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Crypto Minning : Indonesia Carbon Tax Challenges and Safeguarding International Commitment on Human Security

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Abstract

The need for financial transactions in the virtual world that continues to grow demands an increase in the speed, quality, and quantity of various innovations and discoveries in the field of financial technology known as cryptocurrency. This discovery encourages various developments of the virtual world economy which is increasingly diverse and growing according to the needs and interests of existing economic actors. Cryptocurrencies are currently only considered as digital assets that can be traded so they are not recognized as a means of payment. However, cryptocurrency trading in Indonesia is a fast-growing field, so its economic value continues to rise rapidly. This encourages the emergence of crypto mining businesses that tend to use large amounts of electricity. The issue of carbon footprint in cryto mining has in several ways been the cause of the prohibition of this activity. In Indonesia, this activity is still not banned, in 2022 a carbon tax will be applied where every kilogram of carbon equivalent emissions that exceed a certain cap will be subjected to IDR 30 (0.21 cent dollar) tax. So, the paper tries to analyze the extent to which this carbon tax will affect crypto mining in Indonesia and how the mitigation of crypto mining's carbon footprint can be managed through proper regulation without disturbing the crypto economic sector that is blooming in Indonesia. The regulation of carbon taxes can be carried out using the derivation of rules by considering the consequences on the economic aspect and the impact of climate change so that the growing sector can continue to develop but the impact can be managed so that it is not detrimental.

Keywords: Cryptocurrency, Crypto Minning, Carbon Tax Law, Carbon Footprint, Financial Technology.

1. Introduction

Rapid technological developments encourage various innovations and discoveries, one of which is in the economic field, which is currently known as cryptocurrency. Cryptocurrency is defined as a digital coin secured by cryptography, peer to peer transaction in block chain networks (Bouri et al., 2019; Wątorek et al., 2021). The first widely known cryptocurrency was Bitcoin. Then it continues to grow until today there are more than 7735 cryptocurrencies. The value of cryptocurrencies varies and fluctuates from time to time. Along with the development of the use of blockchain technology, the use of cryptocurrencies is currently divided into several functions such as coins, NFT, Defi ("Decentralized Finance"), metaverse, and tokens. This division of functions develops along with the proliferation of projects of each cryptocurrency developer (Liu & Tsyvinski, 2021; Caporale et al., 2018).

NFT (Non-Fungible Token) is a cryptographic record of ownership for a unique item, that recently its widely developed in art and creative industry (Dowling, 2021; Bao & Roubaud, 2022). While, Metaverse token are a unit of virtual currency used to make digital transactions within the metaverse. Metaverse token usually developed by game developer, for instance Mana, Sand, and Gala. Cryptocurrencies is different from Token; Cryptocurrency have their own blockchains while crypto tokens are built on an existing blockchain. Ethereum as the biggest pioneer of cryptocurrency defining DeFi as a collective term for financial products and services that are accessible to anyone with an internet connection (Bolton & Cora, 2021). With DeFi people can access facilities similar to what it provided by conventional banking, for instance send money around the globe, stream money around the globe, access stable currencies, borrow funds with collateral, borrow without collateral, start crypto savings, trade tokens, grow portfolio, fund ideas/project, buy insurance, and manage portfolio DeFi.

The growth and development of cryptocurrencies has only gotten bigger in recent years, so it has enormous economic potential (Phillip et al., 2018). Some countries are starting to see that there are two risks that must be wary of the existence of cryptocurrencies. The first risk is related to economics and law due to the volatile nature of cryptocurrencies, growing rapidly and peer to peer transactions that are prone to risk of money laundering and other financial crimes. The second risk is related to the issue of environmental impact where the activities of using cryptocurrency and other related activities, such as mining. Therefotre in current developmen some countries only recognized cryptocurrency as a digital or virtual aset (e.g., Indonesia and India), but in some others it is used to be a digital currency (Dierksmeier & Seele, 2018).

In addition to trading activities, cryptocurrency mining is one of the activities that is currently developing very quickly, which is shown by the scarcity and extraordinary increase in the equipment used for mining (Chan et al., 2017). However, in recent times, due to the issue of the relationship between climate change and cryptocurrency mining activities, there are several cryptocurrencies that provide alternative methods to get cryptocurrency with proof of stake, proof ofauthority (poa), proof of believability, proof of activity, proof of space, proof of views, and proof of time (Grobys & Sapkota, 2019). Proof of Stake is concept states that a person can mine or validate block transactions according to how many coins they hold. Proof of Authority (PoA) reputation-based consensus algorithm developed by Polkadot. Proof of Believability is consensus algorithm developed by IOST. Proof of Activity is combining Proof of Work component with a Proof of Stake (Hybrid Consensus Algorithm). Proof of Views recently developed by Verasity.

The cryptocurrency mining (proof of works) activities are still considered an easy, profitable and minimal risk method, so that this activity continues to grow and develop even more (Lansky, 2018). Some cryptocurrencies that are considered to provide great benefits for mining are bitcoin, ethereum, monero, etc. Mining activities that are commonly carried out today mostly use ASIC (application-specific integrated circuit) machines and computer GPUs, both of which require a large enough energy consumption to reach a certain hashrate that is used to mine a block of cryptocurrency (Barkatullah & Hanke, 2015). We can see on several sites that provide a calculation of energy consumption and the required hashrate level. The higher the hashrate generated, the less time it takes to get a very large profit.

The cryptocurrency mining activities have been in the spotlight in several studies because of the "hidden costs" they cause, such as the issue of carbon footprints (Wei, 2018). Hidden costs in cryptocurrency mining have also attracted investors' attention, one of which, Elon Musk, the owner of Tesla, raised the issue of the impact of energy consumption in mining and transactions of one of the largest cryptocurrencies, namely bitcoin. Along with the rapid development of cryptocurrencies and reaching a wider international community, the issue of reducing carbon emissions to prevent a worse impact on climate change has become one of the important agendas of the international community. Where several countries have started to prohibit cryptocurrency mining as a concrete form of commitment to reducing carbon emissions, one of which is China.

The bitcoin mining has prompted several studies to measure its impact on the environment. Because the use of electrical energy is very large to produce a high hashrate to be able to produce a block (Putra and Darma, 2019). For example, the higher the hashrate generated, the higher the consumption of electrical energy required. For example, an ASIC machine used for mining for the SHA-256 algorithm with a hashrate of 110.00 Th/s (1 Tera hash is 1 trillion hashes per second) requires 3960 watts of electrical. Where this amount is 2 times the electricity consumption of middle-income homes in Indonesia. Cryptocurrencies need energy for hashing, electrical energy is needed for processing on mining machines to mine blockchain. The higher the hashrate, the more cryptocurrencies will be mined. In 2021, the world's top Bitcoin mining pools all originate from China, with five pools responsible for more than half of the total cryptocurrency hash (Hughes et al., 2019).

Cryptocurrency mining was originally done using a hardware central processing unit (CPU). Furthermore, at the end of 2009 cryptocurrency mining started using a graphics processing unit (GPU). GPUs are equipped with more arithmetic logic units (ALUs) than CPUs. The same ALU is used in mining cryptocurrencies like Bitcoin to generate the SHA-256 hash. As a result, GPUs mine cryptocurrencies faster than CPUs. Then from 2011, miners started to switch to field programmable gate arrays (FPGA) (Sambas et al., 2021; Vaidyanathan et al., 2021). In 2013, cryptocurrency miners started using application-specific integrated circuits (ASICs) to mine cryptocurrencies (de Vries, 2019). The ASIC engine is designed to perform only one type of calculation algorithms such as SHA-256 (Bitcoin), Scrypt (Doge), and Kadena (KDA). ASICs are not like FPGAs, which can be reprogrammed to mine anything). In 2021 many cryptocurrency miners are using GPUs and ASIC engines due to the increasing difficulty level, however, the use of these two tools significantly increases the use of electrical energy.

Based on the Bitcoin Energy Consumption In in 2018, Bitcoin energy use resulted in a carbon footprint of 19.0 to 29.6 million metric tons of CO_2 (475 g CO_2 /kWh). Meanwhile, the average carbon footprint per transaction will then range from 233.4 to 363.5 kg CO_2. This is much higher when compared to the average carbon footprint for a VISA transaction which is only equivalent to 0.4 g CO_2, while a Google search equates to 0.8 g. Based on 2018 data, over the course of a full year, the Bitcoin mining network has consumed at least 40.0 TWh, and possibly as much as 62.3 TWh, which is equivalent to the amount of electricity consumed by countries such as Hungary (40.3 TWh) and Switzerland (62.1 Twh) (de Vries, 2019).

The development of cryptocurrency mining is attracting the attention of a global community that is working towards a new agreement to tackle the impacts of climate change. At the twenty-first United Nations Framework Convention on Climate Change (UNFCCC) conference of the parties (COP21) in Paris in December 2015, the parties will seek to finalize a new post-2020 agreement on climate change. For these agreements to be effective, they must include emission reduction pledges from countries and strong emission measurement, reporting and verification (MRV) requirements to ensure that these promises are fulfilled.

Indonesia as a global citizen who has committed to reducing carbon emissions as a form of mitigation of global warming is one of the important points in environmental security issues. As a good global citizen and committed to climate change mitigation, Indonesia has agreed to several international agreements. This is then revealed in policies at the national level. Indonesia's commitment to reducing carbon emissions is contained in several ratifications of international agreements such as Law Number 6 of 1994 concerning Ratification of the United Nations Framework Convention on Climate Change and Law Number 17 of 2004 concerning Ratification of the Kyoto Protocol on the United Nations Framework Convention on Climate Change. In addition, it is also adopted into national policies in the form of Presidential Regulation of the Republic of Indonesia Number 61 of 2011 concerning the National Action Plan for Reducing Greenhouse Gas Emissions. Furthermore, on April 22, 2016 Indonesia has signed the Paris Agreement which was ratified through the approval of the DPR on October 31, 2016 (UNFCCC, n.d.). The Paris Agreement is a worldwide agreement committed to limit the increase of global average temperature.

Indonesia is vulnerable to climate change and adaptation actions are needed. With global warming, society and its supporting sectors are increasingly exposed to severe climate events such as increasing frequency of heatwaves. Particularly vulnerable sectors are coastal areas (marine and fishery), agriculture, water resources, forest, urban and rural areas, and health. Indonesia needs to reduce its emissions to below 662 MtCO2e (Metric tons of carbon dioxide equivalent) by 2030 and to below 51 $MtCO_2$ e by 2050 to be within its 'fair-share' range compatible with global 1.5°C IPCC scenarios. Indonesia's energy generation mix was 88% fossil fuels in 2019. Indonesia should phase out coal by 2037 and increase its renewable energy targets to at least 50% by 2030, be 1.5°C-compatible and yield substantial employment and other sustainable development benefits. The 2019 Low Carbon Development Initiative (LCDI) aims to integrate the climate agenda into the national development plan. However, the mid-term development plan (RPJMN 2020-2024) has not fully adopted the LCDI recommendations (Climate Transparency, 2020) .

Indonesia's GHG (greenhouse gas) emissions have increased 140% between 1990 and 2017 with the highest increase being the energy sector.In Indonesia, emissions have increased significantly since 1990, reaching a high of 581 $MtCO_2$ in 2019. The industry sector contributes the most, at 37%, followed by transport (27%) and electricity and heat generation (27%). Fossil fuels make up 66% of Indonesia's energy mix (incl. power, heat, transport fuels). The carbon intensity of the energy sector has risen, due to the increase in the share of coal (Climate Transparency, 2020) .

Human security can serve as a valuable lens for understanding and addressing the complex challenges facing individuals and communities in the twenty-first century, including global environmental change. Environmental change as an issue of human security elevates the significance of the problem, adding a sense of gravitas that can influence political agendas (O'Brien & Barnett, 2013). Climate change poses threats that are largely uncertain, diffuse, difficult to quantify and yet potentially catastrophic. Appeals to 'climate security' represent a recent and fairly successful attempt to introduce environmental concerns into the security agenda (Trombetta, 2008). According to The UNDP's 1994 Human Development Report's definition of human security argues that the scope of global security should be expanded to include threats in seven areas economy security, food security, health security, environmental security, personal security, community security, dan political security.

Environmental security issues are one of the human security issues changing security practices (Edwards & Heiduk, 2015). Environmental securitization changes existing practices and concepts regarding human security (Dwinantoaji & Sumarni, 2020). This implies a new role for security actors and a different way of providing security. The call for 'climate security' is a recent and quite successful attempt to put environmental issues on the security agenda. Environmental security issues began to gain a place in political discussion in the 1970s, but it was not until the 1980s that with the emergence of global environmental issues such as stratospheric ozone depletion or global warming the debate on environmental safety gained momentum with issues that came to the fore such as stratospheric ozone depletion or global warming. global debate on environmental safety (Trombetta, 2008).

In April 2007 the security implications of climate change were discussed by the United Nations (UN) Security Council, however representatives of member countries have not yet agreed to include climate change or environmental degradation as a security issue (United Nations Security Council, 2007). The most innovative and thoughtful attempt to conceptualize the social construction of security problems is securitization theory as outlined by the Copenhagen School, a body of research primarily associated with the work of Barry Buzan and Ole Waever. The Copenhagen School's work is relevant to the ongoing analysis as it considers the implications of expanding the security agenda and specifically addressing environmental concerns (Trombetta, 2008).

The carbon footprint as the impact of crypto mining will be an issue of concern in the crypto economy, therefore this paper tries to analyze the extent to which this carbon tax will affect crypto mining in Indonesia and how the mitigation of crypto mining carbon footprint can be managed through proper management. regulation without disrupting the emerging crypto economic sector in Indonesia.

Mohon tambahkan kontribusi penelitian pada bagian ini

2. Methodology

The methodology used in this study is a mixed approach legal research, which is based on methodological pluralism. Two approaches are used in this research, normative juridical approach and legal sociology approach. The normative juridical approach used to conduct the analysis is the statute approach and the comparative law approach. The statute approach is carried out by reviewing all laws and regulations related to the legal issues being handled. The legal approach will open up opportunities for researchers to learn about the consistency and suitability of one law with other laws or legal regimes above it, such as regional legal regimes and international legal regimes. The next approach is a comparative approach, carried out by comparing a law or rule in a country or region with the national legal regime of another country or other regional regime. This research is a descriptive study that tries to explore the object of research with a descriptive-qualitative approach. The main research data will be obtained through library research and (if possible) in-depth interviews with various informants who are considered to know the research problem will be carried out. In addition, this research systematically explains the regulations governing certain types of law, analyzes the relationship between rules, explains areas of law application that are considered difficult, predicts future developments.

3. Results and Discussion

3.1 Regulatory Framework of Cryptocurrency in Indonesia

In some countries cryptocurrencies are prohibited as legal tender. The prohibition of Cryptocurrency as a means of payment is also carried out by Indonesia as stipulated in Bank Indonesia Regulation Number 19/12/PBI/2017 concerning the Implementation of Financial Technology and Bank Indonesia Regulation Number 18/40/PBI/2016 concerning the Implementation of Payment Transaction Processing. The prohibition of cryptocurrency as a legal tender is contrary to the Law of the Republic of Indonesia Number 7 of 2011 concerning Currencies and BI Regulation (PBI) 17/3/PBI/2015 concerning the Obligatory Use of Rupiah. In addition, this government policy is an action to protect the public from losses due to the high-risk nature of cryptocurrency. There are even countries that do not prohibit it as a means of payment but also prohibit all economic activities related to cryptocurrency, for example Bangladesh (Haq et al., 2021).

Regulation on the existence of cryptocurrencies as virtual assets is also recommended by the Financial Action Task Force (FATF), where countries should consider virtual assets as “property,” “proceeds,” “funds,” “funds or other assets,” or other “corresponding value”. Countries should apply the relevant measures under the FATF Recommendations to virtual assets and virtual asset service providers (VASPs) (FATF, 2012). A “virtual asset” is a “digital representation of value that can be digitally traded, or transferred, and can be used for payment or investment purposes”.

In Indonesia, crypto-currencies are regulated as digital assets which are regulated in the Minister of Trade Regulation Number 99 of 2018 concerning General Policy for the Implementation of Crypto Asset Futures Trading, Commodity Futures Trading Supervisory Agency Regulation Number 2 of 2019 concerning the Implementation of the Physical Commodity Market on the Futures Exchange, Commodity Futures Trading Supervisory Agency Regulation Number 5 of 2019 concerning Technical Provisions for the Implementation of Crypto Asset Physical Markets on the Futures Exchange and Commodity Futures Trading Supervisory Agency Regulation Number 7 of 2020 concerning Establishment of a List of Crypto Assets that can be traded on the physical crypto asset market. Crypto Assets are designated as Commodities that can be used as Futures Contract Subjects traded on the Futures Exchange. There are several considerations from the Indonesian government to include crypto as a digital asset, e.g :

1. The development of crypto assets (crypto assets) that have been widely used in the community so that they can be used as commodities that are worthy of being the subject of Futures Contracts traded on the Futures Exchange.
2. As a form of protection to the public and providing legal certainty to business actors in the Futures Trading sector, it is necessary to establish a general policy for the implementation of Crypto Asset Futures Trading.
3. To provide legal certainty for the development of crypto asset businesses and legal protection for the public in transactions, it is necessary to have technical provisions governing the operation of the physical market for crypto assets;
4. To facilitate innovation, growth, and development of Crypto Asset physical trading business activities in Indonesia.

3.2 Proof of Works and Carbon footprint Issue

“Proof of work” is a cryptocurrency consensus mechanism for verifying new transactions, adding them to the blockchain, and creating new tokens. Proof of work, first done by Bitcoin, uses mining to achieve that goal. The concept of "proof of work" because the network requires enormous processing power. The proof-of-work blockchain is secured and verified by virtual miners around the world by solving math puzzles. The proof of works as a lottery

mechanism where a node that solves a computationally-intensive random search operation is allowed to create a new block. The node that first solves a cryptographic puzzle set by the rules of the network is the one that gets to create the next block. This process is known as mining. In general, the higher the computational power available to a miner, the greater the likelihood of finding a valid solution before a less-endowed competing miner. Understanding how a PoW lottery works is important because it determines the main security properties of a blockchain (Ramos et al., 2021).

"Proof of work" becomes a significant source of revenue for entities participating in the consensus process. This activity will further expand with the increasing number of users joining the digital currency market. PoW computing requirements drive methodologies and techniques to achieve more and more computing power with less energy consumption. Over time, the complexity of block mining (usually based on hashing as per Bitcoin and some others) gets higher and harder. This increases the hashrate in mining and increases the need for increasingly sophisticated tools to solve high-level difficulties. The higher the computation, the higher the energy consumption required. As described above, there are cryptocurrency mining computing that uses GPUs and some that use ASICs. In recent times ASIC architecture is considered to guarantee the best trade-off between power consumption, great hash rate, size, cost and lifetime (Caprolu et al., 2021). In other hand, due to the high absolute difficulty of Proof of Works, mining a block without having an extremely costly and potent mining equipment is very hard to achieve by solo miners. Hence, in order to reduce the risk of not finding a block and receiving a reward, pools allow small miners to contribute to the network's hash rate and together mine a block reward which will be later split among the mining pool participants (Ramos et al., 2021). The current proof of work activities depends heavily on electric energy. The energy consumption by the Bitcoin network is significant, and as of January 2020 was 75 TWh, which is equivalent to the annual energy consumption of Chile (Bastian-Pinto et al., 2021).

The growing energy consumption and associated carbon emission of Bitcoin mining could potentially undermine global sustainable efforts. By investigating carbon emission flows of Bitcoin blockchain operation in China with a simulation-based Bitcoin blockchain carbon emission model, we find that without any policy interventions, the annual energy con- sumption of the Bitcoin blockchain in China is expected to peak in 2024 at 296.59 Twh and generate 130.50 million metric tons of carbon emission correspondingly. Internationally, this emission output would exceed the total annualized greenhouse gas emission output of the Czech Republic and Qatar (Jiang et al., 2021).

The several unexpected behaviors of the Bitcoin blockchain have been detected. First, the attractive financial incentive of Bitcoin mining has caused competition in dedicated mining hardware. Second, the Bitcoin mining activity and the constant-running mining hardware has led to large energy consumption volume. Previous literature has estimated that the Bitcoin blockchain could consume as much energy per year as a small to medium-sized country such as Denmark, Ireland, or Bangladesh. Third, the large energy consumption of the Bitcoin blockchain has created considerable carbon emissions (Jiang et al., 2021).

Based on data from coinmarketcap there are around 165 cryptocurrencies that use a proof of works system. Table 1 is the data for the top 10 cryptocurrencies that have a large market cap.

Table 1. Market Cap of the Top Ten Crypto Currencies

#	Name	Price	Market Cap	Volume(24h)	Circulating Supply
1	Bitcoin	$56,316.77	**$1,064,948,939,705**	$36,749,240,405 **651,564 BTC**	**18,881,550 BTC**
2	Ethereum	$4,234.91	**$502,498,429,288**	$21,803,075,860 **5,140,074 ETH**	**118,463,980 ETH**
3	Dogecoin	$0.2221	**$29,417,717,237**	$1,958,438,761 **8,803,415,898 DOGE**	**132,236,148,897 DOGE**
4	Litecoin	$209.58	**$14,487,067,018**	$1,883,802,367 **8,977,563 LTC**	**69,040,445 LTC**
5	Bitcoin Cash	$559.63	**$10,575,373,694**	$1,214,591,840 **2,171,695 BCH**	**18,908,813 BCH**

#	Name	Price	Market Cap	Volume(24h)	Circulating Supply
6	Ethereum Classic	$48.39	**$6,348,014,717**	$667,335,531 **13,790,983 ETC**	**131,186,425 ETC**
7	Monero	$240.74	**$4,341,667,663**	$204,443,352 **849,226 XMR**	**18,034,608 XMR**
8	Zcash	$250.07	**$3,289,201,052**	$1,124,548,750 **4,496,939 ZEC**	**13,153,131 ZEC**
9	Bitcoin SV	$153.02	**$2,892,881,757**	$138,974,225 **908,210 BSV**	**18,905,258 BSV**
10	Kadena	$17.09	**$2,698,986,485**	$67,429,821 **3,946,303 KDA**	**157,957,101 KDA**

The phenomenon of cryptocurrencies is a controversial reality that has been analyzed from multiple approaches and disciplines ranging from legal aspect, economics, sociology, engineering or political science, among others. Indonesia is one of the countries that is considered unsustainable in Cryptocurrency mining by being ranked 97th out of 144 countries with a Cryptocurrency Mining Index of 39.1. Denmark and Denmark are ranked 1 and 2 as the most sustainable countries for Cryptocurrency mining with indexes 87.0 and 82.3. The one of the aspects that are part of the debate around cryptocurrencies is the significant electrical energy needs required by mining processes and the consequent potential environmental impact, which has led some cryptocurrency mining powers such as China to raise the possibility of banning them (Náñez Alonso et al., 2021)

One study on the impact of cryptocurrency mining on climate change states that "every 1 USD of the value of a cryptocurrency coin created will be responsible for 0.66 USD in health and climate damage." Bitcoin is considered responsible for 13,000 kg of CO_2 emissions and 40,000 kg of CO_2 emissions. CO_2 per hour and an increase in "annual electricity consumption for bitcoin which is equivalent to 32.56 tera-watts per hour (TWh), this is greater than the aggregate consumption of Ireland or Denmark. According to the Cambridge Bitcoin Electricity Consumption Index in May 2021 Bitcoin mining consumed 124.6 TWh per year, exceeding the electricity consumption of Pakistan and Norway (120.56 and 124.13 TWh per year, respectively) and consumption above countries such as Argentina and Ukraine which consume only 125.03 and 128.81 TWh per year. In addition, there is empirical research that shows a positive correlation between cryptocurrency trading volume and energy consumption (Náñez Alonso et al., 2021). There are at least 7 countries with a sizeable amount of cryptocurrency mining (de Vries, 2020).

Table 2. List of World Biggest Crypto Mining Countries

Location	Power consumption (megawatts)	% Of surveyed facilities	Carbon intensity (gCO_2eq/kWh)
China	111	47.60	711
Georgia	60	25.80	231
United States	27	11.60	489
Canada	18	7.70	158
Sweden	10	4.3	13
Iceland	5	2.1	0
Estonia	2	0.90	793
Total / Weighted Average	**233**	**100.00**	**475**

3.3 Indonesia Carbon Tax

The issue of mitigating the environmental impact of crypto has attracted the attention of many cross-scientific experts from recommendations for alternative uses of renewable energy to the use of heat generated from cryptocurrency mining to be used as an alternative for heating for several countries that have winter. There are researchers who claim that the cost for mining cryptocurrency (bitcoin) is equivalent to the electricity needs of a country (O'Dwyert & Malone, 2014).

Carbon Tax in Indonesia is regulated in CHAPTER VI Article 13 of Law Number 7 of 2021 concerning Harmonization of Tax Regulations, where in Article 1 paragraph 2 point a it states that one of the objectives of this law is to increase sustainable economic growth. In this law the carbon tax is one of Indonesia's national strategic policies. The new regulation regarding the carbon tax imposed on carbon emissions that have a negative impact on the environment. The imposition of a carbon tax is carried out by taking into account the carbon tax roadmap and/or the carbon market roadmap.

Various instruments can be taken to achieve the Nationally Determined Contribution (NDC) target, including trade and non-trade instruments, including the imposition of a carbon tax (carbon economic value instrument (NEK). A carbon tax is imposed in order to control greenhouse gas emissions to support the achievement of Indonesia's NDC. NDC or nationally determined contributions are national commitments for handling global climate change in order to achieve the goals of the Paris Agreement to The United Nations Framework Convention on Climate Change. What is meant by "carbon emission" is equivalent carbon dioxide emission (Coze). Criteria for negative impacts on the environment include: a. natural resource depletion; b. environmental pollution; or c. environmental damage.

The government has committed to reduce greenhouse gas emissions by 29% (twenty nine percent) with its own capabilities and 41% (forty one percent) with international support by 2030 and towards Net Zero Emission (NZE) by 2060. The emission reduction target for the energy and transportation sectors as well as the forestry sector has covered 97% (ninety seven percent) of the total NDC emission reduction target so that it becomes the main priority for reducing greenhouse gas emissions national industry based on clean energy and carbon tax. In addition to these two sectors, they will follow the transformation towards Indonesia Gold in 2045 and NZE no later than 2060. Based on Article 13 paragraph 1, a carbon tax is imposed on carbon emissions that have a negative impact on the environment. Criteria for negative impacts on the environment includes natural resource depletion, environmental pollution, and environmental damage. The subject of the carbon tax is an individual or entity that buys carbon-containing goods and/or engages in activities that produce carbon emissions. A carbon tax is payable on the purchase of carbon-containing goods or activities that produce a certain amount of carbon emissions in a certain period.

The carbon tax rate is set to be higher than or equal to the carbon market price per kilogram of carbon dioxide equivalent (COze) or equivalent unit. In the event that the price of carbon in the carbon market is lower than IDR. 30.00 (thirty rupiah) per kilogram of carbon dioxide equivalent (COze) or an equivalent unit, the carbon tax rate is set at a minimum of IDR. 30.00 (thirty rupiah) per kilogram of carbon dioxide. equivalent (COze) or equivalent units. Allocation of revenue from carbon taxes for climate change control.

Article 13 paragraph 5 explains that "goods containing carbon" are goods that include but are not limited to fossil fuels that cause carbon emissions. Meanwhile, "activities that generate carbon emissions" are described as activities that produce or emit carbon emissions originating from, among others, the energy, agriculture, forestry and land change sectors, industry, and waste. Included in the scope of buying, such as buying goods that produce carbon emissions in the country and imports. What about cryptocurrency mining activities that use Proof of Works? Based on this definition, cryptocurrency mining activities can be considered as activities that generate or emit carbon emissions originating from, among others, the energy and industrial sectors.

Taxpayers who participate in carbon emission trading, carbon emission offset, and/or other mechanisms in accordance with laws and regulations in the environmental sector will be given incentives in the form of carbon tax reductions and or other treatment for fulfilling carbon tax obligations. Offsetting carbon emissions (carbon emission offsets) is the reduction of carbon emissions by businesses and/or activities to compensate for emissions made elsewhere. While Carbon emission trading is regulated in Article 13 paragraph 13, which defined as a transaction mechanism between business actors and/or activities whose emissions exceed the specified emission limit.

Meanwhile, the provisions regarding the addition of tax objects subject to carbon tax are regulated by or based on a Government Regulation. Related to cryptocurrency mining and activities related to crypto transactions, management can be carried out by being regulated through the addition of tax objects.

4. Conclusion

Reducing carbon emissions will provide great benefits for environmental and economic security, climate change mitigation and incentives for the business world. The policy regarding the imposition of a carbon tax on activities that produce carbon emissions is one of the real compliance actions of the Indonesian government in maintaining international commitments related to human security, one of which is environmental security. The crypto economy that will continue to grow and develop will have a strategic position in the wider community so that all related activities must be regulated so as not to cause impacts that actually harm the community and the environment. The regulation of carbon tax legislation for cryptocurrency mining activities will have a positive impact both in terms of the economy, the environment, and the energy sector as well as public welfare.

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