Carbon Credits:

Unlocking Revenue for a Cleaner Tomorrow

A GUIDEBOOK FOR STUs/ SPVs/ ULBs/ BUS OPERATORS

ASSOCIATION OF STATE ROAD TRANSPORT UNDERTAKINGS

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We hope this report serves as a valuable resource for STUs, SPVs and ULBs enabling them to leverage the benefits of carbon credits and contribute to a greener, more sustainable future.

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Carbon Credits

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Executive Summary

The "Carbon Credits: A Potential Revenue Stream For Financing Electric Buses" guidebook, prepared by the Associate of State Transport Undertakings (ASRTU) with support from Institute of Transportation & Development Policy (ITDP) India, provides a detailed framework for State Transport Undertakings (STUs), Special Purpose Vehicles (SPVs) and Urban Local Bodies (ULBs) in India to leverage carbon credits for their electric bus (e-bus) projects.

India has been operating e-buses since 2016, and as of 2024, there are 8,634 e-buses in operation with over 20,000 more in the pipeline. The Government of India is emphasising the electrification of public bus transport through various schemes like PM eBus, highlighting the growing importance and expansion of e-bus fleets across the country. Given the high capital expenditure (capex) of e-buses, carbon financing can play a crucial role in sustaining their operations by providing a viable financial mechanism to support deployment and maintenance. E-buses are environmentally friendly, generating significantly lower emissions than traditional diesel buses, and carbon credits can offer a viable financial mechanism to support their deployment and maintenance. By strategically planning and monetising these emission savings through carbon credits, STUs, SPVs and ULBs can financially sustain the e-bus operations, thus reducing the requirement for viability gap funding. This approach ensures that the environmental benefits of e-buses translate into financial gains, supporting the long-term sustainability of e-bus projects.

The guidebook details the mechanisms of carbon trading, highlighting the distinctions between mandatory and voluntary carbon markets. It provides a comprehensive process for registering an e-bus project for carbon credits, encompassing several essential steps and strategies. Additionally, the guidebook offers numerous recommendations on how STUs, SPVs and ULBs can approach carbon financing, considering the rapidly evolving global and domestic carbon market dynamics.

The carbon credit system should be viewed as a strategic tool to support the procurement and maintenance of new e-buses. Including carbon credits in contracts signed under the PPP model of ownership ensures control over the credits generated by e-bus projects.

ASRTU and ITDP India are actively working to impart knowledge and provide guidance on leveraging carbon credits. By following these guidelines, STUs, SPVs and ULBs can effectively contribute to India's climate goals while generating significant revenue from carbon credits. Planning at the time of the inception of the e-bus projects can ensure that the potential long term financial benefits from emissions savings are fully realised, advancing the sustainability and viability of e-bus operations in India.

ABBREVIATIONS

BEE	Bureau of Energy Efficiency
CCUS	Carbon Capture Utilisation and/or Storage
CDM	Clean Development Mechanism
CCC	Carbon Credit Certificates
CERC	Central Electricity Regulatory Commission
CCTS	Carbon Credit Trading Scheme
CO2e	Carbon Dioxide Equivalent
DOE	Designated Operational Entity
GWP	Global Warming Potential
GHG	Greenhouse Gas
HVAC	Heating, Ventilation, and Air Conditioning
ICM	Indian Carbon Market
IPCC	Intergovernmental Panel on Climate Change
ITMO	Internationally Transferred Mitigation Outcomes
LDV	Light-Duty Vehicle
MoEFCC	Ministry of Environment, Forest and Climate Change
MoP	Ministry of Power
MRV	Monitoring, Reporting, and Verification
NDCS	Nationally Determined Contributions
NSC-ICM	National Steering Committee for Indian Carbon Market
PDD	Project Development Document
PFC	Perfluorocarbon
SPV	Special Purpose Vehicle
STU	State Transport Undertaking
VCUs	Verified Carbon Units
VCS	Verified Carbon Standard
VERs	Verified Emission Reductions
ULB	Urban Local Body

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INTRODUCTION

Carbon markets have emerged as crucial mechanisms in the global battle against climate crisis, evolving significantly since their inception. Initially embraced by climate activists, these markets gained broader acceptance with the signing of the Kyoto Protocol in 1997, which saw over 150 nations committing to address carbon emissions between 2008 and 2012, aiming for a collective reduction of 5.4% below 1990 levels.

The commitment was further extended under the Doha Amendment to the Kyoto Protocol, covering the second commitment period from 2013 to 2020, with Annex I Parties agreeing to reduce greenhouse gas emissions by at least 18%, below 1990 levels. Today, amidst growing recognition of the urgent need for climate action, carbon markets play a vital role in reducing greenhouse gas (GHG) emissions and mitigating climate impacts. Carbon credits, fundamental to these markets, serve as offsets for emissions, with one credit representing the reduction, removal, avoidance or sequestration of one tonne of carbon dioxide equivalent.

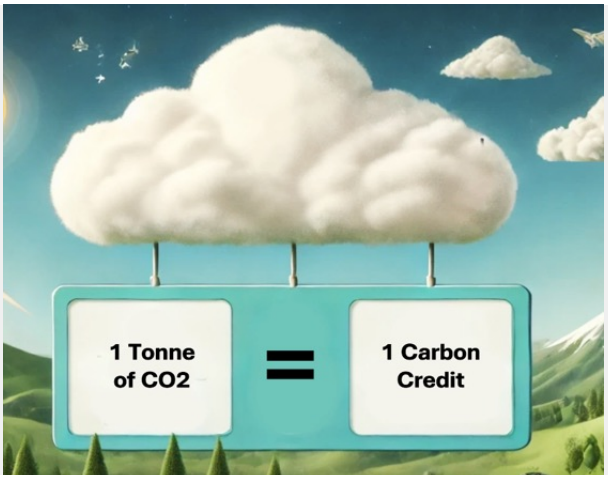


FIGURE 1

Emissions trading—a vital aspect of the Kyoto Protocol—allowed countries to trade emission units, enabling those falling short in achieving reduction targets to purchase excess reductions from others.

Additionally, the Protocol laid the groundwork for market-based instruments (MBIs), such as the Clean Development Mechanism (CDM). The CDM facilitated emission reduction projects in developing countries, providing tradable certified emission reduction (CER) credits to countries striving to meet their Kyoto targets.

These credits are traded within carbon markets, allowing companies and industries to compensate for their emissions by purchasing credits from emission-reducing projects. As awareness of climate crisis grows and emissions regulations tighten, companies increasingly turn to voluntary carbon offset markets[1] to demonstrate their commitment to sustainability. International regulations further underscore the importance of understanding carbon credits, driving investors' and corporations' need for enhanced knowledge. With carbon markets facilitating the trading of both credits and allowances, they provide a versatile platform for climate action and emissions reduction initiatives on a global scale.

Subsequently, the global focus on carbon emissions intensified, prompting the formulation of carbon emissions standards and guidelines worldwide to regulate harmful gas emissions. Article 6 of the Paris Agreement catalyses this cooperation, allowing countries to voluntarily collaborate to achieve emission reduction targets outlined in their Nationally Determined Contributions (NDCs). This collaborative effort signifies a pivotal step towards achieving collective climate goals on a global scale.

HOW CARBON TRADING WORKS

A carbon market is an important component of emissions trading, operating as a market-based mechanism aimed at curbing the concentration of Greenhouse Gases (GHGs) in the Earth's atmosphere. This approach incentivises the reduction of designated pollutants by providing economic incentives to entities willing to take action. Within the framework of a carbon market, investors and corporations trade carbon credits and carbon offsets, driving efforts towards emissions reduction and environmental sustainability.

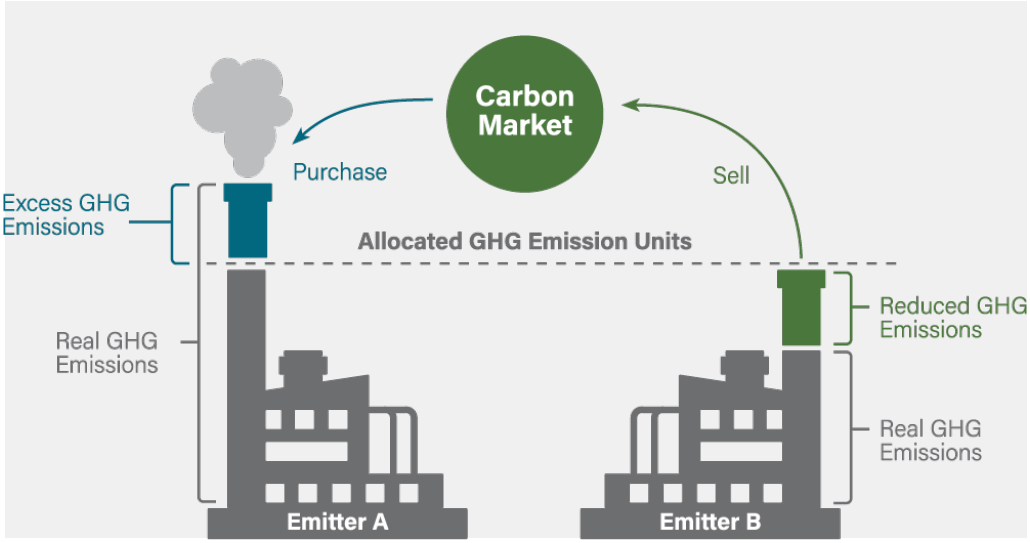


FIGURE 2[2]

When a company acquires a carbon credit, it gains authorisation to emit a specified amount of CO2 into the atmosphere. Each carbon credit represents reducing or avoiding one tonne of carbon dioxide or its equivalent in other greenhouse gases. These credits are measured against predetermined benchmarks or allowable GHG emissions levels. If a company's emissions fall below these limits, they earn carbon credits commensurate with their reduction efforts. Conversely, if emissions exceed the prescribed threshold, the company must purchase carbon credits from entities with surplus credits to offset their excess emissions. Consequently, exceeding emission limits incurs a financial cost on the emitter, driving them to improve efficiency and reduce emissions to avoid additional expenses. This cost-based mechanism aims to incentivise emission reduction and foster a transition to more sustainable practices within industries and sectors.

TYPES OF CARBON MARKETS

Carbon markets are typically categorised into two main types: mandatory and voluntary.

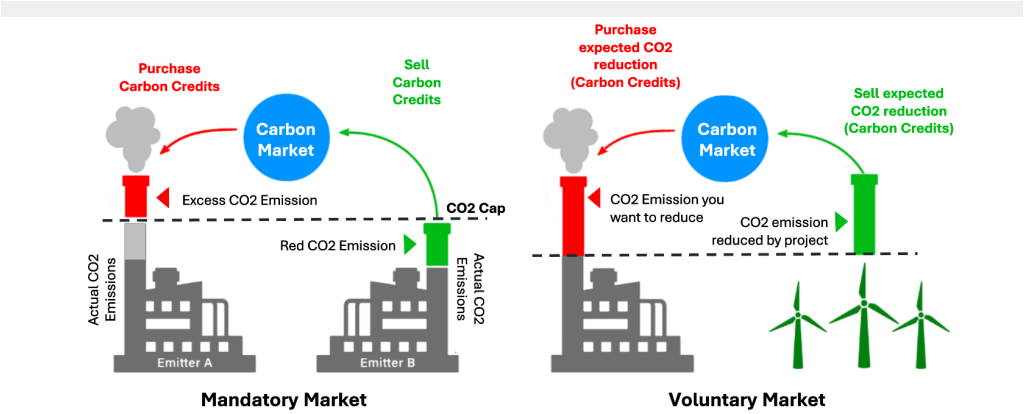


FIGURE 3[3]

Mandatory Market

Mandatory markets are established in response to national, regional, or international policy mandates, such as the Kyoto Protocol or the Paris Climate Agreement, which set limits on carbon emissions. These markets are governed by regulatory frameworks that require entities to comply with emission reduction targets, with Compliance Emission Reduction (CER) credits serving as the central component of these markets. Examples of mandatory carbon markets include the European Union Emission Trading System (EU ETS), the Western Climate Initiative (WCI)[4], and the Regional Greenhouse Gas Initiative (RGGI)[5] . These markets operate under stringent regulations and aim to achieve specific emission reduction goals set by governments or international agreements.

Voluntary Market

Voluntary carbon markets operate independently of regulatory mandates, allowing companies to voluntarily purchase carbon credits to offset their emissions. The voluntary carbon market is smaller than the compliance market but holds promising potential for substantial growth in the future[6]. Unlike the compliance market, participation in the voluntary market is not mandated by regulatory requirements, offering individuals, businesses, and organisations the opportunity to address their carbon emissions proactively. Participants in voluntary markets are motivated by corporate social responsibility (CSR) and sustainability initiatives. These markets provide flexibility and enable proactive action in reducing carbon footprints, contributing to emission reduction efforts without the obligation of regulatory compliance.

Mandatory/Compliance/Regulated Market	Voluntary Market
Markets for carbon credits are created by the need to comply with a regulatory act (carbon allowances)	Corporations, governments, and individuals volunteer to offset their emissions by purchasing carbon credits (carbon credits, also referred to as offsets)
Carbon savings measuring unit: Emission Trading System (ETS) ●Also referred to as cap-and-trade programs ●The 'cap' on GHG emissions declines annually to achieve its jurisdiction's or member's climate policy targets. ●Alliances are freely allocated or authorised to companies, which can then 'trade' allowances to comply with a cap on their emissions. ●Companies with low emissions can sell their extra allowances to more significant emitters.	Carbon savings measuring unit: **Carbon Credits/Offsets** ●This is prompted by projects that avoid, reduce or remove GHG emissions beyond a business-as-usual scenario. ●Projects include reforestation, improved forest management, wetland restoration and renewable energy etc. ●Traded by individuals and companies on the voluntary markets (though some carbon offsets can also be used in select compliance markets) ●The majority of projects follow rules established by standard bodies.

In simpler terms, mandatory markets are compulsory, while voluntary markets are optional and driven by voluntary commitments to sustainability goals[7].

CARBON PRICING INSTRUMENTS AND CREDITS ISSUANCE ACROSS THE WORLD

Mandatory carbon market pricing instruments around the world:

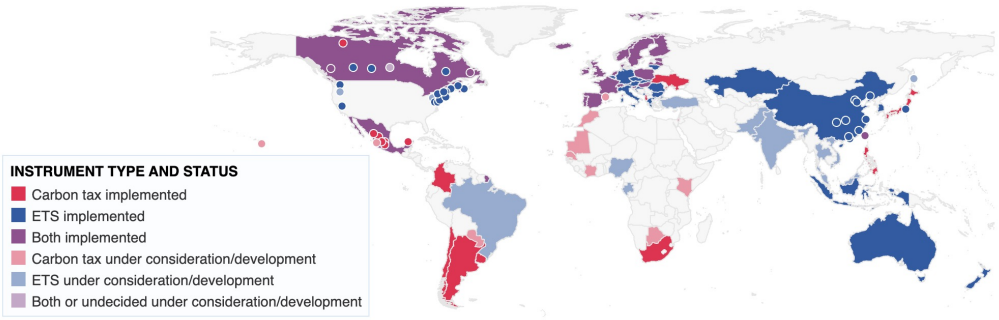


FIGURE 4[8]

Map shows the jurisdiction with carbon taxes or emissions trading system implemented, under development or under consideration. Carbon pricing instruments are considered: "Implemented" once they have been formally adopted through legislation and compliance obligations are in force and enforced; "Under development" if the government is actively working towards the implementation of a specific carbon pricing instrument. Eg. Indian Carbon Market (ICM) is in the initial stages of implementation, with the Central Government actively notifying obligated entities and setting GHG emission intensity targets but not fully functional yet.

Voluntary carbon market pricing instruments around the world:

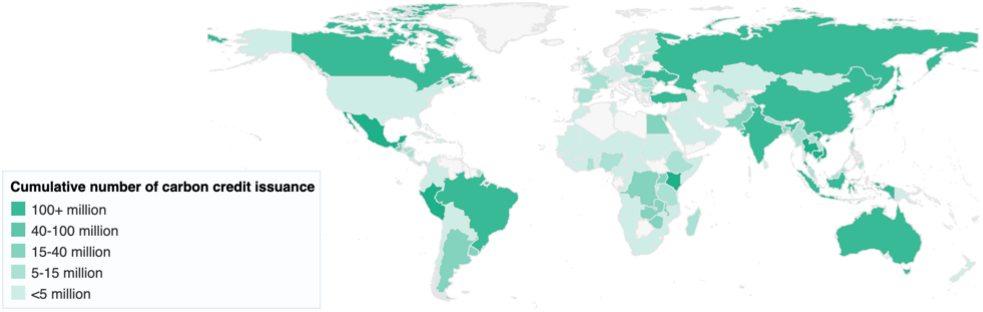


FIGURE 5[9]

Map shows the level of carbon credits issued to emission reduction activities in each country. Till date total 5.7 billion credits have been issued in voluntary market across the globe. India is one of the countries with highest number of carbon credits issued in voluntary market.

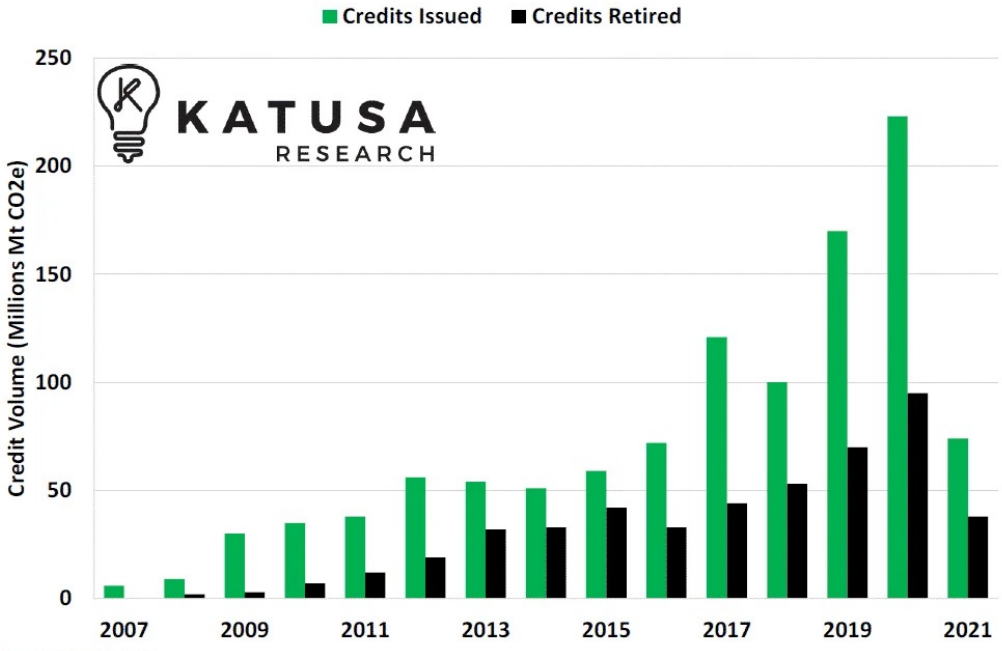


FIGURE 6[9]

PROVISION OF INTERNATIONAL TRANSFER OF CARBON CREDITS

Article 6 of the Paris Agreement (2015), aimed at combating climate change, introduces cooperative approaches to help countries achieve their emissions reduction targets more effectively. Within Article 6, two key provisions, Article 6.2 and Article 6.4, outline mechanisms for international cooperation in emissions reduction efforts.

Article 6.2 (International Transfer)

Article 6.2 of the Paris Agreement establishes a centralised common framework for cooperative approaches between countries to implement their nationally determined contributions (NDCs). This mechanism allows countries to engage in international transfers of mitigation outcomes, including emission reductions, removals, or avoided emissions. Countries can voluntarily transfer portions of their emission reductions to other countries to help them meet their NDCs or to support sustainable development objectives. The transferred mitigation outcomes are recorded and tracked in a corresponding accounting system to ensure transparency and environmental integrity.

Article 6.4 (Voluntary Markets)

Article 6.4 provides a framework for countries to cooperate on voluntary approaches to emissions reductions, such as voluntary carbon markets. Under Article 6.4, countries can facilitate the use of internationally transferred mitigation outcomes (ITMOs) from one country to another to meet national climate targets. This mechanism allows countries to voluntarily collaborate on emissions reductions beyond their domestic borders, providing flexibility and lowering the overall cost of achieving climate goals. Parties to the Paris Agreement can participate in voluntary markets and engage in bilateral or multilateral agreements to facilitate the transfer of ITMOs.

TYPES OF CARBON CREDITS STANDARDS

Various carbon credit standards have been established across the globe to provide frameworks for quantifying, verifying, and trading carbon offsets. These standards are crucial in ensuring carbon mitigation projects' credibility, transparency, and effectiveness. Here's an introduction to some of the prominent carbon credit standards adopted worldwide:

Clean Development Mechanism (CDM)

Established under the Kyoto Protocol, the CDM provides a framework through which emission-reduction projects in developing countries can earn certified emission reduction (CER) credits. Each CER credit represents one tonne of CO2 equivalent emissions avoided or reduced. This mechanism facilitates climate action and promotes sustainable development by supporting projects that improve energy efficiency, promote renewable energy sources, and advance sustainable transportation initiatives, such as the operation of e-buses.

Additionally, the CDM supports emission-reduction projects in developing countries that often lack the financial and technical resources needed to implement large-scale projects. By providing access to international funding and technical expertise, the CDM enables these countries to participate in global climate action. The United Nations Framework Convention on Climate Change (UNFCCC) outlines strict guidelines for CDM projects, ensuring transparency, credibility, and accountability in the carbon market. These guidelines help maintain the integrity of emission reductions and ensure that projects deliver real and measurable climate benefits. Furthermore, by earning carbon credits, projects in developing countries can access international carbon markets, generating additional revenue that can be reinvested in further sustainability initiatives. This access is crucial for developing countries looking to scale up their climate actions. While voluntary carbon standards like the Verified Carbon Standard (VCS) and the Gold Standard provide additional frameworks for verifying and quantifying emission reductions, the CDM's formal linkage to the Kyoto Protocol and its rigorous UNFCCC oversight offer a more structured and recognised approach. This formal recognition is often essential for attracting large-scale investment and ensuring long-term project viability. Therefore, the CDM methodology is more valid for developing countries because it provides a comprehensive, UN-backed framework that supports sustainable development and facilitates access to international carbon markets, thus enabling these countries to actively participate in global efforts to mitigate climate change.

Verified Carbon Units (VERRA)

The VERRA offers a robust framework for verifying and quantifying greenhouse gas emission reductions, enabling projects to generate Verified Carbon Units (VCUs) that can be traded on carbon markets. Projects adhering to VCS standards can generate Verified Carbon Units (VCUs), which can be traded on carbon markets. VCS provides guidelines and methodologies for various project types, including renewable energy and transportation projects.

Gold Standard

The Gold Standard is another widely recognised voluntary carbon standard that certifies projects based on their contribution to sustainable development and environmental integrity. It offers guidelines and criteria for ensuring projects deliver tangible and measurable benefits in addition to carbon emission reductions. e-bus projects can qualify under the Gold Standard if they meet the specified criteria for emissions reduction and sustainable development.

Apart from the above global carbon credit standards, the following are the region-specific carbon credit standards:

Europe - European Union Emissions Trading System (EU ETS)

The EU ETS is the world's most extensive carbon trading system, covering around 45% of the EU's greenhouse gas emissions. Established in 2005, it operates on a cap-and-trade principle, where a cap is set on the total amount of certain greenhouse gases that regulated entities, such as power plants, factories, and airlines, can emit. Regulated entities are allocated or purchase emission allowances, which they can trade with one another. The EU ETS has undergone several phases, with the current phase (Phase IV) running from 2021 to 2030, aiming to reduce emissions further and align with the EU's climate targets.

United States - Regional Initiatives and Voluntary Markets

While there is no federal-level carbon trading system in the US, several regional initiatives and voluntary markets operate nationwide. One notable regional initiative is the Regional Greenhouse Gas Initiative (RGGI), a cap-and-trade programme covering power plants in participating northeastern states. California operates its cap-and-trade programme under the California Global Warming Solutions Act (AB 32), which covers various sectors, including electricity, industry, and transportation. Additionally, voluntary carbon markets exist in the US, allowing companies and individuals to voluntarily purchase carbon offsets to mitigate their emissions. These markets often operate under standards such as the Verified Carbon Standard (VCS), providing credibility and transparency to offset projects.

China - Certified Emission Reduction (CCER) Programme

China has implemented various pilot emissions trading schemes (ETS) in several provinces and cities since 2013 to establish a nationwide carbon trading system. The Certified Emission Reduction (CCER) programme operates within China and focuses on emissions reductions from domestic projects. CCER projects cover various sectors, including energy, manufacturing, transportation, and forestry. The programme allows for the generation and trading of carbon credits, providing incentives for emissions reductions and clean development projects. China's commitment to carbon trading aligns with its broader climate goals, including peaking carbon dioxide emissions by 2030 and achieving carbon neutrality by 2060.

Indian Carbon Market

The Indian Carbon Market (ICM) framework[11], developed by the Government of India, aims to facilitate the reduction of greenhouse gas (GHG) emissions across the nation. This market operates through the Carbon Credit Trading Scheme (CCTS) 2023, which was established under the Energy Conservation Act 2001. The CCTS sets up a compliance mechanism where registered entities, termed 'obligated entities,' must adhere to specific GHG emission intensity targets. These targets are established by the Ministry of Power, in consultation with the Bureau of Energy Efficiency (BEE) and the National Steering Committee for the Indian Carbon Market (NSC-ICM). Entities that surpass their emission reduction targets are awarded Carbon Credit Certificates (CCCs), which can be traded on power exchanges, whereas entities that fall short must purchase CCCs to meet their compliance obligations.

Currently, the ICM is in the initial stages of implementation, with the Central Government actively notifying obligated entities and setting GHG emission intensity targets. The focus sectors include energy-intensive industries such as power, steel, cement, and other high-emission sectors. These sectors are prioritised due to their significant potential for emission reductions and their crucial role in achieving India's Nationally Determined Contribution (NDC) targets under the Paris Agreement. To ensure accurate monitoring and reporting of GHG emissions, obligated entities must develop and implement detailed monitoring plans, submit annual GHG emissions reports, and undergo independent verification by accredited carbon verification agencies. The BEE oversees the issuance of CCCs based on verified data, ensuring that entities that exceed their targets can sell their credits in the market, while those that do not meet their targets are required to purchase additional CCCs to comply. The entire process is designed to mobilise new mitigation opportunities, create a demand for emission reduction credits, and support India's goal of reducing its carbon footprint.

CARBON CREDIT LANDSCAPE FOR TRANSPORT SECTOR IN INDIA

Globally, the transportation sector stands accountable for a quarter of global emissions, a significant contributor to climate change[12]. The transport sector in India is the third largest contributor of GHG emission which accounts for 14% of nation wide GHG emission[13]. The road transport alone is responsible for nearly 90% emissions within the transport sector[14]. Despite its substantial impact on global warming, the transport sector remains notably marginalised regarding climate action and carbon finance strategies.

While carbon credits from renewable energy projects are widespread in India, the credits from the clean transport sector are notably scarce. The transition to electric mobility presents a promising solution, transitioning from fossil fuels to clean fuel and optimising renewable energy sources. E-mobility not only offers a critical avenue for decarbonising transportation but also has the potential to tap into carbon finance avenues. Currently, the transport sector contributes less than 2% to the global carbon credits pool, showcasing its underrepresentation despite its environmental significance[15]. Carbon finance mechanisms can eliminate the key financial impediments for project proponents, such as high vehicle costs and inadequate charging infrastructure, by providing financial incentives for emissions avoidance.

While India's carbon market is still in its early stages compared to developed counterparts like the US, China, and EU the renewable projects in India have played a pivotal role in making India’s presence in the voluntary credit market. These initiatives have not only helped India develop projects eligible for voluntary carbon credits but have also laid the groundwork for future advancements in the Indian carbon market. Due to the absence of a domestic carbon market in India, navigating e-bus programmes' carbon credit registration process demands a deep understanding of international voluntary markets, emphasis on additionality, and meticulous surveys for accurate data collection. Despite challenges, the current Indian landscape presents an opportune moment for those venturing into this realm. However, undertaking extensive groundwork is advised to ensure a seamless process.

The carbon credit market offers avenues for entities to monetise their environmental efforts, necessitating a grasp of the dynamics of Article 6.4 (Voluntary Markets) and Article 6.2 (International Transfer) of the Paris Agreement for effective navigation. Article 6.4 (Voluntary Markets) permits selling carbon credits in voluntary markets for monetisation, while Article 6.2 (International Transfer) allows credit transfer to other countries through corresponding adjustments.

SOURCE:
ITDP INDIA

OVERVIEW OF CARBON CREDIT REGISTRATION FOR E-BUSES IN INDIA

Despite the higher carbon savings among all modes of road transport in India, there is a notable absence of registered e-bus programmes under voluntary carbon market standards. However, this presents an opportune moment given the favourable conditions, including the relatively low penetration rate of e-buses in the country. The willingness to register e-bus projects for carbon credits is advantageous, particularly given the potential for streamlined project approval due to the lower prevalence of such initiatives. Successful project development necessitates extensive background work, highlighting the importance of thorough preparations before embarking on the registration process. By carefully addressing these aspects, e-bus programmes can effectively perform the voluntary carbon market landscape and contribute meaningfully to environmental sustainability efforts[16].

Emission Reduction Estimation

To estimate the emission reductions achieved by state e-buses transport projects, a clear methodology is provided by every carbon credit methodology. Typical steps to estimate emissions are as follows:

Baseline Emission Calculation = (Total Diesel Consumed x Emission Factor): This is determined by calculating the total diesel consumed by conventional buses and multiplying it by the emission factor associated with diesel consumption.

Project Emission Calculation = (Total Electricity Consumed x Emission Factor): This involves calculating the total electricity consumed by e-buses and multiplying it by the emission factor associated with electricity consumption.

Emission Reduction Calculation = (Baseline Emissions – Project Emissions): The emission reduction is then determined by subtracting the project emissions from the baseline emissions.

The actual steps to estimate baseline and project emissions can vary significantly and require detailed methodologies.

Opportunities and Challenges of E-Bus Project[17]

Opportunities	Challenges
● Higher Carbon Credits Volume: Large fleet volumes can generate higher carbon credits, which can be traded for additional revenue. ● Central Implementation: A central implementing agency can improve the monitoring, reporting, and verification (MRV) processes. ● Socio-Economic Benefits: Additional socio-economic benefits from improved air quality and reduced noise pollution can enhance the market value of carbon credits.	● Increased Fleet Requirements: Because electric vehicles (EVs) require charging, more e-buses may be needed than diesel buses to maintain the same level of service. ● Route Adaptations: Extended routes for e-buses may alter the distance traveled by buses, impacting operational efficiency. ● Seasonal Variability: The seasonal heating, ventilation, and air conditioning (HVAC) load can affect e-buses' mileage, influencing their operational costs and efficiency.

Electric vehicles, including e-buses, face challenges in achieving financial viability due to the high upfront costs and the need for infrastructure development. However, carbon and climate financing can help bridge this funding gap by attracting other climate finance funds.

STEP-BY-STEP PROCESS FOR CARBON CREDIT REGISTRATION PROCESS

Successful registration of carbon credits for State Transport Undertakings in India involves detailed documentation, adherence to standards, and collaboration with third-party entities. Despite associated costs, the potential benefits of monetising carbon credits make it a viable avenue for STUs, SPVs and ULBs to contribute to environmental sustainability. The following is the step-by-step process that describes how STUs, SPVs and ULBs can obtain carbon credits[18].

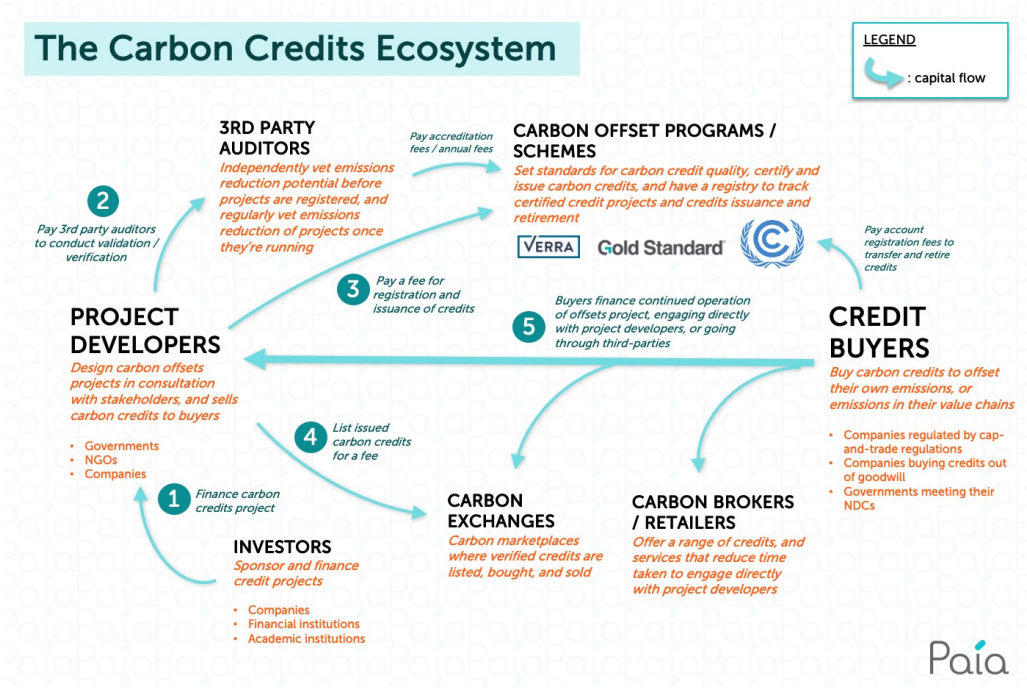


FIGURE 7[19]

Preparation and Background Work

Successful project development necessitates extensive background work and thorough preparations before initiating the registration process. Emphasis should be placed on conducting comprehensive surveys to gather accurate data on key project parameters. This includes assessing the current fleet of vehicles, estimating fuel consumption, and evaluating potential emissions reductions. Detailed project documents should be prepared, outlining the project's objectives, methodologies, and expected environmental outcomes. Ensuring compliance with carbon credit standards and appropriate methodology is essential to maximise the chances of project approval and successful registration. Transparency in data collection and reporting is crucial to ensure the credibility and integrity of the project, providing STUs with confidence in the environmental benefits claimed.

Project Development Document

The process kicks off with a project development where the STU, SPV and ULB can hire a consultant to prepare the project document. This document serves as the foundation for the carbon credit registration process and outlines key aspects of the project, including its objectives, methodologies, and expected environmental outcomes. To ensure adherence to recognised carbon standards and guidelines, the project developer utilises templates available in various global carbon standards. These standards, such as CDM, Gold Standard, Global Carbon Council, and VERRA, provide structured templates that assist in the systematic development of the project document. In the overall process, the STU, SPV and ULB is a project developer who would receive carbon credits upon the successful verification and review of the project report.

Choosing Carbon Standard and Methodology

Selecting an appropriate carbon standard and methodology is a critical step that shapes the entire registration process. This decision determines the framework, rules, and procedures the project will adhere to, from initiation to validation and issuance of carbon credits. The choice of carbon standard, such as Clean Development Mechanism (CDM), Gold Standard, Global Carbon Council, or VERRA, is influenced by various factors, including the project's nature, scale, and intended environmental impact. Each carbon standard has its own guidelines and requirements, and selecting the most suitable one is essential to ensure alignment with the project's goals and objectives.

Additionally, within each carbon standard, there are specific methodologies available for quantifying emissions reductions and environmental benefits associated with the project. These methodologies provide detailed guidelines on data collection, calculation procedures, and reporting requirements tailored to the project's specific activities and context. Therefore, careful consideration and evaluation of carbon standards and methodologies are imperative to ensure that the chosen framework effectively addresses the project's objectives and facilitates successful registration for carbon credits.

Validation by Designated Operational Entities/Third Parties

Validation by designated entities, also known as Designated Operational Entities (DOEs), is a crucial step that ensures the integrity and credibility of the project. These third-party entities play a pivotal role in independently assessing and validating the project developer's document. DOEs are responsible for verifying compliance with the chosen carbon standard's guidelines and requirements, as well as assessing the project's eligibility for carbon credits. Entities such as TUI Nord or Bureau Veritas are commonly appointed as DOEs and have extensive experience and expertise conducting validation assessments for carbon credit projects.

During the validation process, DOEs conduct thorough reviews of the project document, assessing factors such as project methodologies, emission reduction calculations, and monitoring procedures. They also verify the accuracy and completeness of the documentation provided, ensuring transparency and adherence to standards. Upon successful validation, the project becomes eligible for further review by the Carbon Standard Committee. The project developer bears the expenses for third-party validation and verification.

Internal Check by Carbon Standard Technical Committee

Following the validation process conducted by designated operational entities (DOEs), the next step in the carbon credit registration process involves an internal check by the chosen carbon standard. Once the third party submits the validation report, it undergoes scrutiny by the technical and compliance committees of the carbon standard. These committees are responsible for conducting an internal review of the documentation to ensure adherence to the standard's guidelines, rules, and procedures. The review process includes an assessment of the project document's completeness, accuracy, and compliance with the specified methodologies and criteria. Site visits may be conducted in rare cases, with most evaluations based on submitted documentation. This is a quality control measure to uphold the credibility and integrity of the carbon standard, ensuring that only eligible projects are approved for registration and issuance of carbon credits. Upon successful completion of the internal check, the project moves closer to registration to obtain carbon credits. Project developers must pay an initial fee for project registration, varying across standards.

Project Registration

Upon successfully completing the validation and internal check processes, the project enters the important stage of registration in the carbon credit market. Once the project has satisfied the standards and requirements of the chosen carbon standard, it is formally registered and recognised within the carbon credit framework. This registration signifies official acknowledgement of the project's eligibility to earn carbon credits based on its verified emissions reductions and environmental benefits. One significant aspect of project registration is the public listing of the project on the standard's official website, making it accessible to stakeholders and participants in the carbon credit market.

Monitoring, Reporting, and Verification

After the registration stage in a voluntary carbon credits project for e-buses, the focus shifts to the Monitoring, Reporting, and Verification (MRV) stage. This stage is crucial for ensuring the project's credibility and the accuracy of the emission reductions claimed. The MRV process involves continuous monitoring of the e-bus operations, including tracking energy consumption, mileage, and other relevant data to quantify the actual greenhouse gas reductions. This data is then compiled into comprehensive reports following established methodologies and standards. These reports are reviewed by an independent third-party Designated Operational Entity (DOE) for verification. Successful verification by the DOE confirms the project's compliance with specified criteria and the accuracy of the emission reductions. This verification leads to the issuance of carbon credits, which can then be traded in the voluntary carbon market. The rigorous MRV process ensures transparency, reliability, and accountability in the carbon credits generated by the e-bus project.

Issuance of Carbon Credits

Once the project has undergone a thorough review and has been deemed compliant with the chosen carbon standard's guidelines and methodologies, carbon credits are officially issued to

the project developer, i.e. STU, SPV and ULB. These credits represent the verified emissions reductions achieved by the project, quantified based on monitoring and verification procedures. The issuance of carbon credits provides tangible recognition of the project's contribution to mitigating climate change and reducing greenhouse gas emissions. With carbon credits in hand, the project developer gains the flexibility to utilise them in various ways to realise financial benefits. Carbon credits can be openly traded in the voluntary carbon market, allowing the project developer to sell them to entities seeking to offset their own emissions. Alternatively, carbon credits can be transferred to other parties through pre-existing agreements or partnerships, enabling collaboration and cooperation in addressing climate change.

Monetisation of Credits

Monetising carbon credits in the open market involves various steps and methodologies, ensuring transparency, liquidity, and maximum returns for project developers. Below are detailed steps and considerations for monetizing carbon credits effectively:

- **Internationally Transferred Mitigation Outcomes (ITMO)**: ITMO allows countries to meet part of their climate targets under the Paris Agreement by purchasing emission reductions from other countries. Projects generating carbon credits can participate in this international market, selling their credits to countries needing to offset their emissions.

- **Pre-Registration Agreement through Bidding:** This involves securing agreements with buyers before the credits are officially registered. Project developers (STU, SPV and ULB) can auction their future carbon credits at a fixed cost per credit, providing upfront capital and ensuring a market for their credits once they are verified.

- **'As-a-Service' Revenue Model:** Specialised carbon trading agencies can offer carbon credit monetisation services without any risk or cost to e-mobility asset owners and operators i.e. STUs, SPVs and ULBs. These agencies handle the entire process from verification to sale, in exchange for a portion of the revenue generated after the credits are traded. By leveraging this model STUs, SPVs and ULBs can avoid the upfront fees and get their e-bus project registered at ‘no cost’ from market expertise.

Utilising Trading Platforms

- **IHS Markit:** This platform provides a transparent and liquid market for trading environmental commodities, including carbon credits. It facilitates transactions by allowing project developers to list their credits and buyers to purchase them, relevant for trading credits from electric bus projects in India.
- **Voluntary Carbon Markets:** Platforms like the Gold Standard, VERRA, and Climate Action Reserve enable entities to voluntarily offset their emissions. These platforms offer opportunities for trading credits from sustainable transportation projects in India.
- **Power Exchanges in India:** Power Exchange India Ltd (PXIL) aims to launch a carbon credit trading platform by the second quarter of FY25. This platform will cater to the Indian market, providing an additional avenue for trading carbon credits.
- **Understanding Trading Fees:** Trading platforms typically charge a fee per credit traded, which can vary depending on the platform and market conditions. A general estimate for these fees is approximately $0.5 per credit, covering platform operation, transaction processing, and regulatory compliance costs.

STUs, SPVs and ULBs must ensure that their credits meet all regulatory requirements and standards. This includes verification by recognized bodies and adherence to international standards such as those set by the Clean Development Mechanism (CDM) or Gold Standard.

By following these steps and leveraging various monetization methods, project developers can effectively trade and monetize carbon credits, supporting sustainable initiatives and generating financial returns. These steps typically span a timeline of two to thr years from registration until the issuance of credits.

APPROPRIATE METHODOLOGY FOR THE E-BUS PROJECT

Selecting an appropriate carbon standard and methodology is a crucial step. The choice of carbon standard, such as Clean Development Mechanism (CDM), Gold Standard, Global Carbon Council, or VERRA, depends upon the project's nature, scale, and intended environmental impact. Under every carbon standard, there are various sectors that obtain carbon credits, such as renewables, manufacturing, energy distribution, construction, mining, wastewater disposal, agriculture, transportation, etc. Each thematic sector has a different type of methodology, requirements and guidelines, and selecting the most suitable one is essential to ensure alignment with the project's goals and objectives.

Sr. No.	Type of Project	Methodology
1	Bus Rapid Transit System	AM0031 | AMS-III.B.N
2	Mass Rapid Transit System	ACM0016 | AMS-III.U
3	High-Speed Rail System	AM0101
4	Energy Efficiency (Electric, CNG, LNG)	AMS-III.C | AMS-III.AA AMS-III.AP. | AMS-III.BC.
5	Fuel Switch	AMS-III.S | AMS-III.AK. AMS-III.AQ. | AMS-III.AY.
6	Transportation of Cargo	AM0090 | AMS-III.BO.
7	Transportation of liquid fuels	AM0110
8	Technology for improved driving	AMS-III.AT. | AMS-III.BC.
9	Electric Taxiing System for aeroplanes	AM0116
10	Solar Power for domestic aircraft at-gate operations	AMS-I.M.
11	Bicycles, e-bikes and Tricycles	AMS-III.BM.
12	Shore-side electricity supply for ships	AMS-III.BP.

FIGURE 8[20]

Electric vehicles, including e-buses, face challenges in achieving financial viability due to the high upfront costs and the need for infrastructure development. However, carbon and climate financing can help bridge this funding gap by attracting other climate finance funds.

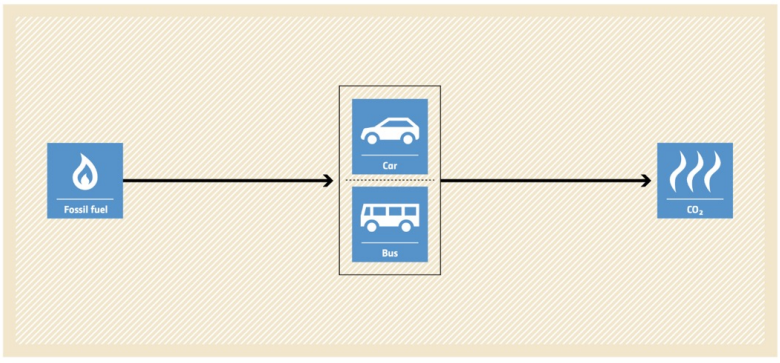
These methodologies provide detailed guidelines on data collection, calculation procedures, and reporting requirements. Therefore, carefully considering carbon standards and methodologies is important to ensure that the chosen framework effectively addresses the project's objectives and facilitates successful registration for carbon credits.

Methodology	Applicable to	Approving carbon standard
CDM AMS III.C	Operation and/or charging of electric and hybrid vehicles for providing passenger and/or freight transportation services.	CDM/GS/VCS
CDM AMS III.S	Introduce and operate new, less-greenhouse-gas-emitting vehicles (e.g., CNG, LPG, electric, or hybrid) for commercial passengers and freight transport on routes with comparable conditions. Retrofit existing vehicles is also applicable.	CDM/GS/VCS
VM0038	Applies to the charging of electric vehicles (EVs) through EV charging systems. GHG emission reductions are achieved through the displacement of emissions from conventional fossil fuel vehicles used for passenger and freight transportation as a result of the electricity delivered by the project chargers. The methodology is globally applicable.	VCS

FIGURE 9[21]

AMS-III.C. - Emission reductions by electric and hybrid vehicles

Methodology	Approving carbon standard
Typical project(s)	Operation and/or charging electric and hybrid vehicles for providing passenger and/or freight transportation services
Type of GHG emission mitigation action	Fuel switch Displacement of more GHG-intensive vehicles
Important conditions under which the methodology is applicable	Project and baseline vehicles should belong to the same vehicle category. Vehicles under a category have comparable/load capacity and power rating with variation of no more than 20%. The prevailing regulations pertaining to battery use and disposal shall be complied with; The procedure for avoiding double counting of emission reductions should be documented in the PDD.
Important parameters	At Validation If applicable: Grid emission factor (can also be monitored ex-post)
	Monitored: Number of electric/hybrid vehicles operated under the project; Quantity of fossil fuel used e.g. for hybrid vehicles and electricity consumption for all-electric and hybrid vehicles, to determine specific electricity/fossil fuel consumption per km; Annual average distance driven by project vehicles; Electricity consumption by the project vehicles.
Baseline scenario	Operation of more GHG-emitting vehicles for providing passenger and/or freight transportation services
Project Scenario	Operation of less GHG emitting vehicles for providing passenger and/or freight transportation services



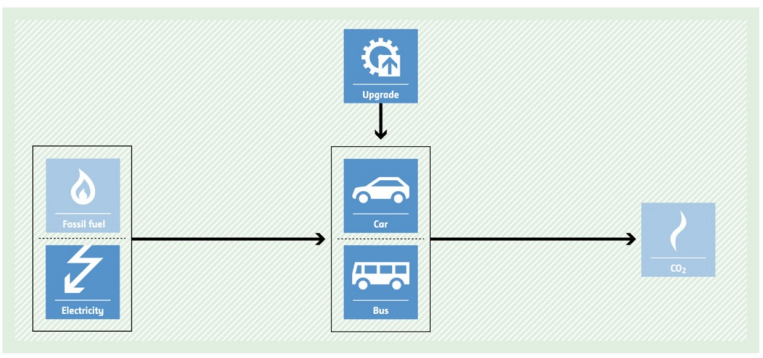


FIGURE 10[22]

AMS-III.S. -Introduction of low-emission vehicles/technologies to commercial vehicle fleets

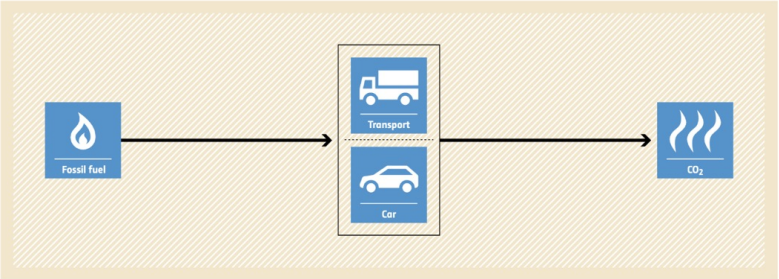
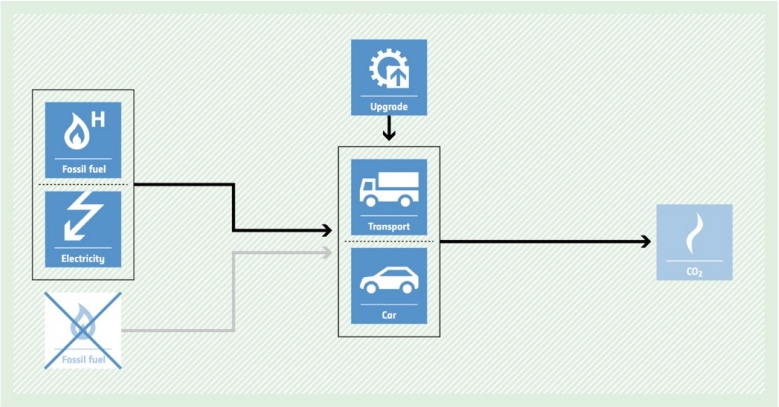
Methodology	Approving carbon standard
Typical project(s)	Introduction and operation of new less-greenhouse-emitting vehicles (eg. CNG, LPG, Electric or hybrid) for commercial passengers and freight transport, operating on routes with comparable conditions. Retrofitting of existing vehicles is also applicable.
Type of GHG emission mitigation action	Fuel switch Displacement of more GHG-intensive vehicles
Important conditions under which the methodology is applicable	The overall level of service on comparable routes before the project implementation shall remain the same, and modal shift in transport is not eligible; There is no significant change in tariff discernible from their natural trend, which could lead to a change in the pattern of vehicle use; The frequency of operation of the vehicles is not decreased; The characteristics of the travel route- distance, start and end points and the route itself and/or the capacity introduced by the project is sufficient to service the level of passenger/freight transportation previously provided.
Important parameters	At Validation The efficiency of baseline vehicles (can also be monitored ex-post)
	Monitored: Total annual distance travelled and passengers or goods transported by project and baseline vehicles on the route; Annual average distance of transportation per person or tonne of freight per baseline and project vehicle; Service level in terms of total passengers or volume of goods transported on route before and after project implementation.
Baseline scenario	Passengers and freight are transported using more GHG-intensive transportation modes. 
Project Scenario	Passengers and freight are transported using vehicles with less GHG emissions or retrofitted existing vehicles on routes. 

FIGURE 11[23]

Steps involved in gaining carbon credits through AMS-III.C. and AMS-III.S. methodology

The AMS-III.C. and AMS-III.S. methodologies under the Clean Development Mechanism (CDM) facilitate emission reductions from electric and hybrid vehicles. The primary difference is that AMS-III.S. focuses on commercial passenger and freight vehicles on specific routes. Both provide frameworks for calculating and verifying GHG emission reductions from using electric and hybrid vehicles compared to conventional fossil fuel vehicles. Here are the detailed steps involved in both methodologies:

1. Establishing Baseline Emissions: The first step is to establish the baseline emissions, representing the GHG emissions that would occur without the project. This involves assessing emissions from conventional fossil fuel vehicles that would have been used instead of electric and hybrid vehicles.

2. Identification of Key Parameters: Next, identify key project parameters, including the type and number of electric and hybrid vehicles, their energy consumption, distance traveled, and the sources of electricity for charging.

3. Calculation of Emission Reductions: Using the identified parameters, the methodology calculates the emission reductions by comparing GHG emissions from electric and hybrid vehicles with baseline emissions from conventional vehicles, quantified in CO2 equivalent (CO2e).

4. Accounting for Various Factors: The methodology considers factors like the efficiency of electric and hybrid vehicles, grid emissions intensity, and the displacement of fossil fuel consumption by electric vehicles.

5. Monitoring and Reporting: A robust monitoring plan is developed to track relevant data, including vehicle usage, energy consumption, and emissions. Regular reporting is required to provide transparent and accurate information on the emission reductions achieved by the project.

6. Project Documentation and Validation: Prepare a Project Design Document (PDD) detailing the project's technical and financial aspects, including methodology, emissions calculations, additionality assessment, and monitoring plan. Submit the PDD to a designated operational entity (DOE) for validation to ensure CDM compliance and registration of the project under the Carbon Standard.

7. Verification: An independent third-party verifier i.e. designated operational entity (DOE) assesses the project's compliance with the methodology and verifies the reported emission reductions. This verification process ensures the credibility and integrity of the emission reduction claims.

8. Issuance of Certified Emission Reductions (CERs): Upon successful verification, the project receives Certified Emission Reductions (CERs), representing its emission reductions. These CERs can be traded on the international carbon market or used by the project sponsor to meet emission reduction targets.

VM0038: Methodology for Electric Vehicle Charging Systems

This methodology applies to EV charging systems and infrastructure, reducing GHG emissions by displacing fossil fuel vehicle emissions. It is globally applicable and includes a positive list for additionality in regions with less than five percent EV market penetration.

1. Scope of Methodology: This methodology applies to projects installing EV charging systems and associated infrastructure aimed at charging EV-applicable fleets, thus reducing GHG emissions by displacing conventional fossil fuel vehicles in passenger and freight transportation.

2. Fleet Limitations: LDV BEVs, PHEVs, and HDV EVs are eligible under this methodology. Project proponents must show that EV models align with their fossil fuel counterparts in vehicle category and passenger/load capacity to ensure comparability and assess GHG emission reductions.

3. Prevention of Double Counting: To prevent double counting, project developer (STU, SPV and ULB) must maintain a detailed inventory of EV chargers and disclose credit ownership to EV drivers. If double counting occurs, emission reduction discounts are applied to ensure accurate and transparent carbon credit issuance.

4. Project Scale: Large-scale projects (over 60,000 tCO2e annual reductions) require credible national data sources for GHG emissions calculations to ensure accuracy. Small-scale projects (60,000 tCO2e or less) do not have this requirement, allowing flexibility while maintaining credibility and adherence to protocols.

5. Proof of Ownership: Project developer (STU, SPV and ULB) must demonstrate ownership of emission reductions through contractual agreements with charging system owners or disclosure to EV drivers.

6. Project Boundary: The project boundary encapsulates various elements, including the applicable fleets of electric vehicles, the geographic locations of EV charging systems, and the associated infrastructure supporting these systems.

7. Estimation of Baseline Scenario: The baseline scenario reflects the operation of fleets that are comparable to those involved in the project, offering the same transportation services that would occur in the absence of the project's implementation.

8. Additionality Demonstration: In the carbon credit registration process, demonstrating regulatory surplus is crucial to comply with the VCS Standard, proving that emission reductions exceed existing regulations. Projects meeting VCS module criteria are on the "Positive List," ensuring additional environmental benefits. If the Positive List criteria don't apply, project developer (STU, SPV and ULB) can use CDM methodologies for small or large-scale projects, allowing tailored assessments of environmental impact and additionality.

9. Project Documentation and Validation: The PDD is a detailed blueprint of the project's technical and financial aspects, including emissions calculations, baseline and project assessments, additionality evaluation, and a monitoring plan. After completion, it is submitted to a DOE for validation. The DOE ensures adherence to VM0038 guidelines, verifying the project's documentation and methodologies to establish credibility and eligibility for carbon credit registration.

10. Registration and Issuance: After DOE validation, the electric bus project is registered with a carbon credit standard like VERRA. This allows the project to generate Verified Carbon Units (VCUs) based on verified emissions reductions. The VCUs, representing the project's environmental benefits, can then be submitted for issuance, converting emissions reductions into tradable carbon credits.

CASE STUDIES FROM THE MOBILITY SECTOR

Bangkok E-Bus Programme

The Bangkok E-Bus Programme is owned by Energy Absolute Public Company Limited, a Thai green energy provider. The project, which aims to replace the fleet of privately-operated internal combustion engine buses in Bangkok with electric buses, was implemented under the Internationally Transferred Mitigation Outcomes (ITMOs) provision of Article 6.2 of the Paris Agreement. This framework allows for bilateral or multilateral agreements between countries to exchange carbon credits, enabling one country's GHG reductions to count towards another country's climate targets[24].

Bangkok e-bus
SOURCE:
nationthailand.com

The project's timeline spans from 2022 to 2030, with the crediting period set from 2022 to 2029. The initial agreement for the purchase of ITMOs was signed on June 24, 2022, with the first issuance of 1,916 ITMOs completed in December 2023. The KliK Foundation intends to use carbon finance obtained through the acquisition of at least 500,000 ITMOs until 2030[25]. The KliK Foundation, representing Swiss fuel importers, provided financial support by purchasing these ITMOs, ensuring the project's financial viability and supporting the transition to electric mobility in Bangkok. The project not only contributes to significant CO2 reductions but also establishes a comprehensive charging infrastructure to support the new electric bus fleet. This initiative not only supports Thailand's Nationally Determined Contributions (NDCs) but also sets a precedent for similar public-private partnerships in climate action globally. The revenue generated from trading these carbon credits will further bolster the financial sustainability of the e-bus programme and promote cleaner air and reduced pollution in Bangkok.

Delhi Metro Rail Corporation's Carbon Credit Programme

The Delhi Metro Rail Corporation (DMRC) has been a pioneer in the carbon credit market, leveraging its green initiatives to generate substantial revenue. In 2007, DMRC became the first metro or railway project in the world to be registered under the Clean Development Mechanism (CDM) by the United Nations[26]. This registration allowed DMRC to earn carbon credits through various projects aimed at reducing greenhouse gas emissions.

Delhi Metro
SOURCE: Economictimes.Indiatimes.com

DMRC has registered several projects under the CDM, including:

- **Regenerative Braking Project:** This was the first project, leveraging regenerative braking technology to reduce emissions.
- **Modal Shift Project:** This project emphasizes the lower carbon footprint of metro travel compared to other modes of transport.
- **MRTS Programme of Activities (PoA):** A comprehensive project covering multiple emission-reducing activities.
- **Solar Project:** Utilising solar energy to power metro operations.

In 2014, DMRC also became the first metro system to be registered with the Gold Standard, a globally recognized certification for carbon mitigation projects. From 2012 to 2018, DMRC sold 3.55 million carbon credits, generating ₹19.5 crore[27] in revenue. This period saw significant efforts in enhancing energy efficiency and reducing emissions through the aforementioned projects. The sale of carbon credits was conducted under the framework of the CDM, which allows public and private sectors in high-income nations to purchase credits from emission-reducing projects in lower or middle-income countries. The carbon credits generated from these projects were primarily Certified Emission Reductions (CERs), with each CER equivalent to one ton of CO2 reduced. The total revenue from these CDM and Gold Standard projects since their inception has been ₹29.05 crore[28].

BluSmart's Carbon Credit Registration and Revenue Generation

BluSmart, India's first all-electric cab service, is spearheading the transition to sustainable urban mobility. BluSmart operates an entirely electric fleet, offering eco-friendly ride-hailing services in Delhi-NCR and Bengaluru. BluSmart's carbon credit registration is conducted under the Verified Carbon Standard (VCS) managed by VERRA. By replacing conventional diesel and petrol cabs with electric vehicles (EVs), BluSmart substantially lowers CO2 emissions, qualifying for carbon credits.

A Blusmart cab
SOURCE: Economictimes.Indiatimes.Com

The company has recently received recognition for its efforts in completing over 300 million kilometres by using all-electric vehicles, providing more than 9.5 million fully electric trips[29]. These emission reductions are converted into carbon credits, which can be traded on the voluntary carbon market. While the exact revenue generated from these carbon credits is not publicly disclosed, the financial benefits are substantial, providing an additional revenue stream that supports the company's growth and sustainability initiatives. With a fleet of around 5,000 electric[30] vehicles, company has completed over 10 million emission-free rides, earning the trust of more than 1 million customers.

Project	Proponent	Project Type	Methodology	Status	Estimated Annual Emission Reduction (tCO2)	Amount received from selling Credits
Grouped Commercial Vehicles EV Projects India	Multiple Proponents	Transport	AMS-I.F; AMS-III.C.	Registered	7,052	-
BlueSmart EV Project in India	BlueSmart Mobility Private Limited	Energy Industries (Renewable/ non-renewable sources); Transport	AMS-I.F; AMS-III.C.	Registered	26,251	-
Convergence Energy Services Ltd. (CESL) EV Charging Infrastructure Project	Convergence Energy Services Ltd. (CESL)	Energy Industries (Renewable/ non-renewable sources); Transport	VM0038	Registered	12,334	-
EV Charging Infrastructure by a project by ENKING International	EKI Engergy Services Ltd.	Energy Industries (Renewable/ non-renewable sources); Transport	VM0038	Registered	20,174	-
Installation of low greenhouses (GHG) emitting Rolling Stock Cars, Regenerative braking, Modal Shift, MRTS Programme of Activities and solar project	Delhi Metro Rail Corporation	Transport	Multiple CDM Methodologies	Registered & traded the credits	5,88,000 (credits generated during 2012-2018 per year)	₹9.55 crore (2007 – 2011) ₹19.5 crore (2012 – 2018)

FIGURE 12[31]

THIRD-PARTY CERTIFICATION, PROJECT LIFESPAN, CREDITS RIGHTS: CLARIFICATION AND KEY CONSIDERATIONS

This chapter has been prepared in consultation with Carbon Credit Experts

Project validation by designated entities, also known as Designated Operational Entities (DOEs), serves as an external validator, ensuring project integrity and credibility. Third-party entities like TUV Nord or Bureau Veritas play a pivotal role in independently assessing and validating project documents, verifying compliance with chosen carbon standards' guidelines, and determining project eligibility for carbon credits.[32]

While DOEs assess project methodologies, emission reduction calculations, and monitoring procedures during validation, project developers, i.e. STUs, SPVs, and ULBs must also understand the project's lifespan and carbon credit claiming practices. Understanding these dynamics is essential for project developers to navigate the registration process successfully, optimise costs, and ensure long-term project sustainability.

• **Rights and Ownership of E-Bus Carbon Credits**
- STUs, SPVs, and ULBs must clearly state in their tender conditions that the ownership and trading rights of carbon credits generated from e-bus projects will remain with them. Regardless of whether the buses are owned by the STU, SPV, and ULB or by a private entity.
- Even if a tender is floated by a third party, such as a government aggregator, STUs, SPVs and ULBs must ensure that the rights to carbon credits and their trading remain with the STU, SPV, and ULB. This guarantees consistent control over the credits generated by the e-bus projects.

• **Appointment of Consultant for Project Development**
- Certified consultants offer a range of services, including document preparation, assistance during validation and verification processes, and addressing queries raised by the carbon standard.
- Consultants play a crucial role in navigating the complexities of the registration process and ensuring compliance with carbon credit standards.

• **Validation by Third-Party Designated Operational Entity**
- Third-party entities are certified entities endorsed by carbon standards such as CDM, Global Carbon Council, and Gold Standard, offering expertise in project validation and verification.
- Third-party entities approved for CDM verification often hold recognition in other standards, providing project developers with flexibility in third-party entities selection.

• **Cost of Verification**
- Verification team payments, whether local or international, are typically denominated in USD.
- The frequency of credit claiming impacts verification costs, with many developers opting for longer intervals to optimise expenses.

• **Project Lifespan and Carbon Credit Claims**
- Projects, such as electric buses, contribute to emissions reduction throughout their operational lifespan, typically spanning 10 to 12 years.
- Depending on project developers ' preferences and comfort levels, carbon credits can be claimed annually, biannually, or triennially.

• **Validity Period for Carbon Credits**
- Once registered, projects remain valid for ten years in the voluntary carbon market, allowing for carbon credit claims over the entire validity period. However, the project lifespan would vary across the diffraction Carbon Standards.

• **Claiming Credits Over Time**
- While there's no prescribed compliance schedule, claiming credits every two or three years is common practice to avoid raising questions about project performance and monitoring.
- The choice between claiming credits annually, biannually, or triennially influences overall project costs, prompting developers to strategies based on their financial constraints and project goals.

COST-BENEFIT ANALYSIS FOR CARBON CREDIT MONETISATION

This chapter has been prepared in consultation with Carbon Credit Experts

Evaluating the cost-effectiveness of carbon credit monetisation[33] for e-bus programmes involves understanding the variability in carbon credit prices, cost of project development, cost of project verification, cost of project validation, potential benefits, and challenges associated with market dynamics and Sustainable Development Goals (SDG) labelling. This analysis underscores the importance of careful consideration and consultation with third-party entities to navigate the complexities of the carbon credit market successfully. Understanding these nuances helps make informed decisions regarding the worthiness of entry into the carbon credit market and maximising the benefits for entities operating electric buses. It is highly recommended that STUs, SPVs, and ULBs perform a cost-benefit analysis before entering into the voluntary carbon market.

Potential Benefits for E-bus Programmes

The potential benefits of electric bus programmes in the context of the voluntary carbon market make them attractive for several reasons. One significant advantage is the relatively limited presence of e-bus programmes in the Indian market compared to other sectors like renewable energy or forestry projects. This scarcity of e-bus programmes creates an opportunity for stakeholders to enter the voluntary carbon market with e-bus projects, as there may be less competition and more demand for such credits. One of the key benefits of engaging in the voluntary carbon market with e-bus projects is the potential for revenue generation over the project's lifespan, typically spanning 10-12 years.

The conversion of carbon credit revenue from US dollars to Indian rupees (INR) presents an additional benefit for e-bus programmes operating in India. Given the potential for substantial volumes of carbon credits generated over the project's lifespan, particularly for large-scale electric bus deployments, the conversion of carbon credit revenue to INR can result in significant financial value. This revenue can contribute to offsetting project costs, funding future expansion or improvements to the electric bus infrastructure, or supporting other sustainability initiatives within the organisation. Furthermore, participating in the voluntary carbon market with electric bus projects can enhance the STUs, SPVs, and ULBs reputation and commitment to environmental sustainability and climate action.

Variability in Carbon Credit Prices

Several factors influence carbon credit prices, making it a dynamic and fluctuating market. One primary determinant is the type of project generating the credits. Different types of projects, such as renewable energy installations, energy efficiency initiatives, or forestry projects, have varying levels of demand and perceived environmental impact, affecting their market value.

Geographical location also plays a significant role in determining carbon credit prices. Carbon credit markets operate globally, with prices varying across regions due to differences in regulatory frameworks, market maturity, and supply and demand dynamics.

Market demand is another crucial factor driving carbon credit prices. As the demand for carbon credits fluctuates over time due to changing regulatory landscapes, corporate sustainability goals, and investor preferences, prices can experience significant volatility. High demand for carbon credits, driven by factors like stringent emissions reduction targets or increased corporate interest in carbon neutrality, net zero targets can lead to upward pressure on prices. Similarly, oversupply or reduced demand can result in price decreases.

Market-Dependent Profitability

The profitability of carbon credit projects is heavily influenced by market dynamics, which can fluctuate similarly to the stock market. This market-dependent nature of carbon credit pricing poses challenges for project developers and investors, as it introduces uncertainties and makes it difficult to predict definitive outcomes. Similar to stock market fluctuations, carbon credit prices can vary widely based on a range of factors, including supply and demand dynamics, regulatory changes, economic conditions, and geopolitical events. For instance, an increase in demand for carbon credits due to corporate sustainability commitments or regulatory mandates can drive up prices, while oversupply or changes in policy may lead to price decreases.

The profitability of a carbon credit project depends on its ability to generate and sell carbon credits at favourable prices within the market. However, since carbon credit prices are subject to market forces, project developers face inherent risks associated with price volatility. Fluctuations in carbon credit prices can impact the financial viability of a project, affecting its revenue generation potential and overall profitability. Project developers, must carefully consider market conditions and price trends when evaluating the economic feasibility of their

feasibility of their carbon credit projects. Conducting thorough market research, analysing historical price data, and monitoring market developments are essential steps to assess market-dependent profitability accurately.

Moreover, STUs may employ risk management strategies to mitigate the impact of market fluctuations on project economics. These strategies may include diversifying revenue streams, entering into forward contracts or hedging agreements, or incorporating flexibility into project planning to adapt to changing market conditions.

Impact of Sustainable Development Goals (SDGs) Labeling

The Global Carbon Council introduces labelling based on contributions to SDGs. Projects contributing to multiple SDGs receive higher labels (e.g., gold or platinum), potentially increasing the market price of carbon credits. The third-party entity engaged for validation and verification ensures compliance with SDGs and labelling criteria. If the project aligns with the labelled contributions stated in the project document, the validation team submits the findings to the carbon standard.

In the evolving landscape of carbon trade projects, there is a notable shift from purely environmental considerations to encompass broader social dimensions—this transition in projects like e-buses, where compliance extends beyond environmental impact to include social benefits. The focus on social benefits aspects, along with the environmental aspects of carbon projects, will add more weightage to the project in terms of approval for the registration and assignment of credits.

• **Expanded Compliance Requirements:** Carbon trade projects now demand compliance with both environmental and social standards, reflecting a broader commitment to sustainability. Compliance extends beyond carbon credit generation to encompass aspects such as battery disposal methods and the social impact of manufacturing processes.

• **Social Focus in E-Buses Project:** In the case of e-Buses projects, scrutiny extends to how batteries are disposed of, emphasising the need for environmentally friendly practices. Additionally, the project's contribution to local communities is assessed, highlighting social benefits and alignment with sustainable development goals.

• **Battery Disposal:** Proper battery disposal is crucial to maximising environmental benefits and ensuring sustainability. Batteries must be disposed of in an environmentally friendly manner, which includes setting stringent guidelines, partnering with certified recycling facilities, and promoting second-life applications for used batteries. These practices not only minimise hazardous waste and reduce environmental impact but also enhance the project's credibility and eligibility for carbon credits, reinforcing the commitment to a full lifecycle approach in reducing carbon emissions.

• **Quality Carbon Credits:** The market values projects that generate carbon credits and adhere to rigorous environmental and social standards. Project developers, i.e., STUs, SPVs, and ULBs must bear additional expenses to ensure high-quality carbon credits that align with evolving market expectations.

• **Public Disclosure:** Carbon standards mandate public disclosure of project documents, providing stakeholders and the public access to emission reduction calculations, project development details, and validation reports. This transparency requirement facilitates scrutiny and understanding of registered projects.

Following are the Sustainable Development Goals, which are typically applicable to e-bus projects:

SDG	Target
	**7.1 - By 2030, ensure universal access to affordable, reliable and modern energy services.** *The widespread adoption of electric buses will deliver clean energy solutions.*
	**13.2 - Integrate climate change measures into national policies, strategies and planning** *Transitioning to electric buses will reduce CO2 emissions and save barrels of oil annually.*
	**11.6 - By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.** *By adopting electric buses, the city/state can reduce CO2 emission annually and thereby improve air quality.*
	**9.b - Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities** *The shift to will boost clean employment opportunities, particularly in the operation and maintenance sector of electric buses and their components.*

FIGURE 13

As the carbon market expands its focus to include social dimensions, stakeholders are urged to embrace a holistic approach to compliance. The integration of social aspects into carbon trade projects signifies a paradigm shift, emphasising the importance of transparency and adherence to environmental and social standards. Through public disclosure and accessible information, stakeholders can learn from case studies and foster a culture of shared knowledge within the evolving carbon market, ultimately advancing sustainability goals.

Understanding the benefits from e-bus project

Following is the hypothetical e-bus project of 100 fleet size illustrated for the understanding for benefits from e-bus project

	Annual savings emission reduction	Tentative annual revenue from Carbon Credits	New job opportunities
Emission Reduction	5741 tonnes	$ 28 thousand (₹24 lakhs)	450 Jobs
Fuel Savings	20.86 lakhs litres		
Fuel Cost Savings	₹10 Crore		

FIGURE 14

Assumptions:

- Total E-Buses: 100
- Daily Assured km: 200
- Total Life: ₹12 years
- Diesel Cost: 90/litre
- Fuel Efficiency of diesel bus: 4 km/litres
- Trading/Bid value of 1 Carbon Credit: $ 5
- Staff ratio under GCC model for new jobs: 4.5
- USD to INR exchange rate: ₹83.76

Disclaimer:
This example calculation and its outcomes serve as a illustration of tentative carbon credit revenue only. They are based on assumptions concerning average technical and operational characteristics of different vehicles, energy systems, macroeconomic environments, currency exchange rates and carbon market circumstances. ASRTU and ITDP India assumes no responsibility or liability for any error or omission therein and actual parameters and outcomes may differ from case to case. As such no rights, claims or liabilities can be derived from this example. No representations to third parties should be made based on this example. Consult with Carbon Credit expert for a further assessment of your potential.

INTEGRATION OF REGULATORY CARBON MARKETS IN INDIA: INDIAN CARBON MARKET (ICM)

This chapter is a summary of "Detailed Procedure for Compliance Mechanism under Carbon Credit Trading Scheme (CCTS) by Bureau of Energy Efficiency"

The Bureau of Energy Efficiency (BEE) has established a comprehensive framework for the compliance mechanism under the Indian Carbon Market (ICM). This framework is a strategic initiative to support India's Nationally Determined Contribution (NDC) targets, aiming to create demand for emission reduction credits by pricing greenhouse gas (GHG) emissions reductions through the trading of carbon credit certificates (CCC). The Carbon Credit Trading Scheme (CCTS), notified in June 2023, delineates the compliance mechanism for obligated entities, setting GHG emission intensity targets and providing a structure for trading, monitoring, and reporting[34].

Priority Sectors for Indian Carbon Market are
- **Cement**
- **Iron and Steel**
- **Pulp and Paper**
- **Petrochemicals**

Compliance Mechanism

The compliance mechanism under the CCTS involves determining obligated entities, which are identified by the Ministry of Power (MoP) based on recommendations from BEE and the National Steering Committee for Indian Carbon Market (NSC-ICM). These entities come from energy-intensive sectors and other designated consumers. The mechanism covers carbon dioxide (CO2) and perfluorocarbon (PFC) gases initially, with emissions converted to carbon dioxide equivalent (CO2e) using Global Warming Potential (GWP) values. BEE, in consultation with technical committees, develops emission intensity trajectories considering NDC targets, available technology, and potential for energy efficiency and decarbonization. These trajectories are set for three-year periods and reviewed regularly. Targets for each obligated entity consider direct energy, process, and indirect energy-related emissions, excluding GHG emissions from renewable energy, biogenic sources, and certain waste co-processing.

Obligations of Obligated Entities

An obligatory entity is a designated consumer or user within energy-intensive industries and other establishments that must comply with greenhouse gas emission intensity targets under the Carbon Credit Trading Scheme (CCTS). Obligated entities must develop and implement monitoring plans to accurately track their GHG emissions and emission intensity. They are required to achieve their GHG emission intensity targets through reduction measures and submit verified GHG emissions reports. In cases where targets are not met, entities must surrender the equivalent number of CCCs to ensure compliance. Additionally, entities must maintain data integrity and support verification processes by providing necessary documents and data. By fulfilling these obligations, entities contribute to the overall effectiveness and integrity of the Indian Carbon Market.

Monitoring and Reporting

Obligated entities must develop detailed monitoring plans that outline emission sources, data control, and calculation methodologies. These plans ensure accurate GHG emissions calculation based on direct and indirect emissions, using standard emission calculation methods or mass balance methodology. Entities are required to submit these monitoring plans and annual GHG emissions reports to BEE. Maintaining data integrity is crucial, achieved through documented procedures and quality assurance measures.

Verification and Assessment

Verification and assessment of compliance with GHG emission intensity targets are conducted by independent accredited carbon verification agencies (ACVA). The verification process involves strategic analysis, site visits, data sampling, and control activities to ensure the accuracy of the information provided by the obligated entities. Verification reports confirm compliance or highlight discrepancies, with a materiality threshold set at 2%. This rigorous verification process is essential for maintaining the credibility and effectiveness of the compliance mechanism.

Issuance and Surrender of Carbon Credit Certificates

Based on verified performance, BEE issues or debits CCCs to or from obligated entities. Entities that exceed their emission reduction targets are issued CCCs, while those that fall short must surrender the necessary number of CCCs to meet their targets. Surplus CCCs can be banked for

future use or traded within the Indian Carbon Market. This system of issuance, surrender, and banking of CCCs incentivizes entities to continuously improve their emission reduction efforts.

Trading and Banking

To facilitate trading, obligated entities must register with the ICM Registry, enabling them to trade CCCs on designated power exchanges. Both obligated and non-obligated entities can participate in the market by registering and paying the prescribed fees. Surplus CCCs from a compliance year can be banked for use in future years, providing flexibility and encouraging long-term planning for emission reductions. This trading mechanism creates a dynamic market for carbon credits, promoting cost-effective emission reductions across sectors.

Compliance and Long-Term Planning

Obligated entities are required to submit long-term action plans for GHG emissions reduction, which are updated annually. These plans should detail identified GHG reduction measures, estimated costs, savings, and implementation strategies. By integrating long-term planning with annual reporting, entities can systematically achieve their emission intensity targets and contribute to national climate goals. This proactive approach ensures that entities remain aligned with evolving regulatory and technological landscapes.

What STUs, SPVs and ULBs Operating E-Buses have to consider about emerging Indian Carbon Market?

As per the compliance mechanism, the transport sector is not included as a priority sector under the Indian Carbon Market. However, STUs, SPVs, and ULBs can explore the voluntary carbon market to trade carbon credits and generate potential revenue from carbon finance. By proactively participating in the voluntary market, STUs, SPVs, and ULBs can avoid missing out on financial opportunities while awaiting the inclusion of the transport sector in the domestic regulated market. It is important for STUs, SPVs, and ULBs to establish robust data tracking and monitoring practices now, ensuring they are well-prepared and can seamlessly transition when the sector is eventually included in the regulated market.

RECOMMENDATIONS

Following are the recommendations and key considerations for STUs, SPVs, and ULBs before applying for carbon credits for their e-bus projects:

1. Understanding market dynamics: STUs, SPVs, and ULBs must thoroughly understand the variability in carbon credit prices, project development costs, and market dynamics. This understanding is crucial for making informed decisions regarding participation in the voluntary carbon market.

2. Consultation with relevant experts: Comprehensive planning and consultation with relevant field experts are crucial for effectively navigating the complexities of the carbon credit market. STUs, SPVs, and ULBs should seek guidance from experts in carbon finance, sustainability, and regulatory compliance to maximise the benefits of their e-bus projects.

3. Cost-benefit analysis: Before applying for the carbon credits, STUs, SPVs, and ULBs should perform a cost-benefit analysis in terms of the variability in carbon credit prices, cost of project development, cost of project verification, cost of project validation, and challenges associated with market dynamics, Sustainable Development Goals (SDG) labelling and estimated revenue from it to assess the worthiness of entering into the carbon credit market. Despite challenges, the potential benefits of participating in the voluntary carbon market are substantial. STUs, SPVs, and ULBs should assess revenue generation opportunities and the conversion rates of carbon credit revenue in US Dollars to Indian Rupees to support project sustainability and future initiatives.

4. Risk free approach for monetizing Carbon Credits: Given the transport sector's emerging status and current exclusion from the Indian carbon market, STUs, SPVs and ULBs should explore the voluntary carbon market to monetize carbon credits from e-buses. Adopting the "As-a-Service" revenue model, where specialized carbon trading agencies manage the registration, verification and sale process at no cost or risk to STUs, SPVs and ULBs in exchange of revenue share, minimizes time and investment risks. This approach allows STUs, SPVs, and ULBs to avoid upfront fees and leverage market expertise, ensuring they capitalise on potential carbon finance revenue while preparing for future regulatory inclusion.

5. Rights and ownership of Carbon Credits: STUs, SPVs, and ULBs must explicitly state in their tender conditions that ownership and trading rights of carbon credits generated from e-bus projects will remain with the STU, SPV and ULB regardless of bus ownership or operation by private entities. Even if a tender is issued by a third party, such as a government aggregator, STUs, SPVs, and ULBs must ensure that rights to carbon credits and their trading remain with them. This ensures consistent control over the credits generated by e-bus projects.

6. Social benefits and alignment with Sustainable Development Goals (SDGs): Emphasising alignment with SDGs can enhance the market value of carbon credits. STUs, SPVs, and ULBs should ensure that their projects contribute to social welfare and adhere to rigorous environmental and social standards. STUs, SPVs, and ULBs should prioritise adherence to high-quality environmental standards while also enhancing social benefit standards. Additionally, the project's contribution to local communities is assessed, highlighting social benefits and alignment with sustainable development goals.

7. Consideration of energy source: The source of electricity used in e-bus programmes significantly impacts carbon credit generation. Charging e-bus batteries through non-renewable sources introduces uncertainties about the clean energy source, potentially impacting emission reduction and carbon credit values. STUs, SPVs, and ULBs should carefully assess their energy sources to ensure a certain percentage of energy is coming from clean sources.

8. Renewable Source of Energy: E-bus programmes can yield higher carbon credits when electricity is sourced from dedicated renewable energy (RE) sources for charging stations. Utilising RE sources results in zero project emissions, displacing baseline conditions, maximising emission reductions and higher prices for carbon credits.

9. Battery disposal: In e-bus projects, achieving carbon credits requires environmentally friendly battery disposal. This includes setting stringent guidelines, partnering with certified recyclers, and implementing tracking systems for transparency. Promoting second-life applications, training for safe handling, public awareness campaigns, and securing financial incentives are crucial. Regular audits and detailed reporting ensure compliance and sustainability, enhancing carbon credit eligibility. Additionally, tender conditions should

require e-bus bidders to clearly provide a battery disposal process that adheres to environmentally friendly norms.

10. Strategic planning for regulatory compliance: As India transitions towards establishing a domestic regulatory carbon market, STUs, SPVs, and ULBs must strategically plan their carbon credit strategies. Assessing projected timelines and regulatory certainty will help STUs, SPVs, and ULBs make informed decisions regarding participation in voluntary markets or waiting to establish a regulated market.

11. Capacity building on data tracking and monitoring: STUs, SPVs, and ULBs should implement precise daily monitoring of energy consumption, emissions, and efficiency against a baseline scenario. This includes developing detailed monitoring plans, ensuring accurate data collection and reporting, and engaging accredited verification agencies for independent assessments during the registration process. Training personnel on monitoring and compliance procedures is crucial for maintaining data integrity and operational efficiency.

Making an informed decision requires evaluating projected timelines for regulatory frameworks, regulatory certainty, and the risks and opportunities of early participation in voluntary markets. While voluntary markets offer immediate carbon credit revenues and sustainable development opportunities, waiting for domestic regulated markets could provide clearer guidelines and greater market stability, however this may lead to STUs, SPVs, and ULBs lose potential revenue stream till the time regulated market takes place in India. STUs, SPVs, and ULBs should carefully weigh these factors to align their strategies with both short-term objectives and long-term sustainability goals.

In conclusion, by considering these key considerations and recommendations, STUs, SPVs, and ULBs can navigate the complexities of the carbon credit market effectively, maximise the benefits of their e-bus projects, and contribute to India's transition towards a sustainable and low-carbon future.

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