilitate trading of proof-of-work cryptocurrencies also generate GHG emissions through the trading transactions themselves (which also rely on complex cryptographical problem solving by specialized computers) and should disclose the emissions generated from their own operations and their facilitation of additional proof-of-working mining to validate transactions and trades. By some estimates, a single Bitcoin transaction uses more energy than 100,000 Visa transactions.⁶⁹ If trends continue, Bitcoin will overtake the banking sector in terms of energy consumption: Bitcoin already uses half as much electricity as the entirety of global banking, according to one estimate.⁷⁰ Further, one study estimates that the average electricity footprint of non-cash transactions by the global banking system is no more

⁶⁶ Cambridge Center for Alternative Finance, *Cambridge Bitcoin Electricity Consumption Index, FAQ: What are mining pools?*, <https://ccaf.io/cbeci/faq> (last visited June 14, 2022).

⁶⁷ Jamie Redman, *Foundry USA Captures the Top Bitcoin Mining Pool Position Over the Last 30 Days*, Bitcoin.com (Jan. 24, 2022), <https://news.bitcoin.com/us-still-dominates-bitcoin-mining-sector-30-day-stats-show-foundry-usa-takes-top-pool-position/>; see also The Chain Bulletin, *Bitcoin Mining Map*, <https://chainbulletin.com/bitcoin-mining-map/> (last visited June 14, 2022) (demonstrating that the top five mining pools based on hash power, a measure of the total computational power used to process transactions, were Foundry USA Pool, F2Pool, AntPool, ViaBTC, and Poolin).

⁶⁸ See, e.g., Cambridge Center for Alternative Finance, *Cambridge Bitcoin Electricity Consumption Index, Mining Map: Methodology*, https://ccaf.io/cbeci/mining_map/methodology (last visited June 14, 2022) (offering that mining pools BTC.Com, Poolin, Via BTC, and Foundry have contributed data). Igor Makarov & Antoinette Schoar, *Blockchain Analysis of the Bitcoin Market* (Nat'l Bureau of Econ. Rsch., Working Paper No. 29396, Oct. 2021), https://gceps.princeton.edu/wp-content/uploads/2021/11/21fall_Schoar_Makarov_NBER-slides.pdf.

⁶⁹ Raynor de Best, *Bitcoin average energy consumption per transaction compared to that of VISA as of April 25, 2022*, Statista (Apr. 25, 2022), <https://www.statista.com/statistics/881541/bitcoin-energy-consumption-transaction-comparison-visa/>. In fact, the latest data from Statista finds that 1 Bitcoin transaction is equal to 2,188.59 kWh of energy, whereas 100,000 VISA transactions account for 148.63. By this estimate, 1 Bitcoin transaction could actually account for 1.47 million VISA transactions ($2,188.59 / 148.63 = 14.72 * 100,000 = 1.47$ million).

⁷⁰ Rachel Rybarczyk, et al, *On Bitcoin's Energy Consumption: A Quantitative Approach to a Subjective Question*, Galaxy Digital Mining (May 2021), <https://docsend.com/view/adwmdeeyfvqwecj2>; see also Cambridge Centre for Alternative Finance, *Cambridge Bitcoin Electricity Consumption Index: Methodology*, <https://ccaf.io/cbeci/index/methodology> (last visited June 14, 2022).

than 0.4 kWh, while the average electricity footprint per Bitcoin transaction ranges from 491.4 kWh to 765.4 kWh.⁷¹ It is imperative that the SEC require companies and exchanges that trade proof-of-work cryptocurrencies to disclose the direct emissions and climate-related risks associated with their operations. In addition, many of these companies may have material Scope 3 emissions due to the mining operations associated with the cryptocurrencies they trade.

Finally, there are significant carbon emissions associated with the production of the computers used for mining themselves. Hardware companies that manufacture and supply the ASICs and Antminers that are used to mine cryptocurrency should disclose the Scope 3 emissions of their supply chain end use because they are likely material. For example, Intel began offering its second-generation Bitcoin mining chip, dubbed the “Intel Blockscales ASIC,” in April 2022—with the supposed claim that this chip will assist cryptocurrency mining companies with sustainability.⁷² A week later, Intel announced that the company aims to achieve net-zero GHG emissions in its global operations by 2040. While the announcement only encompasses Scope 1 and 2 emissions, Intel offered that it aims to “partner[] with suppliers and customers to take aggressive action to reduce overall [Scope 3] emissions.”⁷³ Already, the announcement of an Intel-produced chip to mine proof-of-work cryptocurrency, which is inherently energy-intensive, calls into question the company’s net-zero goals.

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⁷¹ Alex de Vries, *Renewable Energy Will Not Solve Bitcoin’s Sustainability Problem*, 3 *Joule* 893, 893-898 (Apr. 2019), <https://www.sciencedirect.com/science/article/pii/S254243511930087X>.

⁷² Aoyon Ashraf, *Intel Doubles Down on ESG With Launch of Second-Gen Bitcoin Mining Chips*, CoinDesk (Apr. 4, 2022), <https://www.coindesk.com/business/2022/04/04/intel-doubles-down-on-esg-with-launch-of-second-gen-bitcoin-mining-chips/>.

⁷³ Intel, *Intel Commits to Net-Zero Greenhouse Gas Emissions in its Global Operations by 2040*, Intel Newsroom (Apr. 13, 2022), <https://www.intel.com/content/www/us/en/newsroom/news/net-zero-greenhouse-gas-emissions-operations.html#gs.0sr5b1>.

⁷⁴ Aoyon Ashraf, *Intel Doubles Down on ESG With Launch of Second-Gen Bitcoin Mining Chips*, CoinDesk (Apr. 4, 2022), <https://www.coindesk.com/business/2022/04/04/intel-doubles-down-on-esg-with-launch-of-second-gen-bitcoin-mining-chips/>.

⁷⁵ Intel, *Intel Commits to Net-Zero Greenhouse Gas Emissions in its Global Operations by 2040*, Intel Newsroom (Apr. 13, 2022), <https://www.intel.com/content/www/us/en/newsroom/news/net-zero-greenhouse-gas-emissions-operations.html#gs.0sr5b1>.

mining process, companies supplying proof-of-work operations should disclose Scope 3 emissions, given that they are likely material.

Companies like Intel should also disclose the reputational risk from the enormous amount of e-waste generated from the mining machines. Proof-of-work mining companies generate significant amounts of electronic waste. In 2021, Bitcoin mining generated more than 30,000 metric tons of electronic waste,⁷⁶ which is comparable to the e-waste produced by the whole country of the Netherlands.⁷⁷ The mining devices used for proof-of-work quickly go obsolete, often lasting less than two years, and recent changes in the hardware used by miners who continually seek additional computing power only increases the e-waste.⁷⁸ The e-waste generated from proof-of-work mining is significant, and experts predict it will continue to increase as proof-of-work mining operations increase in scale.⁷⁹

VII. Conclusion

Proof-of-work cryptocurrency mining companies, along with many other carbon- and energy-intensive companies, pose risk to investors in the face of regulatory efforts to decarbonize, electrify, and build climate change-resilient infrastructure. These threats ultimately result in regulatory and reputational risks that must be comprehensively and comparably communicated to investors. Our review of the proposed rule in the context of the cryptocurrency mining industry serves as a helpful case study, pointing to the rule's many strengths as well as several areas where it could be improved.

We applaud the SEC's leadership on this crucial issue and appreciate the opportunity to provide these comments.

Sincerely,

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⁷⁶ 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/abs/pii/S0921344921005103?dgcid=author>.

⁷⁷ Alex de Vries & Christian Stoll, *Bitcoin's growing e-waste problem*, 175 Res., Conservation & Recycling 105901 (Dec. 2021), <https://www.sciencedirect.com/science/article/pii/S0921344921005103>; Digiconomist, *Bitcoin Elec. Waste Monitor*, <https://digiconomist.net/Bitcoin-electronic-waste-monitor> (last visited May 5, 2022).

⁷⁸ Joachim Klement, *Geo-Economics: The Interplay between Geopolitics, Economics, and Investments*, at 200 (Apr. 2021); 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>; IANS, *Bitcoin mining generates tonnes of e-waste: Study*, The Economic Times (Sept. 21, 2021), <https://economictimes.indiatimes.com/markets/cryptocurrency/bitcoin-mining-generates-tonnes-of-e-waste-study/articleshow/86391133.cms>.

⁷⁹ 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>.

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Appendix A
**Selected SEC Filings Reviewed for the Thirty-three
Publicly-traded Cryptocurrency Mining Companies**

1. Adit EdTech Acquisition Corp., 2022 Form 10-Q (2022).
https://www.sec.gov/ix?doc=/Archives/edgar/data/0001830029/000156459022020413/adex-10q_20220331.htm.
2. Applied Blockchain, Inc., 2022 Form 10-Q (2022),
<https://www.sec.gov/ix?doc=/Archives/edgar/data/0001144879/000162828022014389/apld-20220228.html>; Applied Blockchain, Inc., 2022 Form S-1 (2022),
https://www.sec.gov/Archives/edgar/data/0001144879/000110465922044841/tm2132377-23_s1a.htm.
3. Argo Blockchain plc., 2021 Form F-1 (2021),
https://www.sec.gov/Archives/edgar/data/0001841675/000110465921136647/tm2130707-7_f1a.htm
4. Bit Digital, Inc., 2022 Form F-3/A (2022),
https://www.sec.gov/Archives/edgar/data/0001710350/000121390022020812/ea158585-f3a4_bitdigitalinc.htm.
5. BIT Mining Ltd., 2022 Form F-3 (2022),
https://www.sec.gov/Archives/edgar/data/0001517496/000110465922047324/tm2126703-17_f3a.htm.
6. Bitdeer Technologies Grp., Form 425, (2022),
https://www.sec.gov/Archives/edgar/data/0001899123/000110465922018969/tm2135137d9_425.htm.
7. Bitfarms Ltd., 2021 Form F-10. (2021),
https://www.sec.gov/Archives/edgar/data/0001812477/000121390021042378/ea145070-f10_bitfarmsltd.htm.
8. BitFuFu, Investor Presentation (2022),
https://www.sec.gov/Archives/edgar/data/1882078/000121390022003620/ea154381ex99-2_ariszacq.htm.
9. BlockFi Inc., Form D (2022),
https://www.sec.gov/Archives/edgar/data/0001726072/000172607220000001/xslFormDX01/primary_doc.xml.
10. Blockware Mining, Inc., Form D (2021),
https://www.sec.gov/Archives/edgar/data/0001797845/000179784521000003/xslFormDX01/primary_doc.xml.
11. Celsius Network LLC., Form D (2022),
https://www.sec.gov/Archives/edgar/data/0001923159/000192315922000001/xslFormDX01/primary_doc.xml.
12. Cipher Mining, Inc., 2022 Form 10-Q (2022),
<https://www.sec.gov/ix?doc=/Archives/edgar/data/0001819989/000095017022008756/cifr-20220331.htm>.

13. CleanSpark, Inc., 2022 Form 10-Q (2022),
<https://www.sec.gov/ix?doc=/Archives/edgar/data/0000827876/000095017022009052/clsk-20220331.htm>.
14. Core Scientific, Inc., 2022 Form 10-Q (2022),
<https://www.sec.gov/ix?doc=/Archives/edgar/data/0001839341/000162828022014350/core-20220331.htm>.
15. Galaxy Digital Inc., 2022 Form S-4 (2022),
https://www.sec.gov/Archives/edgar/data/0001859392/000110465922008454/tm2127871-8_s4.htm.
16. Greenidge Generation Holdings, Inc., 2022 Form S-1 (2022),
<https://www.sec.gov/Archives/edgar/data/0001844971/000119312522108196/d328830ds1.htm>.
17. HashChain Technology Inc., Form D (2018),
https://www.sec.gov/Archives/edgar/data/0001718477/000106299318000897/xslFormDX01/primary_doc.xml.
18. HUT 8 Mining Corp., 2021 Form F-10 (2021),
https://www.sec.gov/Archives/edgar/data/0001731805/000110465921047681/tm218977-4_f10a.htm.
19. Iris Energy Ltd., 2021 Form F-1 (2021),
https://www.sec.gov/Archives/edgar/data/0001878848/000114036121037466/ny20000275x9_f1a.htm.
20. Lancium Technologies Corp., Form D. (2021),
https://www.sec.gov/Archives/edgar/data/0001886863/000188686321000002/xslFormDX01/primary_doc.xml.
21. Layer1 Technologies Inc., Form D (2019),
https://www.sec.gov/Archives/edgar/data/0001791744/000179174419000001/xslFormDX01/primary_doc.xml.
22. Luxxfolio Holdings, Inc., Form D (2021),
https://www.sec.gov/Archives/edgar/data/0001871928/000187192821000001/xslFormDX01/primary_doc.xml.
23. Marathon Digital Holdings, Inc., 2021 Form 10-K (2022),
<https://www.sec.gov/ix?doc=/Archives/edgar/data/0001507605/000149315222006446/form10-k.htm>.
24. Mawson Infrastructure Grp., 2021 Form 10-K (2022),
https://www.sec.gov/ix?doc=/Archives/edgar/data/0001218683/000121390022013830/f10k2021_mawsoninfra.htm.
25. MGT Capital Investments, Inc., 2022 Form 10-Q (2022),
<https://www.sec.gov/ix?doc=/Archives/edgar/data/0001001601/000149315222013347/form10-q.htm>.
26. Rhodium Enterprises, Form S-1 (2022),
https://www.sec.gov/Archives/edgar/data/0001874985/000121390022002442/fs12022a6_rhodium.htm.

27. Riot Blockchain, Inc., 2021 Form 10-K (2022),
<https://www.sec.gov/ix?doc=/Archives/edgar/data/0001167419/000107997322000280/riot10k1221.htm>.
28. Stronghold Digital Mining, Inc., 2021 Form 10-K (2022),
<https://www.sec.gov/ix?doc=/Archives/edgar/data/0001856028/000162828022007706/sdig-20211231.htm>.
29. Terawulf, Inc., 2021 Form 10-K (2022),
<https://www.sec.gov/ix?doc=/Archives/edgar/data/0001083301/000110465922041168/wulf-20211231x10k.htm>.
30. Canaan, Inc., no relevant filings,
<https://www.sec.gov/edgar/browse/?CIK=1780652&owner=exclude>.
31. HIVE Blockchain Technologies Ltd., no relevant filings,
<https://www.sec.gov/edgar/browse/?CIK=1720424&owner=exclude>.
32. Horizon Kinetics LLC, no relevant filings,
<https://www.sec.gov/edgar/browse/?CIK=1519418>.
33. Northern Data AG, no relevant filings,
<https://www.sec.gov/edgar/browse/?CIK=1863502>.