ISSUE No. 2 • MARCH 2026 • CLEAN EXIT CAMPAIGN • methanebrief.org

The Carbon Credit Reckoning

The full case for coal mine methane abatement — and why the voluntary carbon market can no longer afford to ignore it

Kaj Embrén — Founder • Juneia Mallas — Lead Researcher • Richard Mattus — Technical Advisor

82×	40M t	~70%	$7–20	2%
Methane potency vs CO_2 (20-yr)	Coal mine methane per year	VAM share of coal mine CH_4	VAM abatement cost /tCO_2e	Climate funding for methane

EDITOR'S NOTE

This issue is the full-length companion to our LinkedIn and X article of the same name. Where the article made the argument in 900 words, this newsletter makes it in full — with the country case studies, the pricing data, the comparison framework, and the policy detail that investors and policymakers need to act. If you have already read the article, start at page three. If you haven't, start here.

The Market Is Bifurcating — and the Stakes Are High

The methane question is not hypothetical. It is venting, right now, from every active mine. © Shutterstock

The voluntary carbon market (VCM) was built on a simple promise: that companies, investors, and governments could offset their emissions by funding projects that absorb or avoid greenhouse gases elsewhere. For years, that promise was largely fulfilled by forests — vast, photogenic, and emotionally compelling. The market reached approximately $2 billion in transaction value in 2021 and attracted significant institutional interest, with projections suggesting it could

reach $50 billion or more by 2030.

That promise is now under severe strain. The market is not collapsing — it is bifurcating, sharply and permanently, between credits that can withstand scrutiny and those that cannot. Generic, low-integrity avoided-deforestation credits — issued under REDD+ — have plummeted to $5.30–6.00 per tonne. Independently certified, high-integrity removals command $15–25. High-rated credits now cost roughly four times their low-quality equivalents. The burden of proof has shifted permanently: buyers can no longer assume integrity — they must demonstrate it.

The Scandals That Broke the Market

The pricing collapse was precipitated by a sequence of integrity failures. The most consequential was the investigation into the Kariba REDD+ project in Zimbabwe, managed by South Pole. Verra's own investigation found that approximately 15 million excess credits — 57% of the project's total issuance — had been issued against baselines that predicted deforestation rates that were never likely to materialise. Major corporate buyers including Volkswagen, Gucci, and Nespresso faced serious reputational damage. Verra posted a $19.4 million financial loss in 2024 as it undertook a major course correction.

The C-Quest Capital scandal compounded the damage. Former executives were indicted for allegedly falsifying emissions data across Africa and Asia to attract over $100 million in investments. Verra suspended dozens of projects and cancelled millions of over-issued credits. In February 2026, Koko Networks — Kenya's most prominent clean-cooking pioneer — collapsed after a standoff with the Kenyan government over a Letter of Authorisation required to sell credits internationally. Over one million households lost access to clean cooking. The involvement of a World Bank investment guarantee raised urgent questions about the resilience of climate finance mechanisms that depend on state-level policy stability.

The Structural Problems That Cannot Be Labelled Away

Beyond the scandals, nature-based credits face two structural challenges that no integrity label can fully resolve. The first is permanence. Carbon stored in forests can be released at any moment — by wildfire, drought, disease, or land-use change. The Amazon is now approaching a tipping point beyond which large sections could transition from carbon sink to carbon source, releasing rather than absorbing the CO_2 that nature-based credits promised to sequester.

The second is additionality — the principle that a credit should only be issued if the emissions reduction would not have happened anyway. Critics argue that many forest protection credits are issued for forests that faced little realistic threat of deforestation. If the forest would have survived without the project, the credit represents a fictional reduction, not a real one.

> ***"The VCM no longer rewards volume. It rewards verifiability. Coal mine methane abatement offers verifiability that no forest project can match."***

The Engineering-Grade Alternative: Ventilation Air Methane

Into this credibility crisis steps a credit category that solves the permanence and additionality problems not through better modelling, but through engineering. Ventilation Air Methane (VAM) is not a new idea. It is a systematically overlooked one — and its risk profile is the inverse of REDD+.

Methane is approximately 82 times more potent than CO_2 over a 20-year period. It is the second-largest contributor to climate change after CO_2. Coal mines — both active and abandoned — emit around 40 million tonnes annually, with

VAM — the low-concentration methane draining through mine ventilation shafts — accounting for roughly 70% of total coal mining emissions. Until recently, VAM was considered too dilute to capture. It is not.

Regenerative Thermal Oxidiser (RTO) technology destroys VAM through thermal oxidation, converting it to CO_2 — a far less potent greenhouse gas — and, in many installations, recovering the heat energy released by the process for grid electricity sales. This dual revenue stream — carbon credits from verified methane destruction plus energy income from grid sales — fundamentally changes the financial architecture of VAM abatement projects, making them bankable independent of carbon pricing alone.

Biothermica VAMOX — Central Appalachian Region, U.S. © Biothermica

Anguil VAMTOX RTO — Shanxi Province, China © Anguil Environmental Systems

Why the Credit Profile Is Superior

The permanence case is absolute. Methane that has been thermally destroyed cannot be reversed. There are no forest buffer accounts, no climate-driven reversal risks, no baseline controversies. Reductions are measured directly using engineering instrumentation — auditable, precise, and unambiguous. The causal chain is direct: without the project, the methane is vented. With the project, it is destroyed.

The cost profile is equally compelling. Credible VAM abatement projects can be developed at $7–20 per tonne of CO_2 equivalent — directly competitive with independently certified high-integrity nature-based removals, and at a fraction of the verification risk.

KEY DATA POINT

A mere 2% of global climate action funding is currently allocated to methane mitigation — despite methane being the second-largest driver of global warming and coal mine VAM being among the top four global opportunities for methane reduction by 2030 (International Institute for Applied Systems Analysis).

Nature-Based Credits vs. Coal Mine Methane: A Direct Comparison

The table below places the two asset classes side by side across the dimensions most relevant to investors and policymakers. Coal mine methane advantages are highlighted.

Criteria	Nature-Based Credits	Coal Mine Methane
Cost per tCO_2e	$4–$25 (quality-dep.)	**$7–$20**
Additionality	Frequently contested	**Directly verifiable**
Permanence	High risk — fire, drought, land use	**Absolute — gas thermally destroyed**
Verification	Complex, model-dependent	**Engineering-grade instrumentation**

Criteria	Nature-Based Credits	Coal Mine Methane
Climate impact	Decades	**Immediate**
Co-benefits	Biodiversity, community	**Safety, local air quality**
Regulatory status	Widely used, under scrutiny	**CA, Australia, China frameworks**
Investor risk	Reputational & reversal risk	**Low risk, high impact**

The contrast is structural, not marginal. Nature-based credits carry risks that are becoming harder for serious investors to overlook. Coal mine methane abatement credits offer lower cost, higher certainty, and immediate climate impact. The gap is not in the quality of the solution — it is in the market infrastructure to support it. Three jurisdictions are demonstrating that this gap is closable.

Three Jurisdictions. Three Proof Points.

CALIFORNIA

The Compliance Blueprint

Since 2014, California's Mine Methane Capture (MMC) Protocol, administered by the California Air Resources Board, has issued rigorous, independently verified carbon credits for coal mine methane projects — explicitly including VAM. The protocol requires annual independent verification with strict engineering-grade measurement. Credits become ARB Offset Credits, which regulated California emitters can use to meet up to 8% of their compliance obligations. The programme is linked with Québec's cap-and-trade system, covering a combined market representing roughly 85% of California's total greenhouse gas emissions.

At the West Virginia installations, Biothermica's VAMOX technology destroys more than 99% of the methane captured from mine ventilation shafts — a destruction efficiency that underscores why these credits carry no permanence risk and no baseline controversy. Biothermica estimates a minimum credit price of $10–12 per tonne CO_2e is required for project viability — a threshold the California market has consistently exceeded. In November 2024, California and Québec compliance entities surrendered 5.3 million mine methane credits for their emissions obligations. The Climate Action Reserve has issued over 22 million early action offset credits from coal mine methane projects now at full ARB compliance status.

5.3M	22M+	$10–12	>99%
Credits surrendered Nov 2024	Early action credits (Climate Action Reserve)	Min. viable price /tCO_2e	Biothermica VAMOX destruction efficiency

AUSTRALIA

The Emerging Opportunity

Australia is building its own Mine Methane Capture equivalent — and the regulatory catalyst that will drive abatement investment is already in motion. The Coal Mine Waste Gas method under the Australian Carbon Credit Unit (ACCU) scheme mirrors the California protocol's logic: projects capturing and destroying methane from active and abandoned

coal mines earn tradable credits with independent verification. VAM-only projects carry explicit additionality provisions. As of early 2025, 28 projects are registered, and the Emissions Reduction Assurance Committee has independently confirmed the integrity of the methodology.

The pivotal near-term shift is the mandatory transition from Method 1 reporting to Method 2. Open-cut coal mines — roughly 80% of Australian coal production — have historically reported methane emissions using state-based industry average factors rather than direct site measurement. Multiple independent studies, including IEA research, found actual emissions may have been underreported by as much as 90%. From July 2025, covered mines must transition to site-specific geological measurement. Researchers at the University of Queensland warn that reported emissions could quadruple at some operations.

The compliance implications are transformative: mines operating comfortably within baselines under Method 1 may face significant exceedances under Method 2, dramatically increasing the cost of offset purchasing and the financial attractiveness of on-site abatement investment. The NSW and Queensland state governments have committed a combined A$825 million in funding for coal sector decarbonisation, including methane capture. The investment window for early movers is open.

28	A$875M	90%	4×
Projects registered under ACCU method	Projected compliance cost 2025–2030	Potential emissions underreported (Method 1)	Emissions could quadruple (Method 2)

CHINA

The Scale Play

Heavy industry will remain central to China's economy for decades — and so will coal mine methane. © Shutterstock

China accounts for approximately 40% of global coal mine methane emissions. The IEA estimates China's coal mines emit the equivalent of over 500 million tonnes of CO_2 annually. And yet the picture emerging from recent regulatory developments and on-the-ground technology deployment is more encouraging than Western commentary typically acknowledges. China is acting — and in some respects more decisively than jurisdictions with more fragmented governance.

The most compelling on-the-ground evidence is the deployment of Anguil Environmental Systems' VAMTOX RTO technology across six Chinese coal mines — one of the most significant concentrations of commercial-scale VAM

abatement technology operating anywhere in the world. Critically, these systems do not merely destroy methane. They recover the thermal energy from the oxidation process and convert it into electricity sold directly into the local grid, generating a second revenue stream independent of carbon pricing.

In December 2024, China's Ministry of Ecology and Environment published CCER-10-001-V01 — the official China Certified Emission Reduction (CCER) methodology covering VAM streams up to 1.5% concentration and drainage gas up to 8%. For the first time, low-concentration coal mine methane had a carbon finance pathway. China has created a two-tier framework: regulatory obligation for higher-concentration gas, market incentive for lower-concentration VAM. The methodology is not aspirational. It is operational.

Research in Nature Communications found China has the potential to reduce methane emissions by 660 million tonnes of CO_2e by 2030 at a net abatement cost of around $6 per tonne. Those who dismiss China's methane commitments as aspirational may be making the same mistake analysts made about its renewable energy ambitions a decade ago.

40%	6	660M tCO_2e	~$6
Global coal mine methane share	Anguil VAMTOX installations active	Abatement potential by 2030	Net abatement cost per tonne (avg.)

The Elephant in the Room: Coal Is Not Going Away Any Time Soon

> ***"Avoiding investment in coal methane abatement does not make coal mines cleaner. It just leaves the methane in the atmosphere."***

Here is the argument that ESG committees need to hear directly: avoiding investment in coal methane abatement does not make coal mines cleaner. It just leaves the methane in the atmosphere — and it keeps putting it there, every hour of every day the mine operates.

Methane emissions from coal mines are not a one-time event. They are continuous — a constant stream of one of the most potent greenhouse gases on the planet, venting into the atmosphere for as long as the mine is active. VAM thermal oxidation addresses this in real time: the moment a system is operating, methane destruction begins. Immediately. Permanently. Measurably. Every tonne destroyed is a tonne that will never enter the atmosphere.

Coal mines are not going away. Operational lifetimes are being extended well beyond 2030. New mines are opening. In China, India, Indonesia, and parts of Africa, coal remains foundational to growing economies. Even in the United States and Australia, active underground mines continue operating at full capacity. The energy transition will take decades — and unless capital actively finances abatement, methane will be vented throughout every one of those years.

Destroying VAM does not extend a mine's life. It does not increase coal production. It does not provide a social licence for expanded fossil fuel operations. It is a pure decarbonisation play — measurable in engineering terms, permanent by physics, and priced at a fraction of the alternatives. The choice is not between coal and no coal. It is between methane destroyed and methane vented.

The International Transfer Mechanism: Article 6 and ITMOs

The market for coal mine methane carbon credits exists and is expanding. California has been issuing verified credits since 2014. China's CCER framework opened the VAM abatement pathway in December 2024. Australia's compliance mechanism is tightening in ways that will drive significant new demand. But the investment opportunity extends well beyond domestic compliance markets.

Under Article 6 of the Paris Agreement, Internationally Transferred Mitigation Outcomes (ITMOs) allow verified emissions reductions generated in one country to be formally transferred to count toward another country's climate commitments. A government or investor in Europe, Japan, or North America can finance verified VAM abatement in China, Australia, India, or any coal-producing nation with a bilateral authorisation framework in place — and receive ITMOs in return. At $7–20 per tonne, coal mine methane abatement represents some of the most cost-effective climate finance available anywhere in the world.

For policymakers, the ask is specific: embed coal mine methane abatement within Article 6 bilateral agreements; provide methodological support through Verra, Gold Standard, and the Article 6 ITMO mechanisms; create blended finance vehicles, green bonds, and dedicated climate funds that can reach projects private capital alone cannot yet access. The Clean Exit campaign is calling for a dedicated coal mine methane abatement financing window within existing multilateral climate mechanisms.

The Cost Architecture Nobody Is Comparing

Technology	Cost / tCO_2e	vs. VAM
VAM Mitigation	**$7–$20**	**1× baseline**
Carbon Capture & Storage	~$200	10–29× more
Direct Air Capture	$600–$1,000	30–143× more

The First-Mover Window

For institutional investors, the due diligence case is straightforward. As scrutiny of net-zero claims intensifies — from regulators, civil society, and the courts — the quality of underlying offsets will define reputational and financial exposure. Credits grounded in engineering measurement rather than ecological modelling, guaranteed by physics rather than land tenure agreements, and delivering immediate rather than deferred climate impact are precisely what a maturing market will reward.

The market for coal mine methane credits exists and is expanding. The infrastructure — methodologies, registries, project pipelines, and international transfer mechanisms — is maturing across multiple jurisdictions. Investors who engage now enter a market with proven foundations and significant room to grow, positioning themselves ahead of a credit category that is emerging as one of the highest-integrity options in the post-2025 carbon market.

The voluntary carbon market has a critical role to play in financing the energy transition. Coal mine methane abatement represents exactly the kind of high-integrity, cost-effective, technologically proven intervention that a mature carbon market should be scaling. The technology exists. The methodologies are operational. The regulatory frameworks are converging. The climate case is overwhelming.

The goal is not to replace nature-based solutions. It is to build a carbon market worthy of the climate emergency — one where capital follows measurable impact and the carbon stays gone.

> ***"The question is not whether this market will develop. Given the scale of the emissions problem and the cost-effectiveness of the solution, it will. The question is who will be in it when it does."***

Key Numbers at a Glance

82×
Methane more potent than CO_2 over 20 years

40 million t
Annual coal mine methane emissions globally

~70%
VAM's share of total coal mining methane

$7–$20
VAM abatement cost per tCO_2e

$5.30–6.00
REDD+ generic credit price, 2025–2026

$15–$25
High-integrity certified credits

>99%
Biothermica VAMOX methane destruction efficiency

5.3 million
California mine methane credits surrendered (Nov 2024)

25 million
Australia projected compliance credits, 2025–2030

Dec 2024
China CCER-10-001-V01 published — VAM up to 1.5%

6 mines
Anguil VAMTOX RTO deployments active in China

660M tCO_2e
China's abatement potential by 2030 at ~$6/tonne avg.

2%
Global climate funding currently allocated to methane

Further Reading

The research underpinning this newsletter is drawn from the Clean Exit campaign's full policy paper: *The Carbon Credit Reckoning: Why Coal Mine Methane Abatement Deserves a Place at the Top of the Voluntary Carbon Market*. The full document — including extended country case studies, DEB/Non-DEB credit analysis, the 15th Five-Year Plan assessment, and the complete policy recommendations — is available at **methanebrief.org**.

ABOUT THE METHANE BRIEF

The Methane Brief grew out of the Clean Exit campaign — launched June 2025, 500,000+ impressions in six months. Published every two weeks for investors, policymakers, and industry decision-makers who need to act on methane now, not later.

Kaj Embrén — Founder • Juneia Mallas — Lead Researcher • Richard Mattus — Technical Advisor

methanebrief.org • #CleanExit • #MethaneAbatement • #CarbonMarkets • #ClimateFinance