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# **Carbon Credit Quality in India's Voluntary Market: *An Integrity Assessment***

*Evaluating the additionality, permanence, and co-benefit claims of registered Indian carbon projects across forestry, cookstoves, and renewable energy methodologies.*

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## ABSTRACT

India is the second-largest issuer of voluntary carbon credits globally, with approximately 370 million tonnes of carbon dioxide equivalent issued through the principal independent standards as of the end of 2024. Yet recent peer-reviewed evidence and independent rating assessments converge on a disquieting conclusion: a large share of credits produced in the country are unlikely to represent the emission reductions they claim. The meta-analysis of Probst and colleagues in *Nature Communications* found that less than sixteen per cent of global offset credits constitute real reductions; the Berkeley study by Gill-Wiehl, Kammen and Haya in *Nature Sustainability* documented overcrediting by a factor of approximately ten across five cookstove methodologies; and the Integrity Council for the Voluntary Carbon Market determined in August 2024 that eight renewable energy methodologies covering roughly thirty-two per cent of the voluntary market did not meet the additionality threshold of the Core Carbon Principles.

This paper assesses the integrity of Indian voluntary carbon credits against the canonical criteria of additionality, permanence, and co-benefits. It applies the framework to three methodology clusters that together account for most Indian issuance: forestry and land use, improved and clean cookstoves, and grid-connected renewable energy. The findings are that grid-connected renewables, which dominate the Indian pipeline, have largely failed the additionality test because they would have proceeded under prevailing tariff, policy, and cost conditions; that cookstove projects suffer from systematic overestimation of stove adoption, non-renewable biomass fractions, and continued use of baseline stoves; and that forestry and agricultural land management projects present unresolved permanence concerns compounded by equity failures in benefit sharing. Nine Indian projects appeared in the 2025 Corporate Accountability review of the forty-seven largest global retirements of 2024, including named activities in the hydropower, solar, and wind sectors.

The paper concludes that India's voluntary market is at an inflection point. The adoption of eight domestic methodologies by the Ministry of Power on 28 March 2025 and the launch of the Indian Carbon Market Portal on 21 March 2026 create an opportunity to reset integrity standards at the national level. The immediate priorities are the exclusion of grid-connected renewables from offset eligibility, migration of cookstove projects to metered methodologies, and the codification of benefit-sharing obligations in primary legislation. Integrity is not a reputational enhancement; it is the condition under which voluntary carbon finance can retain any mitigative function at all.

**Keywords:** voluntary carbon market, additionality, permanence, overcrediting, cookstoves, REDD+, renewable energy, Core Carbon Principles, Carbon Credit Trading Scheme, India.

**JEL Classification:** Q54, Q56, Q58, O13, L51.

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# 1. Introduction

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The voluntary carbon market sits at an uncomfortable threshold. A decade of rapid growth, punctuated by repeated scandals and independent empirical assessments, has produced a body of evidence that is increasingly difficult to reconcile with the market's central claim. That claim is simple: a tonne of carbon dioxide emitted in one place can be neutralised by a tonne reduced elsewhere, at lower cost, through a tradable instrument. The empirical record casts serious doubt on whether this neutrality holds, even approximately, across the major project categories. Peer-reviewed meta-analyses now suggest that fewer than one in six credits represents a real reduction.<sup>1</sup>

India's position in this market is structurally significant. The country hosts the second-largest national pool of issued credits, trailing only the United States. Its project portfolio concentrates heavily in three categories: forestry and land use, improved and clean cookstoves, and grid-connected renewable energy. These categories are simultaneously the most commercially scaled, the most methodologically contested, and the most consequential for domestic development outcomes. The question of whether Indian credits represent real mitigation is therefore not merely a technical question for market participants; it is a strategic question for Indian climate policy, for the credibility of the Carbon Credit Trading Scheme now entering operation, and for India's future engagement with Article 6 of the Paris Agreement.<sup>2</sup>

This paper offers a structured integrity assessment of Indian voluntary carbon credits. It draws on the peer-reviewed empirical literature, on assessments by the Integrity Council for the Voluntary Carbon Market, on the Corporate Accountability analysis of the largest retirements of 2024, and on Indian domestic regulatory developments through March 2026. Its central finding is that integrity problems are not uniformly distributed across methodologies, but are concentrated in the project types that have generated the majority of Indian volume. Grid-connected renewables, which would have proceeded under Indian tariff and policy conditions without carbon revenue, have largely failed the additionality test. Improved cookstoves, widely promoted as delivering climate and health co-benefits, have been shown to overestimate emission reductions by approximately an order of magnitude. Forestry and agricultural land management projects exhibit unresolved permanence concerns and a documented pattern of exclusion of marginalised communities from benefit sharing.

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<sup>1</sup>B. S. Probst, M. Toetzke, A. Kontoleon, et al., "Systematic assessment of the achieved emission reductions of carbon crediting projects", *Nature Communications* 15 (2024): 9562. Coverage approximately one-fifth of global issued volume, or roughly 972 million tonnes.

<sup>2</sup>World Federation of Exchanges, *The Dynamics of Voluntary Carbon Markets* (Research Note, 2025). India ranked second globally with approximately 370 million tCO<sub>2</sub>e issued, behind the United States (above 500 million) and ahead of China (248 million).

The paper is organised as follows. Section 2 sets out India’s position in the global voluntary market. Section 3 establishes the integrity framework. Section 4 describes the evidence base. Sections 5, 6, and 7 assess the three methodology clusters. Section 8 synthesises cross-sectoral findings. Section 9 draws out the implications for the Carbon Credit Trading Scheme. Section 10 concludes.

## 2. India in the Global Voluntary Carbon Market

India's engagement with project-based carbon markets predates the voluntary carbon market proper. Indian developers were among the most active participants in the Clean Development Mechanism under the Kyoto Protocol, generating a substantial share of Certified Emission Reductions during the 2005 to 2012 period. The transition from the Clean Development Mechanism to the independent standards of the voluntary market during the past decade has left India with deep developer capacity, an extensive project pipeline, and a stock of legacy activities seeking continued crediting under successor methodologies.

As of the end of 2024, approximately 370 million tonnes of carbon dioxide equivalent had been issued through projects located in India across the four principal voluntary registries: the Verified Carbon Standard operated by Verra, the Gold Standard, the American Carbon Registry, and the Climate Action Reserve. This placed India second globally, behind the United States at above 500 million tonnes and ahead of China at 248 million tonnes. The global top three therefore accounted for well over half of all voluntary credit issuance, and India's share alone stood at approximately one-sixth of the cumulative global total.<sup>3</sup>

The sectoral composition of the Indian portfolio is uneven. Grid-connected renewable electricity generation has historically accounted for the largest share of issued credits, reflecting the combination of large-scale solar and wind deployment after 2014 and the availability of legacy methodologies that permitted crediting of such projects. Cookstove projects, agroforestry and afforestation projects, and smaller categories such as waste management and fuel switching together account for the remaining share. In terms of active and registered projects, independent registry data suggest that India hosts in excess of 700 projects on Verra alone, with additional activities under the Gold Standard, the Carbon Registry of India, and smaller national initiatives.<sup>4</sup>

**Table 1. India's Voluntary Carbon Market at a Glance (end-2024)**

Indicator	Value
<b>Cumulative issued credits (tCO<sub>2</sub>e)</b>	approximately 370 million
<b>Global rank by issuance</b>	2nd (after United States; before China)
<b>Share of global cumulative issuance</b>	approximately 17 to 18 per cent

<sup>3</sup>World Federation of Exchanges, *The Dynamics of Voluntary Carbon Markets* (Research Note, 2025). India ranked second globally with approximately 370 million tCO<sub>2</sub>e issued, behind the United States (above 500 million) and ahead of China (248 million).

<sup>4</sup>C. Kesh, A. Sharma and V. Chaturvedi, *Unlocking India's Voluntary Carbon Market: Challenges and the Path Forward* (New Delhi: Council on Energy, Environment and Water, 2025).

Indicator	Value
<b>Active projects on Verra (India-located)</b>	above 700
<b>Principal sectors by volume</b>	Renewable energy; cookstoves; AFOLU
<b>India-located projects in CA 2025 “problematic” list (of 47)</b>	9 (all renewable energy)

Sources: World Federation of Exchanges (2025); Verra Registry data; Corporate Accountability (2025).

This market share is consequential for three reasons. First, it means that integrity problems in Indian projects affect a materially large portion of global issuance, and therefore feed directly into the credibility of the voluntary market as a whole. Second, it means that the methodologies most heavily used in India, particularly those inherited from the Clean Development Mechanism framework, are among those most actively contested in the ongoing reform of voluntary standards. Third, it means that the development of the Indian domestic offset mechanism under the Carbon Credit Trading Scheme is not a marginal or national matter; it will shape the integrity trajectory of a substantial share of global supply.<sup>5</sup>

The market environment into which Indian credits are sold has also shifted. The Integrity Council for the Voluntary Carbon Market, established to set a threshold benchmark for credit quality through the Core Carbon Principles, began issuing category decisions during 2024. The most consequential was the August 2024 decision that eight renewable energy methodologies, covering approximately 236 million unretired credits globally, did not meet the additionality criterion. Buyers increasingly segment the market between Core Carbon Principles approved credits, which trade at a premium estimated at approximately twenty-five per cent, and legacy credits, which face either discount or exclusion from premium demand segments.<sup>67</sup>

<sup>5</sup>Corporate Accountability, *Another Nail in the Coffin of the Voluntary Carbon Market* (Washington, DC, June 2025). Nine of the forty-seven largest 2024-retired projects identified as producing “problematic” credits were located in India.

<sup>6</sup>Integrity Council for the Voluntary Carbon Market, “Carbon credits from current renewable energy methodologies will not receive high-integrity CCP label” (decision of 8 August 2024). Eight methodologies, approximately 236 million unretired credits, or 32 per cent of the voluntary carbon market.

<sup>7</sup>Forest Trends’ Ecosystem Marketplace, *State of the Voluntary Carbon Market 2025* (Washington, DC, 2025). The average weighted price for CCP-labelled credits in 2024 was approximately 25 per cent above non-labelled equivalents.

### 3. The Integrity Framework: Additionality, Permanence, Co-benefits

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A voluntary carbon credit, to function as a unit of climate mitigation, must satisfy a small number of conditions that are individually demanding and jointly stringent. Three of these have organising force: additionality, permanence, and co-benefits. This paper applies these as the principal axes of assessment, alongside subsidiary requirements such as conservative quantification, avoidance of leakage, and prevention of double counting.

#### 3.1 Additionality

Additionality is the requirement that the mitigation activity would not have occurred in the absence of the incentive provided by carbon credit revenue. A project is additional when the carbon finance is a necessary condition for its implementation; it is non-additional when it would have proceeded on the basis of other revenue streams, regulatory requirements, or commercial logic. The empirical literature on additionality is among the longest-established in carbon market research. The Öko-Institut assessment for the European Commission in 2016 estimated that approximately eighty-five per cent of Clean Development Mechanism projects were unlikely to be additional or were otherwise over-credited.<sup>8</sup>

The additionality question has evolved. Early critiques focused on the subjective nature of the investment analyses submitted by project developers and on the asymmetric incentive of developers to claim barriers that their own behaviour contradicted. The more recent literature combines these critiques with structural observations. Large-scale grid-connected renewable energy projects in India, for example, are deployed in an environment in which solar and wind tariffs have fallen below parity with fossil alternatives, viability gap funding is available through the Ministry of New and Renewable Energy, renewable purchase obligations are imposed on discoms under the Electricity Act, and accelerated depreciation and other fiscal incentives apply. In such an environment, the claim that carbon revenue is determinative of project viability is implausible, and the Centre for Science and Environment has documented that carbon finance typically accounts for only three to four per cent of total project costs in sampled Indian renewable energy activities.<sup>9,10</sup>

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<sup>8</sup>M. Cames, R. O. Harthan, J. Füssler, et al., *How Additional is the Clean Development Mechanism?* (Berlin: Öko-Institut, 2016). Approximately 85 per cent of sampled CDM projects were judged unlikely to be additional or otherwise over-credited.

<sup>9</sup>Centre for Science and Environment, *Carbon Markets: A Reality Check* (New Delhi: CSE, 2023), finding that carbon revenue accounted for three to four per cent of total project costs in a sample of Indian renewable energy activities.

<sup>10</sup>Ministry of New and Renewable Energy, Government of India, viability gap funding schemes; state-level feed-in tariffs and renewable purchase obligations under the Electricity Act, 2003. As of late 2025, utility-scale solar tariffs in India were consistently below Rs. 2.50 per kWh.

### 3.2 Permanence

Permanence is the requirement that the claimed emission reduction or removal endures. For avoidance-based projects, such as avoided deforestation, permanence concerns arise when the avoided emissions subsequently occur, for example through later clearance or fire. For removal-based projects, such as afforestation or soil carbon, permanence concerns arise from the physical reversibility of the carbon stock: trees are vulnerable to fire, pest, drought, and harvest; soil carbon is vulnerable to tillage reversion and land-use change. The non-permanence and reversals standard adopted by the Article 6.4 Supervisory Body in 2025 attempts to formalise these concerns through buffer pool requirements and compensation periods, but the empirical evidence from existing programs is cautionary.<sup>11</sup>

The systematic assessment of California’s forest carbon offset program by Badgley and colleagues found that after a severe fire season, almost forty per cent of the buffer pool had been consumed. India’s own forest cover, estimated at approximately 715,000 square kilometres by the Forest Survey of India, is exposed to analogous risks, including monsoon-related disturbance, cyclone damage, and fire. The Verra VM0047 methodology for agroforestry in smallholder bunds, and the VM0042 methodology for soil carbon, impose buffer requirements in the range of ten to twenty per cent, which may prove insufficient under stress.<sup>12</sup>

### 3.3 Co-benefits and Safeguards

Co-benefits are the non-carbon outcomes, typically in the health, biodiversity, gender, and poverty dimensions, that a mitigation activity is claimed to deliver. Safeguards are the procedural commitments that protect against harm, including respect for indigenous and community land rights, free prior and informed consent, benefit-sharing arrangements, and grievance mechanisms. Co-benefits and safeguards are often conflated with integrity; they are more accurately understood as legitimacy conditions. A project may be additional and permanent but deliver inequitable or harmful outcomes to host communities, in which case its market viability and social licence will nonetheless erode.

The Indian context places particular weight on this axis because many voluntary projects are implemented in regions with significant rural and indigenous populations whose land and resource rights are legally complex. The peer-reviewed survey by Bhattacharya and colleagues of 841 farmers across seven carbon farming project villages in Haryana and Madhya Pradesh found that participants were predominantly large holders and non-marginalised castes, reflecting a pattern of systematic exclusion. Twenty-seven per cent of farmers reported yield penalties as the

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<sup>11</sup>G. Badgley et al., “Systematic over-crediting in California’s forest carbon offsets program”, *Global Change Biology* 28, no. 4 (2022): 1433–1445.

<sup>12</sup>Ministry of Environment, Forest and Climate Change, Government of India, *India State of Forest Report 2023* (Dehradun: Forest Survey of India, 2024).

reason for discontinuation of carbon farming practices, a rate rising to sixty-three per cent in certain project types. These findings suggest that co-benefit claims in the Indian context require empirical testing rather than normative assertion.<sup>13</sup>

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<sup>13</sup>S. Bhattacharya et al., “Carbon farming in India: are the existing projects inclusive, additional, and permanent?”, *Climate Policy* (2024), doi:10.1080/14693062.2024.2416497. Survey of 841 farmers across seven project villages in Haryana and Madhya Pradesh.

## 4. Methodology and Evidence Base

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The assessment in Sections 5 through 7 draws on four complementary strands of evidence. The first is the peer-reviewed empirical literature on carbon market integrity, including the Gill-Wiehl, Kammen and Haya study in *Nature Sustainability* on cookstove overcrediting; the Probst and colleagues meta-analysis in *Nature Communications*; the West, Bomfim and Haya analysis of REDD+ baseline bias in *Global Environmental Change*; and the Bhattacharya and colleagues analysis of Indian carbon farming in *Climate Policy*.<sup>14151617</sup>

The second is the body of assessment decisions issued by the Integrity Council for the Voluntary Carbon Market under its Core Carbon Principles framework. These decisions translate academic critiques into operational market labelling. The most consequential for India are the August 2024 decisions on eight renewable energy methodologies, the landfill gas methodology approvals of June and September 2024, and the ongoing assessments of cookstove and REDD+ methodologies.

The third is the independent project-level rating and review work conducted by specialised agencies and civil society organisations, including BeZero Carbon, Sylvera, and Corporate Accountability. The 2025 Corporate Accountability analysis, which examined forty-seven of the largest voluntary carbon market retirements of 2024, identified nine Indian projects as producing problematic credits. These projects are named in the sectoral assessments that follow.<sup>18</sup>

The fourth is Indian domestic regulatory and policy documentation, including the Gazette notifications under the Energy Conservation (Amendment) Act, 2022; the Ministry of Power approvals of offset methodologies in March 2025; the launch of the Indian Carbon Market Portal in March 2026; and the research and policy work of domestic institutions such as the Council on

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<sup>14</sup>A. Gill-Wiehl, D. M. Kammen and B. K. Haya, “Pervasive over-crediting from cookstove offset methodologies”, *Nature Sustainability* 7 (2024): 191–202, doi:10.1038/s41893-023-01259-6.

<sup>15</sup>B. S. Probst, M. Toetzke, A. Kontoleon, et al., “Systematic assessment of the achieved emission reductions of carbon crediting projects”, *Nature Communications* 15 (2024): 9562. Coverage approximately one-fifth of global issued volume, or roughly 972 million tonnes.

<sup>16</sup>T. A. P. West, B. Bomfim and B. K. Haya, “Methodological issues with deforestation baselines compromise the integrity of carbon offsets from REDD+”, *Global Environmental Change* 87 (2024): 102863.

<sup>17</sup>S. Bhattacharya et al., “Carbon farming in India: are the existing projects inclusive, additional, and permanent?”, *Climate Policy* (2024), doi:10.1080/14693062.2024.2416497. Survey of 841 farmers across seven project villages in Haryana and Madhya Pradesh.

<sup>18</sup>Corporate Accountability, *Another Nail in the Coffin of the Voluntary Carbon Market* (Washington, DC, June 2025). Nine of the forty-seven largest 2024-retired projects identified as producing “problematic” credits were located in India.

Energy, Environment and Water, the Centre for Science and Environment, and the Observer Research Foundation.<sup>19,20,21</sup>

The assessment applies the integrity framework of Section 3 to each methodology cluster, using published evidence rather than original data collection. It does not offer project-level verification, nor does it make individualised findings about specific developers beyond those named in the public reports cited. Its purpose is to synthesise, with academic discipline, what is presently known about the integrity of the three dominant categories of Indian voluntary carbon credits.

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<sup>19</sup>Ministry of Power, Government of India, “Approval of Eight Methodologies under the Offset Mechanism of the Carbon Credit Trading Scheme” (Gazette Notification, 28 March 2025).

<sup>20</sup>C. Kesh, A. Sharma and V. Chaturvedi, *Unlocking India’s Voluntary Carbon Market: Challenges and the Path Forward* (New Delhi: Council on Energy, Environment and Water, 2025).

<sup>21</sup>Ministry of Power, Government of India, “Launch of Indian Carbon Market Portal”, Press Release (21 March 2026). The portal integrates registration, validation, verification and issuance functions for Carbon Credit Certificates.

## 5. Sectoral Assessment I: Grid-Connected Renewable Energy

Grid-connected renewable energy has been the largest single source of Indian voluntary carbon credits. The methodologies concerned include the Clean Development Mechanism legacy standards ACM0002 for grid-connected electricity from renewable sources, AMS-I.D. for small-scale grid-connected renewable electricity, and related methodologies for biomass-based electricity and for renewable electrification of rural communities. These methodologies were transferred into the voluntary market through Verra's acceptance of Clean Development Mechanism methodologies and through equivalent provisions in the Gold Standard framework.<sup>22</sup>

### 5.1 The Additionality Problem

The central integrity concern is additionality. Indian utility-scale solar tariffs fell below Rs. 2.50 per kWh during the late 2010s and have remained at or below that level through 2025. The Ministry of New and Renewable Energy maintains viability gap funding and production-linked incentives for selected technologies. State-level renewable purchase obligations, imposed under the Electricity Act, 2003, create captive demand. Accelerated depreciation and other fiscal incentives further improve project economics. Against this policy and commercial background, the claim that a grid-connected wind or solar project would not have proceeded without carbon credit revenue is implausible in most cases, particularly for projects developed by well-capitalised independent power producers.<sup>23,24,25</sup>

The ICVCM reached this conclusion explicitly in August 2024, determining that eight renewable energy methodologies, covering approximately 236 million unretired credits or thirty-two per cent of the voluntary market, did not meet the additionality threshold of the Core Carbon Principles. The decision covered ACM0002, AMS-I.D., AMS-I.A., AMS-I.L., ACM0006, ACM0018, AM0036, and AM0072. The ICVCM stated that the Clean Development Mechanism tools for additionality and the grid factor tool exhibited deficiencies that prevented high-integrity

<sup>22</sup>Comprehensive methodology list includes ACM0002 (grid-connected electricity from renewable sources), AMS-I.D. (grid-connected small-scale renewable electricity), AMS-I.A. (electricity generation by the user), AMS-I.L. (electrification of rural communities), ACM0006 and ACM0018 (biomass electricity), AM0036 (biomass in heat generation), and AM0072 (geothermal space heating).

<sup>23</sup>Central Electricity Authority, Government of India, *CO<sub>2</sub> Baseline Database for the Indian Power Sector* (New Delhi: CEA, updated 2024). The combined margin emission factor is applied in grid-connected renewable methodologies.

<sup>24</sup>Ministry of New and Renewable Energy, Government of India, viability gap funding schemes; state-level feed-in tariffs and renewable purchase obligations under the Electricity Act, 2003. As of late 2025, utility-scale solar tariffs in India were consistently below Rs. 2.50 per kWh.

<sup>25</sup>Cumulative installed renewable electricity capacity in India reached approximately 220 GW by the end of 2025, against a target of 500 GW of non-fossil capacity by 2030 announced at COP26.

crediting, while noting that renewable energy financing in least developed contexts could remain appropriate if supported by more robust methodologies.<sup>26,27</sup>

The Corporate Accountability analysis of 2025 translated this finding into project-level observations for India. Nine of the forty-seven largest voluntary carbon market retirements of 2024 were located in India, all in the renewable energy cluster. These included the Karcham Wangtoo Hydroelectric Plant in Himachal Pradesh, a 300 megawatt wind energy activity by Green Infra Wind Energy Limited, the Vishnuprayag hydroelectric project by Jaiprakash Power Ventures, a wind power project by the Adani Group, and a 300 megawatt hydropower project by JHPL. The projects together accounted for approximately 7.7 million retired credits in 2024. The assessment was that these projects carried a low likelihood of delivering additional reductions because the underlying assets were already highly incentivised within the Indian electricity sector.<sup>28</sup>

**Table 2. ICVCM Renewable Energy Methodology Decision (August 2024)**

Methodology	Scope	CCP Decision
ACM0002 v21.0 and earlier	Grid-connected electricity from renewable sources	Rejected
AMS-I.D. v18.0 and earlier	Small-scale grid-connected renewable electricity	Rejected
AMS-I.A. v19.0 and earlier	Electricity generation by the user	Rejected
AMS-I.L. v4.0 and earlier	Electrification of rural communities using renewable energy	Rejected
ACM0006 v16.0 and earlier	Electricity and heat generation from biomass	Rejected
ACM0018 v6.0 and earlier	Electricity generation from biomass in power-only plants	Rejected

<sup>26</sup>Integrity Council for the Voluntary Carbon Market, “Carbon credits from current renewable energy methodologies will not receive high-integrity CCP label” (decision of 8 August 2024). Eight methodologies, approximately 236 million unretired credits, or 32 per cent of the voluntary carbon market.

<sup>27</sup>Comprehensive methodology list includes ACM0002 (grid-connected electricity from renewable sources), AMS-I.D. (grid-connected small-scale renewable electricity), AMS-I.A. (electricity generation by the user), AMS-I.L. (electrification of rural communities), ACM0006 and ACM0018 (biomass electricity), AM0036 (biomass in heat generation), and AM0072 (geothermal space heating).

<sup>28</sup>Corporate Accountability, *Another Nail in the Coffin of the Voluntary Carbon Market* (Washington, DC, June 2025). Nine of the forty-seven largest 2024-retired projects identified as producing “problematic” credits were located in India.

Methodology	Scope	CCP Decision
AM0036 v7.0 and earlier	Use of biomass in heat generation equipment	Rejected
AM0072 v3.0 and earlier	Fossil fuel displacement by geothermal resources	Rejected

Source: ICVCM, category decisions of 8 August 2024. Combined unretired volume approximately 236 million tCO<sub>2e</sub>.

## 5.2 Empirical Support

The ICVCM decision was reinforced by the Probst and colleagues meta-analysis, which applied rigorous counterfactual methods to wind energy projects and found no statistically significant additional emission reductions. The Probst study covered 2,346 projects and approximately one-fifth of global credit issuance, amounting to roughly 972 million tonnes. The implication, specifically for wind energy, is that the issuance of carbon credits did not lead to additional climate mitigation beyond what would have occurred under prevailing policy and commercial conditions.<sup>29</sup>

## 5.3 Implications for Indian Policy

The policy implications are stark. The eight Ministry of Power methodologies adopted in March 2025 include categories adjacent to grid-connected renewables, particularly in green hydrogen and in renewable energy distribution and demand management. The design of these methodologies should be guided by the ICVCM decision and by the peer-reviewed evidence. A methodology that permits crediting of grid-connected renewable electricity projects that are commercially viable under Indian tariff and incentive conditions would repeat the integrity failure that has compromised the existing voluntary market. The Verra Version 4 standard introduced in 2019 already excludes most grid-connected renewable energy projects in middle-income countries from new registration on additionality grounds. India's domestic offset mechanism, if it is to serve its institutional purpose, must apply comparable or stricter tests.<sup>30,31</sup>

<sup>29</sup>B. S. Probst, M. Toetzke, A. Kontoleon, et al., "Systematic assessment of the achieved emission reductions of carbon crediting projects", *Nature Communications* 15 (2024): 9562. Coverage approximately one-fifth of global issued volume, or roughly 972 million tonnes.

<sup>30</sup>Ministry of Power, Government of India, "Approval of Eight Methodologies under the Offset Mechanism of the Carbon Credit Trading Scheme" (Gazette Notification, 28 March 2025).

<sup>31</sup>Verra, Verified Carbon Standard Program, Standard Version 4 (2019), Section 3, restricts eligibility of grid-connected renewable electricity projects in most countries to those meeting specific additionality tests.

## 6. Sectoral Assessment II: Improved and Clean Cookstoves

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Cookstove projects have been the fastest-growing category in the voluntary carbon market. The policy rationale is strong. Approximately 2.4 billion people globally cook with solid fuels or kerosene, contributing to two to three million premature deaths annually and an estimated two per cent of global greenhouse gas emissions. India has hosted a substantial share of the global cookstove pipeline, particularly under Gold Standard methodologies including TPDDTEC, the simplified methodology, and the Clean Development Mechanism small-scale methodologies AMS-II.G and AM-I.E.<sup>32</sup>

### 6.1 The Gill-Wiehl, Kammen and Haya Assessment

The Nature Sustainability study of 2024 by Gill-Wiehl, Kammen and Haya at the University of California, Berkeley, conducted the first comprehensive quantitative quality assessment of cookstove offsets. The authors compared five methodologies with the published scientific literature and their own independent analysis. Based on a sample covering forty per cent of cookstove credits, they estimated that projects were over-credited by a factor of 9.2. Extrapolating to all cookstove offset credits generated under the five methodologies, the estimated over-crediting factor was approximately 10.6.<sup>33</sup>

The sources of over-crediting are specific and well-documented. They include the fraction of non-renewable biomass, which is frequently assumed at default values higher than empirical geographic estimates; the firewood-to-charcoal conversion assumptions; stove adoption rates, which are typically derived from distribution rather than sustained use; stove usage intensity, which is commonly overstated; continued use of the original baseline stove, which is typically understated because households engage in stove stacking; and fuel consumption per stove. Each of these parameters, when adjusted to empirically supported values, reduces the claimed emission

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<sup>32</sup>Indian Council of Medical Research and Ministry of Health and Family Welfare, *India: Health of the Nation's States* (New Delhi, 2024). Household air pollution from solid fuel use remains among the leading risk factors for premature mortality in India.

<sup>33</sup>A. Gill-Wiehl, D. M. Kammen and B. K. Haya, "Pervasive over-crediting from cookstove offset methodologies", *Nature Sustainability* 7 (2024): 191–202, doi:10.1038/s41893-023-01259-6.

reductions substantially. The cumulative effect is the order-of-magnitude overestimation documented in the Berkeley study.<sup>343536</sup>

The Probst and colleagues meta-analysis reached a consistent conclusion. It estimated that only approximately eleven per cent of credits from cookstove projects represented real emission reductions, the lowest proportion among the project categories assessed in the study. The combination of the Gill-Wiehl and Probst findings has substantially altered buyer behaviour: retirements of cookstove credits from legacy methodologies declined sharply through 2024 and 2025 as corporate purchasers sought credits aligned with more rigorous methodologies.<sup>37</sup>

## 6.2 Methodological Heterogeneity

Not all cookstove methodologies are equally affected. The Gill-Wiehl study found that the Gold Standard Metered methodology, which directly monitors fuel consumption through meters or sensors rather than relying on survey-based adoption estimates, produced results most aligned with the study's independent analysis. The Metered methodology, while more expensive to implement, imposes the kind of direct measurement that permits verifiable claims. This methodological heterogeneity is consequential for the design of the Indian domestic offset mechanism, because the selection of permitted methodologies determines the integrity of the resulting credits.<sup>38</sup>

## 6.3 Additionality in the Indian Context

Additionality for cookstove projects is distinct from additionality for grid-connected renewables. The barriers to household adoption of improved or clean cookstoves in India include upfront cost, fuel availability, cultural preference, and the opportunity cost of labour spent on fuel collection. Carbon finance can genuinely lower these barriers, particularly for the transition from traditional biomass stoves to higher-efficiency improved biomass stoves or to clean fuels such as liquefied petroleum gas, biogas, or electricity. However, the existence of the Pradhan Mantri Ujjwala Yojana, launched in May 2016 and reaching over 100 million beneficiaries by 2024, complicates

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<sup>34</sup>A. Gill-Wiehl, D. M. Kammen and B. K. Haya, "Pervasive over-crediting from cookstove offset methodologies", *Nature Sustainability* 7 (2024): 191–202, doi:10.1038/s41893-023-01259-6.

<sup>35</sup>R. Bailis, Y. Wang, R. Drigo, A. Ghilardi and O. Masera, "Getting the numbers right: revisiting woodfuel sustainability in the developing world", *Environmental Research Letters* 12 (2017): 115002. fNRB values used by legacy methodologies are frequently higher than geographically resolved empirical estimates.

<sup>36</sup>The stacking phenomenon is documented in household energy field studies across Asia and Africa; see Gill-Wiehl, Kammen and Haya (2024) for methodological implications.

<sup>37</sup>B. S. Probst, M. Toetzke, A. Kontoleon, et al., "Systematic assessment of the achieved emission reductions of carbon crediting projects", *Nature Communications* 15 (2024): 9562. Coverage approximately one-fifth of global issued volume, or roughly 972 million tonnes.

<sup>38</sup>Gold Standard Foundation, "Methodology for Metered and Measured Energy Cooking Devices" (Geneva, 2021; updated 2024). The metered methodology requires direct monitoring of fuel consumption via sensors or meters.

the baseline. Projects that distribute improved biomass stoves in Ujjwala-eligible districts must account for the probability that beneficiary households would have transitioned to liquefied petroleum gas under the scheme in any event.<sup>39</sup>

**Table 3. Sources of Over-crediting in Cookstove Methodologies**

Parameter	Mechanism of overestimation
<b>Fraction of non-renewable biomass (fNRB)</b>	Default values exceed geographically resolved empirical estimates (Bailis et al., 2017).
<b>Stove adoption</b>	Distribution treated as equivalent to sustained use; survey-based adoption rates subject to social desirability bias.
<b>Stove usage intensity</b>	Daily use hours commonly overstated in self-reported data; direct sensor measurement rarely applied.
<b>Stove stacking</b>	Continued parallel use of baseline stove for cultural or functional reasons typically understated.
<b>Firewood to charcoal conversion</b>	Inflated conversion factors where baseline fuel was charcoal rather than raw wood.
<b>Fuel consumption per stove</b>	Laboratory-derived values applied to field conditions without adjustment for rebound.
<b>Emission factors</b>	IPCC defaults applied without adjustment for field conditions or stove type.

Source: Synthesised from Gill-Wiehl, Kammen and Haya (2024) and Bailis et al. (2017).

## 6.4 Co-benefits and Safeguards

Cookstove projects are typically justified in part by health and gender co-benefits. The Berkeley study noted that the majority of improved stoves on the market do not reduce emissions sufficiently to meet World Health Organization health standards. Projects that distribute stoves falling short of clean fuel definitions may therefore generate carbon credits without delivering the health co-benefits claimed in their marketing. This matters for India because household air

<sup>39</sup>Pradhan Mantri Ujjwala Yojana, launched May 2016, had reached over 100 million beneficiaries by 2024 according to Ministry of Petroleum and Natural Gas data. The scheme distributes LPG connections at subsidised rates to below-poverty-line households.

pollution remains among the leading risk factors for premature mortality, and because the political and philanthropic acceptability of cookstove projects rests on the health narrative.<sup>4041</sup>

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<sup>40</sup>A. Gill-Wiehl, D. M. Kammen and B. K. Haya, “Pervasive over-crediting from cookstove offset methodologies”, *Nature Sustainability* 7 (2024): 191–202, doi:10.1038/s41893-023-01259-6.

<sup>41</sup>Indian Council of Medical Research and Ministry of Health and Family Welfare, *India: Health of the Nation's States* (New Delhi, 2024). Household air pollution from solid fuel use remains among the leading risk factors for premature mortality in India.

## 7. Sectoral Assessment III: Forestry, Agriculture, and Land Use

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The third methodology cluster covers forestry and other land use, including afforestation and reforestation, avoided deforestation, improved forest management, agroforestry, and soil carbon sequestration. The Verra Agriculture, Forestry and Other Land Use sectoral scope accounts for a substantial share of voluntary issuance, and India has an active pipeline across several of its sub-categories. The integrity questions in this cluster are distinct from those in renewable energy and cookstoves. Additionality is more plausible than in grid-connected renewables, because forestry and soil carbon activities rarely have commercial rationales independent of carbon finance. Permanence, however, is a first-order concern, and benefit sharing raises acute equity questions.

### 7.1 REDD+ Baseline Bias

Avoided deforestation projects under the REDD+ framework have been the most contested forestry category globally. The central technical critique, developed in West, Bomfim and Haya (2024) and in later work, is that project-level baselines consistently overstate the counterfactual deforestation rate by drawing control areas and models in a manner that exhibits selection bias. A synthesis of six independent ex post evaluations covering forty-four REDD+ projects concluded that the projects, while frequently reducing deforestation, claimed 10.7 times more avoided deforestation than was justified by independent estimates.<sup>42</sup>

India's role in REDD+ crediting has been more modest than in Latin American or Southeast Asian jurisdictions, in part because Indian forests are largely under state control, with community forestry rights codified under the Forest Rights Act, 2006. The REDD+ baseline critique nonetheless informs Indian project design in two ways. First, the Verra consolidated REDD methodology VM0048, approved by the ICVCM in 2024, replaces project-level baselines with jurisdictional risk mapping, and is the methodology against which new Indian REDD+ projects will be assessed. Second, the critique highlights the need for ex post certification rather than ex ante crediting, a principle with direct implications for the design of Indian afforestation and reforestation methodologies.<sup>4344</sup>

### 7.2 Afforestation, Reforestation, and Soil Carbon

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<sup>42</sup>T. A. P. West, B. Bomfim and B. K. Haya, "Methodological issues with deforestation baselines compromise the integrity of carbon offsets from REDD+", *Global Environmental Change* 87 (2024): 102863.

<sup>43</sup>T. A. P. West, B. Bomfim and B. K. Haya, "Methodological issues with deforestation baselines compromise the integrity of carbon offsets from REDD+", *Global Environmental Change* 87 (2024): 102863.

<sup>44</sup>Verra's VM0048 consolidated REDD methodology was approved by the ICVCM in 2024, replacing earlier avoided unplanned deforestation methodologies that used project-level baselines.

Afforestation and reforestation methodologies, including VM0047 for agroforestry in smallholder bunds and VM0042 for soil carbon, face the permanence constraint as their principal integrity challenge. Indian forests face multiple reversal risks: cyclonic damage, particularly in the Sundarbans and eastern coastal zones; fire in central and northern forests; drought-related mortality in arid and semi-arid regions; and grazing pressure. Buffer pool provisions of ten to twenty per cent, standard in the Verra methodologies, may prove insufficient in the face of climate-change-amplified disturbance regimes. Badgley's work on California suggests that buffer pools can be consumed rapidly under even current climate conditions.<sup>4546</sup>

Soil carbon projects face a distinct but related permanence challenge. Soil carbon sequestration depends on the continuation of the land management practices that produced it. Reversion to conventional tillage, abandonment of cover crops, or conversion to non-agricultural use releases the sequestered carbon. The empirical evidence from India is consistent with the global pattern. In the peer-reviewed survey by Bhattacharya and colleagues of 841 farmers across seven carbon farming project villages in Haryana and Madhya Pradesh, twenty-seven per cent of participating farmers cited yield penalties as a reason for discontinuation, with the rate rising to sixty-three per cent in certain project types. If a substantial share of participants discontinues practice within the first project years, the claimed soil carbon additions may not be realised.<sup>47</sup>

### **7.3 Benefit Sharing and Equity**

The Bhattacharya survey also documented a pattern of exclusion that is broadly consistent with the broader Indian carbon farming literature. Participating farmers were predominantly large holders and from non-marginalised caste groups. Marginal farmers, scheduled caste and scheduled tribe communities, and women were systematically under-represented. This distributional pattern has three implications. First, it contradicts the co-benefit claims commonly made in project marketing, which typically emphasise inclusion and poverty reduction. Second, it creates reputational risk for corporate buyers seeking credits with credible social co-benefits. Third, it establishes a policy case for statutory benefit-sharing requirements in the Indian Carbon Credit Trading Scheme, analogous to the Kenyan Climate Change (Amendment) Act, 2023, which

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<sup>45</sup>G. Badgley et al., "Systematic over-crediting in California's forest carbon offsets program", *Global Change Biology* 28, no. 4 (2022): 1433–1445.

<sup>46</sup>Ministry of Environment, Forest and Climate Change, Government of India, *India State of Forest Report 2023* (Dehradun: Forest Survey of India, 2024).

<sup>47</sup>S. Bhattacharya et al., "Carbon farming in India: are the existing projects inclusive, additional, and permanent?", *Climate Policy* (2024), doi:10.1080/14693062.2024.2416497. Survey of 841 farmers across seven project villages in Haryana and Madhya Pradesh.

mandates that land-based projects allocate at least forty per cent of net earnings to community beneficiaries.<sup>4849</sup>

## 7.4 Blue Carbon

Blue carbon ecosystems, including mangroves, seagrass meadows, and tidal marshes, represent a comparatively underdeveloped segment of the Indian voluntary market. India's mangrove cover is concentrated in the Sundarbans and along the western and eastern coasts, and its restoration potential is substantial. However, blue carbon projects in India face an unusual institutional challenge. Responsibility for coastal ecosystems is divided among the Ministry of Environment, Forest and Climate Change, State Coastal Zone Management Authorities, state forest departments, and fisheries departments. This fragmentation generates approval delays and methodological ambiguity that have prevented blue carbon from scaling at the rate its biophysical potential would otherwise support. A small number of projects, including the Sundarbans Mangrove Restoration Project registered under Verra and Kosher Climate's proposed 2,000-hectare mangrove restoration activity, demonstrate the project type, but volumes remain modest.<sup>50</sup>

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<sup>48</sup>S. Bhattacharya et al., "Carbon farming in India: are the existing projects inclusive, additional, and permanent?", *Climate Policy* (2024), doi:10.1080/14693062.2024.2416497. Survey of 841 farmers across seven project villages in Haryana and Madhya Pradesh.

<sup>49</sup>The Government of Kenya's Climate Change (Amendment) Act, 2023, Sections 23B and 23C, establishes mandatory benefit-sharing percentages for carbon projects and serves as a comparative reference for Indian reformers.

<sup>50</sup>A. Pandey, "Overlooked and Underutilised: Blue Carbon Credits in India's Voluntary Carbon Market", Observer Research Foundation Issue Brief No. 828 (August 2025).

## 8. Cross-Sectoral Synthesis and Market Implications

The sectoral assessments produce a consistent but differentiated picture. Grid-connected renewable energy, the largest single source of Indian voluntary credits by cumulative issuance, has substantially failed the additionality test. Cookstove projects, while genuinely addressing a first-order development challenge, have been shown to overestimate emission reductions by approximately an order of magnitude under their dominant methodologies. Forestry and land-use projects present unresolved permanence concerns and a documented equity failure in benefit distribution. Table 4 synthesises the assessment.

**Table 4. Integrity Assessment Summary by Methodology Cluster**

Axis	Renewables	Cookstoves	AFOLU
<b>Additionality</b>	Fails for most grid-connected projects; ICVCM rejection of eight methodologies.	Partially plausible; depends on baseline and counterfactual adoption rates.	Generally plausible; carbon revenue often a material share of project financing.
<b>Permanence</b>	Not applicable (avoidance of fossil emissions).	Dependent on continued stove adoption and non-stacking.	Material concern; buffer pools potentially insufficient under climate stress.
<b>Quantification</b>	Grid factor tools disputed; over-crediting documented empirically.	Overcrediting factor approximately 10 across legacy methodologies.	REDD+ baseline bias documented; soil carbon measurement challenging.
<b>Co-benefits</b>	Typically limited beyond emissions claims.	Health claims often unrealised where stoves fail WHO standards.	Equity failures documented in Indian carbon farming survey.
<b>Policy priority</b>	Exclude from domestic offset eligibility.	Migrate to metered methodologies.	Statutory benefit sharing; robust permanence design.

*Source: Synthesis based on Sections 5 to 7 of this paper.*

### 8.1 The Market Consequences

The market implications of these findings are already visible. Corporate buyers, particularly in Europe and North America, have moved towards Core Carbon Principles labelled credits, which traded at approximately twenty-five per cent premium in 2024. Legacy renewables credits, which once commanded prices of four to eight US dollars per tonne on voluntary exchanges, have traded

at one to two dollars where they traded at all. Cookstove credits under legacy methodologies have seen comparable discounting, while credits under the Gold Standard Metered methodology have retained more stable pricing. The market is therefore conducting, through prices, the integrity assessment that regulators and standards bodies are conducting through formal evaluation.<sup>5152</sup>

For Indian developers, the implications are direct. Projects registered under legacy methodologies that have been rejected by the Integrity Council will not receive the Core Carbon Principles label, and credits from such projects will face structural discount or exclusion from premium demand. The economic logic of developing new projects under these methodologies has accordingly eroded. The developer base in India is substantial and experienced, and the transition from legacy to updated methodologies will determine whether this capacity is absorbed into high-integrity activity or dispersed to lower-integrity niches.<sup>53</sup>

## 8.2 Corporate Buyer Behaviour

The Trencher and colleagues analysis in Nature Communications of the twenty largest corporate purchasers of voluntary carbon credits from 2020 to 2023 found that eighty-seven per cent of their purchased credits carried a high risk of not providing real and additional emission reductions. This pattern reflects what the authors describe as a lemons dynamic, in which the information asymmetry between seller and buyer, combined with pressure to retire credits at low cost, selects for low-quality supply. The transition to Core Carbon Principles labelling, and to Integrity Council assessments more broadly, represents an institutional response to this market failure. Its success will be judged by whether integrity-based market segmentation shifts capital flows towards genuinely additional projects.<sup>54</sup>

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<sup>51</sup>Forest Trends' Ecosystem Marketplace, *State of the Voluntary Carbon Market 2025* (Washington, DC, 2025). The average weighted price for CCP-labelled credits in 2024 was approximately 25 per cent above non-labelled equivalents.

<sup>52</sup>AlliedOffsets, *Voluntary Carbon Market 2025 Review* (December 2025). Market value estimated at approximately 2.5 billion euros in 2025, projected to reach 3 billion euros in 2026.

<sup>53</sup>G. Trencher, M. Nick, J. Carlson and M. Johnson, "Demand for low-quality offsets by major companies undermines climate integrity of the voluntary carbon market", *Nature Communications* 15 (2024): 6863. The top twenty corporate purchasers from 2020 to 2023 acquired credits with an 87 per cent high-risk share.

<sup>54</sup>G. Trencher, M. Nick, J. Carlson and M. Johnson, "Demand for low-quality offsets by major companies undermines climate integrity of the voluntary carbon market", *Nature Communications* 15 (2024): 6863. The top twenty corporate purchasers from 2020 to 2023 acquired credits with an 87 per cent high-risk share.

## 9. Policy Implications for the Carbon Credit Trading Scheme

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India's domestic carbon market architecture is at a formative stage. The compliance mechanism of the Carbon Credit Trading Scheme has commenced for approximately 490 obligated entities across seven industrial sectors, with trading expected to begin by mid-2026. The offset mechanism, enabled by the Ministry of Power's approval of eight methodologies in March 2025 and operationalised through the Indian Carbon Market Portal launched on 21 March 2026, will coexist with the existing voluntary market for some period. The policy question is whether this domestic architecture will reproduce the integrity failures of the voluntary market or whether it will apply the lessons of the past decade.<sup>555657</sup>

### ***Implication 1: Grid-connected renewables should be excluded from offset eligibility.***

The empirical evidence supports a categorical exclusion, not a case-by-case assessment. Where a methodology has been rejected by the Integrity Council on additionality grounds, the presumption against integrity is strong. Permitting registration of grid-connected solar, wind, or hydropower projects under the Indian offset mechanism would create an incentive for the large and institutionally robust project developers to continue generating non-additional credits for domestic buyers, even as international buyers migrate to higher integrity categories. The Verra VCS Version 4 standard provides a direct template for such exclusion.<sup>58</sup>

### ***Implication 2: Cookstove eligibility should require metered monitoring.***

Legacy cookstove methodologies that rely on survey-based adoption estimation and default non-renewable biomass values should not be admitted to the Indian offset mechanism. The Gold Standard Metered methodology, which requires direct measurement of fuel consumption via sensors or meters, is the current integrity benchmark and should serve as the reference for any Indian methodology covering distributed clean cooking. The Pradhan Mantri Ujjwala Yojana

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<sup>55</sup>Ministry of Power, Government of India, "Approval of Eight Methodologies under the Offset Mechanism of the Carbon Credit Trading Scheme" (Gazette Notification, 28 March 2025).

<sup>56</sup>International Carbon Action Partnership, "Indian Carbon Credit Trading Scheme", ETS Status Report (updated 2026). Approximately 490 obligated entities across seven industrial sectors.

<sup>57</sup>Ministry of Power, Government of India, "Launch of Indian Carbon Market Portal", Press Release (21 March 2026). The portal integrates registration, validation, verification and issuance functions for Carbon Credit Certificates.

<sup>58</sup>Verra, Verified Carbon Standard Program, Standard Version 4 (2019), Section 3, restricts eligibility of grid-connected renewable electricity projects in most countries to those meeting specific additionality tests.

baseline should be explicitly integrated into the counterfactual analysis, to avoid crediting transitions that would have occurred under the subsidy scheme in any event.<sup>5960</sup>

***Implication 3: Forestry and land-use methodologies require codified benefit sharing.***

The equity failures documented in the peer-reviewed Indian carbon farming literature cannot be addressed through voluntary project design. They require statutory codification. The Kenyan Climate Change (Amendment) Act, 2023, establishes a precedent, and the Indian Parliament could achieve an equivalent outcome through amendment to the Energy Conservation Act or through dedicated legislation on carbon market benefit sharing. The specific percentage is secondary to the enforceability of the commitment. Without such codification, co-benefit claims in the Indian AFOLU market will remain rhetorically strong and distributionally weak.<sup>6162</sup>

***Implication 4: Permanence must be addressed through pooled buffer reserves and extended monitoring.***

The California experience demonstrates that project-level buffer pools are vulnerable to correlated risks, particularly wildfire. Pooled buffer reserves across multiple projects, calibrated to empirically estimated reversal risks, are more robust. Extended monitoring periods, beyond the typical Verra requirement of 100 years but adjusted for monitoring feasibility, should be considered for Indian forestry and land-use activities. The permanence and non-permanence standard of the Article 6.4 Supervisory Body, adopted in 2025, provides a working template.<sup>6364</sup>

***Implication 5: Transparency and independent review should be built in from the outset.***

The Indian Carbon Market Portal creates the technical infrastructure for registry-based transparency. The question is whether the surrounding institutional arrangements permit

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<sup>59</sup>Pradhan Mantri Ujjwala Yojana, launched May 2016, had reached over 100 million beneficiaries by 2024 according to Ministry of Petroleum and Natural Gas data. The scheme distributes LPG connections at subsidised rates to below-poverty-line households.

<sup>60</sup>Gold Standard Foundation, “Methodology for Metered and Measured Energy Cooking Devices” (Geneva, 2021; updated 2024). The metered methodology requires direct monitoring of fuel consumption via sensors or meters.

<sup>61</sup>S. Bhattacharya et al., “Carbon farming in India: are the existing projects inclusive, additional, and permanent?”, *Climate Policy* (2024), doi:10.1080/14693062.2024.2416497. Survey of 841 farmers across seven project villages in Haryana and Madhya Pradesh.

<sup>62</sup>The Government of Kenya’s Climate Change (Amendment) Act, 2023, Sections 23B and 23C, establishes mandatory benefit-sharing percentages for carbon projects and serves as a comparative reference for Indian reformers.

<sup>63</sup>G. Badgley et al., “Systematic over-crediting in California’s forest carbon offsets program”, *Global Change Biology* 28, no. 4 (2022): 1433–1445.

<sup>64</sup>Decision 5/CMA.6, Baku, on guidance for cooperative approaches under Article 6.2 of the Paris Agreement; Supervisory Body Standard on Methodology Requirements, adopted 9 October 2024.

independent review of project-level documentation, methodologies, and verification reports. The Bureau of Energy Efficiency, as administrator, and the National Steering Committee for the Indian Carbon Market, as the governance body, should establish procedures for external expert review, civil society participation, and public access to project documentation comparable to the standards applied by the Integrity Council and the voluntary registries.<sup>65</sup>

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<sup>65</sup>Bureau of Energy Efficiency, “Detailed Procedure for Compliance under the Carbon Credit Trading Scheme”, Version 1.0 (New Delhi, 2024). Monitoring, reporting and verification requirements follow IPCC 2006 Guidelines as updated.

## 10. Conclusion

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The integrity problems in India's voluntary carbon market are neither novel nor uniquely Indian. They are the manifestation, in a large and active national pipeline, of failures in methodology design, additionality testing, and permanence accounting that the peer-reviewed literature has documented across jurisdictions for more than a decade. What is distinctively Indian is the scale. With approximately 370 million tonnes of cumulative issuance, India is the second-largest contributor to a global market whose aggregate integrity has been seriously compromised by the categories that dominate Indian supply.

The evidence reviewed in this paper is not ambiguous. Grid-connected renewable energy projects in India have largely failed the additionality test under empirical scrutiny and under the formal assessment of the Integrity Council for the Voluntary Carbon Market. Cookstove projects under dominant methodologies over-estimate emission reductions by approximately an order of magnitude. Forestry and land-use projects face unresolved permanence concerns and documented equity failures. These findings are consistent across the Probst meta-analysis, the Gill-Wiehl Berkeley study, the West REDD+ analysis, the Bhattacharya carbon farming survey, and the Corporate Accountability project-level review.

The policy response should not be retrospective. The credits already issued cannot be unissued, and the buyers who have retired them will bear whatever reputational and accounting consequences follow. The forward task is to prevent the reproduction of these failures in the domestic architecture now under construction. This requires a set of deliberate choices: exclusion of grid-connected renewables from the offset mechanism; restriction of cookstove eligibility to metered methodologies; statutory codification of benefit sharing for AFOLU activities; pooled buffer reserves for permanence; and transparent, externally reviewable project documentation. None of these choices is politically costless. All are technically straightforward.

India has the opportunity to build a domestic carbon market that is more credible than the voluntary market from which it is emerging. The Carbon Credit Trading Scheme, the Indian Carbon Market Portal, and the offset methodologies approved in March 2025 are the instruments through which this ambition can be realised. The evidence is in place. The architectural choices are what remains.

Further research, to be undertaken by the Sustainable Capital Research Foundation and its partner institutions, will examine project-level integrity assessments for specific Indian activities, the fiscal and industrial policy interaction between the Carbon Credit Trading Scheme and the European Carbon Border Adjustment Mechanism, and the evolution of Core Carbon Principles eligibility for Indian-registered projects under updated methodologies.

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