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The Future of Crypto-Asset Mining: The Inflation Reduction Act and the Need for Uniform Federal Regulation

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Abstract

Crypto-asset mining is energy-intensive and environmentally harmful, presenting challenges and opportunities for federal, state and local governments, regulators, and society as a whole. As of December 2021, the United States has thirty-eight percent of the global crypto network hashrate,[1] which is the total amount of computational power used to mine and process crypto transactions, making the United States the world's largest crypto-asset mining industry.[2] The total electricity consumption of crypto-asset mining in the United States is estimated to be around 121.36 terawatt-hours ("TWh")[3] per year, which is equivalent to the electricity consumption of approximately 10.9 million households in the United States.[4] Crypto-asset mining in the United States is extremely energy-intensive, emitting roughly 65.4 million metric tons of carbon-dioxide annually,[5] or the equivalent of seven million gasoline-powered vehicles.[6] As a result, effective regulatory frameworks are necessary to address the explosion of energy and environmental issues caused by crypto-asset miners, who are under pressure to maximize earnings by using less expensive carbon-emitting energy.

To date, crypto-asset mining has not been governed by a federal regulatory framework, but instead by a patchwork of state-by-state responses that vary from highly restrictive, such as the moratoria proposed in New York, to dangerously permissive, such as the deregulation occurring in Wyoming. This article examines existing federal, state, and local regulatory schemes that directly or indirectly address the negative effects of crypto-asset mining. Although different state and local regulations attempt to strike a balance between reducing crypto-asset mining's negative environmental and energy consumption impact and retaining crypto's economic benefits, the country will continue to suffer from crypto-asset mining's severe energy and environmental consequences until there is a unified response. This article proposes that the Inflation Reduction Act's ("IRA") federal regulatory authority, as well as earlier federal precedent, could potentially prevent a "race to the bottom" among states with permissive crypto-asset mining regulations. In the alternative, the article also evaluates the effectiveness of state-level crypto-asset mining regulatory measures until a uniform federal response is adopted.

I. Introduction

Crypto-assets, also known as virtual or digital currency,[7] have been controversial since their introduction in 2009.[8] In a nutshell, a crypto-asset is a type of digital currency that is traded among users and is created using complex algorithms and computational power.[9] Blockchain is the technology that underpins these crypto-assets.[10] A blockchain is a digital distributed ledger that allows parties who would not otherwise trust one another to agree on current asset ownership and distribution to conduct new business.[11] Despite recent drops in crypto-assets value and rumors of a "crypto winter,"[12] crypto-assets are here to stay, posing unique environmental and energy challenges and opportunities.[13]

Crypto-asset mining is the process of creating additional units of crypto—a type of digital asset—and validating crypto-asset transactions on a blockchain ledger.[14] One of the challenges is that crypto-asset mining companies have an incentive to find low-cost electricity in order to gain a competitive advantage, which leads to crypto-asset mining companies repurposing or restarting abandoned industrial facilities[15] by acquiring or leasing abandoned factories, warehouses, or other industrial facilities with access to low-cost electricity.[16] However, it is important to note that using low-cost electricity generated by abandoned industrial facilities can have environmental and social consequences, particularly if the electricity is generated using fossil fuels or other non-renewable sources.[17]

Governments at all levels in the United States are working on new rules to address the rising energy consumption and environmental concerns brought on by crypto-asset mining operations, and to prevent a "tragedy of the commons"[18] from occurring.[19] One example of the tragedy of the commons playing out is in the context of crypto-asset mining, where companies and individuals would use carbon-emitting energy sources to maximize crypto-asset mining profits, putting at risk the stewardship of shared energy supplies and the environment.[20] Consequently, the United States will continue to suffer from the crypto-asset mining industry's disastrous effects on the nation's energy supply and environment until a unified federal regulatory framework is in place to address the issues posed by crypto-asset mining.[21]

This proposal for a unified regulatory scheme proceeds in three parts beginning in Part II of this article which provides an overview of crypto-asset mining and reviews the effects of this rapidly expanding industry on the environment, energy usage, and infrastructure. Part III examines the spectrum of permissive-to-restrictive regulatory responses to crypto-asset mining at the federal, state, and local levels. Part IV proposes a unified regulatory scheme to address crypto-asset mining, with federal regulations serving as a baseline and state and local regulations providing alternative or supplemental regulation of the issue.

II. Crypto-Asset's Energy and Environmental Impact

A. Overview of Crypto-asset mining

Bitcoin, created by Satoshi Nakamoto,[22] is widely regarded as the first digital currency or crypto-asset, though there were forerunners in the 1990s, including "B-money" proposed by Chinese computer engineer Wei Dai and "Bit Gold" proposed by Nicholas Szabo.[23] Since Bitcoin's inception, many other crypto-assets have appeared, with Ether and the Ethereum blockchain among the most prominent.[24] Blockchain, the underlying technology for crypto-assets, is fundamentally different from a centralized database management system in that information is stored digitally and decentralized across all connected nodes. There are three main ways to obtain crypto-assets: (1) directly by exchanging conventional currency and paying an exchange fee, (2) in exchange for a product or service, or (3) by mining crypto-assets.[25] This article will focus on the third method of obtaining crypto-assets through crypto-asset mining operations.

It wasn't until Satoshi Nakamoto published the Bitcoin white paper in late 2008 and started his own crypto-asset mining efforts in early 2009 that the practice of mining crypto-asset really took off.[26] In its most basic form, crypto-asset mining is the process of adding new blocks or units of crypto-asset (a type of digital asset) and validating crypto-asset transactions to a blockchain ledger.[27] Crypto-asset miners are incentivized in a variety of ways, including monetary reward, reputational reward, and stake reward, though the exact nature of these rewards depends on the crypto-asset in question and the consensus algorithm it employs.[28] However, the primary goal is to incentivize crypto-asset miners to perform the necessary work of verifying transactions and adding new blocks to the blockchain, thereby bolstering the safety and reliability of the network.[29]

To establish the procedures by which miners validate transactions involving these crypto-assets, Bitcoin and many other notable crypto-assets use the "proof-of-work" ("PoW") model.[30]

In general, miners of a crypto-asset compete to solve a complex computational problem or puzzle using computational power in exchange for the reward of posting the next block in the PoW consensus model.[31] The first crypto-asset miner to broadcast the solution to the complex computational problem is awarded the opportunity of adding the next block to the blockchain and the associated block reward if the solution is later verified as correct by the network.[32] However, the PoW consensus algorithm is notoriously inefficient and wasteful due to the large amounts of energy it consumes for no discernible benefit other than the confirmation of transactions and the addition of new blocks to the blockchain.[33]

B. Energy Use and Infrastructure Impacts

Mining crypto-assets, like mining other commodities, can have serious negative consequences for energy consumption and the environment, impeding the United States' ability to achieve the necessary reductions in greenhouse gas emissions to keep global warming below 1.5 degrees Celsius.[34] As a result, factors such as the amount of electric energy consumed by each crypto-asset mining operation, the time of electricity use, the potential grid stress caused by each crypto-asset mining operation's power load, the source of electric energy consumed by each crypto-asset mining operation, the number and location of any existing or planned crypto-asset mining operation, the anticipated increase of new, and expansion of existing, crypto-asset mining operations must be considered. According to a Business Insider report published in September 2021, the annual electricity consumption of Crypto-asset mining was estimated to be around 0.5% of global electricity consumption, or roughly seven times the power consumed by Google in a year.[35] This figure represents a significant increase in Crypto-asset mining energy consumption since its inception.[36]

In general, crypto-asset mining operations infrastructure requires the use of energy to: (1) operate the devices that perform the calculations required to maintain the integrity of the blockchain and to validate transactions via PoW, and (2) thermally regulate the devices for optimal performance (as when computers work they get hot and need to cool down).[37] The energy consumption cycle is especially vicious because each block added to the chain increases the difficulty of the puzzle, requiring more energy to run miners' computers.[38] As of July 2021, two studies that track crypto-asset mining energy consumption—Digiconomist and the Cambridge Bitcoin Energy Consumption Index ("CBECI")—estimated that Bitcoin consumed between 29.96 TWh and 176.98 TWh of energy, or roughly the same as Sweden or Thailand.[39] To provide further context, 121.36 TWh per year is equivalent to the electricity consumption of approximately 10.9 million U.S. households.[40] In short, this is a significant amount of energy consumption, and it highlights the need for more energy-efficient and environmentally friendly solutions in the crypto-asset mining industry.

The infrastructure of crypto-asset mining operation has grown since the first miners began mining Bitcoin with low-cost equipment; in fact, the first Bitcoins were mined on a laptop or desktop computer.[41] Today, crypto-asset miners mine cryptos using specialized hardware such as application-specific integrated circuits ("ASICs"),[42] which are designed specifically for the purpose of mining and offer much higher performance and efficiency than traditional computer hardware but require a lot more computational power and electricity to verify crypto transactions.[43] In addition to specialized infrastructure, crypto-asset miners employ complex cooling systems to keep their mining equipment working at ideal temperatures.[44] This is critical because mining equipment creates a substantial amount of heat, which can lower the equipment's lifespan and raise the danger of hardware failure. As more miners enter the market and the difficulty of mining cryptos increases, competition among miners will increase, as will concerns about the environmental impact of crypto-asset mining, as mining operations consume a substantial amount of energy and leave a significant carbon footprint.

C. The Environmental and Public Health Effects

The environmental and public health consequences of crypto-asset mining can be divided into four categories. First, there's the issue of greenhouse gas emissions and other air pollutants caused by an onsite energy source, by offsite-generated electricity, steam, heat, or cooling used by a crypto-asset mining operation or producing and disposing of computers and mining infrastructure.[45] A study published in 2020 by the University of Cambridge estimated that Bitcoin mining caused worldwide emissions of 39.27 million metric tons of carbon dioxide, with the United States responsible for about 4.5 million metric tons of those emissions.[46] According to a more recent study published in September 2022 by the White House Office of Science and Technology Policy ("OSTP"), global carbon-dioxide emissions from crypto-asset mining could range from 110 million to 170 million tons per year.[47] This is significantly higher than previous estimates and highlights the urgent need for the industry to reduce its carbon footprint.

Second, there's the issue with the electronic waste ("e-waste") produced and the use or discharge of cooling water that occurs during crypto-asset mining operations. Mining for

crypto-assets requires the use of specialized hardware, such as graphics processing units ("GPUs"), which quickly become obsolete, resulting in a large amount of electronic waste that is difficult to recycle and can emit toxic chemicals into the environment.[48] Furthermore, e-waste from crypto-asset mining operations contains heavy metals and carcinogens that, if handled improperly, has the potential to harm human health, as well as air and water quality.[49] Cooling water use can have a negative impact on water resources and aquatic ecosystems, especially in areas where water is scarce, or crypto-asset mining is concentrated.[50] The discharge of cooling water can also contribute to water pollution by releasing chemicals and other pollutants.[51]

The third issue is related to land-use, as crypto-asset mining requires a lot of space to accommodate the necessary equipment and cooling systems.[52] Rising land demand has measurable effects on ecosystems such as deforestation, land degradation (such as soil erosion), biodiversity loss, and increased atmospheric carbon dioxide.[53] Roads and other infrastructure built for crypto-asset mining farms can fragment habitats, making it harder for wildlife to move around and find food, displacing native species.[54] Companies such as immersion cooling expert LiquidStack recognize this issue and gained notoriety in March 2023 when they stated that their product could reduce the amount of land required to cool the computers used in crypto-asset mines by one-third.[55]

The fourth problem is the potential threat to public health and the environment posed by the "noise pollution" created by air-cooled mining computers with high-velocity fans used in crypto-asset mining operations.[56] People who are constantly exposed to loud noise, such as that produced by crypto-asset mining operations, may experience sleep disturbances, stress, and a lower quality of life, all of which may have an impact on their physical and mental health.[57] Furthermore, if crypto-asset mining operations are situated near wildlife reserves or protected areas, the noise pollution from mining equipment could negatively affect wildlife, potentially influencing the behavior, migration patterns, or reproductive success of the animals.[58]

These four factors are just a few of the many factors that must be considered when attempting to calculate the environmental impact of crypto-asset mining. Despite these obstacles, it is evident that crypto-asset mining has a significant and growing impact on the environment, especially in areas where environmental justice communities[59] already face significant challenges.

Consequently, as the crypto-asset mining industry grows and expands, legislative and regulatory actions are required to lessen its carbon footprint and encourage more sustainable practices; this has prompted a review of existing regulatory responses to crypto-asset mining, which is presented below.

III. Existing Regulatory Responses To Crypto-Asset Mining

Several state and local governments in the United States have made crypto-asset mining a top policy priority, even though the federal government has yet to directly address crypto-asset mining's energy and environmental impacts. Although Congress has historically prioritized anti-money-laundering and consumer protection laws in relation to crypto-assets, the passage of the Inflation Reduction Act ("IRA") on August 16, 2022,[60] may change the federal regulatory landscape, indirectly impacting crypto-asset mining. This Section will first review the existing federal response to crypto-asset mining. Next, the piecemeal approach to crypto-asset mining regulation at the state and local levels is discussed.

A. Federal Response

Energy policy has been on the national agenda since the nineteenth century, with the U.S. House of Representatives and U.S. Senate debating and voting on numerous energy-related matters since the passage of the Federal Power Act in 1920.[61] Though recent federal actions are noteworthy, no legislation has been enacted as of this writing to directly regulate crypto-asset mining operations by expanding existing regulatory authority or enacting new legislation. As stated further below, the executive branch has issued an executive order, and the legislative branch, specifically the United States Senate, has begun holding hearings on the subject of crypto-asset mining.

Recent executive branch events include President Biden signing Executive Order 14,067, "Ensuring Responsible Development of Digital Assets," on March 9, 2022.[62] This order seeks to provide guidance and regulatory oversight for the use of crypto-assets and blockchain technology in the United States.[63] The order's goals include fostering innovation and protecting consumers while helping the federal government better understand and regulate crypto-assets and other blockchain-based financial products.[64] In addition, the order calls for the Environmental Protection Agency ("EPA") and others to compile a report that "address[es] the effect of crypto-assets' consensus mechanisms on energy usage, including mitigating measures, alternative consensus mechanisms, and design tradeoffs."[65] However, no concrete steps are taken in the order to implement them through preexisting regulatory authority or new federal legislation.[66]

Some lawmakers support using Section 114 authority under the Clean Air Act ("CAA")[67] to regulate crypto-asset mining operations by mandating reporting energy use and emissions to better understand the industry's environmental impact and begin regulating its emissions.[68] In fact, Congress asked the EPA in 2022 to evaluate the authority of crypto-asset mining facilities under EPA's Greenhouse Gas Reporting Program ("GHGRP"), using Clean Air Act Section 114 authority, which collects emissions data from crypto-asset mining facilities emitting more than 25,000 tons of carbon dioxide equivalent.[69] Further, lawmakers have requested that the EPA and establish, as part of its GHGRP, a database or list of crypto-asset mining facilities that emit more than 25,000 metric tons of carbon dioxide equivalent.[70] In addition, lawmakers want to know when the EPA and DOE plan to begin collecting and analyzing data on crypto-asset mining's energy usage and fuel mix, power purchase agreements, environmental justice implications, and crypto-asset miner and electric utility participation in demand response, all of which

were recommendations from the OSTP report.[71] Congress also wanted to know if the EPA, DOE, and OSTP planned to work together to develop this reporting mechanism, or if they would each develop their own reporting systems and analyses independently.[72]

More recently, the Senate Committee on Environment and Public Works ("EPW") Subcommittee on Clean Air, Climate, and Nuclear Safety held a hearing titled "Scrutinizing Skyrocketing Energy Consumption of the Crypto-asset mining Industry" on March 3, 2023, where they discussed Senator Edward J. Markey's reintroduction of the Crypto-Asset Environmental Transparency Act prior to the hearing.[73] In short, the bill would require crypto-asset mining firms to disclose emissions in accordance with Title 40, Part 98.2 of the Code of Federal Regulations monitoring, recordkeeping, and reporting obligations regardless of whether a crypto-asset mining operation emits at least 25,000 metric tons of carbon dioxide ("CO_2")-equivalent, and the EPA administrator would oversee an interagency investigation into the impact of crypto-asset mining in the United States.[74]

The Crypto-Asset Environmental Transparency Act and its regulation of crypto-asset mining operations have been met with opposition from some members of Congress, including Ranking Member Sen. Pete Ricketts of Nebraska, the leading Republican on the subcommittee.[75] Ricketts, highlighting his state's top ranking in cultivating a crypto economy, expresses keen interest in whether the industry can drive economic development and argues that crypto-asset mining is not the only energy-intensive industry and cites examples like finance, technology, government, and academia and that he advocates for open competition in a free market, cautioning against politicians or bureaucrats in Washington, D.C. favoring certain industries.[76]

B. State and Local Responses

States and municipalities have pursued a variety of approaches to crypto-asset mining regulation. As the cost of electricity continues to fall, crypto-asset mining is becoming more popular in a variety of contexts, states and municipalities are passing or considering passing legislation to address the resulting issues. In fact, New York, Wyoming, Montana, and Washington are among the states that have implemented crypto-asset mining regulation ranging from "liberal to stringent."[77] Therefore, this next section will analyze the various regulatory strategies to regulate crypto-asset mining at the state and local levels.

1. New York: Moratoria on Energy Derived from Carbon-Based Sources

Perhaps the strongest restriction to date may be found in New York, where in November 2022, Governor Kathy Hochul signed a bill[78] prohibiting the use of carbon-based power sources in some crypto-asset mining companies.[79] As a result, for the next two years, the New York State Department of Environmental Conservation will not grant expansions or permit renewals to existing proof-of-work crypto-asset mining operations, and will not allow new crypto-asset mining operations to begin operations unless they switch to using only renewable energy.[80]

For context, in the spring of 2022, Greenidge Generation, a crypto-asset mining company that had reopened a dormant fossil fuel plant in the Finger Lakes region, played a key role in bringing the New York two-year ban to the forefront of politicians' concerns.[81] The two-year ban, however, has no effect on Greenidge's power production because it uses thermoelectric power plants, which generate electricity by using steam to turn turbines.[82] In fact, Greenidge intends to reinvest a portion of its profits in renewable energy initiatives, in addition to compensating for all carbon dioxide emissions generated by its crypto-asset mining operations.[83] Many critics of Greenidge's crypto-asset mining operations claim that the company is dumping millions of gallons of hot water into Seneca Lake, thereby raising the surface temperature to between thirty-two and seventy degrees Fahrenheit.[84] Locals are worried about the lake's rising temperatures, and for context, it's important to note that trout thrive in temperatures between fifty-two and sixty-four degrees Fahrenheit, while levels above seventy-five degrees Fahrenheit are lethal for some species.[85] Now that the lake's temperature is rising, it may be polluting the water and thus in violation of the Clean Water Act's temperature regulations.[86] Worse, rising temperatures are contaminating the lake with "muck, algae, insects, dead fish, and foul odors."[87]

Supporters of a temporary ban on crypto-asset mining operations, for example, prefer a targeted approach to limiting the use of fossil fuels in crypto-asset mining activities rather than a blanket ban.[88] They also generally support a targeted temporary ban and the promotion of renewable energy sources in crypto-asset mining operations.[89] In New York, supporters of the temporary ban have emphasized that the ban will not affect existing crypto-asset mining facilities or halt all crypto-asset mining activities in New York, but will only affect those seeking permits to re-power fossil fuel plants, leaving those that connect directly to renewable energy sources unaffected.[90]

Opponents of the crypto-asset mining temporary ban regulations, such as the Chamber of Digital Commerce, a crypto advocacy group, argue that crypto-asset mining could encourage new renewable energy development, that sidelining the industry for its energy usage sets a dangerous precedent in determining who may or may not use power, and that restricting mining activities would only lead to expansion elsewhere, potentially harming the environment.[91] A statement from an opponent argues that the two-year ban is unnecessary because crypto-asset mining could spur new renewable energy development by providing a lucrative outlet for excess renewable energy generated by wind and solar facilities when the sun and wind are at their strongest.[92] In fact, according to the New York Independent System Operator ("NYISO"), the state produced about 2% more wind energy than it could use in 2017, and this gap is only expected to widen over the next decade unless the state rapidly upgrades transmission.[93] Another opponent, the Chamber of Digital Commerce, said in a statement that the temporary ban on crypto-asset mining unfairly targeted the crypto-asset mining industry, adding that "to date, no other industry in the state has been sidelined like this for its

energy usage. This is a dangerous precedent to set in determining who may or may not use power."[94]

Recently, Pennsylvania considered following New York's lead and imposing a temporary ban on crypto-asset mining, but this will not affect existing crypto-asset mining facilities or halt all crypto-asset mining activities in Pennsylvania but will only affect those seeking permits to re-power fossil fuel plants, leaving those that connect directly to renewable energy sources unaffected.[95] Opponents of crypto-asset mining temporary ban regulation argue against limiting the purchase of retired fossil fuel power plants for crypto-asset mining, claiming that crypto-asset miners are not renegade power producers operating inefficient and highly polluting power plants, and that their plants were primarily designed for mediation rather than power generation.[96] Opponents also argue that mining operations should stay in the United States, where emission controls are stricter, rather than being relocated to countries with laxer regulations.[97]

2. Wyoming: Banking Exemptions and Special Deregulated Zones

Wyoming has become one of the most crypto-asset mining operation friendly jurisdiction in the U.S. because of its relatively permissive regulations and low energy costs.[98] Virtual Currency Exemptions and Special Deregulated Zones are two laws that have recently been considered and passed.

Wyoming is taking a novel approach by not requiring crypto-asset mining operations to register as Money Services Businesses ("MSBs"), among other traditional banking regulations.[99] This is because Wyoming recognizes that the primary function of these mining operations is not to act as intermediaries for financial transactions, but rather to create new crypto-assets.[100] Therefore, Wyoming does not apply the same level of regulation to crypto-asset mining operations as it does to traditional banking and financial institutions.[101] As a result of this regulatory approach, Wyoming-based crypto-asset mining operations can serve customers in other jurisdictions, including New York, while avoiding the stricter crypto-asset mining regulations of that state.[102]

Furthermore, the Wyoming legislature has previously considered establishing "industrial power zones," which would be deregulated areas on state-owned lands catering to large electric power consumers such as crypto-asset miners.[103] That means that unlike in a regulated market, crypto-asset mining operations in those areas would only be responsible for covering their own direct costs, rather than contributing to the larger power delivery system.[104] In the end, the proposal failed to gain support from the Wyoming Legislature's Joint Minerals, Business, and Economic Development Interim Committee in 2022, opposition to the measure by both regulated utilities and electric co-ops helped defeat the effort by one vote.[105] In any case, the Wyoming legislature is actively investigating various options and collaborating with interested parties to shape these zones and guarantee their success in luring energy-intensive industries by reduced permit red tape and lower electricity rates.[106] By taking advantage of its abundant and inexpensive energy resources, Wyoming plans to attract businesses with high power requirements, such as crypto-asset mining operations.[107]

Another case in point is the crypto-asset property tax exemption law (also known as Bill 111), which was passed by the Wyoming legislature in March of 2018.[108] As a result, by exempting crypto-assets from property taxation, Wyoming crypto-asset miners can reduce operational costs.[109] In Wyoming, property taxes are typically assessed on the appraised value of tangible assets such as real estate or physical equipment, and because crypto-assets are intangible digital assets, eliminating property taxation saves miners money.[110] Overall, the case in Wyoming may be the beginning of a "race to the bottom" among state regulators because of these regulatory exemptions and special deregulation zones.[111]

3. Montana: Zoning Measure Requiring Renewable Energy Production or Purchasing

Due to its lenient regulatory climate, Montana has become a popular destination for crypto-asset mining operations in search of cheap, readily available hydroelectric power.[112] Following a pilot program in 2019, Missoula County, Montana enacted crypto-asset mining zoning regulations in March 2021, which require crypto-asset mining operations to (1) be located in "light industrial" or "heavy industrial" districts and (2) "develop or purchase sufficient new renewable energy to offset 100% of the electricity consumed by the crypto-asset mining operations."[113] The new Missoula County zoning law controls where mining operations can be located, what kinds of energy can be used by the industry, and where waste can be disposed of in an effort to reach 100% clean energy in the urban area by 2030.[114]

However, in Missoula County, Montana, environmentalists and business owners disagreed over the new regulations that were implemented in March of 2021.[115] In support of the Missoula County crypto-asset mining zoning regulations, is the Montana Conservation Voters which stated crypto-assets mining operations "only exacerbate our efforts to reduce our energy consumption and could drive up costs for the community.[116] We think it makes perfect sense to implement interim zoning against [the crypto-assets mining] industry while we assess the greater impacts to the general public in Missoula County."[117] Furthermore, the Montana Chapter of the Sierra Club supports crypto-asset mining zoning regulations claiming that "with the relatively recent appearance of [crypto-asset] mining in our county, Climate Smart Missoula estimates that the community's total electricity consumption has increased by [twenty percent]."[118] "That disproportionate and dramatic increase in use of electricity by one industry[, the crypto-asset mining industry,] demands response."[119] One of the business owners who opposed the crypto-asset mining zoning regulations in Missoula County was Hyperblock, LLC, which operates a crypto-asset data center in a converted lumber mill in Missoula County.[120] Hyperblock, LLC argued that the regulations would be "crippling" and make it difficult for the business to operate in the area.[121]

On May 2, 2023, after passing the Montana House and Senate, S.B. 178 was signed into law by Governor Greg

Gianforte, effectively repealing the crypto-asset mining zoning regulations enacted in Missoula County in March 2021 (discussed above).[122] In a nutshell, the bill makes it harder for Missoula County and other municipalities in Montana to limit crypto-asset mining operations.[123] Specifically, S.B. 178 protects the rights of crypto-asset miners in the state by modifying existing laws to ensure that crypto-asset mining companies do not have to pay different rates for electricity and that crypto cannot be taxed when used as a payment method.[124]

4. Washington: Electricity Rate-Design Measure and Energy Standards

The State of Washington's moderate regulatory climate and low electricity costs have made it a popular destination for crypto-asset miners.[125] In fact, there was a "gold rush" of crypto-asset miners who settled in the State of Washington, where "[p]ower is incredibly cheap—between [two] and [three] cents per kilowatt hour" as a result of Columbia River dams that "provide abundant hydroelectric power."[126] Orchards and farm fields in the Mid-Columbia Basin counties of Chelan, Douglas, and Grant have been joined by crypto-asset mines of varying sizes, from converted warehouses to cargo containers to even backyard sheds, dotting the rolling landscape.[127] As a result, in order to regulate the crypto-asset mining industry, the state of Washington and Public Utility Districts ("PUDs") have been forced to develop electricity rate-design measures such as fee schedules and, more recently, clean energy standards, which will be discussed further below.

To meet the increased demand for energy, PUDs in the state of Washington have revised their pricing structures and developed fee schedules to control the crypto-asset mining industry.[128] In April 2023, Douglas County PUD was considering changing crypto-asset miners' demand charge, the fee for electric use measured in kilowatts, to the individual company's highest measured demand from the previous year.[129] Alternatively, the Chelan County PUD, in December 2018 imposed a twenty-nine percent rate increase on crypto-asset miners' operations beginning June 2022.[130] This rate is higher than the one used for the majority of the county's industrial activities.[131] The crypto-asset mining operations were moved from the high-density load rate schedule to the newly created crypto-asset mining rate schedule (also known as Rate 36), which Commissioner Garry Arseneault describes as "ground breaking" and "industry leading," to create a new rate for this type of demand."[132]

Furthermore, in order to regulate the crypto-asset mining industry, the state of Washington recently enacted clean energy standards. On May 3, 2023, Washington Governor Jay Inslee signed House Bill 1416 into law, which would apply the same clean energy standards to municipal and PUD customers, who currently serve the majority of crypto-asset mining operations in Washington and are no longer exempt from the state's mandated emission reduction targets and compliance schedules under the 2019 Clean Energy Transformation Act.[133] House Bill 1416 was introduced by Democrat Beth Doglio of Olympia to close a loophole that allows crypto-asset mining operations to buy power from non-renewable sources on the market if the local PUD that the mining operation uses, which relies on hydroelectric power, is unable to meet the needs of the mining operation.[134]

IV. Proposal For A Unified Regulatory Scheme

Currently, there are no standard laws in the United States governing the energy and environmental effects of crypto-asset mining; instead, each state has enacted its own regulations. As a result, scholars, activists, and skeptics are concerned about the energy and environmental impacts of crypto-asset mining, necessitating the establishment of a unified federal regulatory scheme to mitigate these effects. This will lead to a detailed analysis beginning in Subpart A will discuss the IRA and federal administrative measures, which including questions regarding the extent to which agencies have appropriate authority, the way in which they exercise any authority, and whether they might benefit from additional Congressional guidance. Subpart B will then evaluate the tools available to state and local governments to manage the regional effects of crypto-asset mining growth in response to, or in the absence of, federal leadership.

A. The IRA and Other Federal Regulatory Tools

There are at least five regulatory tools that could be implemented at the federal level to mitigate the severe negative effects that crypto-asset mining operations have on public utility infrastructure and the environment. These six federal options are: (1) federal tax credits and incentives,[135] (2) indirect, carbon-based energy sources excise taxation,[136] (3) energy conservation standards,[137] (4) energy efficiency standards,[138] (5) performance standards,[139] and (6) waste disposal requirements and water usage limits.[140] There are advantages and disadvantages to each regulatory approach; however, if implemented correctly, they should mitigate the widespread damage that crypto-asset mining operations cause to public utilities and the environment.

1. The IRA and Tax Incentives

On August 16, 2022, President Biden signed the IRA marking what some experts are calling the most significant climate governance initiative in American history.[141] The recent enactment of the IRA has far-reaching implications that go beyond crypto-asset miners and into the energy industry, where federal tax credits and other incentives will spur large-scale development of clean energy, allowing the United States to compete in the global market.[142] According to experts, the IRA will open the door to a much broader range of renewable energy projects, potentially extending the push toward a more sustainable and cost-effective landscape for crypto-asset mining construction.[143]

First, the federal government could use climate change provisions in the IRA, such as the production tax credit ("PTC"), the energy investment tax credit ("ITC"), cost recovery, and loan guarantees, to reduce the burden that crypto-asset mining places on public electrical utilities and the environment.[144] While the amount of credit can vary based on factors such as prevailing wages, apprenticeships, domestic content, and designation as an "energy community," IRA Section 13,701 is the best tool

available because it establishes a PTC for electricity generated in the United States that produces greenhouse gas emissions rate not greater than zero.[145] These "energy communities" are the regions that have had significant employment related to coal extraction, or areas where coal mines or coal power plants have been decommissioned.[146] Although Congress has charged the Internal Revenue Service ("IRS") with providing more advice on what constitutes an "energy community," the goal of this provision is to make it easier for towns to transition away from coal mining or coal-powered electricity.[147] In summary, the PTC is one of the IRA's indirect pressures that may benefit the environment by encouraging crypto-asset miners to use renewable energy.

Second, the federal government, under the IRA and acting through the IRS, could plausibly impose an IRA excise tax on coal mining and other carbon-based energy sources, increasing the price of electricity generated from coal and, by extension, the profitability of crypto-asset mining operations that rely on this form of energy.[148] As the profitability of fossil fuel powered crypto-asset mining operations decreases, it is likely that renewable energy sources will gain popularity or become more widely used.[149]

2. Federal Energy and Environmental Regulatory Standards

Although several legislators have expressed concerns about crypto-asset mining and their underpinning technology,[150] most of the federal government attention has been focused on potential energy-saving measures at the Department of Energy ("DOE") and the EPA promulgating various energy and environmental regulatory standards. [151] The most notable are the energy conservation, energy efficiency, and energy source performance standards, which are discussed further below.

a. Energy Conservation Standards

Establishing minimum energy conservation standards for crypto-asset mining equipment, or the cooling equipment that ensures efficient crypto-asset mining operations, could be one method for reducing crypto-asset mining energy consumption. Some advocates believe that voluntary and market-based approaches are more suitable for computer technology than minimum energy conservation standards.[152] Others emphasize the significance of public-private sector collaboration in developing "ambitious and achievable" energy efficiency standards.[153] Congress may consider establishing minimum national energy efficiency standards applicable to crypto-asset mining. Such standards could concentrate on the specific technology utilized by crypto-asset miners, ASIC,[154] or on computer and battery backup systems, as defined in DOE's proposed determination.[155]

b. Energy Efficiency Standards

There are various types of energy efficiency standards, however, most notably is the ENERGY STAR voluntary labeling program. DOE and EPA collaborate to oversee the ENERGY STAR voluntary labeling program for energy-efficient products, homes, buildings, and manufacturing plants.[156] The voluntary ENERGY STAR labeling program provides guidelines for both home and business electrical appliances—like monitors and computers—for energy-efficient products, homes, buildings, and manufacturing facilities.[157] These regulations cover both residential and commercial electrical equipment.[158] In addition to the ENERGY STAR program's specifications for enterprise servers, data storage equipment, small network equipment, large network equipment, and uninterruptible power supplies, there are also specifications for data storage equipment, small network equipment, and large network equipment.[159]

Given the information about the ENERGY STAR program, Congress may choose to develop energy efficiency standards for crypto-asset mining companies' data centers. In fact, during a briefing given to members of Congress on October 17, 2022, representatives from the EPA and the DOE discussed their plans to educate the crypto-asset mining industry on how to use the Energy Star program's Portfolio Manager tool for benchmarking the energy consumption of commercial buildings like data centers, which could also be applied to the mining operations of crypto-assets.[160] Although there are no national standards for data center efficiency, the federal government has used the Federal Data Center Consolidation Initiative ("FDCCI")[161] and the Federal Information Technology Acquisition Reform Act ("FITARA")[162] to improve the efficiency of its own data centers. Specifically, the FDCCI and FITARA collaborate to help the federal government streamline its information technology operations, reduce costs, and improve security. By consolidating data centers and implementing more efficient and effective information technology management practices, the government can better serve its citizens while also ensuring the security of its sensitive data.

c. Energy Source Performance Standards

Regulation of crypto-asset mining operations can take a page from Section 111 of the Clean Air Act,[163] which mandates the establishment of nationally uniform, technology-based standards by the EPA for various types of new and existing stationary "sources" that cause or significantly contribute to air pollution that may reasonably be expected to endanger public health or welfare.[164] These are known as "new source performance standards," and they apply to new, reconstructed, and modified sources and emissions from existing stationary sources in various energy sectors.[165]

Specifically, a source performance standard is the "level of emission limitation that can be achieved by implementing the best system of emission reduction that . . . the EPA Administrator determines has been 'adequately demonstrated.'"[166] That includes the tried-and-true "proof-of-stake" consensus mechanism.[167] These performance standards would be a foundation of rulemaking to reduce carbon-dioxide emissions from existing fossil-fueled power plants, which will have a direct impact on crypto-asset mining operations that use PoW protocols but are rarely used because most energy sources are regulated under other sections of the Clean Air Act. Should these performance

standards be promulgated, they could serve two purposes: (a) ensure all crypto-asset mining companies operate on a level playing field by establishing uniform pollution control standards; and (b) maintain clean air to allow for future growth. The definition of "sources" will determine whether Section 111(d) of the Clean Air Act directly applies to PoW protocols, even if their crypto satisfies the best "adequately demonstrated" technology, considering cost, energy requirements, and other non-air environmental impacts.

3. Federal Waste Disposal Requirements and Water Usage Limits

While there are currently no established federal waste disposal requirements from the EPA for crypto-asset mining companies, they are still subject to federal regulations regarding the disposal of hazardous waste, e-waste, and other types of waste generated by their operations. For example, crypto firms must safely handle and dispose of any "hazardous waste" produced by their activities under the Resource Conservation and Recovery Act ("RCRA").[168] Hazardous waste is defined by the EPA as waste that is dangerous or potentially detrimental to human health or the environment, and it includes things such as batteries, e-waste, and some chemicals.[169]

Currently, there are no federal water usage limits that specifically apply to crypto-asset mining operations in the United States. However, these operations *may* be subject to federal regulations around water quality and conservation. *Notably*, crypto-asset mining operations that discharge wastewater into surface waters, such as rivers or streams, *may* be subject to permitting requirements and regulations under the Clean Water Act and the National Pollutant Discharge Elimination System ("NPDES"), to ensure that the discharged water meets certain quality standards and does not harm the environment or public health.[170] Furthermore, the Safe Drinking Water Act that governs the quality of public drinking water *may* apply to crypto-asset mining companies if their operations may have an impact on nearby groundwater resources.

To summarize, as public concern about waste disposal, water consumption and conservation grows, the federal government may impose additional rules and regulations on crypto-asset mining operations in the future.

B. Evaluation of State and Local Options

According to my research, at least seven state and local regulatory schemes are currently in place to mitigate the severe negative effects that crypto-asset mining operations have on energy infrastructure and the environment.[171] The seven regulatory schemes include: (1) a ban or moratorium on all crypto-asset mining operations, (2) electricity rate-design measures, (3) zoning and land-use measures, (4) demand response and large flexible load registration programs, (5) permitting and licensing requirements, (6) waste disposal requirements and water usage limits, and (7) state tax incentives and exemptions.[172]

1. Ban or Moratoria on Crypto-Asset Mining

In general, if a moratorium is placed on crypto-asset mining, some miners will switch to renewable energy, others will relocate, and the remaining miners will cease operations.[173] Given the early stage of the crypto-asset mining industry's development, a moratorium would have far-reaching effects on mining operations,[174] as the market prefers highly predictable situations. In addition to the possibility of restricting investment in more sustainable energy sources, crypto-asset mining enterprises have a substantial economic impact on the surrounding community by employing many electricians, engineers, and construction workers.[175]

According to analysts, crypto-asset miner migration could result in jobs and tax revenue leaving the state.[176] New York-based crypto-asset miners have threatened to move operations to more mining-friendly states like Wyoming and Texas if a moratorium is signed in the Empire State.[177] Foundry, a company that tracks digital currencies, reports that since the passage of the moratorium, New York's share of the crypto-asset mining network has dropped from twenty to ten percent.[178] This is likely due to miners leaving the state for others that are more crypto-friendly. The New York Senate Environmental Conservation Committee member, Senator Todd Kaminsky, a Democrat from Long Island, was worried that the New York two-year moratorium could lead to "deleterious economic consequences for New York if people perceive it as being hostile to crypto."[179] The acting president and chief strategy officer of BaSIC, Clark Vaccaro, has described the passage of the two-year moratorium as "a grim day for blockchain technology, effectively shutting the door on a nascent industry."[180]

Another argument is that prohibiting crypto-asset mining for businesses that use carbon-based fuels will encourage a shift to renewable energy sources because mining crypto-assets requires a significant amount of energy, which contributes to carbon emissions and ultimately climate change.[181] By prohibiting mining activities that use nonrenewable energy sources, enterprises will be incentivized to convert to renewable energy sources such as solar or wind power.[182] In fact, former presidential candidate Andrew Yang's remarks at the Bitcoin 2022 conference imply that some crypto industry participants see mining activities as a way to generate demand for renewable energy sources.[183] If mining operations are required to use renewable energy, it may create a market for renewable energy providers, driving innovation and investment in the renewable energy sector. However, it is important to note that transitioning to renewable energy sources is not always an easy process. Renewable energy sources can be more expensive and less reliable than traditional energy sources, and there may be infrastructure challenges to overcome, such as the construction of new power grids to support renewable energy distribution.

2. Electricity Rate-Design Measures

There is also the possibility of local governments enacting special rates. On June 1, 2022, Chelan County, Washington, for example, enacted a twenty-nine percent rate increase for

hydroelectric electricity aimed squarely at crypto-asset miners.[184] The county previously offered a lower, high-density load rate for miners, but has now established a new bitcoin rate, called Rate 36.[185] The new rate structure was created to reflect the true cost of providing electricity to crypto-asset miners, which may be higher than the cost of providing electricity to other types of customers.[186] The county is attempting to reduce the environmental impact of crypto-asset mining while also generating additional revenue from this industry by raising the cost of electricity for miners.[187] According to Gary Arseneault, a commissioner for the Chelan County PUD in the state of Washington, "what we did as a commission and what we did as a utility was industry-leading, to create a new rate for this type of demand."[188]

To ensure that companies that have already made significant investments in their mining facilities may continue to do so, officials in Chelan County have approved transition plans that gradually increase energy costs over the next two years.[189] Overall, the transition plans approved by Chelan County officials demonstrate a willingness to work with the crypto-asset mining industry to find a balance between economic development and environmental sustainability. By providing a clear regulatory framework and a reasonable transition period, the county may be able to attract new mining companies while minimizing the impact on the local environment and energy infrastructure.

However, even though there are transition plans in place, the crypto industry and others have expressed concern.[190] The first point to make is that the transition may not be easy or simple, as it may necessarily require significant investments in new equipment, infrastructure, and training. Ultimately, the success of these transitions will be determined by a variety of factors, such as market demand, regulatory frameworks, and technological advancements. For example, Malachi Salcido, CEO of Salcido Enterprises, told a local news outlet that the Chelan County new rate will force him to convert three of his buildings in Chelan County that are currently used for crypto-asset mining into data farms.[191] However, the shift away from crypto-asset mining and toward data processing or storage is not necessarily a bad thing for the industry, as it may lead to greater diversification and innovation in the broader tech sector.

3. Zoning and Land-Use Measures

States and localities are increasingly attempting to innovate crypto-asset mining zoning regulations. Examples of how zoning laws have been used or are being proposed to regulate crypto-asset mining can be found in Missoula County, Montana, and Wyoming, as discussed below.[192] However, often times zoning regulation debates revolve around whether or not to distinguish between data centers and crypto-asset mines, and whether or not these potentially similar uses merit different treatment.[193] In general, crypto-asset mining is an industrial or commercial use of electricity, and its presence in residential areas raises unique safety and reliability concerns in the neighborhood electrical grid, as well as the potential for noise pollution that harms nearby residents, businesses, and wildlife.[194] Consequently, see below for two distinct approaches to dealing with crypto-asset mining through zoning laws.

Missoula County, Montana, attempted to restrict crypto-asset mining by including a provision in their municipal land use ordinance titled "Section 5.05," which made reference to the "contribution to climate change" caused by crypto-asset mining, but this provision was recently overturned by the state of Montana.[195] In Missoula County, Montana, conditional use zoning law governs (1) the placement of crypto-asset mining firms in either the "Light Industrial" or "Heavy Industrial" district, (2) the energy the industry can use, and (3) the proper disposal of waste by a licensed electronic waste recycling firm.[196] Although crypto-asset mining was legal in Missoula at the time, the economic viability of the activity was severely hampered by Section 5.05, specifically requirement #3 (Develop or purchase sufficient renewable energy to offset 100% of its electricity consumption). Since other states, such as Texas, offer incentives for crypto-asset mining and lower transaction costs, the likelihood of a mining company establishing a facility in Missoula is low due to the impact of Section 5.05 on the development of crypto-asset mining.

Alternately, in Wyoming legislators have been exploring the possibility of creating special deregulated zones for industrial-scale energy users, including crypto-asset miners.[197] These deregulated zones, which have been referred to as "innovation zones" or "economic development zones," would be designed to attract high-tech industries and provide a favorable regulatory environment for companies that consume large amounts of energy.[198]

The aim behind these deregulated zones is to promote Wyoming's economic growth and job creation while also leveraging the state's abundant energy resources, particularly wind power.[199] Wyoming hopes to attract businesses that would otherwise be put off by high energy costs and complex regulatory frameworks by offering lower energy costs and a more streamlined regulatory process.[200] Supporters of the deregulated zones argue that deregulated zones could promote innovation and technological advancement in the energy sector, and that the benefits of economic growth and job creation would outweigh any negative consequences.[201] Critics of these deregulated zones, who frequently advocate for stricter regulations on crypto-asset mining operations, have expressed general concern about the potential environmental impact of large-scale crypto-asset mining operations, particularly in states like Wyoming, which is already dealing with the effects of climate change.[202]

Overall, the application of zoning law demonstrates how policymakers are experimenting with new approaches to balancing economic development and environmental sustainability in the face of rapid technological change. It remains to be seen whether these zones will be successful, but they are likely to be a topic of discussion among lawmakers, industry leaders, and environmental advocates in the coming years.

4. Demand Response and Large Flexible Load Registration Programs

While the Demand Response ("DRP") and the Large Flexible Load Registration ("LFLR") programs are both designed to better manage and improve the functioning of the electricity grid, there are significant differences between the two in terms of scope, mechanisms, and the intended participants or customers.[203]

Demand response programs are a type of energy management tactic that encourages consumers to cut back on energy use during times of high demand.[204] Customers who agree to reduce their energy use during these times, such as by turning off non-essential appliances or using less air conditioning, will typically receive financial incentives from these programs.[205] Demand response programs could therefore be used to manage energy consumption and lessen the negative effects of the crypto-asset mining industry on the environment.[206]

To date, some energy companies have begun to offer crypto-asset miners specialized demand response programs that incentivize them to reduce their energy consumption during peak periods.[207] By participating in demand response programs, crypto-asset miners could help to reduce the strain on the grid during peak energy usage periods, while also potentially earning financial incentives for their efforts.[208] For example, a company may offer a lower energy rate during off-peak hours in exchange for agreeing to reduce their energy consumption during peak hours, allowing crypto-asset miners to mine more profitably during cheaper electricity hours.[209] However, the use of demand response programs in crypto-asset mining is not without its difficulties. One significant issue is that crypto-asset mining is a highly specialized and time-sensitive process, making it difficult to simply turn off or reduce energy consumption during peak demand periods.[210] Furthermore, because the bitcoin network is decentralized and anonymous, it can be difficult to track or regulate individual miners' energy consumption.[211]

Alternatively, LFLR Programs provide financial incentives to energy-flexible consumers such as factories, data centers, and crypto-asset miners to adjust their load in response to changes in grid conditions, thereby preventing grid instability.[212] Senate Bill 1751 would require crypto-asset miners to register as "flexible load" operators with the Electric Reliability Council of Texas ("ERCOT"), the state's energy operator.[213] According to Dennis Porter, co-founder and CEO of Satoshi Action Fund, no committee votes were cast in opposition.[214] This places the bill on the "uncontested" list, indicating that it has a better than ninety-five percent chance of passing the Senate before moving on to the Texas House.[215]

5. Permitting and Licensing Requirements

State and local governments may require crypto-asset mining operations to obtain permits and licenses in order to ensure compliance with state and local regulations, as well as to monitor and mitigate any potential negative effects. Assessing the environmental impact, energy usage, safety measures, and adherence to building codes may all be part of the permitting process.[216] Several states and local governments have enacted regulations requiring crypto-asset mining operations to obtain permits and licenses, ensuring regulatory compliance and mitigating potential negative effects.[217]

For instance, the New York State Department of Environmental Conservation requires an environmental impact assessment and proof of compliance with air quality standards (Clean Air Act Title V air permit) for crypto-asset mining operations in the state.[218] Another example is Washington State Department of Ecology oversees environmental permitting and may require crypto-asset mining operations to obtain permits related to water use, wastewater discharge, and stormwater management.[219] These examples demonstrate how state and local governments can regulate crypto-asset mining operations and ensure compliance with environmental, energy, safety, and building code regulations through permitting and licensing processes.

6. Waste Disposal Requirements and Water Usage Limits

Overall, waste disposal requirements for crypto-asset mining operations can vary depending on the jurisdiction but many jurisdictions have waste disposal requirements in place to ensure that crypto-asset mining operations are properly disposing of their waste. Some examples of states and local governments in the United States with waste disposal requirements for crypto-asset mining include New York,[220] California,[221] and Washington State.[222] These requirements can include regulations around the disposal of e-waste, such as requiring crypto-asset mining companies to recycle or properly dispose of their old mining equipment. However, there are no specific state-level regulations in the United States concerning the disposal of heat waste generated by crypto-asset mining operations; although, some states, such as New York or Wyoming, are taking steps to encourage the use of excess heat for other purposes. As a result, some crypto-asset mining companies have developed innovative ways to use the heat generated by their operations to heat neighboring buildings or greenhouses.

In addition to waste disposal requirements, regulations regarding water usage in crypto-asset mining operations are not yet widespread; however, some jurisdictions are beginning to address the issue of water conservation and management in relation to these operations. In particular, New York[223] and Montana have implemented regulations limiting the amount of water that can be used for crypto-asset mining operations, particularly in areas where water resources are scarce, or water conservation is a concern.[224]

As the energy and environmental impacts of crypto-asset mining become more widely recognized, more jurisdictions may begin to implement more innovative regulations that balance the economic benefits of crypto-asset mining with the energy and environmental implications. As a result, ongoing debates are required to determine which regulatory approach—federal, state, or local—will produce the best results in terms of balancing all interests.

7. *State Tax Incentives and Exemptions*

The taxation of crypto-asset mining at the state and local levels varies depending on the jurisdiction, but in general, it is similar to the taxation of any other business activity. As a result, the Multistate Tax Commission ("MTC") launched an investigation into crypto-asset issues in 2021 as part of its review of state taxation of digital products and services from both an income and a sales/use tax standpoint.[225] Presently in the United States, for example, earning crypto-assets through mining, receiving them as a promotion, or receiving them as payment for goods or services is considered regular taxable income.[226] The entire fair market value of the coins you received that day will be taxed at a regular income tax rate.[227] Furthermore, if you own the mining equipment, you may be subject to property taxes; however, in some cases, the cost of your mining equipment can be written off as a deduction in the year of purchase.[228]

Texas, for example, has taken a pro-business stance by rewarding cryptocurrency miners who use carbon-based or low-carbon energy sources (including renewable).[229] However, due to the low cost of carbon-based energy, crypto-asset miners continue to rely on it.[230] Moreover here are a few examples of Texas' crypto-asset mining tax initiatives include: (1) sales tax exemption,[231] (2) competitive electricity rates,[232] (3) property tax exemptions,[233] and (4) job creation incentives. Other states, such as Kentucky, are catching up with tax incentives and offering even more than Texas, including (1) sales tax exemption,[234] (2) competitive electricity rates,[235] (3) business investment tax credits,[236] (4) job creation incentives,[237] and (5) workforce development programs.[238] Even though the state of Kentucky is transitioning to renewable sources of energy, most crypto-asset mining operations in the state still rely on the state's carbon-intensive electrical grid.[239]

IV. Conclusion

Since its inception, crypto-asset mining has exploded due to cheap electricity from carbon-based energy sources, permissive regulations, and falling energy prices. This has, and will continue to have, catastrophic effects on the public utility infrastructure and the environment of the United States. Without a unified federal-based regulatory framework in place to address the effects of crypto-asset mining, the country will continue to suffer from the severe energy and environmental consequences of crypto-asset mining.

While crypto technology has the potential to advance technology and boost the economy, there are also negatives for society, such as high energy consumption, and negative environmental effects. This balance needs to be struck within an appropriate legal framework. Therefore, many local and state governments are currently taking direct action to address the impact of crypto-asset mining on public electric utilities, such as New York's proposed moratorium, while the federal government is currently adopting a more indirect approach through legislation like the IRA, federal tax credits and taxation, and various federal energy and environmental regulatory standards and regulation requirements.

In conclusion, the best solution is the creation of a unified federal-based regulatory framework to directly—rather than indirectly—address the effects of crypto-asset mining. However, if the federal government does not act, states and local governments should strive to adopt a regulatory system similar to Montana's or Washington's, which strikes a balance between the two regulatory extremes of New York and Wyoming.

Endnotes

1 Jeff Thomson, *Tragedy of the Energy Commons: How Government Regulation Can Help Mitigate the Environmental and Public Health Consequences of Crypto-asset mining*, 11 Seattle J. Tech. Env't. & Innovation L. 77, 83 (2020). The term "hashrate" refers to the total amount of computational power used to mine and process transactions on a Proof-of-Work blockchain, such as Bitcoin or Ethereum.

2 *See*, Cambridge Centre for Alternative Finance. *Bitcoin Mining Map*, https://ccaf.io/cbeci/mining_map (last visited May 24, 2023).

3 TWh (terawatt-hours) is an energy measurement unit that specifies the amount of electrical energy consumed or generated over a given time period. One trillion watt-hour, or 1,000,000,000,000 watt-hours, is equal to one terawatt-hour.

4 *See*, Cambridge Centre for Alternative Finance, *Bitcoin Mining Map*, https://ccaf.io/cbeci/mining_map (last visited Mar. 4, 2023).

5 U.S. Energy Info. Admin. ("EIA"), U.S. Dep't of Energy ("DOE"), *Electricity Data Browser*. https://www.eia.gov/electricity/data/browser/ (last visited May 24, 2023).

6 United States Senate, Committee on Environment and Public Works ("EPW"), Subcommittee on Clean Air, Climate, and Nuclear Safety, Hearing on "Scrutinizing Skyrocketing Energy Consumption of Crypto-asset mining Industry," 118th Cong. (2023) (Statement of Senator Edward J. Markey (D-Mass.))(available at: https://www.markey.senate.gov/news/press-releases/sen-markey-rep-huffman-announce-legislation-to-crack-down-on-crypto-energy-consumption-as-markey-holds-first-ever-senate-hearing-focused-on-industrys-environmental-impacts (last visited May 20, 2023)).

7 *See* IRS, IRS Notice 2014-21, 2014, https://www.irs.gov/pub/irs-drop/n-14-21.pdf (noting that Bitcoin and other crypto-assets can be used to make payments without banks or other third-party intermediaries and are sometimes considered "virtual currency.") (last visited May 24, 2023).

8 *See* Benjamin Wallace, *The Rise and Fall of Bitcoin*, Wired (Nov. 23, 2011, 2:52 PM), https://www.wired.com/2011/11/mf-bitcoin/. The first of the major crypto-assets, Bitcoin was created by the possibly pseudonymous Satoshi Nakamoto following the publication of Nakamoto's white paper on Bitcoin in late 2008. Nakamoto initiated bitcoin mining activities in January 2009. *Id.*

9 *See* Jake Frankenfield, *Cryptocurrency Explained With Pros and Cons for Investment*, Investopedia, https://www.investope dia.com/terms/c/cryptocurrency.asp (last updated Feb. 4, 2023) (offering general definition of cryptocurrency).

10 *Id.*

11 *Id.*

12 "Crypto winter" is a term used to describe a period of significant decline in the prices of crypto-assets. The term was first coined in early 2018 when the prices of many crypto-assets, including Bitcoin, experienced a sharp and

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