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Minding Modern Mining: An Analysis of the Energy-Intensiveness of Proof-of-Work Consensus Mechanism and its Violation Against the Right to a Balanced & Healthful Ecology

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Abstract— In the recent Chainalysis Global Crypto Adoption Index 2022, the Philippines ranked second as the leading adopter of cryptocurrency worldwide. The emergence and development of cryptocurrency in the Philippines have resulted in an increase in cryptocurrency mining. This mining process validates crypto transactions through a blockchain by employing a Proof-of-Work consensus mechanism. This mechanism requires significant computational power and energy consumption to solve mathematical algorithms or complex puzzles, generating coins with specific values that can be exchanged for legal tender. Consequently, the coal-based Proof-of-Work consensus mechanism leads to the burning of more fossil fuels to generate electricity, thereby increasing atmospheric greenhouse emissions and exacerbating the current climate crisis.

Considering a number of studies and statistics on the impact of energy-intensiveness of Proof-of-Work Consensus Mechanism in 2018 to 2020 akin to climate change, therefore a sense of urgency then to conduct this study. This paper aims to (1) to prove that the Proof-of-Work consensus mechanism, in relation to cryptocurrency mining, is energy-intensive and contributes to the worsening climate and human rights crisis; and (2) to show that the process of Proof-of Work consensus mechanism and its impacts on ecology violates the right to a balanced and healthful ecology under the 1987 Constitution, alongside international environmental commitments, principles, and legal frameworks.

A method triangulation was used in this study, viz, case study, content analysis and comparative approach. To prove the insufficiency of current laws and policies, the gathered information and materials were analyzed to bridge the literature gap by examining provisions governing environmental laws, constitutional law, human rights law, and technology. The findings then indicate that: (1) among all the consensus mechanisms, Proof-of-Work is the most energy-intensive; the process itself and its impact violate the right to a balanced and healthy ecology under the 1987 Constitution; and (2) there are insufficient frameworks in the Philippines addressing the ecological impacts of the Proof-of-Work consensus mechanism. Therefore, legislative measures are recommended to shift to a proof-of-stake consensus mechanism, a greener and more energy-efficient method for cryptocurrency mining.

Index Terms— *Cryptocurrency Mining, Ecology, Energy-intensiveness, Proof-of Work*

I. INTRODUCTION

Cryptocurrency is defined by the Bangko Sentral ng Pilipinas Circular No. 1108 as a decentralized digital currency produced by a public network, rather than any government, that uses cryptography to make sure payments are sent and received safely. In the 21st century, it has become one of the fastest-growing investment tools for financial stability. Interestingly, despite intense attempts to considerably cut greenhouse gas emissions globally in accordance with the Paris Agreement, the information and communications technology industry has gained increased awareness as a major contributor to the deterioration of the environmental condition. The strategy to lessen the consequences of climate change over the next years, which aims to keep global warming below 2 ° C, was adopted and backed by 196 governments in total under the aforementioned

accord.[1] Unfortunately, new developments in cryptocurrency systems have led to certain global ecological problems. This is attributable to the fact that cryptocurrency mining is dependent on the Proof-of-Work consensus mechanism, an incredibly energy-intensive process which contributes a lot of carbon and greenhouse emissions in the atmosphere, that threatens the capacity of nations all over the world to lessen our reliance on climate-warming fossil fuels.

In Proof-of-Work consensus mechanism, the "miners" present around the globe are in a quest to solve complex mathematical problems wherein if validated, creates new tokens. The token or the mined coin is given to the fastest solver of the highly complex mathematical problem.[2] However, it consumes an enormous amount of energy cost. Due to the puzzle's structure, mining machines must make millions of calculations in order to "guess" at the solution. The earning potential of a Proof-of-Work operation increases along with the price of the underlying cryptocurrency, encouraging current miners to purchase and run more hardware in order to increase their processing capacity.[3]

Nonetheless, according to Chainalysis' Global Crypto Adoption Index 2022, the Philippines is currently ranked second globally for Cryptocurrency adoption, trailing only Vietnam and ahead of Ukraine, India, and the United States, but its future remains uncertain.[4] The miners, which brought in US$1.3 billion in revenue last year, reportedly once had 40% of its users residing in the Philippines. The index, according to Chainalysis, measures where the most people are investing the largest share of their wealth in cryptocurrencies and the countries where individual, non-professional investors are embracing digital assets the most. Crypto mining having detrimental issues for huge energy consumption can aggravate the generation deficiencies of the country.

The fact that only one miner receives the incentive makes it inefficient by design. Because the other miners lost, all of their labor was simply abandoned. The energy used in Proof-of-Work, specifically non-renewable or coal-based ones, might result in significant carbon emissions. It will significantly worsen air pollution, noise, and other local effects for people living close to mining sites since it uses a lot of power, which can lead to greenhouse gas emissions. Hence, the fast rise of crypto assets may compromise larger attempts to help the Philippines meet its climate goals to achieve net-zero carbon emissions, depending on the energy intensity of the technology and the sources of power used.

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Under the 1987 Constitution, the State shall protect and advance the right of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature. Yet, there are no current ecological regulations that specifically focus on protecting the environmental and human rights of Filipinos against cryptocurrency mining particularly on the Proof-of-Work consensus mechanism. Thus, this research aims (1) to prove that the Proof-of-Work consensus mechanism, in relation to cryptocurrency mining, is energy-intensive and contributes to the worsening climate and human rights crisis; and (2) to show that the process of Proof-of Work consensus mechanism and its impacts on ecology violates the right to a balanced and healthful ecology under the 1987 Constitution, alongside international environmental commitments, principles, and legal frameworks.

This study focuses on the standing of the Philippines in terms of cryptomining within 2018-2020 that includes jurisprudence, treaties, legislations, initiatives, frameworks, and customary international law, legal initiatives and responses for the protection of fundamental climate-related human rights affected by Proof-of-Work.

II. MATERIALS AND METHODS

The study utilized a triangulation method (case study, content analysis, and comparative approach) as it increases the credibility and validity of research findings amidst limited time to complete the same. Since it is known that there are no specific environmental laws or policies regulating cryptocurrency mining in the Philippines, content analysis is combined with the comparative approach to fill in the gap between the human rights, environmental and technology aspect of the research and its applicability in the Philippines.

[1] Rogelj, J., Elezen, M., Hohne, N., & Fransen, T. (2016). Paris Agreement climate proposals need a boost to keep warming well below 2 C, *Nature*, 534 (7609), 631-639.

[2]

[3] Alsabah, H. & Capponi, A. (2020). Pitfalls of Bitcoin's Proof-of-Work: R&D arms race and mining centralization. *SSRN*, 44.

[4] Chainalysis, (2022). *The 2022 Global Crypto Adoption Index*. https://blog.chainalysis.com/reports/2022-global-crypto-adoption-index/

III. RESULTS AND DISCUSSION

a. Energy-intensiveness of Proof-of-Work Consensus Mechanism

Theme: Environmental Law and Energy-Intensiveness of Cryptomining (POW) Code: Cryptomining, Energy Dependence, and Paris Agreement				
Title of the document	**Source and type of the document**	**Year published**	**Key topic/s**	**Specific content/ quotation**
Paris Agreement climate proposals need a boost to keep warming well below 2 C	International Institute for Applied Systems Analysis; Journal article	2016	Digital asset's energy usage, sources of energy supply, scale of climate, energy, and environmental impacts	*"Mining of cryptocurrency contributes to the emission of greenhouse gases (GHG) primarily by burning coal, natural gas, or fossil fuels to produce electricity in an onsite dedicated power plant, buying electricity from the power grid, and/or manufacturing and disposing of computers and mining infrastructure, as well as manufacturing fuels and infrastructure for power plants."*[5]
Ecodefence and Others v. Russia,	Climate Change Litigation Database; Pending SC case	2022	Paris Agreement, right to a balanced and healthful ecology, GHG emissions, climate change	**"***If Russia does not improve and adapt its current climate change policy to implement measures to keep the increase in temperature below 1.5°C, this will result in a 4 degrees Celsius global warming and a death toll of 710, 000 from*
ClientEarth v.				

[5] Id at 1.

Poland District Court	Climate Change Litigation Database; Pending case	2021	Human rights, GHG emissions, climate change	*2020 to 210. If the objectives were not able to be reached, it will place a serious risk on the environment and illness on the people, violating their human and environmental rights particularly right to a healthful ecology*."[6] **"***Due to its poor progress in reducing greenhouse gas emissions, Poland is one of the biggest emitters of carbon inside the European Union and has the lowest ranking in terms of climate change. As a result, the Paris Agreement's worldwide commitment was not kept. It claimed that the "right to enjoy the value of the natural environment, including the right to live in stable and safe climatic circumstances, health, respect for the place of residence, right to privacy, and respect for family life" is being violated*."

Table 1.0 Cryptomining, Energy Dependence, and Paris Agreement

Cryptocurrency, specifically Bitcoin, has 2,900,000 number of mining rigs using POW which has been one of the major drivers of rising energy consumption worldwide over the past few years. Its electricity consumption is notably higher than the combined consumption of other types of consensus mechanisms. Note that in the

[6] Ecodefence and Others v. Russia, 9988/13, at *16-18 (ECtHR. 2022) (Eur.)

Philippines majority of the cryptocurrency users and cryptominers are using Bitcoin which utilizes the Proof-of-Work mechanism. In fact, the miners, which brought in US$1.3 billion in revenue last year, reportedly once had 40% of its users residing in the Philippines.

Year	Cryptocurrency/ Consensus mechanism	Estimated Annual Energy Consumption (TWh)	Cryptocurrency/ Consensus mechanism	Estimated Annual Energy Consumption (TWh)
April 2017	Bitcoin/ POW	11.17	Ethereum/POW	<7.75
October 2017	Bitcoin/ POW	23.43	Ethereum/POW	16.33
April 2018	Bitcoin/ POW	63.49	Ethereum/POW	22.36
October 2018	Bitcoin/ POW	73.12	Ethereum/POW	17.14
April 2019	Bitcoin/POW	57.63	Ethereum/POW	8.69
October 2019	Bitcoin/POW	73.12	Ethereum/POW	8.71
April 2020	Bitcoin/POW	76.52	Ethereum/POW	8.47
October 2020	Bitcoin/POW	75.95	Ethereum/POW	7.02

Table 2.0 Bitcoin energy consumption worldwide from April 2017-October 2020

After gathering and comparing all the materials (focusing primarily on 2018-2020) while conducting this research from October-December 2022, all the foregoing is leading to a conclusion that Proof-of-Work is the most energy -intensive among all consensus mechanisms.

Theme: Environmental Law and Energy-Intensiveness of Cryptomining (POW) **Code: Relationship between Climate Change and Cryptomining (POW)**				
Title of the document	**Source and type of the document**	**Year published**	**Key topic/s**	**Specific content/ quotation**

Bitcoin use tied to global warming	University of Hawai'i News; Research study	2018	Bitcoin (POW) emissions to raise global temperatures	*"If cryptocurrency employing the POW mechanism continues to grow at its current rate, by 2033 it may have produced enough emissions to raise global temperatures by 2°C. Clearly, any further development of cryptocurrencies should critically aim to reduce electricity demand,"*[7]
Bitcoin emissions alone could push global warming above 2°C	Harvard University Website; Journal article	2018	Cryptomining's impact through increasing carbon emissions	*"Prior to considering the power efficiency of application specific integrated circuits (ASICs), which are currently used for Bitcoin mining, the university's researchers took into account the locations where Bitcoin, a cryptocurrency using POW mechanism is likely to be computed and the equivalent CO2 emissions. It was determined that a 2-degree Celsius rise in the earth's temperature might have catastrophic and long-lasting effects."* ***"****We cannot predict the future of Bitcoin, but if implemented at a rate even close to the slowest pace at which other technologies have been incorporated,*

[7] University of Hawaii, (2018, October 29) *Bitcoin use tied to global warming*. https://www.hawaii.edu/news/2018/10/29/bitcoin-use-tied-to-global-warming/

				it will spell very bad news for climate change and the people and species impacted by it."[8]

Since a single Bitcoin transaction's carbon footprint is equivalent to the carbon footprint of 788,170 VISA transactions or 59,270 hours of watching YouTube or 355.62 kgCO2; Equivalent to the power consumption of an average U.S. household over 21.85 days or 637.58 kWh or electrical energy; and Equivalent to the weight of 2.17 iPhones 12 or 0.73 iPads (355.8 grams) of electronic waste, it is not surprising that Proof-of-Work is significantly energy-intensive than most of other consensus mechanisms.

The most current data shows that while cryptocurrency prices reached record highs, the total energy used for the Proof-of-Work consensus mechanism also reached unsustainable heights. When it comes to energy use during mining, Bitcoin alone uses more energy than the Philippines, Chile, Venezuela, the Czech Republic, and Austria all together. However, its massive energy usage might not even be the biggest problem; instead, the majority of its network's mining operations are located in places with a significant reliance on coal-based electricity.

Because of this, cryptocurrency mining raises the base load demand on a grid of local communities. The mining adds more processing power, increasing overall electricity consumption and associated GHG emissions. Also, greater computational power from mining rigs and an increase in miners will result in higher electricity demand and greenhouse gas emissions. In the worst-case scenario, the existence of PoW-based crypto miners can therefore act as a catalyst for the construction of new fossil fuel-based power plants or the reopening of shuttered ones.

b. Violation of POW Against Right to a Balanced and Healthful Ecology

The table above shows the energy usage of cryptocurrency mining for the past seven years when the mining of cryptocurrency became prevalent in society. Cryptocurrency mining which utilizes Proof-of-Work as a consensus mechanism needs an enormous amount of computational power, it will undoubtedly contribute to the increase of the share of electricity production from fossil fuels over the years which causes detrimental effects to the environment and to the ecology. In fact, currently, fossil fuels power about 60 percent of Bitcoin mining.

Theme: Human Rights and Cryptomining (POW) Code: Cryptomining, Proof-of-Work, Principle of Prevention, and the Right to a Balanced and Healthful Ecology				
Title of the document	**Source and type of the document**	**Year published**	**Key topic/s**	**Specific content/ quotation**
1987 Constitution of the Philippines	Official Gazette; Constitution	1987	Right to a balanced and healthful ecology	*"The State shall protect and advance the right of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature."*[9]

[8] Mora, C., Rollins, R., Taladay., K. & Kantar, Micheal. (2018). Bitcoin emissions alone could push global warming above 2°C. *Nature Climate Change*, 8, 931–933.
[9] Phil. Const. Art. II, Sec. 16.

Legality of the Threat or Use of Nuclear Weapon, Advisory Opinion	International Court of Justice Reports of Judgments, Advisory Opinions & Orders; Advisory opinion	1996	Environment, quality of life and health of people, obligation	*"...the environment is not an abstract concept but rather embodies the living conditions, the quality of life and even the health of people, including future generations. The body of international law dealing to the environment currently recognizes the existence of the general obligation of States to guarantee that activities under their jurisdiction and control protect the environment of other*
This is What Happens When Bitcoin Miners Take Over Your Town	Politico Magazine; News article	2018	Catastrophic impact, electricity usage, crypto mining facilities	*States or of places beyond national control."*[10]
Fossil Fuels &	Harvard (Center for Climate Change, Health	N. D.	Computer radiation, long-term comput	**"***Because the local grid of the electricity source was not prepared for the rise in electricity usage, the alarming number of people and crypto mining facilities could have a catastrophic impact on the public utility infrastructure. For instance, if a mining operation used so much energy that it overwhelmed the local power plants, a transformer might have overloaded and started a brush fire, endangering*

[10] Legality of the Threat or Use of Nuclear Weapon, Advisory Opinion, ¶ 27 & 29 (Jul. 8, 1996), *available at* https://www.icj-cij.org/public/files/case-related/95/095-19960708-ADV-01-00-EN.pdf.

Health	and Global Environment) School of Public Health; Research		er use, health risks	*nearby residents' property, safety, and security*."
Cordillera Global Network v. Paje	CDAsia; Jurisprudence	2019	Commerce, ecology, human survival	"*Additionally, since confirmed transactions require powerful computer rigs, crypto miners must use their computers for extended periods of time. Computers, on the other hand, are one of the sources of electromagnetic field that harms human health by causing air pollution, computer-related radioactive emissions, and static electricity buildup surrounding the device. "*[11]
Beijing's first Bitcoin "mining" contract case upholds original verdict at	Website of Beijing Court; News Article	2022	Crypto mining, energy requirements, principle of safe and healthy environment, emissions	*"Computer radiation has an impact on disorders of the brain system, immunological system, and heart. Long-term computer use increases the chance of developing hand and wrist diseases, eye conditions (such as Computer Vision Syndrome), and posture-related conditions. When engaging in prolonged computer activities [such as crypto mining], persons who are exposed for longer*

[11] Roberts, P. (n.d.). *This Is What Happens When Bitcoin Miners Take Over Your Town*. https://www.politico.com/magazine/story/2018/03/09/bitcoin-mining-energy-prices-smalltown-feature-217230/

second instance				*than four hours a day run the risk of experiencing all the health risks outlined."*
Senate Bill S6486	Official website of New York Senate; Legislative material	2021-2022	Moratorium, Proof-of-Work, environmental impact statement	*"The shortcuts into the process through which the state assures minimal impact on the environment weighed against the profits to be generated by businesses, must be tolerated. More importantly, it was held that commerce is important for human survival, but so is ecology."*[12] *"The court further holds that cryptocurrency-related transactions and mining jeopardize the security of the public's assets and finances, and that cryptocurrency mining's high energy requirements result in significant carbon emissions—go against the principle of safe and healthy environment, affecting balanced interaction between organisms, the goal of reducing carbon and greenhouse gas emissions."*[13]

[12] Cordillera Global Network v. Paje, G.R. No. 215988, *April 10, 2019.*

[13] Xiaoxia, S. (2022). *Beijing's first Bitcoin "mining" contract case upholds original verdict at second instance*. *https://bj3zy.bjcourt.gov.cn/article/detail/2022/07/id/6791825.shtml*

				"...establishes a moratorium on cryptocurrency mining operations that use proof-of-work authentication methods to validate blockchain transactions and to mandate the evaluation of all generic environmental impact statements, Senate Bill S6486 was signed into law in the US.[14]

The alarming increase in the emission of greenhouse by cryptomining aggravates electricity and energy usage all over the world. This imposes a great risk to human life and property, standard of living, and to a safe and healthy environment. Therefore, the climate-related disasters resulting from the energy intensiveness of Proof-of-work Consensus Mechanism disrupt the balance of the interaction of living organisms.

Theme: Environmental Law and Energy-Intensiveness of Cryptomining (POW) **Code: Relationship between Human Rights and Energy-Intensiveness of Cryptomining (POW)**				
Title of the document	**Source and type of the document**	**Year published**	**Key topic/s**	**Specific content/ quotation**
Estimation of Carbon Monoxide, Sulfur Oxides, Nitrogen Oxides, Volatile Organic Compounds, and Particulate Matters Emission Due to Cryptocurrency Miners' Activity in Iran	Multidisciplinary Digital Publishing Institute; Research study	2021	Cryptocurrency damages in terms of human climate and health impacts	*"... air pollution from burning fossil fuels used by Proof-of-Work mechanism can cause multiple health issues, including asthma, cancer, heart disease, and premature death. In addition, according to the research conducted in University of New Mexico in Albuquerque, in each 1$ of bitcoin being mined was responsible for $0.49 in health and climate damages in the U.S. and $0.37 in China due to its energy intensiveness..."*[15]
Cryptodamages: Monetary value estimates of the air pollution and human health impacts of	Energy Research & Social Science	2020		*"The primary dangerous air pollutants that result from cryptomining utilizing a Proof-of-Work mechanism are recognized as benzene, toluene, ethylbenzene, xylene, and hexan. In*

[14] The New York State Senate, Senate Bill S6486, available at https://www.nysenate.gov/legislation/bills/2021/S6486 (last accessed November 20, 2022).
[15] Id at 24.

cryptocurrency mining	Journal; Journal article			*China, according to data from the Energy Research & Social Science, climate change is responsible for around 89% of the country's cryptodamages, with human health consequences accounting for the remaining 11%. About 60% of cryptodamages in the US are caused by climate change, and 40% are caused by health issues."*[16]

Obviously, POW's energy intensiveness creates an overwhelming effect on the amount of carbon emissions released to the environment and absorbed by human being. Significant increases on carbon footprint from cryptocurrency mining causes high levels of air pollutants affects both animal and human health due to the risk of having skin, heart, brain, and reproductive system disorders and affect immune systems.

In fact, air pollution from burning fossil fuels used by Proof-of-Work mechanism can cause multiple health issues, including asthma, cancer, heart disease, and premature death. That being said, Proof-of-work Consensus Mechanism causes disruption of harmony and balance between the environment and living organisms due to its health-related risk, environmental harm, and disturbance to normal operations of public utilities or infrastructures. Clearly, there is a violation of the right to a balanced and healthful ecology.

c. Right to a Healthy Environment = Other Human Rights

Theme: Human Rights and Cryptomining (POW) **Code: Right to a Healthy and Balanced Ecology and Other Human Rights**				
Title of the document	**Source and type of the document**	**Year published**	**Key topic/s**	**Specific content/ quotation**
Dela Cruz v. Manila Electric Company	CD Asia; Jurisprudence	2020	Right to a Balanced & Healthful Ecology vis-à-vis Right to Health	"*Intrinsic in the right to a balanced and healthful ecology is the right to health*."[17] **"***Thus, a clean and healthy environment is a fundamental part of the enjoyment of the right to health, food, and adequate housing*."
Oposa v. Factoran	CD Asia; Jurisprudence	1993		*"Section 16, Article II of the 1987 Constitution explicitly provides that the State shall protect and advance the right of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature. This right unites with the right to health which is provided for in the preceding section of the same article wherein the State shall protect and promote the right to health*

[16] Goodkind, L., Jones, B., & Berrens, R. (2020). Cryptodamages: Monetary value estimates of the air pollution and human health impacts of cryptocurrency mining. *Energy Research & Social Science*, 59, 101281

[17] Dela Cruz v. Manila Electric Co., G.R. No. 197878, November 10, 2020

Special Rapporteur on the Environment (About human rights and the environment)	Website of the UNHR Office of the Commissioner	N.D.	Right to a safe, clean, healthy and sustainable environment	*of the people and instill health consciousness among them."*[18] *"All human beings depend on the environment in which we live. A safe, clean, healthy and sustainable environment is integral to the full enjoyment of a wide range of human rights, including the rights to life, health, food, water and sanitation. Without a healthy environment, we are unable to fulfil our aspirations. We may not have access to even the minimum standards of human dignity."*[19]

The Republic of the Philippines' citizens are required to exercise and enjoy the right to a balanced and healthy ecosystem under the1987 Constitution. The Supreme Court ruled in Oposa v. Factoran that the right to a balanced and healthy ecology does not need to be stated in the Constitution because it is presumed to have existed from the beginning of humankind.

In relation thereto, according to Dela Cruz v. Manila Electric Co.,[20] the right to life, health, and property is an intrinsic right to a balanced and healthful ecology and thus, when either of those rights is violated, the other one is also being violated. Further, the relationship between the right to a balanced and healthy ecological system and the other rights listed is recognized by various national and international laws and mechanisms Hence, the following rights may be infringed upon: the right to a safe, healthy, clean, and sustainable environment; the right to benefit from scientific advancement; the right to an adequate standard of living; and the right to the highest standard of health that is reasonably attainable.

d. Technology, Cybercrime, and Cryptomining (POW)

Theme: Technology, Cybercrime, and Cryptomining (POW) **Code: Emergence of Cryptojacking in PH and Cryptovalley of Asia**				
Title of the document	**Source and type of the document**	**Year published**	**Key topic/s**	**Specific content/ quotation**
Optimism Tempered with Reasonable Caution: The State of Philippine	Stratsea; Research Article	2022	Cybersecurity; Coherent approach to cryptocurrency regulation	*"There is a need for a coherent approach to the regulation and oversight of cryptocurrencies in terms of cybersecurity. The different*

[18] Oposa v. Factoran Jr.,224 SCRA 792, 811, (1993).
[19] Boyd, D. (n.d.). Special Rapporteur on the Environment (About human rights and the environment). https://www.ohchr.org/sites/default/files/Documents/Issues/Environment/SREnvironment/Report.pdf
[20] Dela Cruz v. Manila Electric Co., G.R. No. 197878, November 10, 2020

Cryptocurrency Regulations				*levels of cybersecurity adoption by cryptocurrency companies need to be evaluated by government regulators to ensure if the cybersecurity in place is secure and safe in terms of personal data privacy protection. There is a need for BSP and SEC to appoint third party organizations to ensure that data privacy follows Republic Act 10173, known as the Data Privacy Act. This is a law that seeks to protect all forms of information, be it private, personal, or sensitive."*[21]
Crypto Valley of Asia' To Rise in The Philippines, Secures $100M Investment	Website of the Cagayan Economic Zone Authority (CEZA); News article	2023	Crypto Valley of Asia and cryptocurrency mining	*"Crypto Valley of Asia will be developed by Northern Star Gaming & Resorts Inc. (Northern Star) and government-owned Cagayan Economic Zone Authority (CEZA) to be a world-class internet data center, **crypto mining firms**, self-contained power production facilities, and a state-of-the-art cyber security and risk assessment facility. The investors of Crypto Valley of Asia claim to secure local and international companies operate to the said facility to perform cryptocurrency mining and blockchain operations."*[22] *"In the year 2018, the Philippines allowed 10 blockchain and cryptocurrency companies to operate in the Cagayan Economic Zone. The companies that will be allowed to operate with issued licenses to the said economic zone will be the cryptocurrency firms to*

[21] Fabe, A. (2022, June 8). *Optimism Tempered with Reasonable Caution: The State of Philippine Cryptocurrency Regulations.* https://stratsea.com/optimism-tempered-with-reasonable-caution-the-state-of-philippine-cryptocurrency-regulations/

[22] Noda, T. (2018, August 06). *'Crypto Valley of Asia' To Rise In The Philippines, Secures $100M Investment.* https://ceza.gov.ph/crypto-valley-of-asia-to-rise-in-the-philippines-secures-100m-investment/

				conduct crypto mining operations and exchange legally in the Philippines. The different companies came from Japan, Hong Kong, Malaysia, and Korea
Philippines to allow cryptocurrency operators in economic zone	Reuters; News article	2018	Virtual currency companies; license; crypto mining	*"Cryptojacking is a cybercrime threat in which actor/s obtains unauthorized computer resources to generate cryptocurrency. Malicious scripts deployed and executed take advantage of the victim's Central Processing Unit (CPU) resource to mine cryptocurrency for benefit of the threat actor/s. This allocation of CPU power is done without consent and knowledge of the device owner. Criminal cryptominers can lurk on your systems for months or years before they are discovered. These can cause instability in your physical infrastructure, increased power costs, slowness, poor performance and more."*
Philippine National Police Anti-Cybercrime Group, Acg-Cyber Security Bulletin Nr 161: Understanding the Risk of Cryptojacking	Official website of PNP Anti-Cybercrime Group; Government report/ Cyberbulletin	N.D.	Cryptojacking; increased power costs, cryptomining	*"Use of malicious emails that can set up cryptomining software in a computer is one of the most common methods. This is accomplished through phishing techniques. The cryptomining script is downloaded onto the computer by running a code when the link is clicked or the attachment is downloaded. In fact, up to 8 harmful apps that were disguising themselves as cryptocurrency mining apps had been taken down from Google Play Store; users had been luring Filipino cryptominers with claims of huge returns on investment in cloud mining operations. There have been many Filipino victims who*

				downloaded these cryptomining software."[23]

Indeed, over the past few months in particular, cryptocurrency mining has captured everyone's attention. However, hackers in the Philippines are taking advantage of the widespread interest in cryptocurrencies to deceive unsuspecting internet users into downloading malicious apps that include harmful viruses and adware onto their smartphones. In fact, up to 8 harmful apps that were disguising themselves as cryptocurrency mining apps had been taken down from Google Play Store; users had been luring Filipino cryptominers with claims of huge returns on investment in cloud mining operations.

As a form of cybercrime, cryptojacking involves obtaining illegal access to computer resources in order to produce cryptocurrency. The Central Processing Unit (CPU) of the victim is used by malicious scripts that are deployed and run to mine cryptocurrency for the profit of the threat actor(s). This CPU power distribution is carried out without the device owner's knowledge or agreement. So, in order to cryptojack, one must become an expert at mining cryptocurrencies as well as aware about it. In order to reduce or completely eliminate the costs of starting up a mining empire, the cryptominers utilize malware to infect other people's devices and use their electricity for their mining operations, making money off of all the infected devices in the process.

Use of malicious emails that can set up cryptomining software in a computer is one of the most common methods. This is accomplished through phishing techniques. A seemingly innocent email containing a link or attachment is sent to the victim. The cryptomining script is downloaded onto the computer by running a code when the link is clicked or the attachment is downloaded. The script then continues to run in the background without the victim's knowledge.[24] There have been many Filipino victims who downloaded these cryptomining software.

Theme: Technology, Cybercrime, and Cryptomining (POW) **Code: PH Cryptominers May Increase in the Future**				
Title of the document	**Source and type of the document**	**Year published**	**Key topic/s**	**Specific content/ quotation**
Blockchain technology in the energy sector: A systematic review of challenges and opportunities	Renewable and Sustainable Energy Review; Journal article	2019	Cryptomining; blockchain; scattered nature	*"Cryptomining using blockchain technology is accessible to all users, who thereby assist in maintaining the network. Because of this, users can frequently interact with one another directly without the use of intermediaries. It can also lower transaction costs and boost productivity. This type of network is challenging to corrupt or shut down due to its scattered nature."*[25]
The Global Crypto Adoption Index 2022	Chainalysis; Firm Report			*"Filipinos are considered one of the leading adopters of cryptocurrency and is now ranked second for*

[23] Philippine National Police Anti-Cybercrime Group. (n.d.) *Acg-Cyber Security Bulletin Nr 161: Understanding The Risk Of Cryptojacking*. https://acg.pnp.gov.ph/main/cyber-security-bulletin/300-acg-cyber-security-bulletin-nr-161-understanding-the-risk-of-cryptojacking.html

[24] Id at 39.

[25] Andoni, M., Robu, V., & Flynn, D. (2019). Blockchain technology in the energy sector: A systematic review of challenges and opportunities, *Renewable and Sustainable Energy Reviews*, 100, 143-174.

		2022	Leading adopters of cryptocurrency	*cryptocurrency adoption behind Vietnam and ahead of Ukraine, India, and the United States."*[26]

Most of the countries pledged to phase out coal-based power plants within the year 2030 onwards and some of the countries are already stopped the operation of their coal-based power plants. On the other hand, there are some countries that does not have attempts to remove coal-based power plants including the Philippines. Therefore, it is the primary reason as to why in the Philippines, cryptocurrency miners and companies exploits the lack of regulation in relation addressing the issue of the environmental and energy related concerns of POW. Hence, the number of crypto miners and cryptomining facilities will continue to increase over the years and thus, it creates the sense of urgency to create a legislation to regulate the POW.

Various factors, such as the cost of the electricity company's services, may vary depending on the selected unit. The Philippines now has a large number of stores selling cryptomining equipment and services, including BitMain and MinerPH. Consider the Antminer for a year, running nonstop for 24 hours a day, seven days a week. People have come to the conclusion that the Antminer can produce 0.85 bitcoins at a cost of about 15,000 kilowatt hours. Mining a single bitcoin might cost anywhere between $600 and $1800, depending on the cost of the electricity.

In addition, 21 overseas blockchain and cryptocurrency companies, including the Hanwha Group of South Korea and Changwei International Co. of China, signed a Memorandum of Understanding with CEZA, which the cryptomining community perceived as a rival in the sector. As bitcoin's value more than doubled in 2021, the cryptocurrency mining industry grew quickly, but this expansion has put additional pressure on margins because the mining process is meant to become more challenging as the number of miners rises.

e. Insufficient Frameworks in PH Addressing Ecological Impacts of POW

Current Frameworks	Does it address the environmental impacts of cryptocurrency cryptomining, and blockchain?	Does it address the environment impacts of Proof-of-Work Mechanism?	Does it, in any way, recognize and promote energy transition utilizing greener technology
Republic Act No. 9136 or the Electric Power Industry Reform Act of 2001 (EPIRA)	To a certain extent	No	Yes
Republic Act No. 11285 or the Energy Efficiency and Conservation Act	To a certain extent	No	Yes
Climate Change Act of 2009	To a certain extent	No	Yes
Philippine Environmental Impact Statement System (PD 1568)	To a certain extent	To a certain extent	Yes

Most of the frameworks in the Philippines only regulate the financial and penal aspects of cryptocurrency and virtual assets. While some frameworks, to a certain extent, addresses the possible or potential environmental effects of financial technology, it did not cover Proof-of-Work. The court also underlined that because virtual currency-related activities are complicated and new, regulatory frameworks must be continually strengthened. The effect of the energy-intensiveness of Proof-of-Work on ecology has a normative impact which creates an urgency to create legislation. It is against the law for the government to do nothing or to do less than expected of them to halt the predicted and actual harm of POW. If appropriate steps are not taken now to minimize greenhouse gas emissions, these violations will grow in geographic extent, severity, and the number of people affected in the future.

[26] Id. at 41

f. Insufficiency of BSP Regulation and Pending Senate Bills

BSP Regulations	Does it address the environmental impacts of cryptocurrency cryptomining, and blockchain?	Does it address the environment impacts of Proof-of-Work Mechanism?	Does it, in any way, recognize and promote energy transition utilizing greener technology
The Anti-Money Laundering Council Warning Advisory on Virtual Currencies	No	No	No
BSP Circular No. 944 on Registration of VC Exchanges	No	No	No
BSP Advisory on the Use of Virtual Currency	No	No	No

The Bangko Sentral ng Pilipinas (BSP) did not advise the public of the characteristics, advantages, and associated dangers while dealing with virtual currencies until 2014. The BSP subsequently issued a formal regulatory framework for VC Exchanges - Circular No. 944 dated 6 February 2017 - requiring VC Exchanges to register with the BSP as remittance and transfer organizations in response to the surge in the usage of VCs for payments and remittances in the Philippines. Another public advice in response to certain deceitful scammers or groups that attempt to persuade people to "invest" in Bitcoins or VCs packaged as an Initial Coin Offering in late December 2017. (ICO). The recommendation advises customers to exercise caution when working with venture capitalists, only hold enough VCs to cover their transactional needs, and take sensible security precautions to safeguard their VC accounts. Despite being a virtual currency, none of them discussed how mining cryptocurrencies, particularly the Proof-of-Work consensus mechanism, had an influence on the environment.

Current Senate Bills	Does it address the environmental impacts of cryptocurrency cryptomining, and blockchain?	Does it address the environment impacts of Proof-of-Work Mechanism?	Does it, in any way, recognize and promote energy transition utilizing greener technology
Senate Bill No. 1694 or an Act Penalizing the Use of Virtual Currency in the Commission of Crimes	No	No	No
Senate Bill 184 or Digital Assets Act of 2022	No	No	No
Senate Bill 157 or Energy Transition Act	Yes	No	Yes
House Bill 658 or The Blockchain Technology Act	Yes	No	Yes

On the other hand, the current or pending bills related to cryptocurrency or digital assets include Senate Bill 184 or An Act Recognizing Digital Assets, Requiring the Registration of Digital Asset Enterprises, Their Operators, And for Other Purpose. It only intends to recognize and institutionalize the existing rules and regulations for digital assets which is too vague. While virtual currencies or digital assets are standardized and recognized, and their advantages can be enjoyed and utilized by the general public in this senate bill it has not mentioned anything particularly related to Proof-of-Work consensus mechanism or even the environmental impacts of digital assets or virtual currency per se.Senate Bill No. 1694, on the other hand, or an Act Penalizing the Use of Virtual Currency in the Commission of Crimes only adopted a regulatory framework due to the emerging threats of the use of virtual currency for the commission of crimes including but not limited to estafa, financing terrorism, and money laundering. It has not mentioned any word related to the environmental aspect in its framework nor any provision related to cryptocurrency mining. It is focused on the penal and prosecutorial nature of virtual currency including

penalties incurred for the said penal violations which may lead to illicit activities. Thus, insufficient to address the environmental impacts of the Proof-of-Work consensus mechanism.

g. Insufficiency of Energy-Related and Climate Laws in the Philippines

Electric Power Industry Reform Act (EPIRA) of 2001

Republic Act No. 11285, also known as the Energy Efficiency and Conservation Act[27], was passed in 2021 and only outlines actions to increase energy efficiency and decrease usage within the Philippines. Although the legislation that the Department of Energy was supposed to produce includes new performance and labeling standards, rules for financial and other incentives, and encouragement of the use of concessionary financing for energy efficiency measures, these are not targeted at the energy-intensiveness of cryptomining.

Regarding Section 38 of Republic Act No. 9136, also known as the Electric Power Industry Reform Act (EPIRA), it abolished the Energy Regulatory Board, which was established under Executive Order No. 172, and established the Energy Regulatory Commission as an independent, quasi-judicial regulatory body. While it is the responsibility of the ERC to foster competition, support market growth, guarantee customer choice, and punish abuse of market power in the electricity sector, it has yet to verify the reasonable amounts and establish performance standards and measures to deter/punish abuse of market power, cartelization, and any anti-competitive or discriminatory behavior by any participants in the electric power sector, such as cryptocurrency and cryptomining companies.

The growth of cryptomining in the Philippines has raised concerns about the impact it could have on the EPIRA. One of which is the increased demand for electricity. Cryptomining requires a lot of electricity, and it could lead to increased demand for electricity in the Philippines. This could put a strain on the power grid, and it could lead to higher electricity prices for consumers. There could also be reduced reliability of the power supply. Cryptomining facilities can be a significant source of load on the power grid. If there is a sudden increase in demand for electricity, it could lead to brownouts or blackouts.

Climate Change Act of 2009

The Philippines' vulnerability to climate change and the need for effective adaptation are only recognized by the Climate Change Act (RA 9729) and its Implementing Rules and Regulations[28], as are other states. It establishes a thorough framework for methodically integrating disaster risk reduction and the idea of climate change in the several phases of formulating policy, establishing plans, reducing poverty, and other development tools and procedures. There was no particular or in-depth discussion of cryptocurrencies or crypto mining; it was merely a discussion of the fundamental principles of climate change policy. Even if nothing beneficial or efficient has been created as a result, it established the Climate Change Commission as the sole government entity with the jurisdiction to design and approve laws, policies, strategies, and programs on adaptation and mitigation.

This is nevertheless not inclusive of the immediate and tangible effects of the energy-intensive nature of cryptomining on the climate, making it confusing and vague to be applied to the abovementioned topic. Although the Philippines already has a thorough framework in place that integrates the effects of climate change into current Environmental Impact Assessments (EIA), the processes are said to have technical issues and run slowly, which limits their usefulness.

Lastly, while there were Executive Orders Nos. 43 and 24 created the Cabinet Cluster on Climate Change Adaptation and Mitigation and recognized the Cluster's emphasis on environmental preservation and natural resource preservation. The goal was to take the lead in finding ways to mitigate the consequences of climate change on the Philippine archipelago, adapt to them, and make the necessary preparations for both natural and man-made disasters. Nothing has been done to make POW in the Philippines illegal for breaching the aforementioned duties, despite efforts to advance and protect Philippine national interest.

[27] An Act Ordaining Reforms in The Electric Power Industry, Amending for The Purpose Certain Laws and For Other Purposes [Electric Power Industry Reform Act], Republic Act No. 9136, §§ 2 (b) (f) (g) & 37 (a) (2001).

[28] An Act Mainstreaming Climate Change into Government Policy Formulations, Establishing the Framework Strategy and Program on Climate Change, Creating for this Purpose the Climate Change Commission, and for other Purposes [Climate Change Act], Republic Act No. 9729 § 2 (2019).

h. PH Government's Obligation to Address POW's Negative Environmental Impacts

Theme: Insufficiency of Philippine Environmental Frameworks **Code: PH Government's Obligation to Address POW's Negative Environmental Impacts**				
Title of the document	**Source and type of the document**	**Year published**	**Key topic/s**	**Specific content/ quotation**
An Act Providing for A National Energy Policy and FrameworkFor A Clean and Just Energy Transition in The Country, And Appropriating Funds Therefor	Senate Website; Legislative Material (Pending Senate Bill)	2022	Obligation of the State as a Party to United Nations Framework Convention on Climate Change.	*"On 15 April 2021, the Philippines communicated its updated NDC to the United Nations Framework Convention on Climate Change. It commits to a projected GHG emissions reduction and avoidance of 75%, of which 2.71% is unconditional and 72.29% is conditional, representing the country's ambition for GHG mitigation for the period 2020 to 2030 for the sectors of agriculture, wastes, industry, transport, and energy."*[29]
Rio Declaration on Environment and Development	Report of the United Nations Conference on Environment and Development; International Document	1992	Obligation of the State as a Party to the Rio Declaration	*States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction*."[30]
An Act Mainstreaming Climate Change into Government Policy Formulations, Establishing the Framework Strategy and Program on Climate Change, Creating for This Purpose the Climate Change Commission, and	The Official Gazette; Law	2009	Obligation of the State Under – Philippine Agenda 21 Framework and as Party to United Nations Framework Convention on Climate Change	*In this light, the State has adopted the Philippine Agenda 21 framework which espouses sustainable development, to fulfill human needs while maintaining the quality of the natural environment for current and future generations.*[31] *"As a party to the United Nations Framework Convention on Climate Change, the State adopts the ultimate objective of the Convention which is the stabilization of greenhouse gas*

[29] An Act Providing for A National Energy Policy and Framework for A Clean and Just Energy Transition in The Country, And Appropriating Funds Therefor, S.B. No. 157, § 2, 19th Cong., 1st Reg. Sess. (2022).

[30] United Nations Conference on Environment and Development, *Rio Declaration on Environment and Development*, annex 1, princ. 2, U.N. Doc. A/CONF.151/26 (Vol. I) (August 12, 1992).

[31] An Act Mainstreaming Climate Change into Government Policy Formulations, Establishing the Framework Strategy and Program on Climate Change, Creating for this Purpose the Climate Change Commission, and for other Purposes [Climate Change Act], Republic Act No. 9729 § 2 (2019).

for Other Purposes				*concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system..."*[32] ***"...****the State adopts the principle of protecting the climate system for the benefit of humankind, on the basis of climate justice or common but differentiated responsibilities and the Precautionary Principle..."*[33] "*.. to enjoin the participation of national and local governments, businesses, nongovernment organizations, local communities and the public to prevent and reduce the adverse impacts of climate..."*[34] *"...to incorporate a gender-sensitive, pro-children and pro-poor perspective in all climate change and renewable energy efforts, plans and programs and in the implementation of plans and programs to address climate change in the context of sustainable development..."*[35]
Oposa v. Factoran	CDAsia; Jurisprudence/ SC Decision	1993	Obligation of the State Under the Philippine Constitution	*"The right to a balanced and healthful ecology carries with it the correlative duty to refrain from impairing the environment. It is the policy of the State to create, develop, maintain and improve conditions under which man and nature can thrive in productive and enjoyable harmony with each other and to ensure the attainment of an environmental quality that is conductive to a life of dignity and well-being...."*[36] *"...a framework to encourage sustainable development while assisting in the mitigation of greenhouse gas emissions must be established in a way that another Party can utilize them to meet their*

[32] Id.
[33] Ibid.
[34] Ibid.
[35] Ibid.
[36] Oposa v. Factoran Jr.,224 SCRA 792, 811, (1993).

				own nationally defined contribution..."[37]
Paris Agreement	UN Climate Change Website; International Treaty	2015 (adopted)	Obligation to reduce greenhouse gas emissions, particularly carbon dioxide (CO2)	*"The obligation of States to address climate change includes the enactment of laws to regulate businesses. These laws should hold enterprises within their jurisdictions legally liable for acts harming the environment and the climate system. In general, States must establish a general regulatory or policy environment that would incentivize the discovery, development, and use of clean energy. "*[38]
National Inquiry on Climate Change Report	Commission en Banc of the Commission on Human Rights; Government report	2022	Obligation to establish regulatory or policy	

Most of the countries, including the Philippines, are heavily dependent to fossil fuels to produce the electricity despite the present environmental laws and international frameworks mandating to reduce carbon emissions due to global warming. In addition, it is clearly shows that the Philippines is 80% dependent to fossil fuels to produce electricity and thus, it means that more fossil fuels are being burned in the country resulting to more carbon emissions released in the atmosphere. Therefore, the government has not performed its obligation under the Climate Change Act and the Paris Agreement creating adaptation and mitigation procedures to reduce carbon emissions and the increase in global temperature.

In an important victory in April 2018, Colombia's Supreme Court of Justice held the government responsible for failing to fulfill its obligation and commitments to combat climate change, which raised the nation's average temperature and jeopardized the rights of the young to life, health, food, and water, as well as a healthy environment. While in Leghari v. Republic of Pakistan, a farmer from the area sued the Pakistani government for failing to implement adequate adaptation measures and the ensuing harm to his.
In relation thereto, under the Philippine context, in the case of Segovia v. Climate Change Commission[39], a case was instituted due to the failure of the government to perform the acts mandated by environmental laws which results to prejudice to right life, health, and property of the citizens which is tantamount to detrimental effects to natural resources such as land, water, and air.

[37] Paris Agreement to the United Nations Framework Convention on Climate Change, Dec. 12, 2015, T.I.A.S. No. 16-1104.
[38] Commission on Human Rights. (n.d.). *National Inquiry on Climate Change Report.* https://chr.gov.ph/nicc-2/
[39] Segovia v. Climate Change Commission, 806 PHIL 1019-1053 (2017).

As supported by other jurisprudence, in the case of Cordillera Global Network v. Paje,[40] the court held that the state has the obligation to protect the environment and the healthful ecology from disruption and imbalance even though there is no specific provision providing the same. It was also supplemented in the case of Laguna Lake Development Authority v. Court of Appeals, in which the court ruled that immediate response to the demands to protect the public interest is a vital part of the right to a balanced and healthful ecology.

Under the Philippine laws, the Electric Power Industry Reform Act of 2001 (EPIRA), it is the policy of the state to protect the interest of the public when it comes to the quality, reliability, security, and affordability of the supply of the electricity. In addition, the law mandates the Department of Energy to implement regulations in relation to energy supply in consideration of environmental protection and conservation and maintenance of ecological balance. On the other hand, under the Climate Change Act of 2009, it is the policy of the state to ensure the protection and advancement of the right of the people to a healthful ecology in accord with the rhythm and harmony of nature and establishes the state's adoption of climate goals under international frameworks.

These were important since all the aforementioned landmark rulings and laws were made that highlighted the importance of governmental action on climate adaptation based on human rights and constitutional safeguards. As a result, the state has the obligation to immediately address activities that causes any disruption to the environment and the imbalance to the healthful ecology.

More precisely, states are required by human rights legislation to take proactive steps to prevent and mitigate the effects of climate change and to make sure that everyone has the skills necessary to adapt to the environmental catastrophe. Because the climate catastrophe affects human rights, the human rights framework must be a part of the solution. The dangers to our human rights and the climate issue will only worsen if there are not considerable reductions in GHG emissions.

In fact, there are already developments in other countries to address environmental concerns by eliminating the use of fossil fuels or coal in energy production however, the Philippines does not have legal improvements to address the same. That being said, the government has the obligation to address both the environmental and energy-related concerns of the Proof-of-Work Consensus Mechanism since the latter has both inimical concerns about electricity, environment, and the people. This obliged the state to perform immediate mitigation and adaptation responses to the negative effects of the energy intensiveness of the Proof-of-Work Consensus Mechanism.

i. Refusal to Take Meaningful Action is a Human Rights Violation

Theme: Right to a Balanced and Healthful Ecology: A Human Rights Based Approach **Code: Refusal to Take Meaningful Action is a Human Rights Violation**				
Title of the document	**Source and type of the document**	**Year published**	**Key topic/s**	**Specific content/ quotation**
Climate Change Adaptation and Human Rights: An Equitable View	JSTOR; Journal Article	2013	Climate change, international human rights, adaptation apartheid, policies	*"This emphasizes the importance of ensuring that human rights norms and principles "guide and strengthen policy activities in the realm of climate change." The norms, standards, and guiding principles of international human rights treaties and declarations are essentially incorporated into a rights-based strategy for addressing climate change. According to the Committee on Economic, Social, and Cultural Rights in its Statement on Poverty, these norms, standards, and principles, which include "the entire range of civil, cultural,*

[40] Cordillera Global Network v. Paje, G.R. No. 215988, April 10, 2019.

				economic, political, and social rights and the right to development," direct and shape institutions and policies intended to combat climate change and empower those affected by it by granting them entitlements or rights."[41]
Report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment	Human Rights Council Website; Government report	2016	Combating climate change while taking into account their human rights obligation	*"Additionally, when taking action to combat climate change, parties should respect, promote, and take into account their respective obligations regarding human rights, the right to health, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities, and people in vulnerable situations, as well as the rights to development, gender equality, women's emancipation, and intergenerational equity."* [42]
National Inquiry on Climate Change	Commission en Banc of the Commission on Human Rights; Government report	2022	State obligation includes setting concrete metrics	*"Citizens may hold their governments accountable for failure to mitigate–not just adapt to–climate change. The pursuit of the State obligation to mitigate climate change cannot just be framed as aspirational, where the standard of fulfillment is vague and the timeline uncertain. Concrete metrics must be set against which States may be held accountable. Failing in this, States enable the human rights of their citizens to be harmed, which equates to a violation of their duty to protect human rights.* [43] *"For the purpose of holding States in failure of their human rights obligations in the context of climate change, which failure may, itself, be categorized as a human rights violation, it is sufficient to establish the absence of meaningful State resolve and action to address the*

[41] Hall M. & Weiss, D. (2013*). Climate Change Adaptation and Human Rights: An Equitable View*. https://www.jstor.org/stable/pdf/j.ctv941w8s.14.pdf?refreqid=excelsior%3A306aeb2c5a1fe8786e96a4b7341aea7d&ab_segments=&origin=

[42] Knox, J. H. (2017). Report of the special rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment: biodiversity report. *United Nations Human Rights Council, A/HRC/34/49, Wake Forest Univ. Legal Studies Paper*.

[43] Id at 56

			Holding states accountable when science cannot establish relationship between GHG and climate-related effects of particular party	*major anthropogenic actors and factors driving global warming. That science cannot yet establish to a high degree of accuracy the causal relationship between GHGs and specific climate-related effects on particular parties is a problematic only in establishing legal liability for the purpose of claiming awards for damages from specific parties, which is a matter for courts to determine."* [44]

Governments must be held accountable for upholding their international obligations and defending citizens' human rights by adopting swift and aggressive action in order to close the emissions gap. States who refuse to take action allow the human rights of their citizens to be violated, breaching their duty to protect human rights. The absence of meaningful State resolve and action to address the main anthropogenic actors and factors driving global warming is sufficient to hold States in violation of their human rights obligations in the context of climate change, which failure may, in and of itself, be categorized as a human rights violation.

Only in establishing legal liability for the purpose of claiming awards for damages from specific parties, which is a matter for courts to decide, is it problematic that science cannot yet establish with a high degree of accuracy the causal relationship between GHGs and specific climate-related effects on particular parties. States must implement regulations governing corporations as part of their duty to combat climate change. These regulations ought to make businesses operating under their purview accountable for actions that endanger the environment and the climate system

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[44] Ibid.

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A graduating AB Legal Management student of the Lyceum of the Philippines University - Manila. Aside from being a consistent dean's lister and scholar, she became the President of LPU LEX, the official student organization of AB Legal Management students at Lyceum of the Philippines University-Manila, from year 2021-2022. Subsequently, she became an intern at the Public Attorney's Office – Taguig District Office. She is persistently invited by some student organizations to talk about leadership and the role of youth in the present socio-political landscape.

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She also authored social science textbooks produced and distributed by different publishing houses like Mutya Publishing, Inc., HisGoPhil Publishing House, Inc and Panday Lahi Publishing, Inc. Aside from research and academic commitments, she manages also to take her knowledge, skills and values to be with community partners for capacity building, feeding programs, tutorials, need assessments, monitoring, and other community development engagements. Walls are Bad, Inc is one of the organizations she usually works with as a volunteer and an organizer as well. The university she is currently affiliated with is also keen on assisting the hunter-gatherers of the provinces of Aurora, Quezon, and Zambales – the *Dumagats* and the *Aetas.* These exposures then opened and led her to opportunities into studying the indigenous groups while providing them assistance to the needs of the community.