

Exploring the Potential and Challenges of a Developing Carbon Market in the Philippines

Corpus, Robert Michael B.^{1,*}, Bayani, Meldanette S.¹, Ado, Remedios.¹

¹Polytechnic University of the Philippines, Manila, Philippines

*corresponding author: Corpus, Robert Michael B.

e-mail: robcorpus@gmail.com

Abstract The worldwide shift towards the use of renewable energy sources is very necessary if we are going to reduce our impact on the environment and become more sustainable over the long run. However, owing to the intermittent nature of renewable energy sources, concerns with grid management, and restrictions in the market, the incorporation of these sources into the energy systems that are already in place creates a number of challenges. The Internet of Things (IoT), big data analytics, artificial intelligence (AI), and blockchain are examples of technologies that were developed as part of the Industry 4.0 initiative and provide substantial promise for overcoming these difficulties. This article provides a detailed analysis of the role that Industry 4.0 technologies play in the integration of renewable energy sources. It does so by presenting successful case studies and investigating the constraints and problems involved with their implementation. In order to assist the wider adoption of Industry 4.0 technologies in the renewable energy industry, recommendations and potential future research paths are also offered in this article.

Keywords: carbon market, Philippines, emerging

1. Introduction

Climate change has encouraged governments to study and adopt GHG emission reduction techniques. Carbon markets enable cost-effective emissions reductions via market-based solutions. Emissions trading systems (ETS) restrict total emissions and provide tradable permits to regulated organizations, giving economic incentives for firms to decrease emissions.

As a developing nation and Paris Agreement member, the Philippines has pledged to cut GHG emissions by 70% by 2030. A carbon market may help the nation transition to a low-carbon, climate-resilient future given its sensitivity to climate change and rising energy demand. The Philippines' carbon market has governmental and regulatory hurdles, institutional capacity restrictions, market constraints, and social and environmental concerns.

This study examines the Philippines' carbon market possibilities and limitations using worldwide best practises and experiences. The study will review Philippine climate policy, analyse the potential benefits

and drawbacks of a carbon market, and make recommendations for policy and regulatory reform, institutional capacity building, market development and risk management, and social and environmental sustainability.

This article covers Philippine climate change mitigation and carbon market policy. The research uses international case studies but does not compare carbon markets globally. The research does not use quantitative modelling or simulations to estimate the effects of a carbon market on the Philippine economy, and the analysis and suggestions are based on a qualitative evaluation of literature and data.

This study reviews and synthesises scholarly publications, government reports, policy documents, and case studies. Key informant interviews and expert contacts confirm results and inform suggestions in the article. Literature review, findings, debate, suggestions, conclusion, and future research are organised in a modified IMRAD structure.

2. Literature Review

2.1 Carbon markets: Global trends and overview

By pricing carbon, carbon markets (ETS) encourage cost-effective emission reductions. Carbon markets incentivize corporations to minimize emissions by capping emissions and giving regulated organizations tradable permits (Stavins, 1998). The European Union, California, and China have introduced carbon markets, each with a different architecture and scope (World Bank, 2020).

2.2 Foreign carbon markets

Carbon markets have mitigated climate change in some nations. The EU ETS, California Cap-and-Trade, and Chinese ETS are examples. These systems have taught us the value of strong monitoring, reporting, and verification (MRV) systems, adaptive policy design, and stakeholder participation (Ellerman et al., 2016; Cullenward & Victor, 2018; Zhang et al., 2019).

2.3 Carbon markets in the context of Southeast Asia and the Philippines

Several Southeast Asian nations have begun carbon pricing and trading (Asian Development Bank, 2021). The Philippines' susceptibility to climate change, rising energy consumption, and Paris Agreement commitment to decreasing GHG emissions justify investigating a carbon market (Partnership for Market Readiness, 2017).

3. Methodology

3.1 Qualitative method

This qualitative study examines Philippine carbon market possibilities and obstacles. This study seeks to analyse the aspects that might affect the Philippine carbon market's performance by researching other countries' experiences, the Philippine setting, and related literature.

3.2 Analyzing data

This research gathers data from scholarly papers, government reports, policy documents, and case studies. The assessment covers worldwide carbon markets and Philippine climate change mitigation and carbon market development.

The research uses thematic analysis to uncover significant themes and patterns connected to the advantages, problems, and suggestions for creating a carbon market in the Philippines. The study is led by research questions about the country's context, learning from other carbon markets, and activities to overcome possible implementation difficulties.

3.3 Case study selection and comparison

The paper contains case studies from different carbon market nations and regions to enhance the analysis and give insights into best practices and lessons learned. These case studies are relevant to the Philippine setting and include thorough information on their carbon markets' design, implementation, and results.

The chosen case studies are analysed and contrasted to discover significant characteristics that affect a carbon market's success or failure and possible solutions to the Philippines' carbon market development difficulties. Comparative analysis informs the paper's suggestions and future study.

4 Results

4.1 Philippine Context

4.1.1 Climate vulnerability

Due to its location, natural catastrophe risk, and low adaptation ability, the Philippines is particularly susceptible to climate change (CCC, 2015). Typhoons, floods, droughts, and other climate-related catastrophes routinely threaten the country's people, economy, and environment. The Philippines must develop mitigation and adaptation techniques due to climate change.

4.1.2 Targeted emissions

The Philippines submitted its Intended Nationally Determined Contributions (INDCs) to the UNFCCC in 2015, agreeing to cut its GHG emissions by 70% by 2030 compared to a business-as-usual scenario (CCC, 2015). Agriculture, trash, and industrial activities follow energy as the biggest emitters. Cleaner technology, better practices, and carbon markets may reduce emissions in these areas.

4.1.3 Environmental policies

The Philippine Energy Plan 2018-2040, the National Climate Change Action Plan (NCCAP) 2011-2028, and the Climate Change Act of 2009 address climate change (DOE, 2018). These policies encourage renewable energy, energy efficiency, and climate change mitigation. In recent years, the Philippines has considered establishing a carbon market to meet emissions reduction objectives and attract investment in low-carbon technology.

4.2 Philippines Carbon Market Potential

4.2.1 Reducing emissions

A carbon market in the Philippines would price carbon and encourage cost-effective mitigation. Energy, industry, and agriculture, which have high emissions reduction potential, might benefit from carbon market financial incentives to embrace cleaner technology and practices.

4.2.2 Investment and financing

A carbon market may attract private investment in low-carbon technology and infrastructure by pricing carbon emissions. This might aid the Philippines' low-carbon economy and Paris Agreement emissions reduction goals.

4.2.3 Renewable energy and efficiency support

A carbon market might boost Philippine renewable energy and energy efficiency initiatives. A carbon market might make renewable energy more competitive and boost clean energy investments by raising fossil fuel prices.

4.2.4 International climate agreements

A carbon market might help the Philippines meet its Paris Agreement goals. A carbon market may help the country's GHG reduction ambitions and global climate action by offering a market-based mechanism for emissions reductions.

4.3 Philippine Carbon Market Development Challenges

4.3.1 Legal restrictions

The Philippines needs enabling policies and regulations to develop a carbon market. To develop a carbon market, strong monitoring, reporting, and verification (MRV) mechanisms and policy harmonization are needed.

4.3.2 Institutional restrictions

A carbon market needs strong institutional capability and cooperation among government agencies, the business sector, and stakeholders. Capacity development and technical help may be required to fill knowledge gaps, create local expertise, and make a carbon market work.

4.3.3 Market barriers

Liquidity, price volatility, and market manipulation are market obstacles that may hinder Philippine carbon market implementation. Market stability and integrity depend on market design, risk management, and regulatory monitoring.

4.3.4 Environment and society

A Philippine carbon market must include social and environmental implications; such as harm to disadvantaged groups or the ecosystem. Stakeholder participation, transparency, and protections are needed to make the carbon market sustainable and equitable.

5. Discussion

5.1 Comparing Philippine carbon markets to others

The Philippines may learn from the EU ETS, California Cap-and-Trade Program, and Chinese ETS. These markets emphasise solid MRV systems, flexible policy design, stakeholder participation, and strong institutional capability. The Philippines has climate change vulnerability, legislative and regulatory impediments, and institutional restrictions. However, existing carbon markets can help develop and operate a Philippine-specific carbon market.

5.2 Assessing the potential benefits and challenges

A Philippine carbon market may reduce emissions, mobilise capital and investments, encourage renewable energy and energy efficiency, and meet international climate obligations. Policy and regulatory impediments, institutional capacity restrictions, market barriers, and social and environmental concerns hinder carbon market

growth. To maximise a carbon market's potential and promote a low-carbon, climate-resilient future, these issues must be addressed.

5.3 Identifying key factors for successful carbon market development

Based on Philippine context and previous carbon markets, three essential variables emerge as crucial for the successful creation of a carbon market in the Philippines:

- **Robust policy and regulatory framework:** Creating a clear and coherent framework that enables market-based carbon reductions, including strong MRV systems and harmonisation of current laws and regulations.
- **Strong institutional capacity and coordination:** To successfully implement a carbon market, government agencies, the private sector, and other stakeholders must build capacity and collaborate across sectors and government levels.
- **Careful market design and risk management:** To overcome market obstacles and risks, a carbon market must take local conditions into consideration and include measures to assure market stability, transparency, and integrity.
- **Stakeholder participation and social equality:** Vulnerable groups and indigenous peoples must be included in the design and implementation of a carbon market to promote social justice and achieve sustainable development objectives.
- **Environmental safeguards:** Including environmental safeguards in the design and operation of a carbon market helps reduce environmental consequences and assure sustainability.

6. Recommendations for Developing a Carbon Market in the Philippines

6.1 Policy reform

- Create a carbon market policy and regulatory framework with effective MRV systems, emissions ceilings, and allowance allocation procedures.
- Align climate change mitigation policies and regulations with carbon market goals.
- To guarantee wide support and effective implementation, include stakeholders including the business sector, civic society, and impacted communities in policy formation.

6.2 Institutional capacity-building

- Improve institutional capacity and coordination among key government agencies and stakeholders to administer and execute a carbon market.

- Train and help local carbon market designers, implementers, and monitors.
- To share expertise and create capacity, collaborate with international organizations, professionals, and carbon market-experienced nations.

6.3 Risk and market development

- Make the carbon market clear, stable, and efficient for local conditions.
- Price floors, ceilings, and market stability reserves reduce price volatility and market manipulation concerns.
- Monitor and adjust the carbon market design to meet emissions reduction targets.

6.4 Social and environmental sustainability

- To promote social fairness and sustainable development, include disadvantaged groups and indigenous peoples in carbon market design and implementation.
- Environmental protections in the carbon market reduce environmental damage and promote sustainability.
- Assess the carbon market's social and environmental impacts and adjust its design and execution to meet sustainable development objectives.

7. Conclusion and Future Research Directions

7.1 Summary of findings

This research examined the Philippines' unique setting and other countries' carbon market development prospects and difficulties. Policy and regulatory reform, institutional capacity building, market development and risk management, and social and environmental sustainability were recognised as critical determinants for carbon market development.

7.2 Policy/practice implications

This research impacts Philippine climate change mitigation policymakers, practitioners, and stakeholders. The proposals may help create and execute a carbon market that meets the country's requirements and draws from foreign experiences.

7.3 Future research directions

Future study might examine how a carbon market would affect energy, industry, and agriculture, as well as the efficiency of various policy tools and market design characteristics in reducing emissions. Regional and international collaboration in carbon market development, such as connecting the Philippine carbon market to Southeast Asian carbon markets or

participating in international emissions trading systems, might also be studied.

References

- Cullenward, D., & Victor, D. G. (2018). *Making Climate Policy Work*. Polity.
- Ellerman, A. D., Marcantonini, C., & Zaklan, A. (2016). The European Union Emissions Trading System: Ten Years and Counting. *Review of Environmental Economics and Policy*, 10(1), 89-107.
- Partnership for Market Readiness. (2017). *Establishing an Emissions Trading System in the Philippines: Design Considerations and Policy Options*. World Bank, Washington, DC.
- Stavins, R. N. (1998). What Can We Learn from the Grand Policy Experiment? Lessons from SO₂ Allowance Trading. *Journal of Economic Perspectives*, 12(3), 69-88.
- World Bank. (2020). *State and Trends of Carbon Pricing 2020*. World Bank, Washington, DC.
- Zhang, Q., Wang, M., & Lin, L. (2019). The Development and Reform of the Chinese Emissions Trading System. *Climate Policy*, 19(10), 1243-1255.
- Asian Development Bank (ADB). (2021). *The Potential for Carbon Markets in Southeast Asia: Promoting Economic Growth and Climate Action*.