ESI Bulletin

ESI Bulletin on Opportunities and Challenges for Voluntary Carbon Markets (Volume 19 / Issue 4 · December 2025)

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INTRODUCTION

The main theme of this issue is the opportunities and challenges for voluntary carbon markets.

The global carbon market has been dominated by compliance carbon markets (CCMs) under various government-regulated emissions trading systems. According to Global Market Insight's Carbon Credit Market Report, published in February 2025, CCMs accounted for 98.5% (113.1 billion USD) of the global market, while voluntary carbon markets (VCMs) comprised 1.5% (1.7 billion USD). Although VCMs remain much smaller than CCMs, they have experienced substantial growth in the 2020s due to heightened demand for high-quality carbon credits, an increase in the firms' net-zero pledges, and stakeholder pressure for corporate social responsibility. VCMs are expected to continue to grow, as greater efforts to decarbonise are required and global carbon credit demand will also increase. Leading global consulting firms, such as McKinsey and the BCG, estimate that the size of VCMs could reach 5-50 billion USD in 2030.

Despite such rosy prospects, VCMs face challenges that need to be addressed to enable further development. In particular, the lack of a unified international framework for carbon credit standards has long been a barrier to the expansion of VCMs. Although there have been significant efforts to refine the standards, several independent

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standard organisations that certify the carbon credits in VCMs still use different assessment and verification methodologies. It was expected that the rules for carbon trading under the Paris Agreement Article 6, agreed at COP29 in 2024, would facilitate both CCMs and VCMs by providing specific guidance on international carbon trading. However, certain principles of carbon credits, such as non-permanence and reversals, were still debated and left unresolved at COP30 in November this year. The absence of a standardised methodology to certify the quality of carbon credits not only impedes market efficiency but also undermines market confidence by casting doubt on the environmental integrity of VCMs.

Several initiatives were launched in recent years by non-profit organisations and governments to address these challenges, particularly to enhance the credibility and environmental integrity of VCMs. The Integrity Council for the Voluntary Carbon Market (ICVCM) released the Core Carbon Principles and Assessment Framework in 2023, which established standards for high-quality carbon credits grounded in the latest science and best practices. The Voluntary Carbon Markets Integrity Initiative (VCMI) also published a set of recommendations for VCMs, including a demand-side rulebook on the use of carbon credits and a supply-side toolkit for countries. Moreover, organisations in Malaysia, Indonesia, Singapore, and Thailand developed a regional initiative, the ASEAN Common Carbon Framework (ACCF), to address both the supply and demand for high-quality carbon credits within Southeast Asia by creating an interoperable, transparent, and efficient carbon market. Finally, the Coalition to Grow Carbon Markets, launched by the governments of Singapore, the UK, and Kenya, unveiled its Shared Principles for Growing High-Integrity Use of Carbon Credits by Companies and Other Buyers. The principles set benchmarks for credible corporate use of carbon credits and link Article 6 and VCMs.

With this background, this edition of the ESI Bulletin discusses the opportunities and challenges for further development of VCMs. In the first article, Dr. Joydeep Ghosh, ESI Research Fellow, provides an overview of recent carbon market developments in Southeast Asia and argues that increased demand for high-quality carbon credits and the growth of VCMs can play an essential role in industrial decarbonisation in this region. Notably, he emphasises the role of the industrial sector as a carbon credit supplier rather than a carbon credit buyer. He also points out the importance of assessing the impact of carbon markets on the economy, periodically reviewing regulations, monitoring economic conditions, and fostering international cooperation.

The second article, by Dr. Li Hongyan, ESI Research Fellow, focuses on the challenge of VCMs mentioned above: the integrity gap arising from the different standards and assessment methodologies. She explores the complexity of defining and verifying high-quality carbon credits by reviewing and comparing several assessment and rating systems currently in use, and explains how these systems interact and where they diverge. While identifying remaining gaps in existing assessment frameworks that must be addressed to strengthen market integrity, she underlines the importance of clearer guidance and harmonisation among the rules, and the potential role of advanced technological and methodological tools, such as satellite/remote sensing, IoT sensors, blockchain and AI/ML modelling, in monitoring, reporting and verification (MRV).

The final contribution, written by Mr. Gao Xi, ESI Research Associate, highlights that the widespread overstatement of mitigation effects and a lack of additionality led to a significant loss of confidence in VCMs among businesses and the public, thereby causing a downturn in VCMs between 2023 and 2024. He emphasises that enhancing the credibility of VCMs is difficult to address solely through voluntary private initiatives or project-level reforms. Instead, it is required to harmonise standards, strengthen oversight and provide credible assurances to market participants through government-led multilateral cooperation. He introduces the Coalition to Grow Carbon Markets as an example of such government-led initiatives and explores its potential roles in the development of global VCMs.

We hope that this edition of the ESI Bulletin will be informative and valuable to readers within and beyond academia and will lead to more discussions and further research.

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Leveraging Voluntary Carbon Markets for Industrial Decarbonisation in Southeast Asia

Dr. Joydeep GHOSH, ESI Research Fellow

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Background

Industrial growth has been a major driver of the recent increases in energy demand and greenhouse gas (GHG) emissions in Southeast Asia. For instance, steel production has significantly boosted coal demand while the expansion of supply chains for electronics, vehicles and textiles has contributed to increased demand for other forms of energy. Collectively, industrial energy consumption grew by about 20% between 2019 and 2022. In 2022, the industrial sector represented about 43% of total energy consumption and about 28% of energy-related carbon dioxide (CO_2) emissions in the region.[1]

Hard-to-abate industries such as steel and cement face significant decarbonisation challenges as most CO_2 emissions from these sectors are directly linked to their operations (Scope 1 emissions). For instance, almost 50% of primary steel production in Southeast Asia uses the coal-based blast furnace-basic oxygen furnace (BF-BOF) route,[2] which has a lifespan of about 40 years with very few commercially viable decarbonisation options. Furthermore, the high cost of capital and the lack of de risking tools often make it difficult for many entities in the region to invest in low-carbon initiatives. The flow of climate finance is also relatively low despite the strategic importance of these industries. Scaling up decarbonisation efforts in hard-to-abate industries will require innovative approaches in this context. Leveraging the voluntary carbon market is one such approach.

Key Issues Related to the Voluntary Carbon Market (VCM)

The global carbon credit market was valued at 114.8 billion USD in 2024, with the compliance carbon market (CCM) accounting for 98.5% and the VCM accounting for the remaining 1.5%.[3] The drivers of the VCM differ from those in the CCM. Compared to the CCM, which is regulated and has a level of certainty regarding the emission reduction target, the VCM is a fragmented market which is sometimes driven by factors such as corporate social responsibility and public relations rather than genuine climate ambition.

In that sense, VCMs are often criticised for their poor environmental integrity. The environmental integrity of carbon credits is mainly based on the principles of additionality and permanence. Credits are additional only if the project reduces emissions relative to an established baseline, which implies that the reductions would not have occurred without the credit payment. Though the concept of additionality is simple, it is often difficult to determine the baseline (into the future) without clear guidelines. The permanence of credits is another issue related to future policy uncertainty. For instance, forestry offsets could be influenced by changes in land-use policies. There is also the problem of asymmetric information, i.e., project developers know more about the projects in which they invest compared to credit buyers.

Initiatives such as the Core Carbon Principles of the Integrity Council for the Voluntary Carbon Market aim to address the environmental integrity issues of carbon credits. The implementation of Article 6 of the Paris Agreement is also likely to strengthen the market for carbon credits by setting clearer guidelines. Article 6.2 provides a framework for trading carbon credits, known as internationally transferred mitigation outcomes (ITMOs), between countries through emissions reduction projects or by linking carbon markets. Article 6.4, which succeeds the Clean Development Mechanism (CDM) under the Kyoto Protocol, establishes a new centralised crediting mechanism under the UN to generate credits from emissions reduction and removal activities. While Article 6.2 will be implemented based on the agreements between two or more countries, Article 6.4 will operate under a supervisory body designated by member countries, with standardised procedures for carbon credit projects.

Carbon Market Development in Southeast Asia

Southeast Asia is increasingly exploring market-based approaches to reduce emissions and achieve their net-zero targets cost-effectively. Both the CCM and VCM are gaining momentum in the region with a focus on decarbonising the power generation and industrial sectors. Indonesia launched its emissions trading system (ETS) and carbon trading platform (IDX Carbon) in 2023, and is looking at ways to attract foreign investment through the sale of carbon credits. Additionally, at COP29, Indonesia signed an agreement on bilateral carbon credit trading with Japan. Vietnam approved a roadmap for implementing a domestic carbon market, incorporating both ETS (starting as a pilot in 2025 and expanding to full implementation by 2029) and VCM. Certified Carbon Credits (CCCs) will be eligible for ETS compliance and can be sourced from both domestic and international mechanisms, including Article 6.4. Thailand has implemented the voluntary GHG reduction programme (T-VER) for 12 emission-intensive sectors since 2013, and now aims to launch the VCM by 2027, ahead of the mandatory market. The cap on carbon credits for offsetting emissions is set at 15%.[4] Singapore has signed Implementation Agreements with ten countries, such as Papua New Guinea, Chile, Mongolia and Rwanda, on carbon credits collaborations aligned with Article 6.2 of the Paris Agreement and prioritising sustainable development and co-benefits for local communities and the economy. Finally, the Philippines is also drafting guidelines for the carbon credit market for the country's energy sector.

Leveraging the VCM for Industrial Decarbonisation

The development of carbon markets could play a key role in industrial decarbonisation in Southeast Asia. The growing demand for high-quality carbon credits presents an opportunity for industries in the region to adopt energy-efficient and cleaner technologies and to emerge as suppliers of such carbon credits. Industrial decarbonisation mainly refers to four areas: energy efficiency improvements to lower energy consumption and emission intensity; electrification of industrial processes wherever feasible to leverage clean power; switching to cleaner fuels such as low-carbon hydrogen, ammonia and biofuels; and carbon capture and storage (CCS) to address process-related emissions. Most of these decarbonisation options qualify as high-integrity credits. Industrial decarbonisation is not only a source of high-quality carbon credits but also addresses concerns regarding the bypassing of own efforts for decarbonisation through offsets.

Meanwhile, efforts must be made to assess the implications of carbon markets for the economy, especially small and medium enterprises, and households. Furthermore, the implications for export competitiveness need to be studied in the context of trans-border carbon pricing such as the Carbon Border Adjustment Mechanism (CBAM), which is an EU regulation that aims to price the carbon content of energy-intensive imports, such as steel, entering the EU market. Finally, the carbon market like any other market is subject to both internal and external influences. To ensure the efficient functioning of the carbon market, there is a need to periodically review regulations, for instance, sectoral coverage, the number of free allowances, emission intensity targets, and share of offsets. Economic conditions need to be monitored as the carbon market is linked to the broader economy through the demand and supply of carbon credits. Higher levels of international cooperation also play an important role in the development of carbon markets.

1 ERIA, ADB and Japan METI, *Decarbonising Southeast Asia's Hard-to-Abate and High-Emitting Sectors: Transition Finance, Technologies, and Policy Approaches* (Jakarta: Economic Research Institute for ASEAN and East Asia, 2025), 14.

2 ERIA et al. (2025), *Op. cit.* 18.

3 Global Market Insights (GMI), *Compliance Carbon Credit Market Size – By End Use, Analysis, Share, Growth Forecast, 2025 – 2034*, February 2025. https://www.gminsights.com/industry-analysis/compliance-carbon-credit-market; GMI, *Voluntary Carbon Credit Market Size – By End Use, Analysis, Share, Growth Forecast, 2025 – 2034*, February 2025. https://www.gminsights.com/industry-analysis/voluntary-carbon-credit-market.

4 Lin, B., "Thailand's Voluntary Carbon Trading Set for 2027 with 15% Offset Limit," *Reccessary News*, August 18, 2025. https://www.reccessary.com/en/news/thailand-s-voluntary-carbon-trading-set-for-2027-with-15-offset-limit.

Narrowing the Integrity Gap: A Multi-Layer Framework for Vetting Carbon Credit Quality

Dr. LI Hongyan, ESI Research Fellow

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Introduction

As voluntary and compliance carbon markets increasingly converge, ensuring the credibility and integrity of carbon credits has become a critical policy and market priority. Governments engaging in Article 6.2 cooperation rely on high-integrity credits to meet their nationally determined contributions (NDCs). Private investors in the voluntary carbon market (VCM) also seek the same assurance to manage reputational and investment risks. Yet, defining and verifying high integrity remains complex. Current assessment systems operate across multiple layers, from public-sector benchmark setting to private-sector project-level evaluations, each with different objectives and standards. This article reviews and compares these layers, clarifying how they interact and where they diverge. It offers practical guidance for VCM participants navigating the fragmented landscape and identifies remaining gaps in existing assessment frameworks that must be addressed to strengthen market integrity and investors' confidence.

Core Carbon Principles (CCPs)

The Integrity Council for the Voluntary Carbon Market (ICVCM) awards the Core Carbon Principles (CCPs) label to carbon credits that satisfy all of the ten quality principles set out in the two-tier assessment system. At the programme level, ICVCM evaluates the governance and operational integrity of the crediting programme (i.e., registries and standards) to ensure institutional soundness. Key criteria include five principles: i) tracking (documentation to track carbon mitigation activities and credits), ii) robust independent third-party validation and verification, iii) effective governance (grievance mechanisms), iv) transparency (strong controls to prevent fraud and money laundering), and v) sustainable development benefits and safeguards to ensure co-benefits and avoid harm. Programmes meeting these requirements are designated CCP-eligible, signalling sound governance but not yet confirming the environmental integrity of the credits they issue.

At the category level, ICVCM evaluates clusters of related methodologies (e.g., improved forest management and industrial gases) against CCP technical quality criteria. These also include six principles: i) additionality (demonstrable additionality supported by credible counterfactuals), ii) permanence (permanent reductions and strong risk-control measures, such as extended monitoring periods and well-capitalised buffer reserves), iii) robust quantification of emission reductions and removals (conservative baseline setting and quantification), iv) no double counting, v) sustainable development benefits and safeguards, and vi) contribution to net zero transition. Credit programmes may choose to exclude certain methodologies from review; these exclusions are made public, and credits generated under such methodologies are not eligible for the CCP-Approved label.

A carbon credit can obtain the CCP-Approved label only if it meets both criteria: it must be issued under a CCP-Eligible programme and derived from a CCP-Approved category. This dual-gate structure is deliberately designed to reduce false positives. Strong programme-level governance cannot compensate for permissive or poorly designed methodologies, while stringent methodologies cannot offset weak institutional controls. Together, these two levels establish a layered assurance system that blends institutional oversight with methodological rigour. ICVCM's Assessment Framework (2024)[1] formalises these standards and is now being applied across major

crediting programmes and methodology families, aiming to harmonise quality benchmarks throughout the VCM.

Eligible Units for Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)

CORSIA, developed by the International Civil Aviation Organization (ICAO), requires international airlines to surrender eligible emission units for carbon dioxide (CO_2) emitted above a baseline. ICAO's Technical Advisory Body (TAB) assesses crediting programmes against CORSIA's Emissions Unit Criteria—with a strong focus on programme design, MRV infrastructure, avoidance of double counting, registry tracking, and related safeguards. Based on TAB recommendations, the ICAO Council decides which programmes (and, where relevant, vintages and activity types) are eligible.[2] In effect, CORSIA functions as a programme-level gate tailored to aviation compliance, rather than a general-purpose quality label for the VCM. ICAO publishes and periodically updates eligibility decisions and guidance, providing a transparent, compliance-grade baseline for governance and accounting.

Comparison of CCPs and CORSIA

Although ICVCM partly accepts CORSIA eligibility by applying a relatively simplified assessment framework for the CORSIA programme, CCP and CORSIA are still incompatible. CCPs use a dual-gate system: i) programme-level approval for institutional governance and ii) category-level approval for methodology families. By contrast, CORSIA designates programme eligibility for aviation compliance and sets rules for unit use, accounting, and vintages. As a result, a CCP-Approved credit may still be ineligible under CORSIA if the issuing programme is not on ICAO's list, if the activity type or vintage falls outside CORSIA rules, or if registry arrangements do not meet aviation requirements. The converse also applies: a unit from a CORSIA-eligible programme does not carry the CCP label unless the relevant activity type has passed ICVCM category approval. Overlap exists only where the programme is recognised by both ICAO and ICVCM and the activity is CCP-Approved.

Each framework applies stringency in different ways. CORSIA is more stringent in compliance-oriented aspects—including MRV infrastructure, emissions tracking, and the prevention of double counting—to ensure credible accounting for international aviation. CCPs, by contrast, place stronger emphasis on methodological integrity, with rigorous tests for additionality, conservative baselines, leakage control, permanence, and alignment with long-term transition goals. Yet, neither framework conducts project-level assessment. As a result, residual risks—such as site-specific baseline inflation, unmonitored local leakage, limited data reliability, and varying developer performance—remain unresolved. These gaps can only be addressed through independent project-level ratings or structured buyer due diligence, which together serve as the final safeguard for environmental integrity across both compliance and voluntary markets.

Private Ratings: Filling the Project-level Assessment Gap

Private ratings help close the integrity gap by adding a third assessment layer at the project level, which current public frameworks do not cover. These providers issue independent opinions about whether one credit plausibly represents one tonne of CO_2 equivalent reduced or removed. Table 1 summarises key features of four providers: BeZero Carbon, Sylvera, Calyx Global, and MSCI (with Trove Research). These ratings do not substitute for ICVCM programme or category approvals or for CORSIA eligibility; rather, they operate after those public gates to support differentiation within a methodology and to enable ongoing monitoring through rating transitions. Methodologically, providers converge on project-level diagnostics but differ in what their headline rating represents. BeZero and Sylvera estimate the likelihood of delivery using multi-pillar frameworks (e.g., additionality, over-crediting, leakage, permanence, MRV/information risk, policy risk). Calyx Global expresses the risk of non-delivery and explicitly maps criteria to public integrity concepts (e.g., additionality, baseline conservatism, performance). MSCI produces a composite integrity grade that combines standardised criteria with geospatial hazard modelling (e.g., wildfire and drought) and publishes project-type appendices such as for REDD+. Hence, the ratings among different providers are not directly comparable.

Such discrepancies in rating systems and methodologies suggest that it will be important for investors and carbon credit buyers to read each provider's scale and methods before setting thresholds, look for alignment across multiple providers and probe the reasoning, including baseline evidence, leakage pathways, permanence instruments/buffers, and monitoring periods.

Practical Implications for Integrity Assessment

A workable integrity framework operates among these three layers. At the programme level, CCP-eligible or CORSIA-eligible programmes set the assessment baseline for governments and MRV; at the category level, CCP category approvals provide methodological assurance. Furthermore, the project-level assessment, which is mainly based on private ratings currently, identifies residual, site-specific risks that are not fully captured by the category-level review. Although this multi-layer approach does not entirely eliminate uncertainty, it structures and reduces the uncertainty by improving the transparency and defensibility of procurement and policy decisions. Therefore, there are two practical implications. Firstly, integrity labels should be treated as necessary but not sufficient, as they only set the minimum purchasing floor. Subsequent decisions on pricing, position sizing, and portfolio limits should incorporate project-level ratings. Secondly, Ratings are dynamic: methodologies evolve, data are updated, and projects' risk profiles could also shift. Thus, VCM participants should track updates regularly and adjust the thresholds and portfolio accordingly.

Table 1. Summary of Key Features of Four Private Carbon Credit Ratings

Features	BeZero Carbon	Sylvera	Calyx Global	MSCI
Primary Rating Focus	Likelihood that a credit achieves one tonne of CO_2 avoided or removed (probability-based).	Likelihood that the claimed GHGs have been avoided or removed (integrity-focused).	Risk that carbon credits do not meet their claims of reducing or removing CO_2 (risk-based).	Likelihood that a carbon credit project has delivered on its promise of reducing or removing GHGs.
Rating Scale	AAA - D (8-point scale)	AAA - D (8-point scale)	AAA - D (8-point scale)	AAA - CCC (7-point scale)
Core Integrity Pillars	Additionality, Over crediting, Leakage, Non-permanence, Information risk, Policy Risk, MRV risk.	Carbon Accounting, Additionality (which includes over-crediting risk), Permanence.*	Additionality, Over crediting (including baseline, project emissions and leakage), Performance. Overlapping claims.	Additionality, Quantification, Permanence, Co-benefits, Reputational risk, Delivery risk.
Transparency & Access	Known for making their headline ratings and some justification public.	Typically requires a subscription for full detailed reports and reasoning. Some ratings are publicly available on platforms like Salesforce's Net Zero Marketplace.	Typically requires a subscription for full detailed reports and reasoning. Some ratings are publicly available on platforms like Salesforce's Net Zero Marketplace.	Comprehensive reports available through MSCI's platform, aimed at institutional investors.
Projects Covered	18,000+ projects, with 100% coverage across seven major registries, including CDM (UNFCCC), Verified Carbon Standard (Verra), and Gold Standard.	Strong historical focus on nature-based solutions (e.g., REDD+, ARR), though expanding.	893 projects from multiple categories, including forest & land, household & communities, manufacturing & industry, and renewable energy.	Covers 4000+ projects from major categories, including jurisdictional REDD+ and engineered carbon removal solutions.

* *While Sylvera includes co-benefits as a fourth pillar, the assessment is reported as a standalone score and is excluded from the project's composite rating.*

Source: Authors' own summary based on multiple sources.[3-6]

Unaddressed Issues of the Current Assessment Framework

Addressing methodological heterogeneity across assessment levels is critical to strengthening market confidence. At the programme level, CCP-labelled and CORSIA-eligible programmes still differ in baseline construction, project boundaries, leakage treatment, and parameter choices. As hard-to-abate sectors increasingly rely on offsets, converging these rules and issuing clearer guidance would reduce transaction costs for market participants. In parallel, mandatory frameworks should better integrate project-level diagnostics—where private ratings often diverge on baselines, permanence buffers, leakage pathways, and monitoring quality—to deliver a more consistent view of residual risk.

Properly integrating the current assessment framework with more advanced technological tools can strengthen the quality of carbon credit assessments. Digital MRV tools, such as satellite/remote sensing, IoT sensors, and tamper-evident data logs, can improve the accuracy and traceability of reported reductions and removals. Blockchain or other append-only ledgers can provide audit trails for issuance, transfer, and retirement, thereby reducing double-counting. On the methodological side, advanced AI/ML modelling can support baseline estimation, leakage and anomaly detection, and permanence-risk forecasting for verifier review. These gains depend on data quality, transparent model documentation, and interoperability with registries and reporting systems. Without those guardrails, technology can add complexity instead of improving integrity.

Finally, integrity assessments must be made consistent with Article 6 of the Paris Agreement, ensuring that voluntary market activities complement rather than conflict with countries' NDCs. Clearer correspondence rules, transparent reporting, and avoidance of double claiming will be essential to harmonise voluntary and compliance market mechanisms under a unified global architecture.

1 ICVCM, *Core Carbon Principles, Assessment Framework and Assessment Procedure Version 2* (Integrity Council for the Voluntary Carbon Market, 2024).

2 IATA, *CORSIA Handbook Version 6* (Montreal: International Air Transport Association, 2024).

3 Sylvera. "Sylvera's Carbon Credit Framework: How We Rate Carbon Credits on the VCM (Updated)," *Sylvera Blog*, September 10, 2025. https://www.sylvera.com/blog/carbon-credit-ratings-frameworks-and-processes-white-paper.

4 MSCI ESI Research, *Carbon Markets Overall Integrity Framework* (New York: MSCI, 2024).

5 Calyx Global. "The Calyx Global Approach to GHG Ratings." June 16, 2023. https://calyxglobal.com/research-hub/ratings-approach/the-calyx-global-approach-to-ghg-ratings/.

6 BeZero Carbon. "Introducing the BeZero Carbon Portfolio Rating." Accessed October 27, 2025. https://bezerocarbon.com/insights/introducing-the-bezero-carbon-portfolio-rating.

Government-Led Institutional Innovation and the Enhancement of Credibility in Voluntary Carbon Markets

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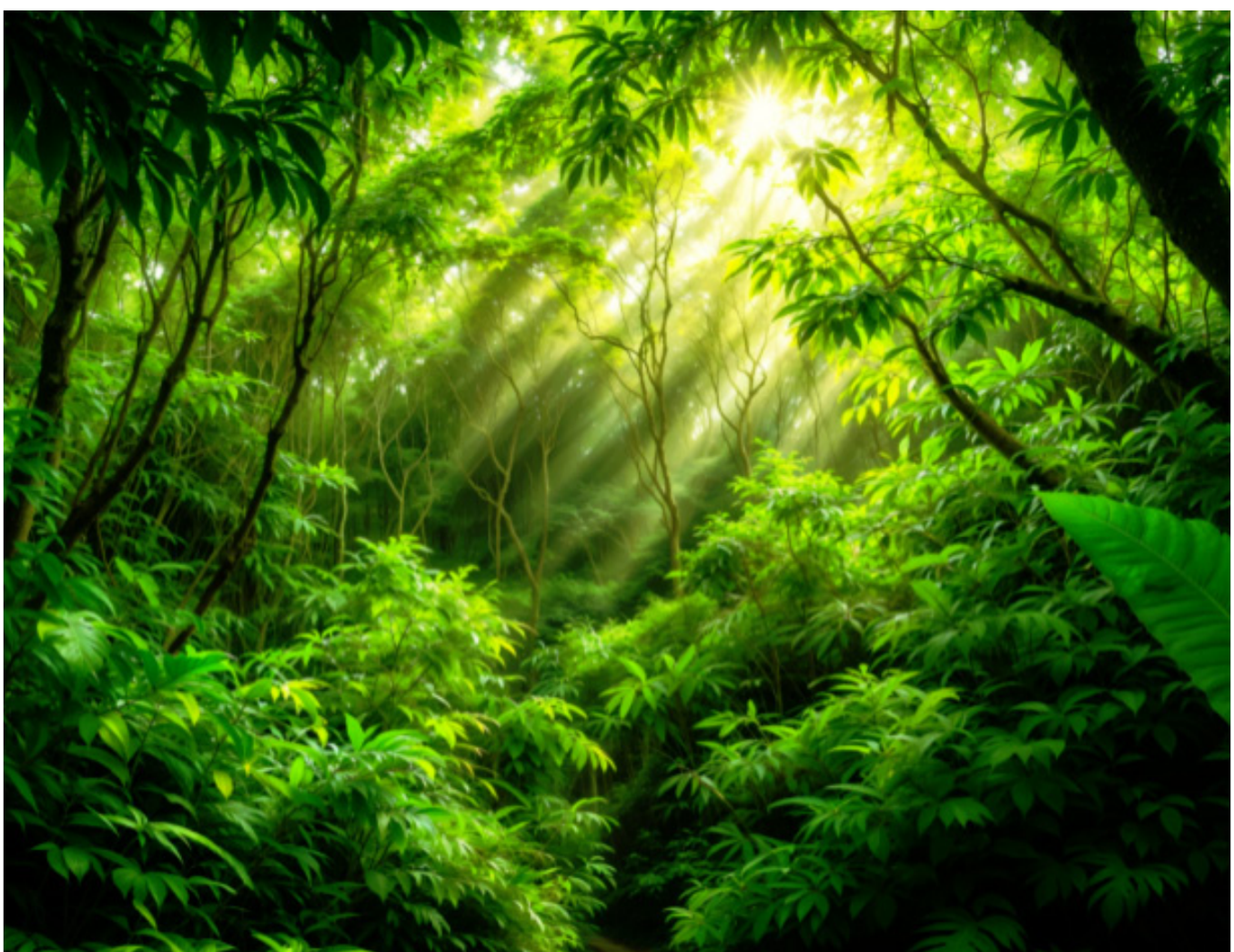

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Introduction

The voluntary carbon market (VCM) has long been seen as a supplementary mechanism to support global emissions reductions. However, the rapid growth of the VCM in recent years has highlighted ongoing concerns about the quality and credibility of credits. Multiple reviews have uncovered widespread overstatement of mitigation results and a lack of additionality, leading to consistent declines in market value and a significant loss of confidence among businesses and the public. This crisis jeopardises not only the market's sustainability but also its functional role within the global effort to tackle climate change. Against this backdrop, the Coalition to Grow Carbon Markets (CGCM), jointly launched by Singapore, the United Kingdom, and Kenya in June 2025, could become a notable example of institutional innovation for the VCM. As the world's first government-led coalition of its kind, the CGCM aims to enhance trust in the VCM through public authority and cross-border cooperation.

Challenges in the VCM and the Issue of Additionality

The concept of "additionality" refers to whether a project's emissions reductions would not have occurred without income from carbon credits. As market integrity

is questioned and information gaps remain, verifying if a project is genuinely additional remains difficult. For example, in a forest conservation project, it may be unclear whether logging would in fact take place in the absence of carbon credit revenue, or whether existing legal protection and alternative livelihoods would already be sufficient to keep the forest standing. In such cases, it is technically challenging to demonstrate that the emissions reductions claimed by the project are truly additional.

These conceptual challenges regarding additionality have played out visibly in recent controversies in the VCM. As leading certification bodies, Verra and South Pole have issued significant volumes of credits for projects that reduce emissions from deforestation and forest degradation (REDD+) in developing countries. However, investigations by *The Guardian* and *Die Zeit* in 2023 revealed that several rainforest protection projects certified by Verra overstated their emissions reductions. The reports indicated that the baseline scenarios greatly overestimated deforestation rates by about 400%.[1] In the same year, *Bloomberg* also reported that South Pole's flagship Kariba forest protection project in Zimbabwe faced claims of exaggerated climate benefits and mismanagement.[2] Taken together, these incidents illustrate how weaknesses in baseline setting and project governance can lead to systematic overestimation of mitigation outcomes and call the additionality of credits into question. They have seriously undermined the credibility of the VCM, raising doubts about its environmental integrity and eroding trust in additionality, the foundation of market confidence. Meanwhile, concerns about greenwashing and weak incentives for real mitigation persist, as some companies used low-quality credits to boost their net-zero claims while delaying meaningful internal decarbonisation.

In response, airlines like EasyJet and Delta, along with other industry giants, have announced that they will stop conventional carbon offsetting through VCM and shift towards investments in real emissions reductions. This retreat has increased price volatility and eroded trust. In 2024, the average price of carbon credits fell to 6.34 USD per tonne from 6.71 USD in 2023, while overall market capitalisation shrank to about a third of its value two years earlier.[3] These recent downturns suggest that the VCM's problems indicate more profound structural and institutional weaknesses beyond isolated project failures, especially in verifying additionality and maintaining market integrity, worsened by information asymmetries. Because these weaknesses are systemic and cross-border in nature, they are difficult to address solely through voluntary private initiatives or project-level reforms. They therefore create a strong rationale for government-led multilateral cooperation to harmonise standards, strengthen oversight and provide credible assurances to market participants.

Coalition to Grow Carbon Markets (CGCM)

The CGCM was established in June 2025 as a government-led initiative that brings together ambitious governments to strengthen demand for high-integrity carbon credits and help close the climate finance gap. Co-chaired by Kenya, Singapore and the United Kingdom, with France and Panama as founding members, it seeks to mobilise public authority to support high-integrity corporate use of carbon credits. Its main goals include agreeing on a set of shared principles to guide corporate credit use in the VCM, expanding membership among both buyer and host countries, advancing cross-border credit standardisation, and reducing uncertainty related to greenwashing and reputational shocks through government endorsement and policy coordination. The initiative marks a significant shift in cross-border governance, moving from reliance on private certification bodies to a model based on public authority. In doing so, it could provide clearer public guidance on the acceptable use and quality of carbon credits and serve as a reference point for broader multilateral cooperation.

By the time of COP30, the CGCM had already begun to translate its vision into concrete outputs. It brought together its founding members to present two flagship documents: the Shared Principles for Growing High-Integrity Use of Carbon Credits by Companies and Other Buyers and the Plan of Action for the Coalition. The Shared Principles set out governments' expectations for how companies should use carbon credits alongside deep decarbonisation, emphasising high environmental integrity, fair pricing and benefit-sharing, transparent disclosure, and accurate claims. The Plan of Action then outlines how governments intend to operationalise these principles in the period from COP30 to COP33, including strengthening policy implementation, scaling capital mobilisation with equitable pricing and access, and fostering market development through clearer legal treatment of credits and interoperable market infrastructure. Taken together, these COP30 outcomes signal that governments are now prepared to play a more active role in shaping high-integrity carbon credit demand, rather than leaving the VCM solely to private initiatives.

Expected Roles for Multilateral Coalitions: Institutional Innovation, Fairness Enhancement, and North-South Cooperation

In addition to signalling and common principles, the CGCM is expected to serve as an institutional innovation by building an integrated "assurance stack" that elevates VCM credits into credible, claims-ready instruments. In practice, it can offer a shared governance framework that provides jurisdiction-wide reference baselines with regular review cycles. It can also include a digital Measurement, Reporting, and Verification (MRV) layer where project-level data, audit trails, and verifier reports are traceable across registries. Creating official interoperability protocols to enable mutual recognition of registries, transparent application of adjustments, and a shared allowlist and blocklist is also worth considering through cooperation. When paired with incentive measures, such as performance-based floor-price tenders for high-additionality categories and de-risking facilities for innovative first-of-a-kind methodologies, the CGCM can

transform fragmented rules into a clear public-interest framework. This will undoubtedly lead to less information asymmetry and more confidence in the VCM.

Beyond technical assurances on market integrity, the CGCM is expected to highlight the importance of fairness and balanced participation. Governance of the VCM must go beyond verification systems and technical challenges in order to address distributive justice and openness issues, especially between developed and developing countries. Historically, carbon credits have not fully and fairly compensated local communities, thereby undermining the project's sustainability and moral legitimacy and resulting in a lose-lose situation for both the project site and the purchasing company.[4] In this context, the CGCM should clearly incorporate equity and benefit-sharing mechanisms into its institutional framework, emphasising the need for equitable compensation for local communities, encouraging member states to adopt fair pricing schemes and monitoring systems to ensure revenues from carbon credits benefit residents.

In principle, the coalition's structure promotes North–South cooperation. Developed nations meet part of their emission-reduction targets by purchasing high-quality credits, while developing countries generate these credits through verified activities like rainforest conservation, blue carbon restoration, and biocarbon use.

Conclusion and Outlook

The VCM's credibility crisis has revealed its institutional weaknesses, particularly in its commitment to additionality and market integrity. The CGCM highlights the importance of government support and illustrates how a government-led multilateral coalition can offer an institutionalised solution. Through transparent standard-setting, the exploration of potential digital MRV systems, and North–South collaboration, the CGCM could demonstrate that VCM can evolve into credible institutional mechanisms that support both climate and development goals. This marks a notable shift toward embedded multilateralism with a hybrid governance model that balances public regulation and private innovation. Ultimately, this paradigm shift repositions the VCM as a crucial, trustworthy element of global climate governance, promoting long-term decarbonisation and sustainable development.

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Staff Publications

Internationally Refereed Journal Articles

Ákos Orosz, Bing Shen How, **Lip Siang Yeo**, Dhanaraj Turunawarasu, Viknesh Andiappan, Jean Pimentel, Sin Yong Teng, and Ferenc Friedler, "Exhaustive Enumeration of Heat Exchanger Networks with Minimum Utility Consumption Using Graph-Theoretic Approach", *Energy* 335 (2025): 137898. http://doi.org/10.1016/j.energy.2025.137898.

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Alvin Wei Liang Ee, **Shee Jia Chew**, Hsien Hui Khoo, Adam Tsan Sheng Ng, and Harn Wei Kua, "Circular Economy for the Building Industry: Life Cycle Assessment of Biochar-enhanced Concrete", *Resources Conservation and Recycling* 223 (2025): 108537. https://doi.org/10.1016/j.resconrec.2025.108537.

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Kendra H.Y. Ho, Alvin W.L. Ee, Minhee Son, Sita Rahmani, Faadhil Mohamed Liyaff, and **Roger Fouquet**, "Environmental Impact Assessment of Solar Panel Production and Recycling in Southeast Asia", *Journal of Cleaner Production* 522 (2025): 146277. https://doi.org/10.1016/j.jclepro.2025.146277.

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ESI Policy Briefs

Wannaphaluk Tonprasong and **Kim Jeong Won**, "Trade Wars and Climate Goals: Implications for ASEAN's Low-Carbon Future", *ESI Policy Brief* 83 (22 August 2025). https://esi.nus.edu.sg/docs/default-source/esi-policy-briefs/esi-pb-83_trade-wars-and-climate-goals.pdf.

External Reports and Papers

Joydeep Ghosh and Rajat Verma, "Assessing theDistributional Implications of EU's CBAM on India: A CGE Analysis", *Centre for Social and Economic Progress (CSEP) Working Paper* 100 (August 2025). https://csep.org/wp-content/uploads/2025/08/Assessing-the-Distributional-Implications-of-the-EUs-Carbon-Border-.pdf.

External Articles (Commentaries, Op-eds, and other pieces in non-academic publications)

Li Hongyan, "Transforming Shipping through Strategic Public-Private Finance", *Marine & Industrial Report*, 47(5), September/October 2025. https://issuu.com/charlton_media/docs/marine_report_vol._47_no._5.

Li Hongyan, "Green Shipping's Future: Strategic Partnership between Public and Private Finance", *Singapore Business Review*, 12 September 2025. https://sbr.com.sg/commentary/green-shippings-future-strategic-partnership-between-public-and-private-finance.

Staff Presentations and Moderating

31 October Roger Fouquet moderated "Scaling AI Sustainably in Asia: Opportunities and Risks" session at the *Singapore International Energy Week (SIEW) Thinktank Roundtable: The AI-Energy Nexus: Transforming the Transition to Low-Carbon Power*, organised by Energy Market Authority (EMA) and ESI, Singapore.

30 October Zhong Sheng was a panellist in the "Building Scalable, Low-Carbon Energy Systems in Singapore and Sweden" Session at the *Singapore – Sweden Forum, SIEW*, organised by EMA, Singapore.

27 October Roger Fouquet moderated "Fireside Chat" at the *SIEW Summit*, organised by EMA, Singapore.

24 October Kim Jeong Won presented "Challenges to the Legitimacy and Integrity of Decarbonization Policies: Review of Climate Change Litigation Against Governments" at the *4th World Conference on Climate Change & Sustainability*, organised by The People Events, Milan, Italy.

17 October Roger Fouquet presented "Historical ICT Trends in Southeast Asia" at the *Bytes and Biomes: Navigating the Digital-Environment Nexus in Southeast Asia*, organised by Asia Research Institute (ARI), National University of Singapore (NUS), Singapore.

17 October Sita Rahmani presented "Decarbonising the Digital Backbone: Unbundled Renewable Energy Certificates (RECs) Procurement in Data Centre Operators" at the *Bytes and Biomes: Navigating the Digital-Environment Nexus in Southeast Asia,* organised by ARI, NUS, Singapore.

2 October Alvin Ee was a panellist in the "Tracking ASEAN's Readiness for Urban Energy Modelling in Smart Cities: Global Benchmarks and Regional Pathways" session at the *2nd Workshop on Integrated Urban Energy Planning and Modelling (IUEPM) on Selected ASEAN Cities*, organised by ASEAN Centre for Energy (ACE), Putrajaya, Malaysia.

1 October Alvin Ee Wei Liang presented "The Moving Target: Modelling Gaps in Building and ICT Energy Futures" at the *2nd Workshop on IUEPM on Selected ASEAN Cities*, organised by ACE, Putrajaya, Malaysia.

25 September Kim Jeong Won presented "Enhanced Mitigation Targets But Insufficient or Reversed Policies" at the *3rd ESI Workshop on Achieving Net Zero*, organised by ESI, Singapore.

24 September Roger Fouquet presented "Overview of ESI's Research Priorities around APG and Green Transition" via internet at the *RCI-POD Webinar #42 Regional Cooperation for Green Transition*, organised by Asia Development Bank (ADB), Manila, The Philippines.

24 September Sung Jinseok presented "Role of APG in Supporting Clean Energy Goals and Net-Zero Pathways" via internet at the *RCI-POD Webinar #42 Regional Cooperation for Green Transition*, organised by ADB, Manila, The Philippines.

10 September Alvin Ee presented "Cumulative Energy Demand and Greenhouse Gas Reduction Potential of Alternative Maritime Fuels: A Life Cycle Assessment Approach to Maritime Decarbonization" at the *12th International Conference on Life Cycle Management*, organised by Circular s.r.l., Palermo, Italy.

9 September Sung Jinseok presented "Assessing Southeast Asia's Gas Market: Trends, Challenges, Opportunities, and Policy Impacts" at the Gastech Conference and Exhibition 2025, organised by dmg events, Milan, Italy.

9 September Yao Lixia presented "Evolution of China's Energy Transition and Energy Security: A Historical Review" at the College of Economics and Management, Nanjing University of Aeronautics and Astronautics, Nanjing, China.

2 September Hoy Zheng Xuan presented "Curbing Global Solid Waste Emissions Toward Net-Zero Warming Futures" at the *Navigating the Energy Transition in an Insecure World Summer School*, organised by ETH Zurich, Ascona, Switzerland.

7 August Kim Jeong Won was a panellist at the *Asian Impact Webinar: Carbon Pricing Options and Implications for Asia,* organised by ADB, Manila, The Philippines.

Staff Media Contributions

Kim Jeong Won was quoted in "S'pore's 2035 Climate Target for COP30 and the Absent Submissions from Other Countries", *The Straits Times*, 27 October 2025. See https://www.straitstimes.com/singapore/environment/why-did-singapore-submit-its-2035-climate-targets-on-time-when-so-many-missed-the-cop30-deadline.

Kim Jeong Won was quoted in "What Is the Significance of Singapore's Carbon Trading Pacts on Firms and the Economy?", *The Straits Times*, 20 October 2025. See https://www.straitstimes.com/singapore/environment/what-is-the-significance-of-spores-carbon-trading-pacts-on-firms-and-the-economy.

Kim Jeong Won was quoted in "本地35体育设施或部署太阳能体理会料明年完成评估", Lianhe Zaobao, 19 October 2025. See https://www.zaobao.com.sg/news/singapore/story20251019-7609604

Sung Jinseok was quoted in "Can Singapore Keep the Lights on While Cutting Carbon from Its Energy Sector?", *The Straits Times*, 18 October 2025. See https://www.straitstimes.com/singapore/environment/can-singapore-keep-the-lights-on-while-cutting-carbon.

Gao Xi was quoted in "Singapore Secures $655m to Fund Green, Sustainable Projects in South-East and South Asia", *The Straits Times*, 8 September 2025. See https://www.straitstimes.com/singapore/environment/spore-closes-655-million-to-fund-green-and-sustainable-projects-in-south-east-and-south-asia.

Recent Events

25 September, 3rd ESI Workshop on Achieving Net Zero

ESI hosted its 3rd Workshop on Achieving Net Zero with the theme of "Are Efforts to Reach Net Zero on Track? Progress and Challenges" on 25 September 2025. During the workshop, participants examined climate ambition and performance across various countries and discussed the challenges they face in their net-zero journeys. Dr. Lauri Peterson (University of Eastern Finland/Uppsala University), Dr. Kim Jeong Won (ESI), Dr. Emi Gui (Monash University), and Dr. Marlene Kammerer (University of Bern) identified gaps between current mitigation efforts and ambitious net-zero goals of various countries. Then, Ms. Qiu Jiahui (ISEAS – Yusof Ishak Institute) and Ms. Rika Safrina (ASEAN Centre for Energy) focused on the enhancement of the NDCs and energy transition efforts in ASEAN countries. Based on these presentations, participants explored how to close the emissions gaps and enhance the credibility of the NDCs and net-zero pledges, as well as possible policies and regional/international cooperation to support them.

Photo by ESI staff

30 October, Guest Lecture by Commissioner of the United States Federal Energy Regulatory Commission (FERC)

On 30 October 2025, the ESI and NUS Sustainable Futures co-hosted a guest lecture by Ms. Judy W. Chang, Commissioner of the United States Federal Energy Regulatory Commission (FERC). Commissioner Chang began her talk by introducing FERC's key functions and identified the current challenges facing FERC: meeting load growth – particularly driven by data centres, managing higher electricity costs due to increases in the costs of new supplies and transmission,

Photo by ESI staff

Photo by ESI staff

and reforming planning and interconnection processes to enable supply adequacy. She then outlined the US FERC's approach to ensuring supply and transmission adequacy in response to these challenges and emphasised the importance of system reliability, having transparent rules, allowing for regional flexibility, and collaboration across stakeholders in the energy sector. During the subsequent Q&A session, she and participants discussed the energy efficiency in the data centres, the application of AI in power systems and grid management, and the management of uncertainty from a regulatory perspective.

Prior to the lecture, Commissioner Chang and Mr. Adam Pollock, Technical Advisor at the Office of Commissioner Judy Chang, FERC, had a meeting with Prof. Lee Poh Seng, Executive Director, and ESI Programme Leads. They exchanged insights by sharing findings from research and the various experiences across energy-related areas, such as technology adoption for achieving low-carbon pathways, grid interconnection, supply chain challenges, and carbon markets from various jurisdictions.

31 October, SIEW Thinktank Roundtable: The AI-Energy Nexus: Transforming the Transition to Low-Carbon Power

ESI co-hosted a roundtable with the Energy Market Authority of Singapore during Singapore International Energy Week (SIEW) 2025, titled "The AI-Energy Nexus: Transforming the Transition to Low-Carbon Power," on 31 October 2025. The opening presentation was delivered by Mary Burce Warlick (IEA) and Dr. Naoko

Photo by Energy Market Authority of Singapore

Doi (IEEJ). With the growing concern of data centre growth on local grids, continued improvement in power usage effectiveness through advanced cooling, ICT efficiency, and algorithm optimisation could reduce electricity demand by 20% by 2035. On the other side, AI adoption in energy systems could save 2–5% compared to advanced technology scenarios.

The first panel, "Scaling AI Sustainably in Asia: Opportunities and Risks," moderated by Dr. Roger Fouquet (ESI), featured: Dr. Naoko Doi (IEEJ Japan); Sunil Yadav (Ernst & Young/EY); Darryll Howell (RED Engineering); Dr. Saji PK (Amazon Web Services); Rakhi Anand (SMBC); and Ghazi Zouari (BeeBryte). The discussion focused on optimising computing infrastructure through efficient data centres and ICT equipment, green power integration, and supply chain sustainability. Measures to balance data centre expansion with resource management are being implemented. The experts emphasised the need for continued collaboration and robust policies.

The second panel, "Powering the Future: AI Integration for Smarter Grids and Sustainable Power Systems," moderated by Kenneth Cheng (The Straits Times), featured: Ricardo Reina (McKinsey & Company), Xueyong Chin (DBS Bank); Will Hudson (Microsoft); Dr. Bo Zhang (Concord New Energy Group Limited); and Abhishek Kaul (IBM Consulting). Experts discussed AI's role in grid flexibility and optimisation, emphasising smarter infrastructure, public-private partnerships, and transparent planning. Key challenges include data access, cybersecurity concerns, and building trust in AI governance.

Contact

- Collaboration as a Partner of ESI (research, events, etc.)
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- ESI Upcoming Events
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