# Market-Based Instruments in Environmental Policy: Lessons and Principles


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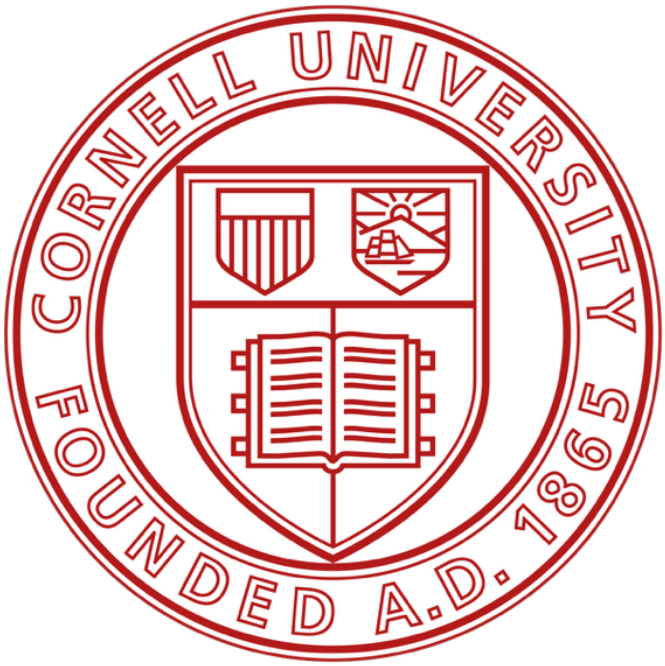


***Cornell University Land Acknowledgement***

*Cornell University is located on the traditional homelands of the Gayogo̱hó:nǫˀ (the Cayuga Nation). The Gayogo̱hó:nǫˀ are members of the Haudenosaunee Confederacy, an alliance of six sovereign Nations with a historic and contemporary presence on this land. The Confederacy precedes the establishment of Cornell University, New York state, and the United States of America. We acknowledge the painful history of Gayogo̱hó:nǫˀ dispossession, and honor the ongoing connection of Gayogo̱hó:nǫˀ people, past and present, to these lands and waters.*

# Abstract

This paper explores the role of market-based instruments (MBIs) in environmental policy, examining them within both the historical context of economic theory and their contemporary use around the globe. By tracing the roots of MBIs in both Pigouvian and Coasean theory, this paper shows how MBIs evolved as a product of neo-liberal environmental governance and appeared as flexible, incentive-based governance alternatives to traditional, coercive command-and-control regulation. The paper shows how MBIs (through selected case studies of carbon markets, debt-for-nature swaps, and green/blue bonds, and payments for ecosystem services) have the power to generate massive new private capital flows to environmental impact, diminishing greenhouse gas production, and incentivizing conservation. However, analysis also reveals continuous weaknesses and vulnerabilities of MBIs: non-additionality, price volatility, burden and sovereignty risks which fall disproportionately on marginalized communities, and commodification risk of irreplaceable ecosystems. Important design and implementation challenges remain. Based on this analysis, the paper identified five principles that will help make MBIs effective and judicious: integrity of outcomes, justice and equity, sovereignty and consent, acknowledgment of non-fungibility, and cultural fit. In summary, the study argues that MBIs are extremely effective in aligning finance with environmental objectives, however, for them to be long-lasting and ethically sound, they must prioritize social justice, moral accountability, and cultural engagement in their design.

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# Section I: Introduction

## i.The Foundation

Never has humanity been confronted with such an existential paradox. On one hand, human civilization is more advanced, scientifically, than it has ever been, with the broadest understanding of our environmental systems that we have ever had. However, on the other hand, humanity has never threatened our own environment's suitability more than we have today. The prospect of anthropogenic climate change is often described as a futuristic threat, an issue for our children. This notion is presented through prospective models of global temperature increase, sea level rise, agricultural deficiencies, and other models often dismissed as speculative. However, climate change is no longer a looming possibility. Anthropogenic activity is only increasing, with proven effects of weather extremes, destabilized agriculture, flooding, and health risks, posing social, economic, and health consequences to humans. Biodiversity loss is accelerating at rates homogenous with historic extinction-level events, decimating the very ecosystems on which humans depend. The entanglement of these crises has created the polycrisis {a term coined by Edgar Morin in reference to global climate issues, meaning "a complex intersolidarity of problems"[1]}humanity faces today, where social vulnerability, as well as economic and political instability, interact with environmental degradation.

A wide range of responses from individuals, corporations, and governments brings hope to slow or even reverse the negative impact human civilization has made on our environment. Classic governmental regulation has produced some important gains. Early in the fight against

[1] Edgar Morin and Anne-Brigitte Kern, Homeland Earth: A Manifesto for the New Millennium, trans. Sean Kelly, Roger Lapoint, and Robert G. Lawrence (Cresskill, NJ: Hampton Press, 1999), 74.

climate change, policies under the Montreal Protocol set emission standards for factories and vehicles. In the 1980s and 1990s, conservation easements were popularized and set up protected areas, providing modest economic incentives for environmental stewardship. However, over the past decade, public subsidies and incentives have become more prominent, encompassing large portions of environmental market capitalization. With much of Wall Street and global markets shifting towards sustainability-focused or attributed investments, market-based instruments (MBIs) have grown in popularity. These policy mechanisms and financial innovations that both use and require the power of capital markets seek to achieve environmental improvement goals. With large portions of global finance oriented in this capacity, market-based instruments underscore the importance of the cohesion between environmental activism and finance. While historically juxtaposed and in competition with one another, there is possibility for tremendous results.

Often proposed as the catalyst for environmental issues; by perpetuating consumeristic tendencies through marketing campaigns, capitalism is at the forefront of the discussion in environmental degradation. However, removing capitalistic frameworks from American economic practice would require an undoing of hundreds of years of cultural and political structure. The arguments against such action would be almost infinite. Few disagree that capitalism results in one of the most efficient economies, and the proposition seems clear. Can we leverage such competitive and efficient capabilities to improve our environment?

**ii. MBIs Present Economic Hope**

The evidence seems clear that MBIs offer promising economic results when contrasted to Command-and-Control (CAC) regulation. Below, Hugo Minney models economic growth rates under both MBIs and CAC policy.

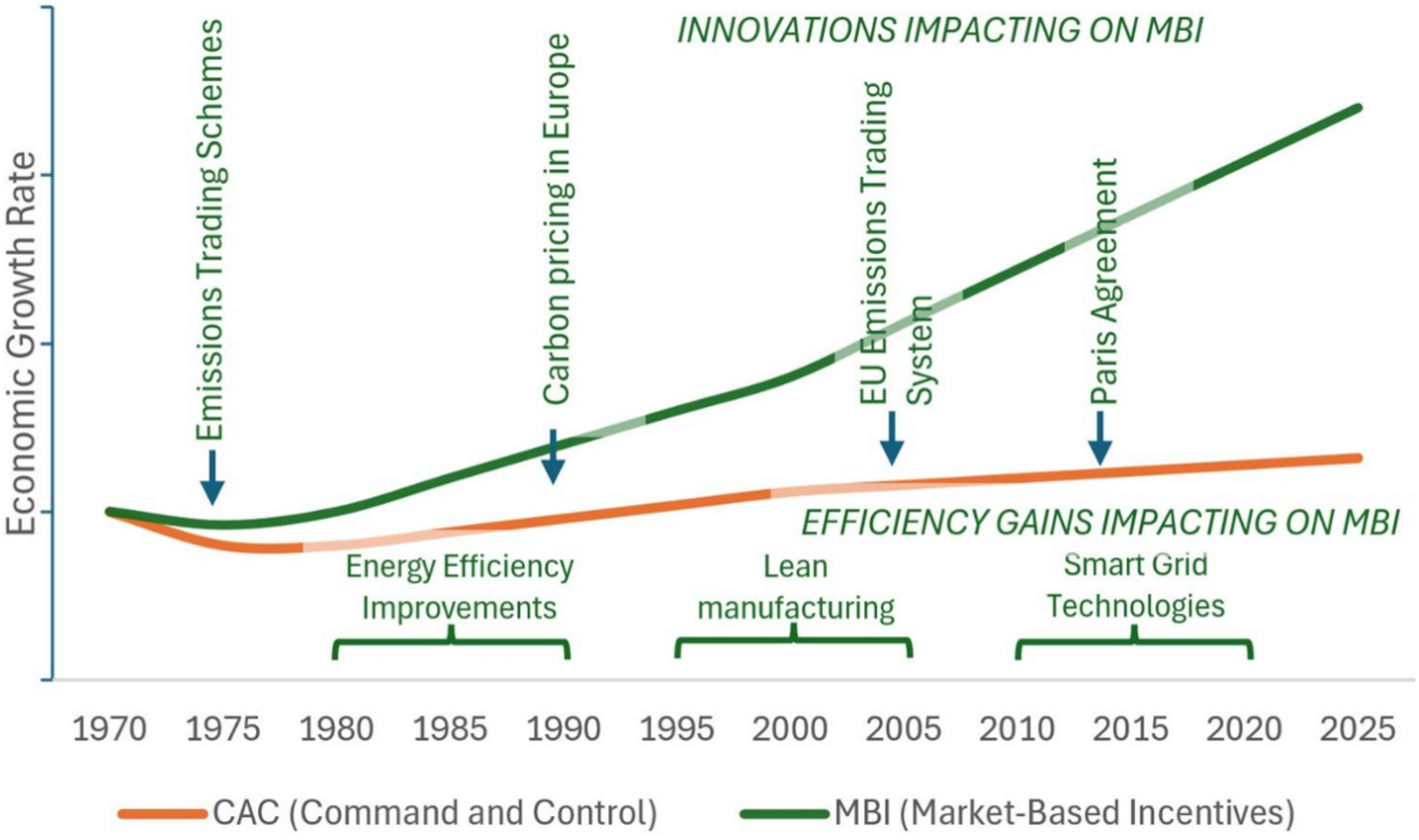


*Figure 1: Minney, Hugo. 2025. "The Impact of Environmental Regulations on Economic Growth: Debunking Myths and Exploring Opportunities."*

While studies like these show a convincing argument for MBIs, philosophical notions not only contribute to support for MBIs but also prove flaws in many implemented incentives. Most market-based instruments rely on a simple proposition: if a failure to properly value nature leads to environmental degradation, then creating markets that properly value nature can correct such

problems. Rather than relying on forced or inorganic policy, which is often quickly reversed during administrative change or overturned by social or political intervention, MBIs offer flexibility within the competitive confines of capitalistic principles. By leveraging such competition, the goal for MBIs is to find cost-effective methods of reducing pollution, conserving ecosystems, or financing environmental restoration. In theory, they promise economic efficiency by allowing a free trade of credit, bonds, or payment schemes between invested stakeholders. The prospect that such competition and open markets can leverage this capitalistic efficiency to outperform the comparative dollar-for-dollar impact of uniform regulation proposes their uncapped capability. Mobilizing private investments (previously directed in capacities outside of environmental impact), MBIs propose the ability to complement limited public budgets and increase funding power in environmental activism.

At times, these propositions have made MBIs attractive across previously divided ideological frameworks. For the capitalist or financier, they propose ways to solve environmental problems without heavy-handed governmental intervention. For the academic, they propose the notion of large funding allocations to data-driven solution implementation. And for the activist, they propose a cohesion between corporations (largely responsible for environmental degradation) and grassroots impact organizers. Therefore, the speed at which MBIs have spread has been remarkable. Carbon trading schemes now have stakeholders worldwide. Debt-for-nature swaps have been implemented across Latin American, African, and Asian nations. Green, blue, and sustainability-linked bonds have grown into trillion-dollar asset classes. Payments for ecosystem services programs (PES) are becoming more common across much of the southern hemisphere. Many first-world countries are exploring or even requiring biodiversity offsets. Water quality and water allocation trading systems function across the Western United States

and many areas of Europe. While 50 years ago, Wall Street seldom considered environmental or social implications, MBIs have begun to reward moral action. However, the devil lies in the details, and the scrutiny of MBIs must remain at the forefront of the conversation when addressing tangible and quantifiable impacts.

**iii. Vulnerabilities**

The proliferation of market-based instruments has called into question serious vulnerabilities. The integrity of carbon markets has been called into question over scandalized, non-additional credits, highly volatile prices, and social issues in jurisdictions with non-equitable land tenure structures.

Similar to non-additional credits in carbon markets, green bonds face accusations of financing projects that would likely have already occurred, as well as questions regarding the quantifiable impact such projects have had. For instance, the EU is constantly under fire for only requiring self-assessment, self-reporting, and self-monitoring structures. PES schemes often exclude communities that lack land tenure, or simply falter once funding ends, calling into question their "permanence" integrity. Biodiversity offsets frequently struggle with ethical debates surrounding habitat substitutions. Water markets can drive social inequities, often pricing out small farmers who are unable to build infrastructure comparable to large-scale industrial farms. This results in shifting cultural narratives and industry engagement within communities and often driving local agricultural production abroad.

Many of these issues have been scoffed at or plainly ignored by financial professionals concerned with these market-based incentives. Such inaction degrades investor confidence and dilutes the necessary cohesion between environmental activism and finance. The entire structure

of market-based instruments is predicated on a cohesive duality; a give and take between policy makers, industry actors, and the activists who drive the debate.

This study is thus highly motivated by the political structure of sustainability. MBIs do not emerge from thin air; they are shaped by global finance, political agendas, international relations, and cultural phenomena. For instance, leakage across jurisdictional or international borders plagues carbon markets, while the entanglement between traditional creditor-debtor structures limits the power and applicability of debt-for-nature swaps.

To study MBIs is therefore to study the structure of valuation within environmental activism, not just the structure of the instruments themselves. For example, traditional finance rewards risk with proportional reward; large stakeholders take proportionally large profits. However, with environmental MBIs, often financial risk is rewarded, while environmental or social risk remains undiscussed. By analyzing who determines nature's worth, who receives payment, and who carries risk, this paper will reframe MBIs as not only economic tools, but universally beneficial tools with moral and cultural implications considered.

**iv. Why this study is needed**

Most existing literature reveals several academic gaps that this paper seeks to address. First, MBIs are most often studied in isolation. Comparative work across instruments is seldom found, limiting our ability to detect philosophic principles across a multisectoral scope, which allows for successes or failures. By addressing these incentives together, the result will be an analysis of comparative qualities that policymakers can use in improving current MBIs or further structuring environmental solutions in the future.

Second, where some comparative assessments exist, the focus remains solely on scientific, environmental, or economic performance. Efficiency and impact are frequently

emphasized, while issues of social justice, legitimacy, and cultural implications are marginalized or undiscussed.

Third, many of the current assessments remain focused on short-term scopes. Often, policymakers look for quick reports of performance during their administration and ignore the long-term durability of market-based incentives. This has driven much of the current literature to focus on two-, four-, and eight-year time scales, rather than assessing the lifespan of the instrument, let alone projecting likely future impacts.

Fourth, the philosophical aspect of market-based instruments is rarely discussed. Trading strict economic assessment for ecological understanding, cultural awareness, and indigenous philosophy, this paper will assess not only the notion of the commodification of nature but also the understanding of philosophical frameworks that have and are likely to contribute to the success of future policy.

*This paper is oriented to diagnose the vulnerabilities of market-based incentives and to articulate the principles of successful frameworks to guide their future design and implementation.*

# Section II: Historical Background

### i. Early Economic Foundations

The groundings of MBIs can be found more than a century ago, embedded in Western economics, neo-liberal environmental policy, and global political ideological shifts throughout the 1900s.

Economic theory has long recognized that externalities underlie market failures. Arthur Pigou formally introduced the concept of externalities in the early 20th century, noting situations

where costs or benefits of an economic activity are not felt only by those engaged in the activity.[2] For example, Pigou described a factory that polluted the air by emitting large volumes of smoke, resulting in adverse health and environmental impacts to neighboring communities, for which the producing firm did not compensate.

Pigou asserted that the State could remedy such market failures in the form of Pigouvian taxes: taxes equal to the marginal social damage of the pollution. Pigouvian taxes would shift the private costs of pollution to the social costs of pollution, thus aligning private industry with social welfare.[3] The goal was direct compensation aimed at penalizing the polluter, whilst providing funds to remedy potential industrial consequences.

Despite the pragmatism of the Pigouvian tax framework, there were practical problems with this structure, such as determining how to quantify damages, calculating the financial tax, and accounting for changes in technological advancements and societal preferences over time. Nevertheless, even with such criticisms, the Pigouvian tax framework provided the economic rationale for internalizing externalities, a notion that represents the economic rationale for MBIs today.

Later throughout the mid-20th century, Western economics saw an evolution in the dichotomic relationship between environmental consideration and fiscal policy in Ronald Coase's famous 1960 essay, The Problem of Social Cost.[4] In his work, Coase articulated the argument that externalities are not just failures of the market, but failures of property rights. If property rights could be well-defined and transaction costs were (relatively) low, the parties affected by the externality could bargain any sort of outcome most efficiently without

[2] A. C. Pigou, The Economics of Welfare (London: Macmillan, 1920).
[3] Ibid., 134–40.
[4] Ronald Coase, "The Problem of Social Cost," Journal of Law and Economics 3 (1960): 1–44.

government involvement. For example, if a farmer has the right to clean air, a factory would compensate the farmer for the industrial pollution it causes. Conversely, if the factory has the right to pollute, the farmer could pay the factory to reduce their pollutants and improve his crop. In both examples, bargaining would result in an economically efficient allocation, according to Coase.

The Coase theorem became central to law-and-economics scholarly work and paved the way for trading permits, an instrument that received its design from property rights. This shifted movement away from tax-based instruments that assumed the singularity of government involvement towards specifying rights and instead allowed stakeholders to accommodate the exchanges in resources. However, the critique of the Coase theorem provides reason for skepticism. The assumption of low transaction costs is often unrealistic, especially in societies where governmental involvement is crucial to national economic viability. Further, power asymmetries are present globally, resulting in often inequitable negotiations. Lastly, environmental systems are often difficult to commodify, as stakeholder engagement often takes the form of the voiceless. Nevertheless, Coasean ideas provided the substrate throughout the late 1900s from which MBIs would grow.

### ii.The Rise of Environmental Activism in Market Thinking

By the 1960s and 1970s, it was clear that global environmental degradation was an international problem: air pollution, oil spills, deforestation, etc. Governments tried traditional regulatory approaches. Command-and-control standards based on intangible goals and industrial bans were the first policies. These early approaches to regulation were successful in some

respects, but criticism arose around regulatory rigidity and the subsequent incurred costs and inefficiencies.

Thus, the discipline of environmental economics developed, providing a blend of Pigouvian and Coasean approaches, creating a case for flexible, incentive-based policies. Economists David Montgomery and William Baumol both developed models that showed the cost-effectiveness of allowing firms to trade pollution permits instead of complying with uniform standards. By the late 1970s, these models were influencing discussions on U.S. policy, particularly regarding air pollution and energy consumption.[5] The intellectual landscape was clear: MBIs offered the promise of achieving the same environmental outcomes at lower costs, in an era of mounting anti-regulation social disposition. It is essential to understand the American political ideology of the time. Governmental regulation was seen negatively, as overregulation in economic policy was likely to be mislabeled as "communist." In a period of Cold War between the Western capitalist and Eastern communist worlds, and with the United States recently recovering from an era of McCarthyism, environmental economics struggled to test broad-spectrum regulatory policy, resulting in the frameworks for neoliberal MBIs.

### iii. Early Experiments in Market-Based Environmental Policy

The most famous early experiment in market-based environmental policy was the U.S. Acid Rain Program. This program was created under the 1990 Clean Air Act Amendments, as there was mounting evidence of acid deposition from emissions of sulfur dioxide ($SO_2$). Policymakers decided to approach the challenge of reducing $SO_2$ emissions with a market-based approach, implemented as a cap-and-trade system.

[5] William J. Baumol and Wallace E. Oates, The Theory of Environmental Policy (Cambridge: Cambridge University Press, 1975).

Rather than developing rules for uniform emission cuts, Congress established an overall cap on $SO_2$ emissions and a system of tradable allowances that would be allocated to utility providers. Allowances traded between companies at a low cost, with some producers selling surplus allowances to others if they reduced their own emissions. By 2010, $SO_2$ emissions were reduced by over 50 percent, while compliance costs dove to rates proportionally lower than traditional regulation.[6]

This apparent success became a model for market-based instruments, as referenced by economists and policymakers as evidence that capital markets could solve environmental issues. Notably, the legacy of the Acid Rain Program resulted in the design and implementation of the carbon cap-and-trade scheme in the European Union (EU).

The success of the $SO_2$ program was undisputed. However, more importantly, were the flaws revealed by the pioneering MBIs in the U.S. While the environmental benefits were undeniable, such results remained uneven, as some areas of the U.S. still experienced significant acidification. Communities near manufacturing facilities that purchased allowances saw little improvement. The social inequities became apparent, with communities disproportionately affected based on geographic, social, and economic factors. The program illustrated the potential of MBIs but brought to attention the commensurate equity-risks associated with their implementation.

While praised for their efficiency since their emergence, MBIs have been criticized for their ethical implications. Proponents argued that markets provided flexibility, innovation, and cost savings to taxpayers. They also proposed that scalability made ambitious environmental improvement realistically feasible. Opponents argued that the markets represented the

[6] A. Denny Ellerman et al., Markets for Clean Air: The U.S. Acid Rain Program (Cambridge: Cambridge University Press, 2000).

commodification of nature, that ecosystems were considered fungible, and that ecological destruction was legitimized when conducted in the interests of "compensation."

Environmental economists such as Herman Daly warned back in the late 1970s and 1980s that efficiency arguments, while important, excluded the consideration of ecological limits and intrinsic values.[7] Political ecologists emphasized the power relations around MBIs. Who decides on the provision of property rights, who engages in trading, and who is, or should be, handed the bill for those costs? Indigenous scholars weighed in. Many cautioned that market structures were antithetical to relational world views about land and species; that commodifying nature proposes a disconnect between humans and the natural world we inhabit. These existential questions, considered throughout human history from pre-Socratic thinkers to transcendentalist authors, underscore the complexity surrounding the place of MBIs in our society today.

# Section III: Cases

To derive principles for the future success of MBIs, one must look at the successes and shortcomings of instruments already tried. In analyzing current flaws, we might remediate and correct areas of opportunity for social justice, equity, and investor confidence.

### i. Carbon Markets

Carbon markets, often referred to as the flagship of environmental commodification, encompass a varied set of principles, vulnerabilities, and economic structures. Designed to quantify the externality of greenhouse gas emissions and commensurately offset these emissions

[7] Herman E. Daly, Steady-State Economics (San Francisco: W.H. Freeman, 1977).

by proving an amount of sequestered and stored carbon or reduced carbon emissions. The power of these markets is solidified in a three-part structure. First, by putting a financial evaluation on carbon, governments, industries, and firms create incentives to reduce or offset emissions where it is cheapest to do so. Second, by allowing the trading of carbon commodities, these systems enable innovation and flexibility across a multisectoral scope, leading to the most volumetric reduction of greenhouse gas, regardless of geography or industry. And third, by scaling across this multisectoral scope, carbon markets have an inability to mobilize billions, and even trillions of dollars into low-carbon investment. However, time has shown complexity in these structures. With measurable reductions in emissions and quantifiable stored sequestered carbon, the environmental benefits seem clear. But two decades of experimentation have revealed recurring scandals, integrity crises, and social inequities.

The European Union Emissions Trading System (EU ETS) began in 2005 and remains one of the most influential carbon markets in the world. This cap-and-trade scheme was initially criticized for over-allocation of carbon emissions allowances, leading to highly volatile carbon pricing, with huge price crashes early on. However, reforms in the mid-2010s, such as creating market stability reserves and stricter allowance-generation protocols, strengthened the system. Surging to prices over $50, allowances begin to show a truly financially viable solution for pricing carbon and using markets to disincentivize carbon emissions. This shift of pricing from nominal to material led to a shift in the power sector toward renewable or cleaner energy. Most analysts agree that the EU ETS was a primary contributor to the union's ability to meet its 2020 environmental impact goals. Importantly, this highlights the sizable impact market-based instruments can have on decarbonization when designed carefully and reworked intentionally.[8]

[8] A. Denny Ellerman, Frank Convery, and Christian de Perthuis, Pricing Carbon: The European Union Emissions Trading Scheme (Cambridge: Cambridge University Press, 2010).

Parallel to the EU ETS, the Kyoto protocol created the clean development mechanism (CDM), designed to create a symbiotic relationship between developed and developing countries through environmental markets. Developed countries finance projects in developing countries or underdeveloped countries in exchange for certified emissions reductions (CERs). In theory, the clean development mechanisms' proposed win-win outcomes were developed. Countries would receive cost-effective environmental mitigation, and developing countries would receive capital investment. However, the flaws became apparent early on. Additionality enforcement became almost impossible. The subjective nature of early definitions for additionality requirements provided critics of the CDM with grounds for skepticism. Many critics argued that some CDM projects, such as large hydro dams or wind farms, would have likely been built even without carbon finance, as they proved profitable in areas of economic growth on their own merits.[9] Also, a conflict of interest arose, where industrial gas projects were now incentivized to produce greenhouse gases, just so they could restructure and be paid to reduce emissions. There was no incentive to start a clean business, but rather an incentive to start a business that polluted at alarming rates, so proprietors and stakeholders could then be paid to reduce their emissions. This conflict of interest highlighted the need for more rigorous regulatory standards in market-based incentives.

The next example of compliance markets is California's cap-and-trade program. While the program has achieved many of its targets, critics have raised controversial issues over environmental justice. Firms with large capital resources have been able to meet their obligations through allowances or offsets purchased elsewhere. Therefore, facilities have sometimes continued their emissions locally, causing low-income communities - often disproportionately

[9] Lambert Schneider, "Is the CDM Fulfilling Its Environmental and Sustainable Development Objectives?" Climate Policy 9, no. 1 (2009): 85–111

people of color - to experience co-pollutant burdens, even as aggregate emissions decline statewide.[10] So, while the state is achieving its goals and many of the reports show promising results, critical questions about distributive justice and the ethics of trading schemes that prioritize cost-effectiveness over social equity arise.

The last notable market to explore is voluntary carbon markets (VCM). These markets have surged over the past five years as companies have pledged their net-zero goals to investors and consumers. Often, these markets help to finance forestry, clean energy, and agricultural projects while simultaneously driving technological advancement in carbon measurement, reporting, and verification. The market has demonstrated tremendous growth, as firms see tangible fiscal benefits when working towards these goals. However, questions arise around credits, which are often issued for forests not under legitimate threat of harvest, inflated carbon baselines, or overstated impact.[11] Furthermore, land tenure issues have shown that social inequities persist, as profitability in these projects requires an economy of scale that small landowners lack access to. Critics further raise questions over indigenous and local communities' benefit from these projects, as nebulous land tenure and profit allocation often leave out inhabitants of these lands.

**Vulnerabilities and Philosophies**

The consistency of vulnerabilities across these four carbon markets shows meaningful reason for skepticism. First, the integrity of outcomes is likely the most impactful vulnerability. Be it CDM's accusations of non-additional projects, or inflated baselines or leakage issues in

[10] Danny Cullenward and David Victor, Making Climate Policy Work (Cambridge: Polity Press, 2020), esp. Ch. 3 on California.
[11] Barbara Haya et al., "Managing Uncertainty in Carbon Offsets: Insights from Recent Investigations," Global Environmental Politics 22, no. 3 (2022): 1–24.

carbon markets, prioritizing the quality of environmental impact and quality of science quantifying that impact remains an apparent necessity. The market simply cannot function if the commodity traded does not represent the real-world quantity associated with it.

Furthermore, justice and distributive equity are often marginalized. Both in California's cap-and-trade scheme and in global voluntary carbon markets, a critic can see how aggregate compliance can frequently lead to uneven burdens across social boundaries. Most argue that these uneven burdens disproportionately affect marginalized groups, often based on race or socioeconomic factors.[12] Lara Cushing's 2022 paper *Carbon Trading, Co-pollutants, and Environmental Equity: Evidence from California's Cap-and-Trade Program* found:

> *GHG-emitting facilities regulated under California's cap-and-trade program are disproportionately located in disadvantaged communities (Fig 1). The relative differences between neighborhoods within 2.5 miles (4.0 km) (based on their geographic census block group centroids) of a regulated facility as compared to neighborhoods located beyond 2.5 miles were, on average, 59% higher in population density, 34% higher in the proportion of residents of color, 23% higher in the proportion of poor residents, 64% higher in the proportion of residents with low educational attainment, and 80% higher in the proportion of linguistically isolated households in which no one age 14 years or older speaks English very well.*

[12] Lara Cushing et al., "Carbon Trading, Co-pollutants, and Environmental Equity: Evidence from California's Cap-and-Trade Program (2011–2015)," *PLOS Medicine* 15, no. 7 (July 2018): e1002604, https://doi.org/10.1371/journal.pmed.1002604

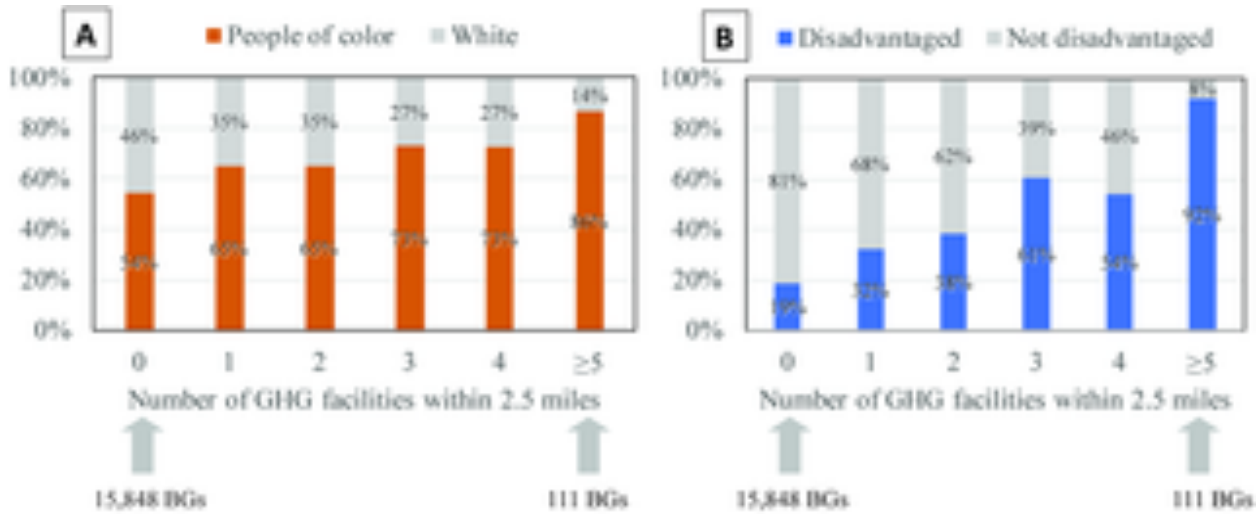


*Figure 2: Carbon Trading, Co-pollutants, and Environmental Equity: Evidence from California's Cap-and-Trade Program (Cushing et al.)*

While operating under the guise of environmental stewardship, accusations of indigenous communities being excluded from land use remain. Issues of land tenure should lead investors to question just who the financial beneficiary of these projects is, and further, what ethical implications are associated with the structure of the project's profit-sharing protocols. Frequently, counterarguments criticize states' land tenure issues as a problem in profit-sharing. Yet, in examining North America, we see highly structured land tenure enforcement; however, we should still pause to question the justice of the tenure in place.

These vulnerabilities strike at the philosophical foundations of market-based incentives, rather than the technical glitches that are often attacked and quickly rectified. Aristotle, the philosopher, would say that everything has a telos, or a proper end. The ultimate goal of carbon markets is to reduce carbon emissions and capture atmospheric carbon, storing it in a solid state. That goal must be solidified and honored, rather than twisted and manipulated to be a goal of financial transaction. Highlighting vulnerabilities is crucial for correcting markets, as investor confidence is essential for driving the market toward achieving environmental goals.

### ii. Debt for Nature Swaps and Green/Blue Bonds

Debt-for-nature swaps (DNS) began in the late 1980s, sprouting from a debt crisis in Latin America. During this, the emergence of international environmental non-governmental organizations led to the first widely recognized swap in 1987, when Conservation International negotiated with a commercial bank to purchase $650,000 of Bolivian debt at a discount in exchange for the government's commitment to preserve 3.7 million acres of tropical forest. The model rapidly spread. Other NGOs, like the Nature Conservancy and World Wildlife Fund, were able to coordinate dozens of swaps across Latin America, Africa, and Asia. Later, arrangements grew, including the U.S. Tropical Forest Conservation Act (TFCA), which further institutionalized the model by converting large patches of debt into conservation endowments held by local trust funds.[13]

Green and blue bonds have followed a separate but parallel course, beginning with the World Bank and European Investment Bank in 2007-2008, channeling capital market investment into projects with a label of environmental benefit. By the 2010s, sovereign issuances were distributed from countries in Europe and South America, indicating the broad adoption and adaptation of this model. Blue bonds were most recently developed, first with Seychelles' 2018 issuance, and further refined with the administrative arrangements under Belize's 2021 debt conversion. By 2022, the cumulative issuance of the green bond market reached over $2 trillion, indicating a growth in the appetite of institutional investors for environmental finance.[14]

[13] Ascher, William. "Debt-for-Nature Swaps: Taking Stock." Environment 33, no. 4 (1991): 6–11.
[14] Climate Bonds Initiative, Green Bond Highlights 2021 (London: CBI, 2022).

**Vulnerabilities and Philosophies**

While creativity in DNS and green/blue bonds provides stakeholders with flexibility, these mechanisms share similar vulnerabilities to issues with other MBIs. Issues of sovereignty and legitimacy have arisen in the fixed-income space. Critiques of DNS began with their "green" conditionality on developing country borrowers. While these conditionalities were mostly referred to as "voluntary," DNS usually resulted in power relations that favored the creditors of heavily indebted countries. Even when conservation priorities were being established, they were being set in Washington or Geneva, rather than democratically within the project's geographic area.

Scalability and durability present other issues. DNS have remained small in scale when compared to states' debt load. For example, a swap may contain tens of millions of dollars for a country with a debt load of billions of dollars. While this presents an opportunity for scalability, there will always be a finite market for fixed-income instruments. Many financial institutions carry fixed asset class ratios and are only willing to extend themselves so far in fixed-income markets. Short of artificial inflation of market demand through regulation, this appears to be a likely long-term issue.

Further, the rate of growth in green and blue bonds is ahead of the development of robust standards. Many issuances are being criticized in the press for labeling expenditures as "green" without any actual environmental benefit. The issue of "Greenwashing" persists. Further concern is voiced about the sustainability-linked bonds (SLBs) design. Often using weak or easily achievable key performance indicators, SBLs can compromise the credibility of these schemes and MBIs entirely.[15]

[15] Daniela Gabor, "The Green Bond Market: A Critical Appraisal." *New Political Economy* 25, no. 3 (2020): 423–36.

Transparency and accountability have also been reported as issues in DNS. The rules around disclosure vary significantly. Some issuers provide detailed impact reports audited by third-party organizations, while others offer little-detailed summaries. The lack of a standardized reporting system diminishes comparability and investor confidence. One of the largest regulating agencies, the Sustainable Finance Disclosure Regulation (SFDR), has maintained only a self-reporting and self-assessment protocol. Further, civil society actors often have less oversight of bond proceedings, limiting their ability to effectively ask questions, and in turn, raising questions of legitimacy.

*It is worth noting, however, that the SFDR standard, at the time of this paper, is currently under review, with multiple proposed amendments that would enhance MRV for EU-accepted green bonds.*

Vulnerabilities of DNS and green/blue bonds expose the philosophical structure of environmental finance. For Habermasian legitimacy, often touted for considerations for social equity, decision-making must be inclusive and transparent, with justifiable decisions by all stakeholders.[16] When conservation priorities are externally defined by creditor countries or collations of investors, the absence of deliberative legitimacy disgraces the moral legitimacy of these instruments.

Theories of sovereignty and non-domination are important here. While a debtor nation facing coercive financial pressures might accept environmental terms, it may not be a legitimate actor free to do so. At the community level, particularly for Indigenous Peoples, Free, Prior and

[16] James Gordon Finlayson and Dafydd Huw Rees, "Jürgen Habermas," *Stanford Encyclopedia of Philosophy*, last modified September 15, 2023, https://plato.stanford.edu/entries/habermas/

Informed Consent (FPIC) extends and solidifies the argument: conservation finance that restricts livelihoods to secure rights to land or privileges in land use without consent reproduces colonial dynamics. For projects seeking ethical legitimacy, accountability in finance must be connected to a philosophical orientation toward truthfulness, trust, and inclusion.

From DNS and green/blue bonds, several principles emerged that build on and extend the principles found in carbon markets.

Sovereignty and consent seem of utmost importance. Environmental finance must align with democratic priorities and commit to obtaining consent from communities affected by any projects. Debt service conversions must be endorsed in domestic processes. Investment funds will commit to local community representation, and FPIC will be a condition valued wherever Indigenous rights are affected. Absent these conditions, environmental progress and financial profit overshadow human dignity.

Next, accountability and additionality are premises that, while specific, lend to broader principles in the structure of MBIs. Green and blue finance must produce specific outcomes that "would not occur otherwise," be marketed with independent audits, and be monitored by transparent disclosures. The various taxonomies and standards (e.g., EU Green Bond Standard, SFDR) are initial steps; enforcement will be the pressing issue. If investors and issuers are not subject to credible penalties, the solution for everyone will be to game the system. Additionally, accountability requires complete disclosures to the public with data about reported impacts, allowing civil society to keep oversight on these public projects.

Where carbon markets exposed challenges in the number of layers to integrity and justice compliance, DNS and green/blue finance reveal similar issues of sovereign and capital markets. The lesson is clear: without sovereignty, consent, accountability, and verifiable additionality,

conservation finance will be solely for financial gain or exploitative in practice. As we explore payments for ecosystem services and biodiversity offsets, the same questions continue to emerge in another form: who is being incentivized for financial benefit and who is being left out?

**i. Payment for Ecosystem Services**

While carbon markets commodify emissions, stored carbon, and reduced carbon impact and debt for nature swaps reframe fixed income financial instruments as tools for environmental impact, payment for ecosystem services (PES) similarly uses market logic to value the services provided by nature. In PES systems, landholders receive payments for environmental stewardship, which maintains or enhances ecosystem services, such as carbon storage, watershed protection, or biodiversity improvements. In such settings, for instance, developers who damage ecosystems are required, in theory, to compensate for such damage by funding restoration or environmental impact elsewhere, ideally achieving a "no-net-loss" scenario. Superficially, the systems show promise and opportunity in areas where human impact is inevitable, and ecological management can benefit ecosystems elsewhere. However, at deeper levels, PES often illustrate issues around justice, consent, and fungibility.

Costa Rica's national payment for ecosystem services program was launched in the 1990s, funded primarily by a fuel tax. The program seeks to pay landowners for forest conservation, including afforestation, reforestation, and sustainable forestry management. Positive reports on this PES system show that the system has contributed to slowing, and in some cases, reversing deforestation, as well as channeling resources to thousands of small and medium

landholders.[17] Importantly, it emboldened the practice of creating a domestic policy, directing funds to conservation deserving of compensation.

Next, Mexico's PES program focused on communal lands known as ejidos. The structure highlights the potential of PES when specifically built to accommodate local governance systems. The incorporation of already present environmental institutions and regulatory systems reinforced collective management.[18] However, globally, the expansion of payment for ecosystem services has been extremely uneven. In many developing countries, payments frequently fail to account for gendered divisions of labor, often leaving women's contributions invisible. As some nations may be able to incorporate PES schemes with their current structure, the key takeaway is that there must be local adaptations and considerations for socially equitable results. Further, PES schemes dependent on external donor funding often collapse once this external finance ends, proving to fold: one, that inorganic systems are temporary Band-Aid solutions, and two, that PES schemes, derived solely from non-market-based funding, present durability problems.

**Exposed Vulnerabilities and Philosophies**

While many cases of success show promising futures for PES schemes, many vulnerabilities have been expressed by critics globally. First, distributional equities remain present in many schemes, often in developing nations with land tenure issues. Like carbon markets, PES programs often exclude the poorest populations, while payments accrue to the wealthiest population who hold political or economic power already. Landless farmers, or indigenous groups, who lack enforceable tenure, often remain uncompensated despite their

[17] Sven Wunder, "Payments for Environmental Services: Some Nuts and Bolts," CIFOR Occasional Paper No. 42 (2005).
[18] Leticia Merino, "Ejidos, Local Governance, and PES in Mexico," World Development 40, no. 10 (2012): 2096–2107.

stewardship. Even when smallholders do participate, critics frequently highlight payment levels, lower than opportunity costs, limiting long-term financial viability for smallholders, voiceless in scheme composition. This leads to arguably the greatest issue in PES, which is that local participation in scheme development is frequently limited. Contracts may be signed without consent or consultation with local groups or communities, sometimes leading to benefits being distributed in ways that fuel local conflict. For indigenous communities, the absence of FPIC is particularly notable, echoing colonial patterns of imposed Conservation to rectify issues not caused originally by said indigenous groups. Lastly, issues of non-fungibility arise. Many PES offsets assume that ecological losses and gains are substitutes across geographies or timescales, but many ecosystems are simply unique and irreplaceable. Even where equivalent metrics are applied, subjectivity clouds the quantitative ability of PES projects. Scholars warn offsets may do more harm than good, legitimizing environmental destruction by offering a purchasable license to do harm.

## A Note on Commensurability

One of the largest philosophical lessons learned from PES pertains to the notion of fungibility. The question of commensurability (whether all values can be reduced to an economic good of a single unit) is a key issue in many philosophical debates around payments for ecosystem services . In *Nicomachean Ethics*, Aristotle asserts: while money facilitates exchange between some unlike goods, it does not necessarily function as a commensurable value for all goods.

*"All goods must therefore be measured by some one thing… now this unit is in truth demand, which holds all things together, but in a manner of speaking it is money, for this is a sort of representative of demand; and so all things become commensurable in a way. But it is not possible that things differing so much should become truly commensurable."*[19]

His assertion that money can represent commensurate demand proves true in most free markets. However, it begs the question: "What are we to do for a necessary resource that has no demand, yet is crucial to humanity's very existence?"

# Section IV: Principles for Effective, Inclusive Market-Based Instruments

The case studies of carbon markets, payment for ecosystem services, and fixed-income instruments exhibit both the opportunity within market-based incentives, as well as the flaws within such systems. Each instrument revealed inherent vulnerabilities, which undermine the structure's credibility, the subsequent impacts on justice or ethical implications, or the long-term durability of environmental outcomes. From these examples, several broader principles can be distilled into frameworks for improvement or new design of MBIs. When applied together, and in consideration of one another, they ensure the ability of an MBI to deliver tangible, quality environmental benefits.

[19] Aristotle, *Nicomachean Ethics*, trans. Terence Irwin (Indianapolis: Hackett, 1999), V.5

### i. Integrity of Outcomes

By quantifying and verifying environmental impact from MBIs, we can grow investor confidence and scale future financial allocation toward environmental improvement. Carbon markets specifically, exhibit the indispensability of integrity. When issued credits or retired offsets do not reflect real, additional, and verifiable reductions or removals, the system becomes a shell for financial players to exploit environmental interests. Further, inflated forest carbon baselines, improper accounting of buffer pools, or leakage metrics, and lack of real critique for jurisdictional enforcement of permanence, deflate investor confidence and divide the cohesion between financial systems and environmental impact.

A similar risk applies to PES and sovereign bonds. When these fixed-income programs are designed with inorganic external funding resources, conservation outcomes are short-lived past the moment donor support ends. While these payments may alter or slow environmental degradation in the short term, financial actors have disingenuous opportunities by frequently portraying their schemes as permanent solutions. Sovereign green bonds, similarly, exhibit the importance of integrity of outcomes while deflecting fire from critics questioning the methods of self-reporting and self-monitoring environmental impact projects. By requiring third-party validation and verification bodies, like the many carbon registries are now, the integrity of conservation outcomes will be ensured and protected. Not only does protecting these outcomes ensure tangible environmental impact, but it further strengthens investor confidence and protects the durability of market-based incentives in the long run. For instance, voluntary carbon markets reflect price differences in the quality of credit issuances. For example, Verra, one of the most rigorous registries, with intentional methodological standards, issues credits that always trade at higher prices than registries' issuances of less verifiable VCUs. This shows an interest in quality

and verifiability of environmental outcomes by investors, which drives the market toward more rigorous methodological standards in the future. This cycle shows the ideal symbiosis between leveraging capitalistic ideology and yielding improved environmental outcomes. In turn, outcome integrity is not only paramount to environmental impact, but also to the durability of the market structure in the long-term.

### ii. Justice and Equity

Justice emerges as another consistent challenge market-based incentives face. Reflecting capitalistic histories, frequently marginalized groups are disproportionately negatively affected by flaws in market systems. As discussed, California's cap-and-trade system not only allowed but financially encouraged industrial facilities to purchase allowances rather than reduce local emissions. Prioritization of *aggregate* efficiency of greenhouse gas emissions reductions statewide led to the negative cost of distributive fairness.

Similarly, PES often excludes not only the voice, but the financial benefit of poor communities that lack enforceable land tenure. In turn, globally, indigenous communities suffer at the hands of modern-day colonialism. This is further reflected in issues with debt-for-nature swaps, where developing nations are at the mercy of imbalanced power structures between themselves and their creditor nations.

The solution to this seems clear – in designing market-based incentives, the structure must not remain purely capitalistic, but require enforceable regulation protecting marginalized groups globally. In a rush to solve environmental issues, there has been oversight on social ramifications. We must revisit these considerations. We must further consider proper flows of

money to reduce humanitarian conflict and provide equitable compensation by understanding local politics, geopolitics, and anthropological history in areas affected.

### iii. Sovereignty and Consent

The notion of justice and equity pertains primarily to the flow of money. However, control and participation are equally responsible for humanitarian conflict. Often, environmental projects perpetuate negative co-effects on local populations. For instance, building hydroelectric dams can disrupt access to water resources or fisheries in local communities. Carbon projects may prohibit certain Agroforestry practices or revenue-producing timber harvests. However, far too often we have seen local small holders and indigenous communities negatively affected by projects funded by debt for nature swaps, payment for ecosystem services, or carbon markets. Frequently, these marginalized groups lack the ability to voice their opinions or issues and get overshadowed by developed nations' financing or corrupt local politicians. This can lead to a myriad of factors, including water access, impacted agricultural production, or means of livelihood becoming impracticable. Human conflict often arises in areas where people's ways of life have been disrupted by capitalistic ventures. We must ensure that human sovereignty is protected and affected local populations are given not only a voice, but decision-making capacities for environmental projects in their areas of occupation.

### iv. Non-fungibility and Ethical Limits

The pretense for environmental offsets, as exhibited in carbon markets, biodiversity offsets, and other MBIs, raises questions about fungibility. Ethical limitations are presented when trying to replace one natural ecosystem or process with another. While academics hash out

the details, the premise seems clear – that much of our natural world is unique and irreplaceable. While doing improvement projects for environmental benefit elsewhere may present positive outcomes, the destruction of initial development remains unchanged. Offsetting schemes frequently legitimize processes that remove old-growth forests and erase coral reefs or sacred landscapes, reducing unique ecosystems to fungible commodities. Industry stakeholders must consider the necessity of project origins and ethically weigh the costs of ecosystems affected. Compensation must not take the form of a 1:1 ratio but rather exhibit such a ratio to disincentivize environmental degradation, and justly account for the damages caused.

**v. Cultural Fit**

Finally, market-based instruments must fit the cultural and institutional systems in which they are to be implemented. As seen in Mexico's ejidos, PES schemes' success depends on building communal governance structures, rather than imposing top-down policy. Further, in lesser-known MBIs, such as water markets, commodification of water was sometimes antithetical to local social meanings of water as a "shared good." Without local support, market-based incentives lack financial durability and will appear as a mere blip on the time scale of anthropogenic environmental impact in that area.

Cultural fit requires inclusive governance, respect for traditional ecological knowledge, and consideration for local cultural values and practices. Successful markets succeed when they resonate with lived realities. The NASDAQ reflects American and global interest in industry and firms; environmental markets should reflect global interest in environmental impact, including *all* voices affected. Designing MBIs without regard to cultural fit risks both their effectiveness

and legitimacy. Coupling such risk with a much higher risk of low market durability and investor confidence will reflect in an unstable market.

# Section V. Conclusion

When put together and considered holistically, these principles form a centrifuge around which an MBI can be properly designed and implemented. Considering the integrity of outcomes ensures not only an effective market, but a market which can provide investor confidence and remain durable, while respecting justice and sovereignty, ensuring the fairness and equity of the MBI. Recognizing non-fungibility will prevent irreplaceable loss, while considerations for cultural fit ensure quality of human impact and market permanence. The ethical implications seem clear, but an idealist will understand that many investors won't care. However, a participant in these markets must understand that these principles are not only about morality, but the preservation of the market systems from which financiers profit. Without these considerations, a market-based instrument will be at best temporary but may even demand compensatory damages. The profitability and ethical implications of market-based instruments lie in these principles, whereby environmental consciousness and human dignity are valued higher than financial gain.