Improving Emissions Trading:

Indonesia as a Case Study

May 2022

The Nature Conservancy

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Frank Batten School of Leadership and Public Policy

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Client Profile

Founded in the U.S. through grassroots action in 1951, The Nature Conservancy has grown to become one of the most effective and wide-reaching environmental organizations in the world. They impact conservation in 76 countries and territories: 37 by direct conservation impact and 39 through partners. The International Climate Policy team works to advance international cooperation on climate issues like nature-based solutions, climate finance, and sustainable landscapes.

Disclaimer

The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, by the University of Virginia, or by any other agency.

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Abbreviations

AFOLU: Agriculture, Forestry and Other Land Use
BAU: Business as Usual
CDM: Clean Development Mechanism
COP (26): Conference of the Parties (26^{th} year)
CORSIA: Carbon Offsetting and Reduction Scheme for International Aviation
CPI: Carbon Pricing Instrument
ECR: Emissions Containment Reserve (part of RGGI)
ETS: Emissions Trading System or Scheme
EU: European Union
GHG: Greenhouse Gas
Gt: Gigatons (CO2)
(I)NDC: (Intended) Nationally Determined Contribution
IPCC: Intergovernmental Panel on Climate Change
LULUCF: Land Use, Land-Use Change and Forestry
MSR: Market Stability Reserve
MRV: Monitor, Report, and Verify
Mt: Megatons (CO2)
NBS: Nature-Based Solution
NCS: Natural Climate Solution (same as above)
PSAM: Price or Supply Adjustment Mechanism
RGGI: Regional Greenhouse Gas Initiative
SCC: Social Cost of Carbon
UNFCCC: United Nations Framework Convention on Climate Change
USD: United States Dollars

Key Terms

Allocation: the method through which the jurisdiction distributes allowances in a compliance cap-and-trade system.

Allowance: a permit that allows an entity to emit a set amount of a regulated substance. In the case of a carbon market, this is one ton of CO2e.

Cap: the limit on total allowable greenhouse gas emissions as determined by the jurisdiction in a cap-and-trade compliance market.

Offset credit: a certified credit sourced from a project that measurably reduces greenhouse gas emissions that is verified to meet additionality, permanence, and non-leakage requirements. Once certified, a credit can be purchased by an entity to "offset" their greenhouse gas emissions.

Executive Summary

Climate change has grown to become one of the most pressing international concerns over the past few decades. Due to a vast body of research and growing interest in the field, carbon pricing has become one of the leading ways to address externalities caused by climate change. From supranational to subnational, carbon markets can serve as a cost-effective way to address excessive emissions. Indonesia is one of many countries worldwide working to reduce their emissions to mitigate climate change. As one of the world's top 10 emitters, Indonesia plays an essential role in reducing its global CO2 footprint. The externality costs of climate change to Indonesia are enormous—totaling approximately USD $89 billion, even when utilizing a lower bound estimate of the social cost of carbon (Appendix, Calculations). One approach the government is developing to address this issue is a carbon market. Since the government is still drafting the regulations on the structure of the market, a window of opportunity to influence policy exists presently.

Carbon markets have proven impacts on emissions reduction, but in practice, these impacts can be smaller than desired (Best et al., 2020). A review of existing literature on carbon markets revealed there are several structural improvements that might bolster the beneficial effects of an emissions trading scheme (ETS). These include an initial cap below business-as-usual emission levels, price collars on allowances, using auctions for allocation, and limiting international and domestic credit use.

An analysis of the economic impact, emissions reduction impact, and political feasibility of each option reveals that the most important structural feature to implement could be a low initial cap. Ideally, a jurisdiction should consider each alternative as a best practice and strive to implement all of them since each element interacts with the others to create a well-functioning carbon market. But overall, this analysis reveals a cap below business-as-usual emission levels is essential to a well-functioning carbon market.

Problem Statement

In the face of devastating consequences from global warming, mitigating emissions has become a global necessity (IPCC, 2021). To limit emissions, multiple countries are turning to market-based solutions. Looking into implementing and improving an Emissions Trading System (ETS) is a natural step for many countries interested in climate change, not only because carbon markets are growing in popularity as an implementation mechanism, but also because they can be quite cost-effective at mitigating emissions (Schmalensee & Stavins, 2019). As more and more jurisdictions adopt carbon markets, the body of literature on their efficacy and best practices grows, and they become safer, well-tested options to implement. Indonesia is one of those jurisdictions now looking to take the leap into ETS implementation with a hybrid carbon trade and tax approach. However, carbon markets are not reducing CO2 emissions as effectively as they should in theory (OECD, 2021). How can countries like Indonesia utilize Emissions Trading Systems more effectively to reach their emissions mitigation goals?

Introduction

Climate change has grown to become one of the most pressing international concerns over the past few decades. Internationally, 197 nations agreed it was essential to take action to prevent dangerous anthropogenic interference with the climate system when they became parties to the United Nations Framework Convention on Climate Change (UNFCCC, 2021b). At the Conference of the Parties (COP) in 2015, these countries took further action by signing on to the Paris Agreement, which introduced Nationally Determined Contributions (NDC). NDCs lay out a voluntary emissions reduction target and a plan to achieve it, as determined by the country. However, even with the existence of NDCs, Climate Action Tracker still projects that the earth with experience 2.4 °C of warming by 2100 (Stockwell et al., 2021). The total global greenhouse gas (GHG) emissions level in 2030, even taking into account implementation of all the latest NDCs, is still expected to be 16.3% above 2010 emission levels. This is far from the estimated 45% GHG reduction from 2010 levels necessary to avoid overshooting a total warming of 1.5 °C (UNFCCC Secretariat, 2021). This would lead to catastrophic outcomes internationally, as projected by the IPCC in its sixth assessment report (IPCC, 2021). Therefore, it is of the upmost importance that every country makes sincere efforts to limit their greenhouse gas emissions to achieve and even outperform their NDC targets.

Indonesia is one of many countries worldwide working to reduce its emissions to mitigate climate change. Indonesia was the world's eighth largest emitter in 2018, and consistently ranks in the top ten over the past two decades (Friedrich et al., 2020). Presently, national emissions are decreasing, but not at a fast enough rate (Climate Watch, 2018). Indonesia is not currently on track to reach its necessary emissions reduction goal, which will lead to massive ecological consequences if the problem continues unabated (Climate Action Tracker, 2021). Putting a price on carbon is an essential step to reach an appropriate level of global mitigation.

Indonesia is in a transitional policy stage right now because the country is looking to reduce CO2 emissions but is still in the trial stages of a few options. One is a carbon market mechanism. In March of 2021, the Indonesian Minister of Energy and Mineral Resources announced the launch of a voluntary emissions trading trial for the power sector (Ministry of Energy and Mineral Resources, 2021a). Because the final program is still under development, there is room for structural changes before a national rollout. This presents an opportunity to apply best practices learned from past emissions trading scheme (ETS) implementation.

The Cost of Climate Change

Externalities are easily the largest source of costs to Indonesia born from climate change. The purpose of carbon pricing is to internalize costs from GHG emissions. There are a variety of estimates for pricing carbon across the world that may help reveal the relative costs of carbon and how it should be accounted for. In Indonesia, there will a set price on carbon of USD $2 per ton/CO2 in effect next year, but this is considered low. It also will only apply to coal-fired power plants initially (Asia News Network, 2021). In comparison, Canada and the EU price carbon at USD $20 and $30, respectively (The World Bank, 2021a). However, Indonesia's price is regionally competitive in relation to Singapore and Japan, which both have prices below USD $4 (World Bank, 2019). Environmental economists label this externality as the "social cost of carbon". U.S. federal agencies have collaborated to estimate this marginal cost to be approximately USD $40 per additional ton of CO2 on average (Brooks, 2016). Research from the OECD suggests that an ideal carbon price per ton internationally ranges from USD$35 on the lowest side to $140 at the most ambitious, with a midrange benchmark of $70 (OECD, 2021).

Indonesia's total CO2 emissions in 2018 across all sectors, including land-use change and forestry, were 1270 Mt CO2 (Climate Watch, 2021). This is equivalent to 552.09 Mt CO2 in the energy sector alone (Climate Watch, 2018). A simple estimate of the externality cost can be derived by multiplying Indonesia's CO2 emissions by the recommended carbon pricing per marginal ton. Using the country's total emissions and the estimated cost of USD $35 to $70 would lead to an estimated range of USD 44.45-88.9 billion (Appendix, Calculations). This would be the ideal circumstance in which Indonesia also considered its land use change and forestry emissions, since they account for approximately half of total estimated emissions. A more reasonable cost estimate for the political realities would be to use the lower bound price of USD $35 with emissions from only the energy industry, which is equivalent to USD $19.32 billion (Appendix, Calculations). The larger estimates are still relevant when considering the negative consequences of carbon emissions that will continue to exist, as well as Indonesia's stated goal to achieve net zero emissions by 2070 (Republic of Indonesia, 2021). The country will need to consider emissions from all industries eventually.

These cost estimates do not include potential direct costs associated with climate change adaptation and loss and damage, which would present even greater costs on top of the externalities.

Background

Carbon Pricing

Financial mechanisms use the market to improve carbon emissions, as opposed to a "command and control" approach, which can take the form of mandated environmental standards. The most common financial regulatory approaches are cap and trade or taxes. Cap and trade allows for certainty on reduction goals, while a carbon tax allows for price certainty. There is a robust body of literature on the economics of why pricing carbon is important. Economic solutions to climate change broke into mainstream discussion following the 2007 publication of the Stern Review on the Economics of Climate Change. Stern carried out a rigorous cost-benefit analysis of climate change, totaling over 600 pages. He concluded it was essential to invest immediately and extensively in policy to avoid the worst possible climate outcomes (Weitzman, 2007). Since the release of that review, several other prominent economists have released analyses of the Stern review. While they critique some of his discount rates and cost estimate approaches, they all agree climate change requires immediate economic action (Nordhaus, 2007) (Weitzman, 2007).

Since 2007, the field of environmental economics has grown substantially with different emerging theories on carbon pricing techniques. Carbon pricing stems from the idea that carbon emissions create an externality that is not being priced appropriately in the market. To internalize this externality, economists suggest pricing carbon into the market through a carbon tax or carbon market policy. William Nordhaus has previously suggested the best way to achieve significant emissions reductions is through a global carbon tax (Nordhaus, 2011). More recently he has written about how to use carbon clubs to implement a global carbon price while detering freeriding (Nordhaus, 2020). Another area of research is the social cost of carbon (SCC). Nordhaus also discussed the importance of estimating a social cost of carbon for understanding and implementing climate change policies (Nordhaus, 2016). The social cost of carbon can help policymakers determine an appropriate price on carbon. Estimations of both the social price of carbon, and therefore, a price on carbon, vary, but the vast body of research recommends a global price on carbon in the range of USD $50-120 per ton of carbon by 2030 (OECD, 2021) (High-Level Commission on Carbon Prices, 2017). Carbon pricing implementation should take into account a variety of factors when determining an appropriate price for the local context, including revenue use from carbon pricing, the political economy, and social attitudes towards pricing mechanisms (High-Level Commission on Carbon Prices, 2017).

Cap and trade is a kind of policy where the government or another organization sets an overall cap on the right to pollute a certain substance and then allocates allowances freely or through auctions (International Carbon Action Partnership, 2021b). Those allowances can then be traded on the market or sometimes banked for future use. The United States was a former leader in cap and trade policy when it first implemented cap and trade to reduce lead in gasoline, and later sulfur dioxide as part of the Clean Air Act in the 1980s and 1990s (Schmalensee & Stavins, 2019). Since then, cap and trade policy has expanded globally to include various kinds of carbon markets. A carbon market is a more specific term for a cap and trade policy that specifically targets carbon dioxide and other greenhouse gas emissions. There are two kinds of markets: voluntary and compliance. The voluntary market exists for businesses and other entities looking to offset their emissions to achieve self-imposed reduction goals. Compliance markets, the focus of this review, are markets formally established by legislation in a jurisdiction.

Carbon Market Structure

Emissions can have a set quantitative limit cap or intensity targets (Diaz-Rainey and Tulloch, 2018). Carbon markets can also vary in the sectors they cover, like energy, transportation, or agriculture, though the most efficient and effective market would cover all sectors with an equal price (See Appendix Figure 1). The most common form of a carbon market is an emissions trading scheme, or ETS. Emissions trading schemes have flexibility built into the system in a variety of different ways. As previously mentioned, allocations can be purchased and banked for future use; they can also potentially be borrowed, which is when a company "borrows" allowances from future trading periods (International Carbon Action Partnership, 2021c). However, this strategy is typically limited or prohibited (International Carbon Action Partnership, 2021c). Another option for carbon markets is linking, which is when one emissions trading system is linked with another system, effectively merging the two. This offers access to more emission reduction options and can decrease mitigation costs (International Carbon Action Partnership, 2021a). It also reduces competition concerns. Carbon markets can be created and regulated at all levels: city, state or province, regional, national, and even international.

One component of flexibility that interplays with carbon markets is the role of offset credits. Offsets, also known as carbon offsets or carbon offset credits, are a means of essentially canceling out greenhouse gas emissions elsewhere in the world. One credit is equivalent to one ton of CO_2 (Broekhoff et al., 2019). Carbon offset credits are produced through projects that reduce emissions or increase carbon sequestration, like avoided deforestation (Broekhoff et al., 2019). An offset credit must meet three requirements in order to qualify as a certified, purchasable credit: additionality, permanence, and non-leakage (Parajuli et al., 2019) (Broekhoff et al., 2019). Jurisdictions with an ETS have different approaches to offsets, including whether they allow importation of international offsets to count towards required abatement goals, whether they allow domestic purchasing of offset project credits, or whether offsets are permitted at all.

The Present State of Carbon Pricing

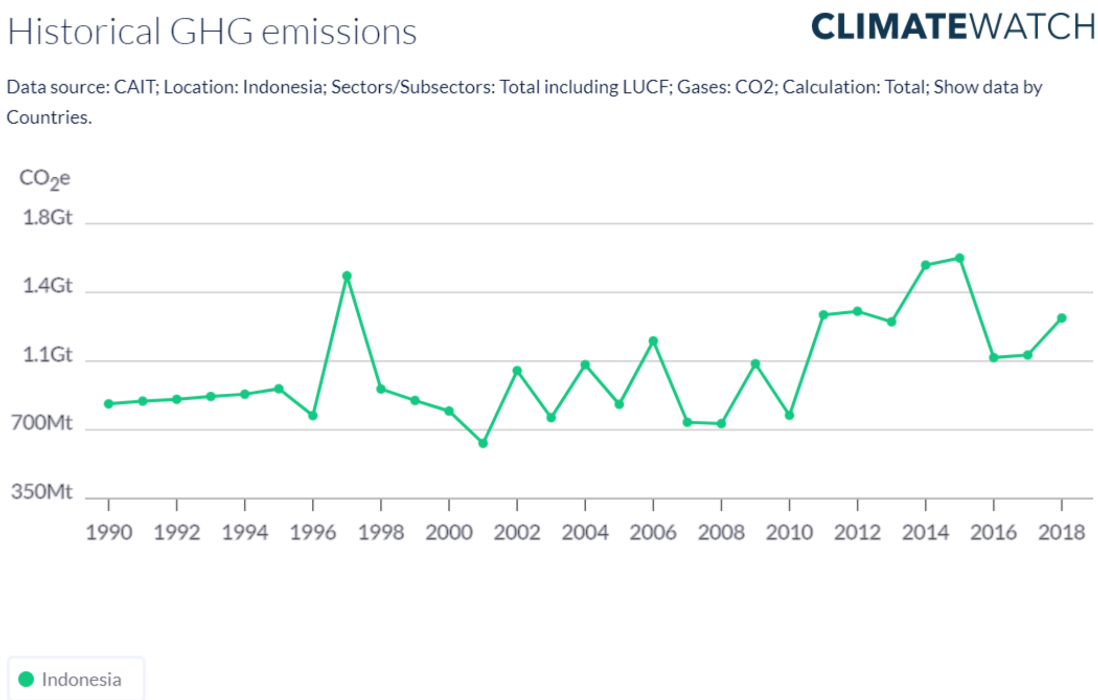
Worldwide in 2021, there were 64 operational carbon pricing instruments with three scheduled for implementation. However, only 3.76% of global emissions are covered by a carbon price at or above the USD \$40–80/tCO_2 range needed in 2020 to meet the 2°C temperature goal of the Paris Agreement (The World Bank, 2021b).

Indonesian Context

Indonesia is presently the fourth most populous country in the world, with 274 million people living across the 17,000+ islands that make up the nation (Dunne, 2019). Indonesia's GDP was USD $ 1.06 trillion in 2020, making it the 16th largest economy in the world, though it should be noted the population experiences sizable income inequality represented in a low GDP per capita (The World Bank, 2020). Its top industries include agriculture, manufacturing, and services, and major exports include coal and palm oil (Asian Development Bank, 2020). The country is a democracy led currently by President Joko Widodo (Dunne, 2019).

Emissions History

Indonesia's carbon emissions have varied over time. Over the last 50 years, the annual emissions of CO_2 alone have increased from 50 million to 600 million tons of CO_2 (Climate Watch, 2021). There were substantial spikes in 1997 and 2015 due to severe forest and peatland fires that contributed vastly to emissions from the LULUCF sector (Carrington, 2015).



There is presently an overall decrease in emissions, but emissions will need to continue to drop dramatically in the next few years to be impactful enough to limit dangerous climate effects. In recent decades, Indonesia has overlapped closely with Japan's CO2 emissions. In the East Asia Pacific region, China, Indonesia, and Japan have been the top three emitters for the past several years. Globally, Indonesia remains in the top 10, especially due to changes in the LULUCF sector (See Appendix Figure 2).

Indonesia's most emitted gas is CO2, with methane coming in second, as is typical internationally. The top sources of methane are the waste and agricultural sectors, while top CO2 emitting sectors are land use change and energy (See Appendix Figure 3). However, LULUCF data is notoriously hard to measure accurately; Climate Watch rates the uncertainty of their forestry and other land use data as ± 50% (Climate Watch, n.d.). CO2 emission from fossil fuels, however, are known with only an 8% uncertainty (Climate Watch, n.d.). Therefore, it may be best to acknowledge that land use is a major contributor to Indonesian CO2 emissions, but to pay closer attention to numbers surrounding CO2 emissions from sectors excluding LULUCF. Under these circumstances, the largest source of CO2 emissions is by far the energy sector, with 552 MtCO2 in 2018 (Climate Watch, 2021) (See Appendix Figure 4). It makes sense that Indonesia would address this sector with some form of carbon pricing to improve emissions. Within the energy sector, a sizeable portion of power generation comes from coal fired power plants, with plans for more in the future. This is concerning since coal is considered the "dirtiest" and most carbon-intensive of the fossil fuels (IPCC, 2021).

Addressing Emissions

As a ratifier of the Paris Agreement, Indonesia has submitted a Nationally Determined Contribution, most recently updated in summer 2021 (Republic of Indonesia, 2021). Its NDC targets include an unconditional reduction in emissions of 29% below BAU levels by 2030, or a 41%

decrease with the necessarily financial support from other countries and institutions. Sectors covered by this target include land use and forestry, energy, waste, industrial processes and product use, and agriculture. Indonesia's long-term strategy, which was submitted with its updated NDC, also included an intention to achieve net zero by 2060, which is 10 years later than the international goal of 2050 (NDC Partnership, 2022). Indonesia's current NDC targets are rated as "highly insufficient" externally because it does not align with Indonesia's estimated "fair share" based on its emissions reduction to emissions ratio (Climate Action Tracker, 2021). Indonesia has also been criticized for the ambition of its NDC targets because they are considered easily attainable with almost no changes to the forestry sector alone, based on some projections (Dunne, 2019). Indonesia argues in its NDC that the targets are fair and appropriately ambitious because of more pressing concerns with poverty alleviation and GDP depression due to COVID (Republic of Indonesia, 2021). Beyond greenhouse gases, Indonesia's NDC also includes commitments to restore two million hectares of peatlands and twelve million hectares of degraded forests, which would improve carbon sequestration in line with Indonesia's goal to transform forests into a net sink rather than source of CO2 (NDC Partnership, 2022).

Government Regulations on Carbon Pricing

The Indonesian government has produced a variety of regulations on carbon pricing in the past several years. The foundation for carbon pricing in the country comes from "Government Regulation No. 46/2017 on Environmental Economic Instruments", passed in 2017 (ICAP, 2022b). President Widodo has since expanded on this government regulation with a presidential regulation, which is similar an executive order in the United States. "Presidential Regulation No. 98/2021 on the Instrument for the Economic Value of Carbon for Achievement of the NDC and Control of Carbon Emissions in Development", signed in October 2021, will serve as the legal framework for domestic carbon pricing regulations (ICAP, 2022b). This presidential regulation is intended to work in conjunction with Law No. 7/2021, "Concerning Harmonization of Tax Regulations", which formally established the nation's first official carbon tax (ICAP, 2022b). The tax will scale up in phases, starting with only applying to coal-fired power plants in July 2022. The tax was initially supposed to begin in April but was delayed to aid Indonesia's recovery from recession (Asia News Network, 2022).

Plans for Economic Mechanisms

The Ministry of Finance aims to approach climate change and conservation as an opportunity to generate revenue with projects that green the economy, rather than automatically considering environmental improvements a budgetary sink. This includes projects like "Green Sukuk", a type of environmentally friendly bond (Jakarta Post, 2018). For pricing carbon, Indonesia has signaled plans for a hybrid approach, utilizing multiple different economic mechanisms in an interconnected way to best address emission externalities across sectors. The government intends to use a combination of an emissions trading system, a carbon tax, and results-based payments. The expectation is that sectors covered by the emissions trading scheme will not have to pay the carbon tax on their emissions if they meet the requirements of the ETS (ICAP, 2022b). Presently, the government expects the power sector to be covered by the ETS, the forestry sector to engage with results-based payments, and the rest of the economy to be covered with the carbon tax, starting with the energy sector. The government hopes this will provide a fiscal incentive for industries to make necessary changes. In preparation for a more robust carbon market, the government launched a pilot voluntary emissions trading program covering only select coal power generation plants, which ran through the summer of 2021 (ICAP, 2022b). It included 32 total power plants, with 14 acting as buyers and 18 acting as sellers (Ministry of Energy and Mineral Resources, 2021b). Power plants producing energy from renewable sources served as the producers of carbon credits. The pilot resulted in 42,455.42 tons of CO2 transferred at an average unit price of USD $2 per ton over 28 separate transactions (Directorate of Electricity, 2022). This analysis will look into improvements to ETS policy exclusively since the Indonesian carbon tax has exited the planning stage and will officially entered into force July 2022 (Asia News Network, 2022).

Literature Review

Evidence on Carbon Pricing

Though the first emissions trading scheme, the European Union Emissions Trading Scheme (EU ETS), did not come into effect until 2005, there is still a substantive body of literature analyzing carbon pricing and existing carbon markets around the world (Parker, 2019). Carbon pricing is generally thought to have a positive effect towards emission reduction efforts, though sometimes small (Best et al., 2020) (Hibbard et al., 2018) (Murray & Maniloff, 2015) (Lin & Li, 2011). A study of 142 countries on the effect of a carbon price on CO2 emissions from fuel combustion from 1997-2017 found that the average annual growth rate of CO2 emissions from fuel combustion was two percentage points lower in countries that had a carbon price compared to countries without (Best et al., 2020). An additional euro per ton of CO2 in carbon price is associated with a subsequent reduction of approximately 0.3 percentage points in the annual emissions growth rate (Best et al., 2020). While it is impossible to fully control for all relevant influences on emissions growth, the results suggest that the emissions trajectories of countries with and without carbon prices tend to diverge over time. Bayer and Aklin find that the EU ETS policy was responsible for 1.2 billion tons of decarbonization from 2008 to 2016. This is an additional reduction of about 7.5% relative to the emissions covered under the EU ETS, or roughly 3.8% compared to the EU's total emissions (2020). Studies on earlier trading periods of the EU ETS find similar results; in Phase I, the EU ETS was responsible for reducing emissions by 2.4 to 4.7% from the counterfactual (Ellerman and Buchner, 2008) (Anderson et al., 2011). Beyond just the European Union, other carbon markets have shown promising results. The study by Murray and Maniloff found that emissions in the electricity sector dropped by 52% during the period the Regional Greenhouse Gas Initiative took effect and 24% of those reductions were attributable to RGGI (2015). In California and Quebec, the cap and trade program on emissions has overperformed on its reduction goals even with a cap on sectoral emissions below BAU levels (Narassimhan et al., 2018). Another study finds that carbon pricing does have some impact on reducing emissions, especially in a hybrid ETS and tax format; though policies will need to increase in ambition to meet the thresholds for avoiding detrimental climate impacts (Kiss & Popovics, 2021). Despite prices being lower than the estimated social cost of carbon, carbon markets can impact emissions. The results suggest that continual increases in price and/or sectoral coverage could lead to even more substantial results.

Beyond emissions, carbon markets can also have economic benefits. An analysis of the Regional Greenhouse Gas Initiative (RGGI) found that over the first three compliance periods, 2009 to 2017, RGGI produced a net benefit of USD 4.7 billion through changes in the electricity sector and direct use of auction proceeds (Hibbard et al., 2018). Those proceeds improve citizens and the environment by being invested into green energy projects and electricity bill rebates.

Some academics oppose carbon pricing, arguing that global ambition is now oriented towards eliminating carbon emissions entirely, and therefore, carbon pricing mechanisms are no longer relevant. One paper states that carbon prices are outdated because the markets themselves do not show to have deep impact on emissions reduction (Patt & Lilliestam, 2018). However, the authors note that oftentimes moderate carbon prices generate revenue needed to fund programs that contribute to observed changes in emissions overtime. This benefit alone offers enough reason to keep carbon pricing in the picture as a policy option. Another argument is that carbon pricing has no effect on zero-carbon investment (Lilliestam et al., 2020). This conclusion is refuted by van den Bergh & Savin, who say they do find evidence of a small but positive effect of carbon pricing on low-carbon innovation (2021).

While carbon markets can have net-positive outcomes for society, there are a few design flaws, namely, leakage and heavy linkage, that should be avoided based on research. Leakage can be a serious concern, especially in subnational markets or markets covering electricity (Caron et al., 2015) (Fell & Maniloff, 2017) (Lee & Melstrom, 2018). Leakage happens when one jurisdiction setting a cap on emissions causes industries to outsource production of a good to areas not covered by the cap due to increased costs. This can lead to zero net improvement of conditions if emissions only move across borders instead of decreasing below overall business as usual levels. There are cases of this happening in California and RGGI (Caron et al., 2015) (Fell & Maniloff, 2017). However, leakage can vary in severity; sometimes it takes the form of increased emissions in leaker regions, but the generation of energy in those leaker regions might show a transfer to less emissions-intensive generation (Fell & Maniloff, 2017). Leakage is of particular concern in a market structure like Indonesia since the market currently only covers power generation, the most susceptible sector to leakage (Schmalensee & Stavins, 2019) (Asia News Network, 2021). There are solutions to this problem; namely the carbon border adjustment tax, which charges a tax equivalent to the amount of the regional carbon price on imports. This removes the competitive advantage of producing outside of the regulated area. So far, the European Union is the only place to actively pursue this policy (The World Bank, 2021b). Another issue is overly ambitious linking policies. In New Zealand, unlimited market linking caused prices of the domestic emissions unit to bottom out, generating no auction income for the country and fewer credible emissions reductions due to poor-quality offset credit imports (Diaz-Rainey & Tulloch, 2018). Unlimited linking in New Zealand led to no credible firm-level emissions reductions because of the abundance of cheap offset credits available (Bullock, 2012). Smaller emissions trading systems should impose a quantitative import restriction on credits in order to maintain market integrity.

One concern addressed by some carbon markets is price volatility from supply heavily outpacing demand. There are two current methods used to solve this problem: a quantity collar, like the Market Stability Reserve mechanism used by the EU ETS, and a price collar, which includes a price floor and ceiling on allowances. A market stability reserve mechanism, or MSR, is a relatively new component to carbon markets designed to avoid system shocks during periods of economic uncertainty. The EU was the first to create an MSR, conceptualized following the 2008 economic depression (Knopft et al., 2014). The purpose of an MSR is to set quantity thresholds on the number of allowances in the market. If the quantity crosses a threshold, a predetermined amount is then added or removed from the market. If, for example, the initial cap is too high and allowance supply heavily outpaces demand, the MSR will remove extra allowances and bank them for the rest of the trading period (Narassimhan et al., 2018).

Some research makes the case that a Market Stability Reserve should have set price collars rather than just quantity floors to improve market stability and price certainty (Holt & Shobe, 2016)

(Flachsland et al., 2019) (Knopf et al., 2014) (Richstein et al., 2015). This is proven to increase market stability and reduce price volatility. At times, a quantity collar like the EU MSR can produce worse outcomes than a market with no stability mechanism (Holt & Shobe, 2016). The Regional Greenhouse Gas Initiative is one example of an ETS that plans to implement price collars in its next trading period (Holt & Shobe, 2016).

ETS Best Practices

The currently available literature offers a variety of suggestions for best practices when implementing a carbon market. The performance of a market depends on how well it is designed. Economy-wide systems are feasible, though sectoral programs are more common (Schmalensee & Stavins, 2019). Free allowance allocation has proven to help build political support for carbon markets up front (Schmalensee & Stavins, 2019). One issue with the EU ETS was that it started with an initial cap that far exceeded actual emissions due to the decentralized, bottom-up approach of creating the cap (Parker, 2019). The cap should be determined ideally in a less political and more scientific way. The good thing is that ETSs exhibit policy diffusion as jurisdictions implement positive lessons from other places over time (Parker, 2019). There is some overlap between what has worked well in existing ETS that provides lessons learned. These include:

- Only allow very limited domestic credits and no use of international credits for meeting compliance goals
- Start with a strong initial cap
- Use price collars to regulate oversupply
- Cover more sectors with the ETS
- Have a more dramatic cap reduction every compliance period
- Limit free allowance allocation; start using more auctions and scale up over time
- Include strong anti-leakage protections, like a carbon border adjustment tax
- Membership flexibility for coalitions (ex. EU)
- Allow banking
- Data and rule transparency
- Penalize non-compliance

While there is substantial room for making carbon markets more effective along these lines, best practices often fall by the wayside during practical policy design due to the highly politicized nature of the issue. Therefore, this paper will address some political feasibility aspects of the issue but will primarily opt to suggest best practices based on an ideal scenario in which the political environment lines up with designing the best possible emissions trading system.

There are many considerations for structuring a carbon market which are touched on across the literature. This paper intents to give only a high-level view of a few structural options to improving the efficiency of carbon markets. Therefore, I won't be going into great detail on all of the ways to improve. There are many technical reports out there that offer greater detail. The following alternatives were selected based on the research supporting them as improvements. Additional considerations such as banking and linking are not discussed because they are widely standardized across existing markets.

Alternatives

1. **Low initial cap**

One issue with the EU ETS was that it started with an initial cap that far exceeded actual emissions due to the decentralized, bottom-up approach of creating the cap (Parker, 2019). This alternative recommends a government set an absolute emissions cap lower than the business as usual (BAU) scenario for the sector emissions it is covering. The emissions scheme will not function effectively if the cap is not, at minimum, set lower than BAU levels. This alternative will only apply to countries in the beginning stages of designing an ETS, since existing markets will already have a set cap from when they went into effect. Ideally, the cap should come from peer-reviewed scientific research based on a combination of what emissions levels are and the potential effect the allowances could have on the economy compared to the potential for CO2 reduction (PMR & ICAP, 2021). In the case of Indonesia, the government will likely set an intensity-based target on emissions rather than an absolute cap. While an absolute cap is easier to monitor, this alternative still applies to intensity-based targets by recommending an intensity cap below typical emission rates.

2. **Price collar**

This alternative recommends implementing a price collar to improve the stability of an ETS. Based on the literature, the most useful price collar has a price floor and a soft price cap. A soft collar "uses an allowance reserve to buffer the short-run supply of allowances, but does not explicitly limit the market price" (Holt & Shobe, 2016). I do not recommend a quantity-based collar like the EU MSR. A price collar modeled similarly to that of RGGI would improve market stability and confidence in the market, while a quantity-based collar might harm market stability (Holt & Shobe, 2016).

3. **Rely on auctions**

An essential component of carbon market structure is how the emission allowances are distributed. There are a variety of ways through which the initial new allowances can be distributed from the government before they are traded between companies on the market. Two of the most common ones are through free allocation or auctions. Free allocation is when the government provides a set of number of allowances for free to the businesses that need them based on some type of criteria, such as their historic emission levels. Auctions mean that the government puts the allowances up for auction, so the companies must immediately pay to receive the right to pollute. This auction revenue collected by the government can then be distributed towards environmental benefits or consumers in a variety of ways. Carbon markets almost always use a combination of these methods, but most rely primarily on free allowance over auctioning (Ji et al., 2018). RGGI is the exception, distributing more than 80% of allowances via auction (Lee & Melstrom, 2018). This method has proven benefits for its constituents, as it generates huge amounts of revenue that then return to electricity consumers via credits on their bills and other environmental project funding (Lee & Melstrom, 2018). This alternative suggests that more carbon markets should rely more heavily on auctions up front based on the established benefits auction revenue can have not only on environmental emissions reductions and state funded projects, but also fiscal offsets for consumers to help accommodate price increases that may arise from carbon markets. Free allowance is proven to help generate buy-in for carbon markets, so this alternative does not suggest relying entirely on auctions immediately; it only suggests utilizing auctions for at least 50% of allowance distribution (Dworsky et al., 2009).

4. **Limited domestic credit use**

Carbon markets are structured in a way so that individual businesses within a covered sector must meet certain benchmarks during a compliance period. Sometimes, jurisdictions allow offset credits separately from allowances to be used to cover a portion of their compliance requirements. Because offset credits do not sustainably reduce emission levels, they should not be permitted as a long-term solution to meeting compliance period goals. If companies can simply buy additional offsets at lower prices than domestic allowances, it means they will make no serious efforts to alter industrial processes. This is especially relevant when considering international credits because international credits often are lower priced and lower quality than domestic credits (Diaz-Rainey & Tulloch, 2018). Unlimited access to international offset credits means no revenue for the government and no net emissions reductions globally. Therefore, this alternative suggests carbon markets should be structured in a way that do not allow international offset credit use and limit the fraction of domestic credit use that can be used towards meeting a compliance goal. In some systems this can be 20%, and others it can be zero (Ji et al., 2018). The appropriate percentage will depend on the context of the country.

Criteria

This analysis will use three criteria to compare the alternatives: potential economic impact, potential emissions reduction, and political feasibility.

Potential economic impact:

This criteria will investigate possible economic disruption to industries covered by an emissions trading system. Economic impact includes impact on GDP as well as potential impacts on the market stability of an emissions trading system. Alternatives will be rated as low, medium, or high based on their potential negative impacts to the economy. An alternative rated as low is best, because it means it will have minimal negative impacts to GDP, or actively improves market stability. An alternative rated as high is worse because it means it may potentially disrupt industry activity at a rate that could inhibit growth and endanger future implementation of economic mechanisms.

Potential emissions reduction:

This alternative considers the quantity of avoided emissions in tons of CO2 an alternative could produce in a given year. An alternative may be rated as high if it offers strong potential to directly reduce a substantial quantity of CO2 emissions. An alternative may be rated as low if it has little direct impact on emissions.

Political feasibility:

For this criteria, I will evaluate the outlook of three factions in society: government, private sector, and civil society. Within each faction, I will look at a range of relevant stakeholders selected for their relevance to Indonesian climate policy and rate their outlooks on the alternatives as positive, neutral, or negative, or N/A if research is inconclusive. Based on the outlooks, I will assign each faction an overall outlook from the average of the responses. An alternative will be rated as low, medium, or highly politically feasible depending on how broad consensus is. If the government, private sector, and civil society all view an alternative positively, it is highly feasible. Depending on the level of disagreement, the alternative then becomes medium or low in terms of feasibility.

These are the stakeholders I will be looking at:

Government

- Ministry of Finance
- Ministry of Energy & Mineral Resources
- Ministry of Environment & Forestry
- Coordinating Ministry of Maritime Affairs and Investment

Private Sector

1. PT Indonesia Power: private power company
2. PT PLN: state-owned power company
3. Association of Indonesia Forest Concession Holders (APHI)

Civil Society (The general public is not very influential at this stage in the process; they are not invited to provide feedback on the various options considered by the government, so there is no indication of public opinion from official townhalls or surveys.) Instead, we can use information from think tanks and academia as a proxy for public opinion.

- Institute for Essential Services Reform
- Climate Policy Institute (CPI)
- University of Indonesia

To allow for easier comparison, each alternative will be scored based on the criteria. For economic impact, low=3 points, medium=2 points, and high=1 point. For emissions impact and political feasibility, low=1 point, medium=2 points, and high=3 points. These criteria are weighted equally, with each representing a third of the score. This is because all three of these areas represent important considerations for the policy implementation process.

Analysis

Alternative 1: Low Initial Cap

Criteria 1: Potential economic impact

A cap below BAU levels would have different impacts on GDP depending on how far below BAU levels the cap is. There are presently no existing cases to draw upon for comparison of how this alternative might affect the economy adversely, because so far there have only been cases of jurisdictions setting a cap too high rather than too low. This option is rated **medium** because it could have a noticeable impact on GDP if the cap is too far below BAU levels, but it does not rank high since it is so politically and logistically unlikely that a government would set an intensity target well below what would be economically feasible.

Criteria 2: Potential emissions reduction

The impact on emissions is directly proportional to the total cap set by the government, assuming it as an absolute cap. That is the one certainty in carbon markets: the level of emissions reduction. Therefore, if the government sets a cap at or below business-as-usual emission levels, then that cap will be attained since the cap sets the number of available allowances and, by extension, their price. RGGI and the Quebec ETS are examples of systems that set a cap below sectoral BAU emissions at the beginning of a compliance period. We may draw anecdotal evidence from the fact that both have been proven to reduce their emissions at faster rates than systems like the EUETS, where the cap was higher than the rate of sectoral emissions (Narassimhan et al., 2018).

In Indonesia, it is likely the government will opt for intensity-based targets since each of the five sectors identified by the NDC are expected to set their own sectoral reduction targets according to the presidential decree, and the 2021 carbon market trial was intensity-based. Even with an intensity-based target, this alternative will have strong impacts on emissions reduction because having a cap below BAU levels will certainly reduce emissions. The degree of the emissions reduction will depend on just how low below business-as-usual the cap is, but, this alternative ultimately ranks as **high** because of how directly it has the potential to reduce emissions.

Criteria 3: Political feasibility

The private sector appears neutral on this issue, offering general support for carbon markets with no mention of low caps affecting profits (APHI Center, 2021a) (PT PLN, 2021b). Civil society also appears neutral, with essentially no mention of carbon markets at all. But based on the Institute for Essential Services Reform's strong opposition to coal, it would be logical to assume they would support any measures that would put a price on the coal industry (Simanjuntak & IESR, 2021). This lack of strong input leaves the rating up to the government. Having a more ambitious cap on a compliance ETS ranks **medium** for political feasibility due to the way the cap selection process is set up in the presidential regulation on carbon pricing. The government is generally in favor of stronger climate action and looks optimistically at carbon pricing as a way to achieve that, based on public statements (Ministry of Energy and Mineral Resources, 2021b) (Communications Bureau of the Coordinating Ministry of Maritime Affairs and Investment, 2021a) (APHI Center, 2021a). However, it is unclear how low the cap will ultimately be due to the flexibility key industries have in the process. Per the regulation, sectors are permitted to set their own intensity caps—this means individual ministries in charge of overseeing certain sectors, like the Ministry of Energy and Mineral Resources, gets to select their own cap on just the energy industry—before the cap is then passed down the chain for the subsectors to identify individual goals within that target. In practice this means that the ministries might come together with multiple different caps that are more generous than necessary for the respective industries they represent, leading to an overall unambitious cap. This option does not rank as highly unfeasible, though, because the government has clearly stated intentions to use an ETS to legitimately reduce emissions, and has made concerted efforts with greenhouse gas inventories so that it will be easier to understand what business-as-usual levels really are for the country at large and within sectors (Directorate of Electricity, 2022).

Alternative 2: Price Collar

Criteria 1: Potential economic impact

Studies suggest that the implementation of an MSR that exclusively regulates the quantity of allowances could have minor impacts on the stability of a carbon market (Holt & Shobe, 2016). But, literature shows that the use of price collars could heavily improve the market stability of an ETS (Perino & Willner, 2016) (Knopf et al., 2014) (Richstein et al., 2015). Including soft price floors and ceilings along with an allowance quantity regulation would provide a benefit to the economy by reducing the volatility of a carbon market. Therefore, this option ranks **low** for negative economic impacts, since it could actually improve the economy.

Criteria 2: Potential emissions reduction

A price collar only has indirect impacts on emissions. It is possible to have very minor impacts on emissions due to decreased quantities of available allowances in circulation. However, an MSR does not directly impact emissions reduction, meaning it ranks **low** for this criteria.

Criteria 3: Political feasibility

Stakeholder analysis of all three groups is inconclusive on the outlook towards a price collar, largely owing to the specific and technical nature of the alternative. It is not a contentious policy option that groups are discussing. Therefore, this ranking is tentative based on possible opinions of the groups. A price collar is generally viewed as a more economic tool rather than an environmental one, which helps prevent it from becoming too contentious (Richstein et al., 2015). Because it is a market-oriented strategy that improves market stability, I would anticipate positive reception from all stakeholders. The government wants to ensure allowance prices do not fall too low or high so that allowances continue selling and businesses continue to participate in the market. The private sector would appreciate the price transparency as well as assurance that allowance prices will be adjusted automatically should the initial cap happen to be too low for the market. Civil society would probably not be too invested in whether there is a price collar, but researchers and economics would likely approve of a set price floor to ensure stable demand and reduce price shocks. Based on these assumptions, this alternative ranks **medium**, since price collars could easily be viewed positively, but receive some push back from jurisdictions concerned with dictating allowance price (Perino & Willner, 2016).

Alternative 3: Allowance Distribution through Auctions

Criteria 1: Potential economic impact

An analysis of possible market structures for the subnational ETS in China revealed that compared with free allocation, auctioning would lead to higher production costs for trading sectors (Wu et al., 2016). Pure auctioning of allowances could result in a -0.54% economy-wide decrease in GDP, compared to -0.11% for purely free allowance. In the context of Indonesia, that would equate to a loss of approximately USD $56,340,000 if the auction loss estimate is applied to the 2020 annual GDP of the power sector (Ministry of Energy and Mineral Resources, 2020). However, this estimate based purely on projection models and not on case study experience.

Alternatively, a different analysis claims that a loss in GDP could be entirely avoided as long as a fraction of total economy-wide allowances are allocated freely to certain industries. In this study as it applied to the United States, to avoid profit losses for major industries, 20.6% of all allowances would need to be allocated freely rather than auctioned. Out of that 20%, 3.2% of freely allocated allowances would need to go to the coal fired electricity generation sector (Dworsky et al., 2009). While those exact percentages might change for the Indonesian context, it suggests that it is entirely possible to auction a majority of allowances with no GDP losses as long as a select few are properly distributed freely to each industry. Because this alternative seeks to use primarily auctioning to distribute allowances rather than exclusively auctioning, this alternative ranks **low** in economic impact since it has the potential to prevent GDP losses while providing valuable revenue to the government.

Additionally, auctions can provide beneficial economic impacts beyond changes in GDP. One study found that the Regional Greenhouse Gas Initiative found that it produced a net benefit of USD $4.7 billion through changes in the electricity sector and direct use of auction proceeds over the first three compliance periods (Hibbard et al., 2018). This suggests that auctions might not only have no negative impact on GDP, but net positive impacts on the broader economy.

Criteria 2: Potential emissions reduction

Auctions as a form of distribution do not directly impact emission levels. It only means emitting industries must purchase allowances from the carbon market rather than receiving them all freely from the government. Auctioning has no recorded negative impacts like actively increasing emissions, but there is no indication that it would improve them in some way either. The only possible correlation is that companies would need to pay more to continue emitting the same amount as they were compared to having more of their allowances received freely. This could encourage additional behavior to reduce emissions more quickly because it will become more cost-effective to do so. Due to the indirect nature of this effect and the lack of a recorded relationship in research, the impact on emissions reduction is **low.**

Criteria 3: Political feasibility

Similar to a price collar, the more technical decision of allowance distribution method means stakeholder analysis of the groups is generally inconclusive. However, we can again make logical assumptions to discern what the rating of this alternative could be. The private sector would generally be opposed to this alternative, since compared to free allocation, businesses would be required to pay more money upfront to purchase allowances. This could be mitigated if auctioning it balanced with an appropriate level of free allowance, as described in the economic impact criteria. The government would likely be in favor of this alternative, since auctions are proven to generate substantial revenue for the government (Fell & Maniloff, 2017). The ministries would need to determine how to split it up and what policies to use the money for. Depending on how the revenue is distributed, the public sector could be for, against, or neutral towards auctioning. If the government follows a similar approach to RGGI and compensates citizens with tax refunds on their energy bills, the public would likely support this policy. If Indonesia takes a more Canadian approach by heavily reinvesting in climate and environmental programs, the public would likely skew more neutral to positive, depending on how much they value climate programs (Narassimhan et al., 2018). Based on these assumptions, this alternative ranks **medium**, since the government and most of the public would likely favor it, and the private sector would not respond negatively if the policy is implemented well.

Alternative 4: Limited Domestic Credit Use

Criteria 1: Potential economic impact

This alternative ranks **medium** for economic impact due to a few potential factors. The voluntary carbon trading market is sizeable and growing (APHI Center, 2021a). Formalizing that market with government legislation could help or hurt the economy. A private company based out of Singapore even signed a deal planning to expand the voluntary market (Kiernan, 2022). Right now, the government has signaled animosity toward unmonitored offset trading due to the inability to determine how carbon trading is affecting NDC goals, requesting instead that programs register formally for permission to trade and certify offset credits (ForestHints.News, 2021). Should the government apply a limit to the use of carbon offsets for domestic use toward ETS emissions reduction, it could shrink the market demand for offsets in the country. This could have repercussions for businesses counting on credit revenue to offset costs from transitioning to more climate friendly practices, like in the forestry sector. Alternatively, a formal government limitation in the compliance market might have little impact on the economy due to the existing voluntary market structures that have continued to grow in recent years (APHI Center, 2021a). Due to the unknowns at play, this alternative is ranked medium out of caution. It is unclear if a limitation on offset credit use will negatively affect the economy, but it certainly seems like a valid possibility to consider with this option.

Criteria 2: Potential emissions reduction

Setting limitations on the application of international and domestic credits to meet emissions reduction requirements under an ETS can indirectly improve a jurisdiction's overall emissions reduction. Domestic credits and carbon offsets come from certified projects that capture CO2 or avoid emissions in some way. These credits can come from domestic projects inside a jurisdiction, or they can be bought internationally. International credits do nothing to measurably reduce a jurisdiction's gross emissions. As seen in New Zealand, oversupply of international offset credits can lead to an ETS having no impacts on emissions (Bullock, 2012). Domestic credits do at least represent emissions offsetting projects within the same jurisdiction as the carbon market, but allowing too many to be used to meet ETS requirements means firms are not driven to transition toward less emissions-intensive technology if credits available at lower prices than allowances. Therefore, banning the use of imported offset credits and limiting the use of domestic credits to meet ETS requirements for firms can have an indirectly positive effect on gross emissions reduction. This alternative ranks **medium** due to the correlation between unlimited offset usage and lack of emissions reduction.

Criteria 3: Political feasibility

Putting a firm limit on carbon offset usage is likely the least politically feasible of the alternatives. I would consider a firm limit to be no international credits and at least a 20% maximum limit on domestic credit usage. This was the only alternative with clear positions from almost all parties, so it was easier to more realistically assess political feasibility.

The private sector does generally feel strongly in favor of carbon offset credit trading, which suggests it might view limits on buying and selling credits negatively. One private sector power company received government awards for buying and selling carbon credits through their coal and renewable energy power plants, which is similar to the experiences of other private power companies in the country (Indonesia Power, 2021). Their compliance with the voluntary credit market shows that they would likely prefer to continue using credits. A state-owed power company, PT PLN, has clear preference for international carbon offset trading. The company is already trading in the voluntary market, using the Verified Carbon Standard (VCS) to certify credits from renewable energy generation (PT PLN, 2021b). PLN has noted a strong interest in seeing Article 6 of the Paris agreement operationalized, which would standardize global carbon offset trading (PT PLN, 2021b). They also hinted at interest in seeing regulations on how power plants must meet emission goals relaxed (PT PLN, 2021a). Finally, in the forestry sector, APHI has indicated strong interest in carbon offset sales as well, noting the Indonesian forestry sector's presence in voluntary credit markets already (APHI Center, 2021a). APHI said that its members are primarily interested in carbon markets due to the value-adding opportunities they present. In a presentation by one power plant, the Program Director revealed the scope of the voluntary market in Indonesia: renewable energy credits are the highest volume of carbon credits available on the voluntary market with forestry and land use sourced credits coming second, for a total of 36.7 million tons of CO2 available to trade in the 2019 market (APHI Center, 2021a). The credits from forestry, like avoided deforestation programs, are traded at higher prices than other credits at a little over USD $4 per ton (APHI Center, 2021a). Due to this overwhelming interest in developing carbon offset trading, I would anticipate some negative response to perceived limitations on offset usage.

The government seems to be signaling an intent to limit the use of carbon credits. They do vocally express plans for carbon offsets as part of the upcoming ETS (Ministry of Energy and Mineral Resources, 2021a). Director of Electricity Techniques and Environment under the Ministry of Energy and Mineral Resources discussed interest in how the power sector could continue benefiting from cap-and-trade (Ministry of Energy and Mineral Resources, 2021a). The Director General of Climate Change Control in the Ministry of Environment and Minister Luhut from the Coordinating Ministry of Maritime Affairs and Investment both shared desire to see Article 6 operationalized to help Indonesia successfully fulfill its climate goals (PT PLN, 2021b) (Communications Bureau of the Coordinating Ministry of Maritime Affairs and Investment, 2021b). However, it is unclear how many carbon offsets will be permissible to use in place of allowances under an ETS. One article references draft regulations from the Ministry of Environment, which would put a limit at 50%, far above the already high 20% suggested limit (Christiawan, 2022). The same draft ministerial regulation also supposedly says carbon trading abroad is only permissible after the NDC target is fulfilled (Christiawan, 2022). At the same time, the government wants to limit voluntary market trading and direct to consumer credit sales (ForestHints.News, 2021). The goal is to ensure there is no double counting toward the country's NDC goal, a message reiterated by the Director General of Nature Resources and Ecosystem Conservation (ForestHints.News, 2021).

In civil society, there is little discussion of carbon markets generally in Indonesia. Only the Climate Policy Institute had anything specific to say. In an op-ed, the authors recommended that the Indonesian government structure and regulate a more robust voluntary carbon market with offsets (Mafira & Mecca, 2021). They did not mention any thoughts about a compliance market. I would consider civil society to range from negative to neutral on this issue, based on the lack of firm positions from more entities.

It seems like almost no organizations within the government or in the private sector are particularly involved in carbon market policy beyond an awareness of, or interest in, offset credits. In fact, in private and public sector publications, it appears that "carbon markets" and "carbon trading" are commonly conflated terms. Many companies say they are interested in carbon trading, but are primarily interested in opportunities presented by voluntary carbon markets rather than the compliance market, which is the one set up by the government with allowances. This suggests that Indonesian society as a whole has little awareness of or opinions on compliance carbon markets, and that offset trading is something generally interesting to those who might be involved in the market.

If credit sales were limited, it means sellers would likely turn to voluntary markets to sell their credits internationally. But if the government is unable to bolster a monitoring system for a sanctioned voluntary market and instead continues to block voluntary trading, it would likely lead to political backlash from private sector constituents that planned to rely on money from credit sales. Though, the private sector might not feel negatively about limitations on offset usage within the compliance market if stakeholders understand that the limitations would be put in place partially to maintain a competitive price on offsets. As seen in New Zealand, unlimited linking to international markets meant there was no market for domestically produced credits (Diaz-Rainey & Tulloch, 2018). Overall, it is hard to say for sure what the political feasibility of limiting credits would be due to unknowns with government intentions and how private businesses view the issue. But at least based on the public comments that could be gathered at the time of writing, putting serious limits on offset usage and voluntary carbon markets seems like an unpopular option across multiple stakeholder groups. This criteria ranks **low**.

Outcomes Matrix

	Economic	Emissions	Political feasibility	Scores
Low cap	Medium (2)	High (3)	Medium (2)	7
MSR/price collars	Low (3)	Low (1)	Medium (2)	6
Auctions	Low (3)	Low (1)	Medium (2)	6
Limited credit use	Medium (2)	Medium (2)	Low (1)	5

It is essential to note that the political feasibility analysis could easily change as information becomes more readily available from the government. Right now, because the carbon market is in the developmental stages, individual ministry views on policy are not easily accessible due to the lack of transparency in the development process. The government has not held townhalls or solicited public comments on their plans for a market structure, so right now it is unclear what the technical elements of the trading system are even on the table. Due to the somewhat complicated and technical nature of the issue, even within the government, meetings are primarily happening between experts. As a result, most of the analysis on political feasibility is conjecture.

Recommendation

Alterative #1: Low Initial Cap

Ideally, all of these solutions should be used in tandem to improve the efficacy of a carbon market. Each has pros and cons, but together they can balance out their flaws. However, as demonstrated by the outcomes matrix, one main option should be prioritized if necessary. An initial cap below business-as-usual levels is absolutely essential for reducing carbon emission effectively and quickly. It improves the effectiveness of carbon markets by encouraging institutions covered by the market to make changes to their operating structure within the first trading period. It also strengthens the carbon market by making the value of an allowance credit stronger.

Implementation

Timeline

This alternative can be implemented at any point along the line of the deliberative process on the carbon market structure within the Indonesian government. The carbon market is expected to take force in 2024, so the policy framework should take place before then. The first step would be to conduct a research and analysis on the estimates for emissions levels in the country by sector in order to determine an appropriate cap below BAU levels.

Logistics

According to the Emissions Trading in Practice Handbook, there are multiple steps to determining a cap, which includes:

1. *Decide the ambition and type of cap, as well as the approach (top or bottom up)*

The ambition will relate to how far above or below BAU emission levels the cap goes. Type refers to whether the cap will be absolute—a set number of permitted tons of CO2 per emissions trading period—or intensity-based—where a cap is set on the amount of permitted CO2 per watt of electricity generated, for example. Intensity-based targets are set unique to each sector covered in an ETS and are far rarer than the absolute cap approach. Finally, top-down or bottom-up approaches to cap-setting are whether the government will dictate a set cap and emissions reduction target and expect subnational jurisdictions to align their plans with the national plan, or whether the subnational states get to self-determine appropriate emissions targets which are then communicated to the national government for consideration and approval. Top-down is the more common approach.

2. *Gather foundational data to determine the cap*

This could include historic emissions data, estimates of future emissions, estimates of the technical and economic potential to reduce emissions in covered sectors, and impacts of other existing or planned policies on emissions. The data "should predate serious consideration of an ETS; otherwise, firms may have an incentive to exaggerate their emissions, or emit more, in the hope of a looser cap, particularly if they anticipate that allocation will be through grandparenting". (PMR & ICAP, p. 85-86)

3. *Choose time periods for cap setting*

This is closely linked to when the cap is scheduled to decrease. Part of cap and trade is that the cap decreases overtime to ensure continued movement toward the total reduction goal. Time periods should be set times in which the cap is consistent. The government must also choose how far in advance these periods are set. Caps can be annual or they can cover multiple years. A cap period should correspond to a time when major program design features do not change (PMR & ICAP, p. 79).

4. *Set formal legal and administrative governance arrangements*

Policymakers will need to designate the appropriate government authority with responsibility to administer and set levels of the cap (PMR & ICAP, 2021). In Indonesia, the government has already identified the relevant ministries in charge of ETS design and oversight in its laws on economic mechanisms and carbon markets. The Coordinating Ministry of Maritime Affairs and Investment is in charge of overseeing the development of an ETS.

5. *Agree on a strategy for providing a consistent price signal*

Indonesia's ambition strategy for emissions is clearly laid out in its NDC, which is the frame for the goals of the ETS. To set consistent price signals, the public should receive clear information upfront about what the emissions trading periods are and what the cap reduction rate will be each period. There should also be transparency about the rules of the market, like reporting processes, as soon as possible as this is anticipated to improve outcomes (Schmalensee & Stavins, 2019). Indonesia should have little issue with this since select power plants already took part in a trial, so those rules have been tested. Finally, a price collar can bring stability to the price signals provided by the overall cap.

The structural choices will ultimately be up to Indonesian scientists and policymakers on what approaches will likely work best for the context of the country. However, I would suggest a combination the cap setting approach with a national government cap on overall emissions reduction while taking into account Indonesia's jurisdictional NDC ambition plans. In the words of the Partnership for Market Readiness, "a hybrid approach takes elements from both top-down and bottom-up cap setting. Bottom-up data and analysis might be used as a basis for the cap, which is then adjusted to reflect interaction effects between sectors, and the intended contribution of the covered sectors to top-down mitigation objectives" (PMR & ICAP, p. 83)

Actions for Stakeholders

It is essential for the government to consult with relevant stakeholders when determining the appropriate type of carbon market to develop. Stakeholders could include market participants, groups that may be adversely affected by or benefit from the carbon price, authorities responsible for policies interacting with ETS, researchers who can help model the impacts of choices…and trade partners (PMR & ICAP, 2021). At this point in time, while the structure is still under development, NGOs should be advocating for some of the best practices laid out in this document. The government is presently aware of many options but may not necessarily understand the ways in which some could be more effective than others at reducing emissions. NGOs, think tanks, universities, and other experts should be included in conversations with the government on what best practices and Indonesian ETS should adopt in order to ensure they are receiving the best possible feedback. The government has already been engaging extensively with private and public sector power generation companies to receive input as part of the voluntary carbon market trial of 2021. Within the government, the national administration should ensure they consult subnational jurisdictions to receive input based on the anticipated needs and emissions in each jurisdiction. Subnational jurisdictions in Indonesia tend to be highly knowledgeable on their climate policies and needs since each was required to carry out a separate NDC analysis for the long-term national framework. Consulting provinces will even be mandatory as there is a piece of the laws on environmental economic instruments that requires subnational input on targets.

Challenges

One of the challenges will be building consensus on the best choice for structuring the cap based on the standpoint of different ministries. There could be disagreement about whether to use an overall cap vs. an intensity cap, for example. However, this could be ameliorated if external partners like NGO's promote the same kind of structural suggestions to multiple ministries. Another challenge is that industries might fear the economic burden and uncertainty of a new carbon market. Having a low starting cap might mean unpredictably high abatement costs. However, this can easily be addressed with an MSR that includes a price ceiling. That means if it turns out the cap is too low at first and drives the price of allowances too high above a selected price threshold, the MSR will automatically release additional allowances, keeping the price lower. There might also be administrative challenges, due to the complex nature of monitoring and maintaining a carbon market. Carbon markets are only effective if covered entities are held accountable for failing to reach their mandatory goals. What will be important long-term is whether a government can sustain the required labor needed to ensure smooth operation. This should be feasible, given Indonesia's existing ministry structures and the new revenue the federal government will receive through selling domestic offset credits and auctioning some percentage of allowances. Luckily, there are few major structural challenges facing a carbon market program. In the context of Indonesia, the vast majority of the government and businesses are interested in adopting some form of carbon market, as proven by the existing legislation and participation in a voluntary carbon market trial. This means it may be less difficult to make the transition into a more ambitious carbon market structure in the country.

Evaluation

Monitoring and evaluation metrics are inherently built into the framework of a carbon market. This is an essential element of an ETS because of emissions must be continuously monitored to check if reported levels are accurate. These mechanisms will not just measure the efficacy of a lower cap, but of the ETS at large. This will help determine the extent to which real emissions reductions are occurring. More information about setting up appropriate monitoring structures is available in great detail in the Partnership for Market Readiness' "Developing Emissions Quantification Protocols for Carbon Pricing" guide.

Conclusion

This paper seeks to illuminate the ways carbon markets are working, as well as some of the key structural improvements carbon markets can have to become more effective at reducing emissions. Based on existing literature, there are a variety of ways that carbon markets can and should be altered to help reduce the dangers of climate change. Due to the interconnected nature of the elements of a carbon market structure, every small change can affect other pieces of the picture. Hopefully countries like Indonesia will adopt not just an appropriate initial cap, but all the additional alternatives as well. Based on comparisons of existing carbon markets, we would expect the most successful ETS to combine all of these elements into one, more effective market. Of course, there are many different ways application can change in practice. With this in mind, I hope the use of the case of Indonesia can help policymakers not just in Indonesia but in other jurisdictions around the world think through how these alternatives could be applied in different contexts. The biggest takeaway from this research is that the most effective carbon market is one that can effectively adapt to changes. Ensuring that a market has room for periodic review of efficacy and space for alteration means even if the market does not start out will these best practices, that does not mean there will not be changes down the line as the field of emissions trading research continues to grow.

Appendix

Sensitivity Analysis

The scoring of these alternatives based on the criteria analysis is moderately sensitive, depending on how the weights of the criteria may change. For the purposes of this investigation, each criteria was weighted equally. However, if a policymaker values emissions reduction over economic impact or political feasibility, the recommendation could change. Below are examples of how the scoring would be affected if one of each criteria was weighted heavier than the others. To derive these results, I multiplied the original table of scores by a new weight: 0.4 for the emphasized criteria, and 0.3 for the other two.

Economic impact weighted more heavily (.4, .3, .3)

	Economic	Emissions	Political feasibility	Scores
Low cap	0.8	0.9	0.6	2.3
Price collars	1.2	0.3	0.6	2.1
Auctions	1.2	0.3	0.6	2.1
Limited credit use	0.8	0.6	0.3	1.7

Emissions reduction weighted more heavily (.3, .4, .3)

	Economic	**Emissions**	Political feasibility	Scores
Low cap	0.6	1.2	0.6	2.4
Price collars	0.9	0.4	0.6	1.9
Auctions	0.9	0.4	0.6	1.9
Limited credit use	0.6	0.8	0.3	1.7

Political feasibility weighted more heavily (.3, .3, .4)

	Economic	Emissions	**Political feasibility**	Scores
Low cap	0.6	0.9	0.8	2.3
Price collars	0.9	0.3	0.8	2
Auctions	0.9	0.3	0.8	2
Limited credit use	0.6	0.6	0.4	1.6

Depending on the criteria used, the recommendation does not deviate from the existing recommendation, which is to use a low initial cap. In each case, this alternative is still the recommended solution. The weighting distribution would have to rise to a bold 0.5, 0.25, 0.25 to begin seeing changes in the recommended outcomes.

Calculations

<u>For the total externality costs to Indonesia using CO2 emissions data from 2018:</u>

\$35 per ton x 1.27* $GtCO_2e$ = \$44.45 billion

\$70 per ton x 1.27 $GtCO_2e$ = \$88.9 billion

*This number includes CO_2 emissions only, not all greenhouse gas emissions

For the externality cost of the 2018 energy sector CO_2 emissions only:

\$35 per ton x 552.09 $MtCO_2e$ = \$19.32 billion

Price per ton source: (Climate Watch, 2021)

Emissions data source: (OECD, 2021)

Recommended Literature Reviews and Background Reading

- Narassimhan, E., Gallagher, K. S., Koester, S., & Alejo, J. R.: "Carbon pricing in practice: a review of existing emissions trading systems"
- Parker, S: "From ETS to Carbon Coalitions: Carbon Market Standards Will Improve Over Time"
- Schmalensee, R., & Stavins, R.: "Learning from Thirty Years of Cap and Trade"
- The World Bank: "State and Trends of Carbon Pricing 2022"

Recommended Resources for Policymakers

- Guidance from the Partnership for Market Readiness: Technical Notes and Guidance Documents
    - Partnership for Market Readiness & International Carbon Action Partnership: "Emissions Trading in Practice, Second Edition: A Handbook on Design and Implementation"
    - A Guide to Developing Domestic Carbon Crediting Mechanisms
    - Guide For Designing Mandatory Greenhouse Gas Reporting Programs
- OECD: Effective Carbon Rates 2021: *Pricing Carbon Emissions through Taxes and Emissions Trading*
- ICAP: *Emissions Trading Worldwide: Status Report 2022*

Figures

Figure 1

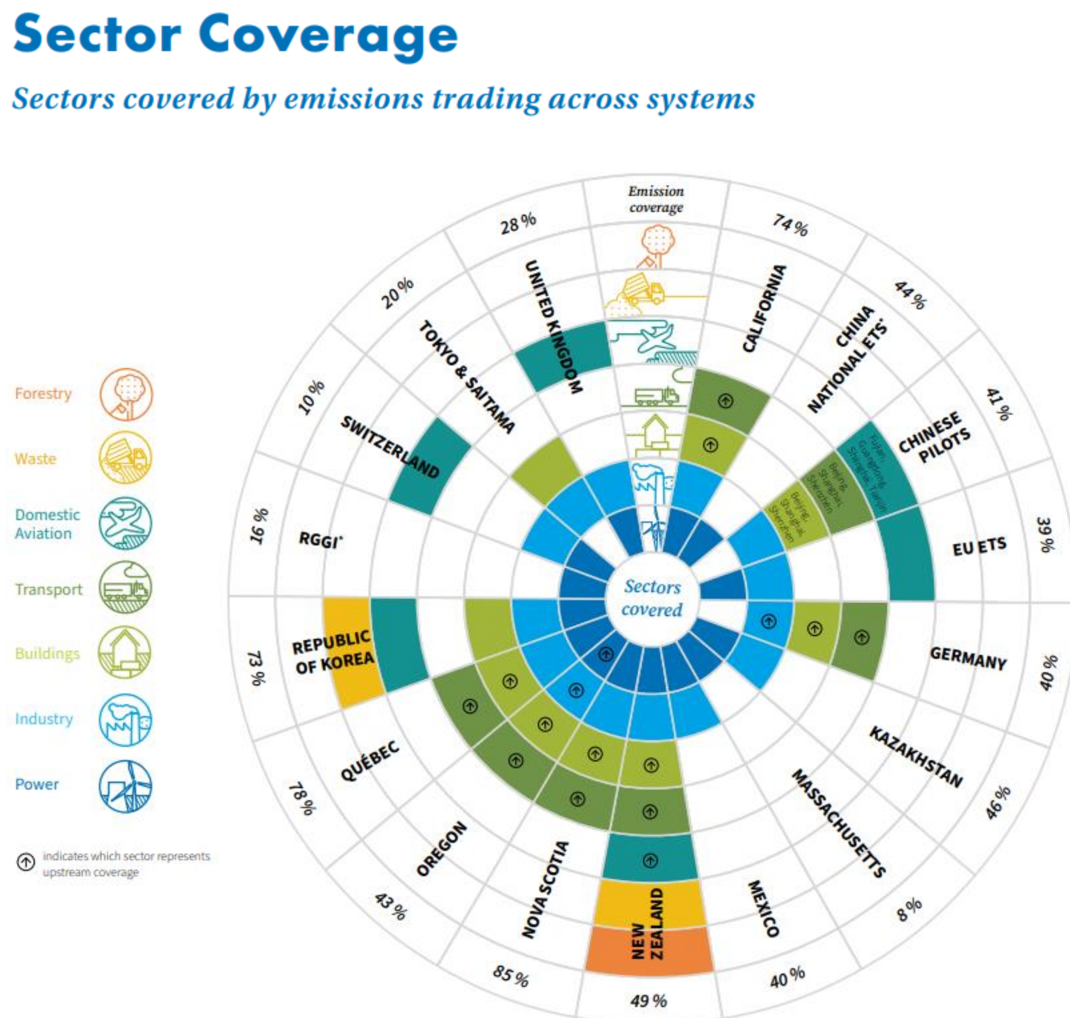


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Figure 2 (Climate Watch, 2021)

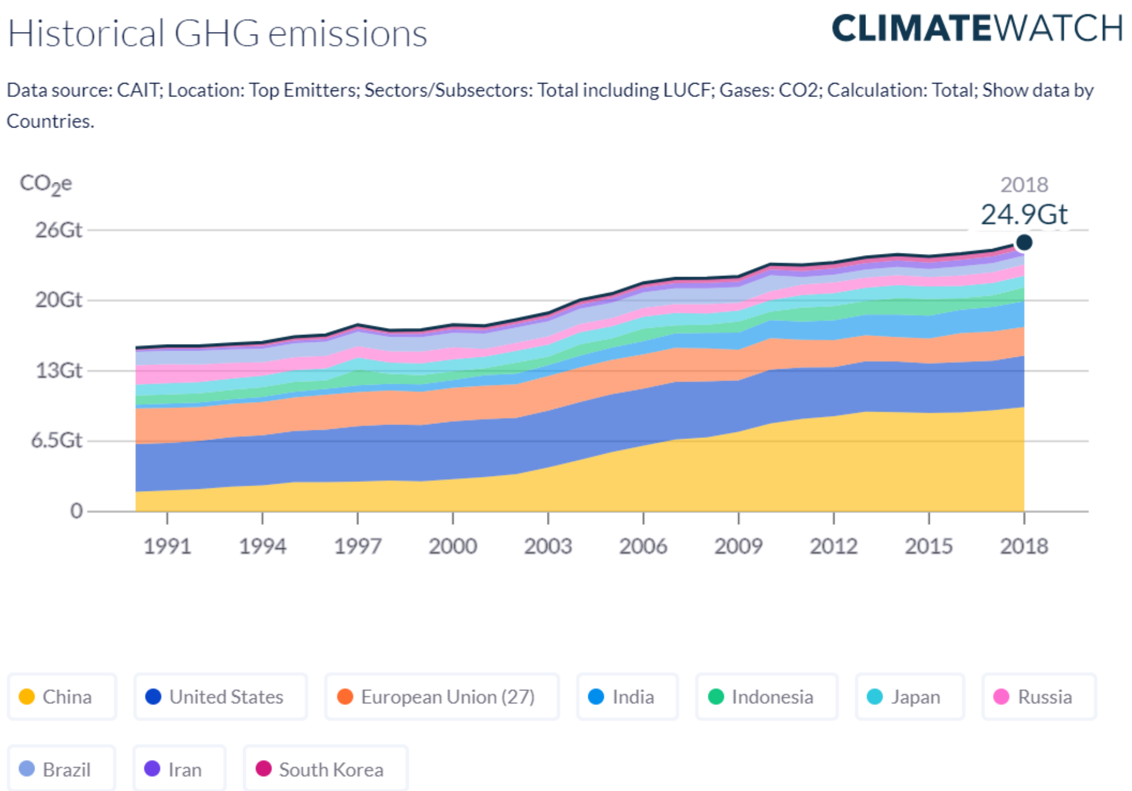


Figure 3 (Climate Watch, 2021)

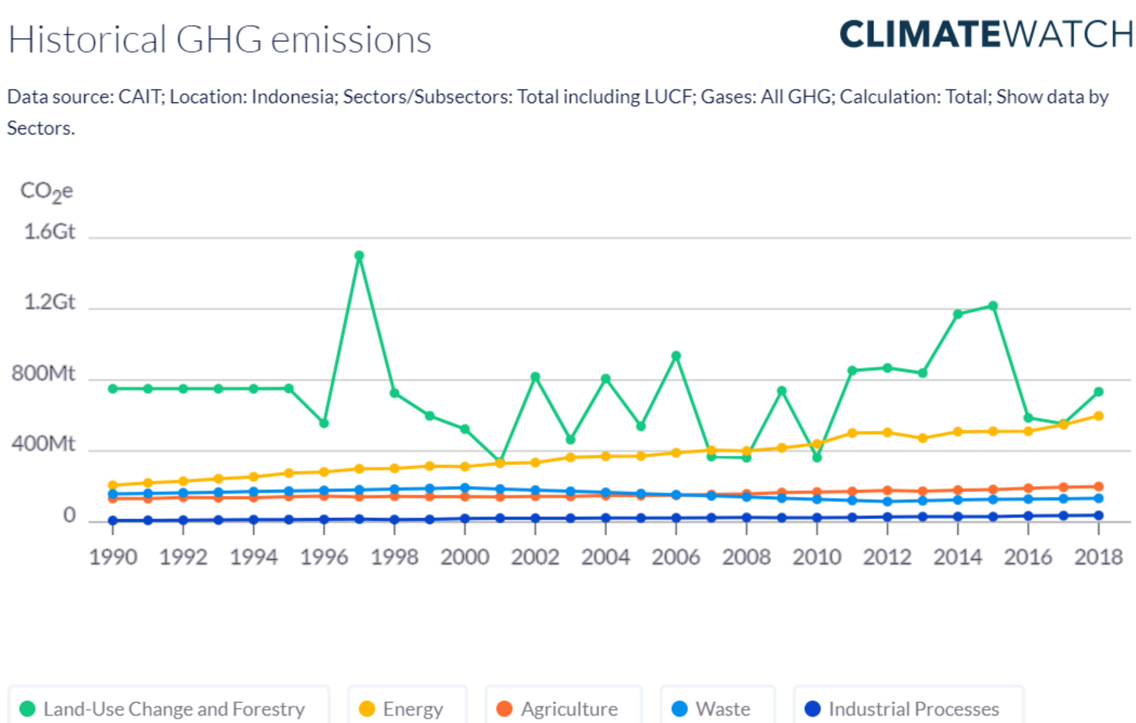
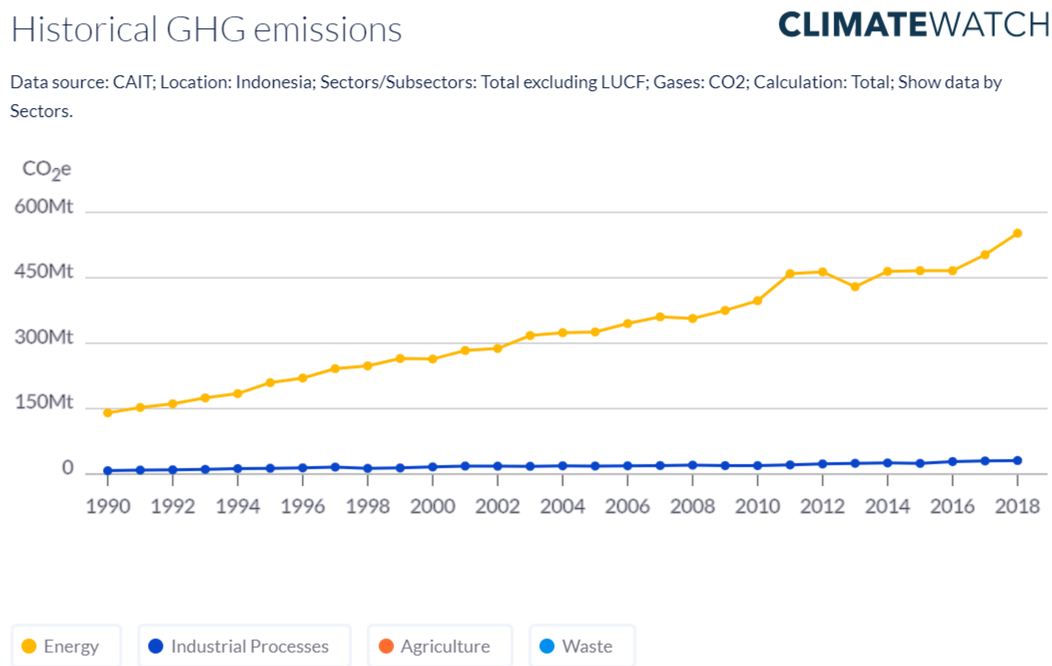


Figure 4 (Climate Watch, 2021)



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