Carbon Project Ratings – Landfill Gas Methodology

MSCI ESG Research

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Methodology overview

Objective

MSCI Carbon Project Ratings are composite ratings that independently assess the integrity and risks of carbon credit projects across multiple criteria, including their impacts on the climate, environment and society.

A project with a higher rating reflects a greater likelihood of having a positive emissions impact and a reduced risk of overestimating its emissions impact. It is also more likely that such project would have been implemented in a way that supports positive social and/or environmental outcomes and upholds legal and ethical standards. Consequently, a project with a higher rating would have a lower likelihood of incurring reputational risks.

Document description

This document describes the specific methodology used to assess landfill gas projects within the Carbon Project Ratings and Pipeline Carbon Project Ratings (but not Preliminary Carbon Project Ratings).

This project type-specific methodology is applied in addition to, and partially in replacement of, the methodology that is described in the overall MSCI Carbon Project Ratings methodology document, "MSCI Carbon Project Ratings and Assessments Methodology." Where an element of the overall methodology is replaced by this project type-specific methodology, it is detailed below. Every element of the overall MSCI Carbon Project Ratings methodology also applies to MSCI ESG Research's assessment of Carbon Project Ratings and Pipeline Carbon Project Ratings for landfill gas projects unless explicitly excluded in this document.

This methodology is subject to MSCI ESG Research's methodology governance and update process, as outlined in the overall methodology note. This ensures that updates and refinements to the methodology align with evolving best practices, stakeholder input, and the latest data insights. For details on the governance process, methodology updates, and review timelines, please refer to Section 12 of the MSCI Carbon Project Ratings and Assessments Methodology document.

Section 2 introduces the core concept of carbon credit integrity and why its assessment is important to the development of the global carbon credit market. Section 3 introduces and defines landfill gas projects. Sections 4-8 provide details on the project type-specific methodology, including data sources and assumptions, used in MSCI ESG Research's Carbon Project Ratings and Pipeline Carbon Project Ratings assessments for landfill gas projects.

Introduction to carbon project integrity

What is carbon credit integrity?

Carbon credits have varying quality characteristics. These stem from fundamental differences in project types, but also from which methodologies have been used to define each project and create the credits (these methodologies are among the standards set by carbon crediting programs, and are hereafter called crediting program methodologies) and how rigorously they have been applied. Projects also differ in terms of their potential co-benefits and their legal and ethical characteristics.

This variation in quality was not intended. Standard setting and governance bodies attempted to create a system in which all carbon credits had an equivalent climate benefit (representing a tonne of carbon dioxide equivalent (CO_2e) removed or avoided) which could be used for voluntary or compliance purposes. This effort dates back to the Clean Development Mechanism (CDM) created under the 1997 Kyoto Protocol and has continued with the evolution of the carbon credit market.

A key challenge lies in the quantification of the climate benefit of a project — i.e., whether the carbon credits calculated for a project are genuinely equivalent to mitigating or removing one tonne of carbon dioxide from the atmosphere. This difficulty stems from the calculation method used to determine what would have happened in the absence of a project, i.e., in the "baseline" scenario (sometimes referred to as the "counterfactual" scenario).

Another difficulty is that projects differ hugely in age, size and technology. The science behind some crediting program methodologies has also evolved over time, as has the enforcement of standards and levels of governance.

Readers should note that, within the carbon markets, the words "quality" and "integrity" tend to be used somewhat interchangeably. Through the rest of this document, the word integrity is used when referring to carbon projects.

The importance of assessing carbon credit integrity

Corporate climate action is critical in the fight against climate change, and carbon credits represent one of the mechanism for corporates to mitigate their carbon footprint. However, concerns over carbon credit integrity may have held back, and may continue to hold back, the global carbon credit market from reaching its potential. These concerns center around the perception that many carbon credits are of low integrity and are not delivering the benefits they claim to.

In 2021, the Taskforce for Scaling the Voluntary Carbon Market (TS-VCM) found that credit integrity was at the "heart of buyers' hesitancy,"[1] with 45% of buyers identifying it as a key pain point. Buyer concerns around credit integrity and the related risk of being accused of greenwashing due to the use of low-integrity credits have only grown since then. For example, some 55% of respondents to an April 2023 survey run by the Science-Based Targets Initiative (SBTi) stated that the risk of a greenwashing accusation was stopping them from buying more credits.[2]

Concerns over carbon credit integrity have been central to the creation of two major initiatives: the Integrity Council on the Voluntary Carbon Market (IC-VCM) and the Carbon Credit Quality Initiative

[1] "Taskforce on Scaling Voluntary Carbon Markets: Summary of the Public Consultation Report," ICVCM, June 3, 2021.

[2] "Beyond Value Chain Mitigation (BVCM) Research," SBTI_press_release, September 1, 2023.

(CCQI). The IC-VCM aims to create minimum standards of integrity with a set of Core Carbon Principles (CCPs), and the CCQI has developed a scoring system for certain project types. Both initiatives primarily assess integrity at the project-type level (primarily based on a project's methodology used) or at the project-registry level (a project registry is an organization that registers mitigation activities and issues carbon credits for the emissions reductions or removals achieved by the mitigation activities). Neither initiative assesses integrity at the individual-project level.

MSCI ESG Research's assessment methodology draws on the IC-VCM's and CCQI's approach to assessing integrity, building on their principles to apply a more in-depth evaluation of integrity at the individual-project level.

The key components of carbon project integrity assessment

Market approaches to assessing carbon project integrity typically focus on three main issues:

A. **Emissions impact integrity:** How much CO_2e has been reduced/removed?

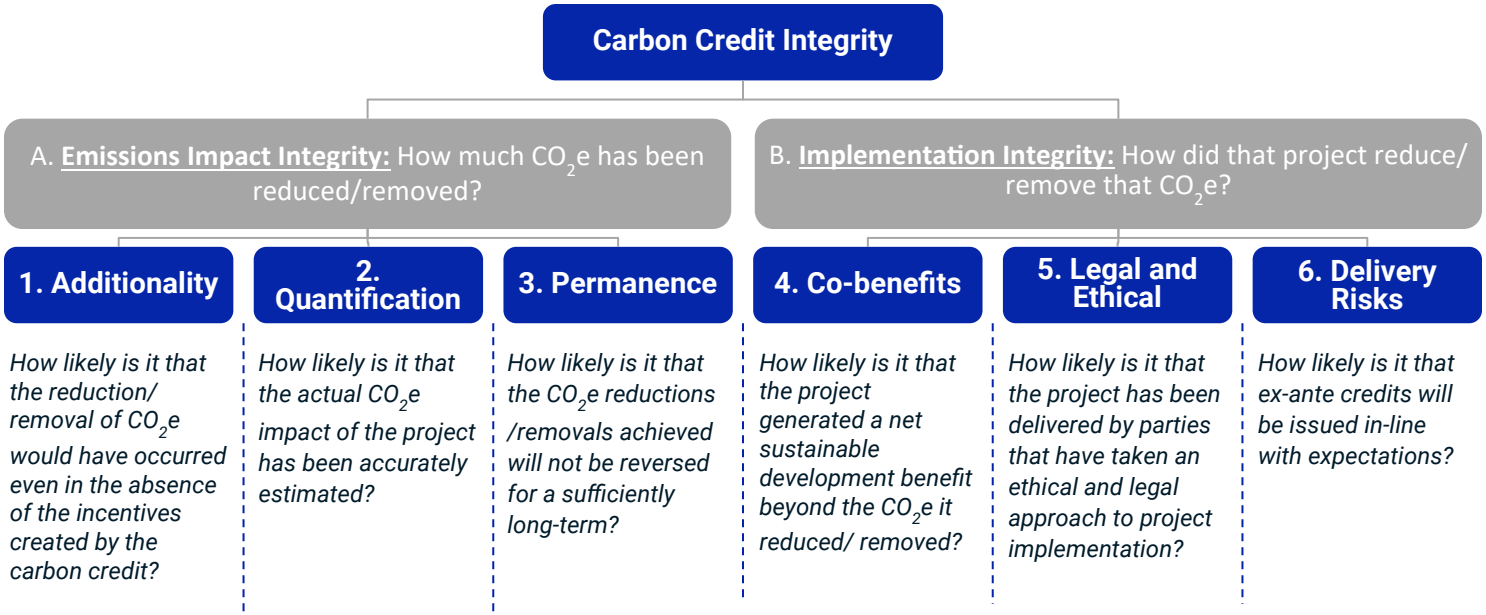
B. **Implementation integrity:** How did that project reduce/remove that CO_2e?

C. **Usage integrity:** How are the credits then reviewed and used?

Emissions impact integrity and implementation integrity can each be further broken down into three main areas of common concern. These are summarized in **Figure 1** and outlined in detail below.

Emissions impact integrity, implementation integrity and usage integrity are each described in more detail in the overall MSCI Carbon Project Ratings methodology document, "MSCI Carbon Project Ratings and Assessments Methodology."

Figure 1: Key components of carbon project integrity



Introduction to landfill gas projects

What are landfill gas projects?

When waste is deposited in landfills (also referred to as municipal solid waste [MSW] sites), bacteria decompose the organic material. This bacterial decomposition and the oxidation of solid waste produces landfill gas, which is composed of methane (CH_4) and carbon dioxide ($C0_2$). If not collected and destroyed, this landfill gas is released into the atmosphere.

These emissions represent a very significant proportion of some countries' environmental impact. Indeed, landfills are the third-largest source of all methane produced in the United States, accounting for 14% of overall CH_4 emissions. Tackling this source of emissions is therefore crucial to transition to lower-intensity economies.

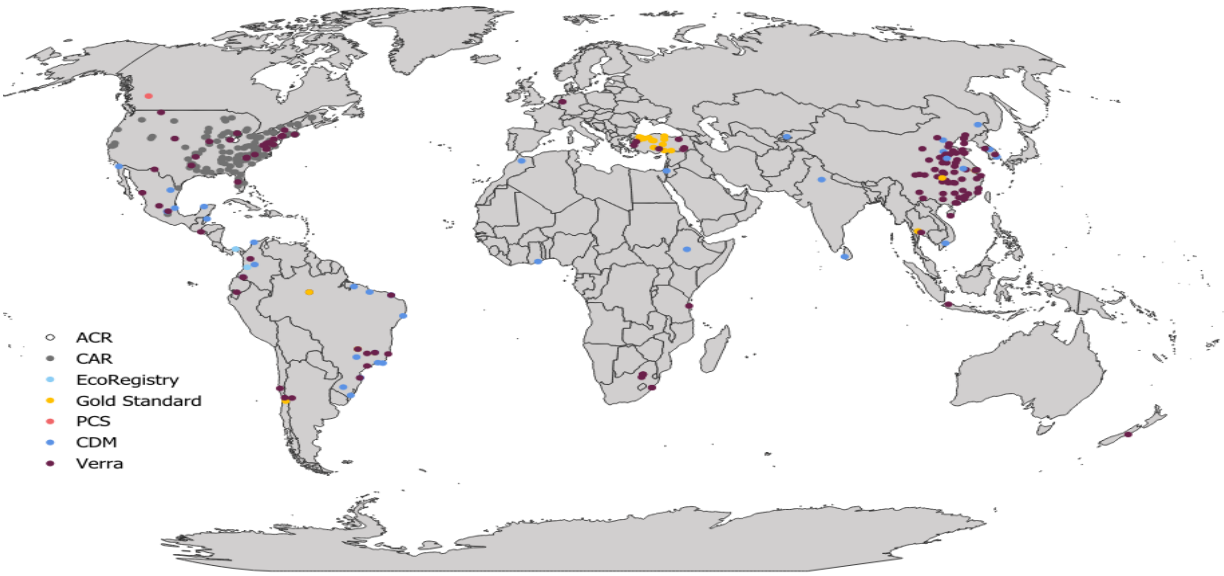
The emissions from landfill sites can be avoided if the right infrastructure and systems are put in place at waste sites, so that the methane can be captured before it is released into the atmosphere. Landfill gas projects can either destroy the methane (flaring only) or utilize the methane by converting it into energy (utilization), which can displace energy that would otherwise have been created by fossil fuels and therefore avoiding CO_2 emissions.

Market Overview

Landfill gas projects are an important project type within the voluntary carbon market. As of February 2024, there were 318 registered landfill gas projects that had issued over 100 Mt CO_2 of carbon credits. These projects are split between flaring only and utilization projects, with nearly 35% of currently registered projects flaring only.

Unlike renewable energy projects, the distribution of landfill gas projects is heavily skewed towards the United States. There are 153 landfill gas projects in the United States currently registered under the Climate Action Reserve registry, leading to the United States representing nearly 50% of currently registered projects. This geographical distribution of landfill gas projects is illustrated in Figure 2.

Figure 2: Landfill Gas Geographic Distribution



Note: Projects include the following registries: American Carbon Registry (ACR), Climate Action Reserve (CAR), Clean Development Mechanism Registry (CDM, Nationally Determined Contributions-eligible credits only), EcoRegistry, Gold Standard, Pacific Carbon Standard (PCS) and Verra registries. Date: As of October 2024. Source: MSCI Carbon Markets

Key integrity considerations

The integrity considerations for landfill gas projects primarily revolve around additionality and quantification risks.

Assessing the integrity of landfill gas projects requires a detailed analysis of the project's financial and legal context, and key assumptions. In particular, risks are primarily found in four areas:

- **Financial Attractiveness:** To be additional, a project should demonstrate both that it would have been financially unattractive without carbon credits, and that the existence of carbon credits was decisive in making it financially feasible. For flaring only projects, financial additionality risks are very low given that few financial incentives exist to implement the project otherwise. However, for utilization projects, earning revenue from the sale of generated electricity can create paths to profitability for projects even without carbon credits.
- **Common Practice:** The market penetration of a practice in a region or country gives an indication of whether a particular type of project would have occurred even without carbon credits. A project located in a region where that technology is already common is considered quite likely to have happened even without carbon credits.
- **Legal Incentives:** Given the significance of methane emissions from municipal solid waste within many regions' total carbon footprints, some governments may implement measures to incentivize the reduction of methane emissions from landfills. These requirements or policies may incentivize a project to implement the activities even without carbon credits.

- **Oxidation Factor:** Nearly all landfill gas projects without synthetic covers assume an oxidation factor of 10%. Academic literature indicates that, in reality, this factor varies significantly between landfills, and can reach up to 40%. Emission reductions in these cases may be overestimated.

Approach to assessing the integrity of landfill gas projects

MSCI ESG Research's assessment of landfill gas projects builds on the overall MSCI Carbon Project Ratings methodology to provide more in-depth analysis of landfill gas projects. This project type-specific assessment includes sub-criteria that are additional to, and partially in replacement of, the sub-criteria of assessment used in the overall MSCI Carbon Project Ratings methodology, as detailed below. These project type-specific sub-criteria evaluate a deeper set of questions, which are focused on the most important, specific drivers of integrity for landfill gas projects.

These project type-specific assessments are conducted at the individual project level, including a review of each individual project's data and assumptions. In this way, these assessments represent a more granular, project-level review of landfill gas projects than what would be possible using the overall MSCI Carbon Project Ratings methodology alone.

In total, MSCI ESG Research assesses 16 sub-criteria (see **Figure 3**) under this project type-specific methodology that are either not assessed or are assessed differently in the overall MSCI Carbon Project Ratings methodology, as illustrated in **Figure 4**. These sub-criteria are focused on addressing the key drivers of integrity for landfill gas projects. Each of these sub-criteria align with and replace corresponding sub-criteria scores in the overall MSCI Carbon Project Ratings methodology.

In the following sections, information is only provided on those sub-criteria that are pertinent to the assessment of landfill gas projects and differ from the overall MSCI Carbon Project Ratings methodology. To review the sub-criteria that are shared between both the landfill gas assessment and the overall ratings assessment, please refer to the methodology titled: MSCI Carbon Project Ratings and Assessments methodology.

Figure 3: MSCI ESG Research Overall Carbon Project integrity assessment

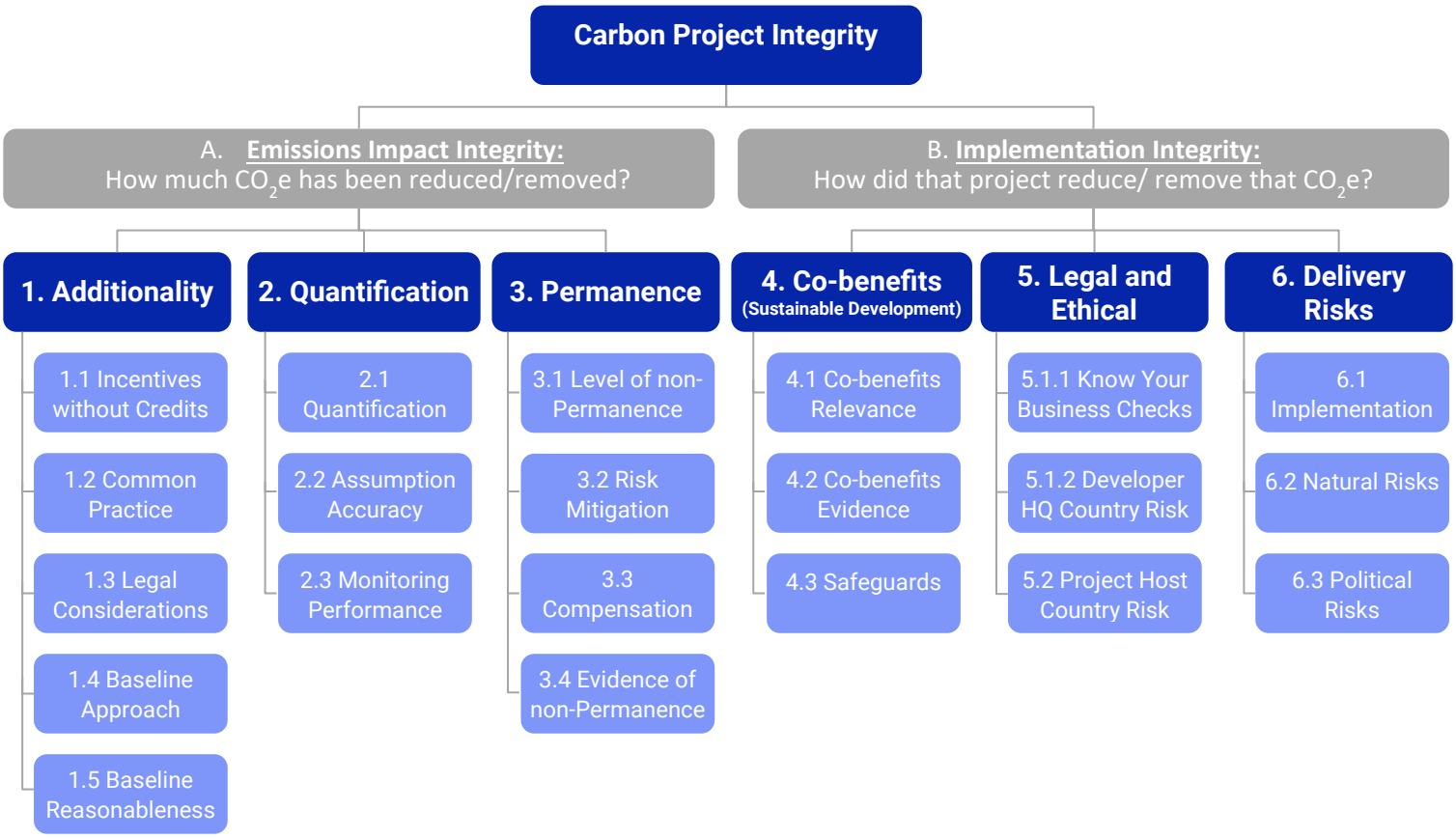
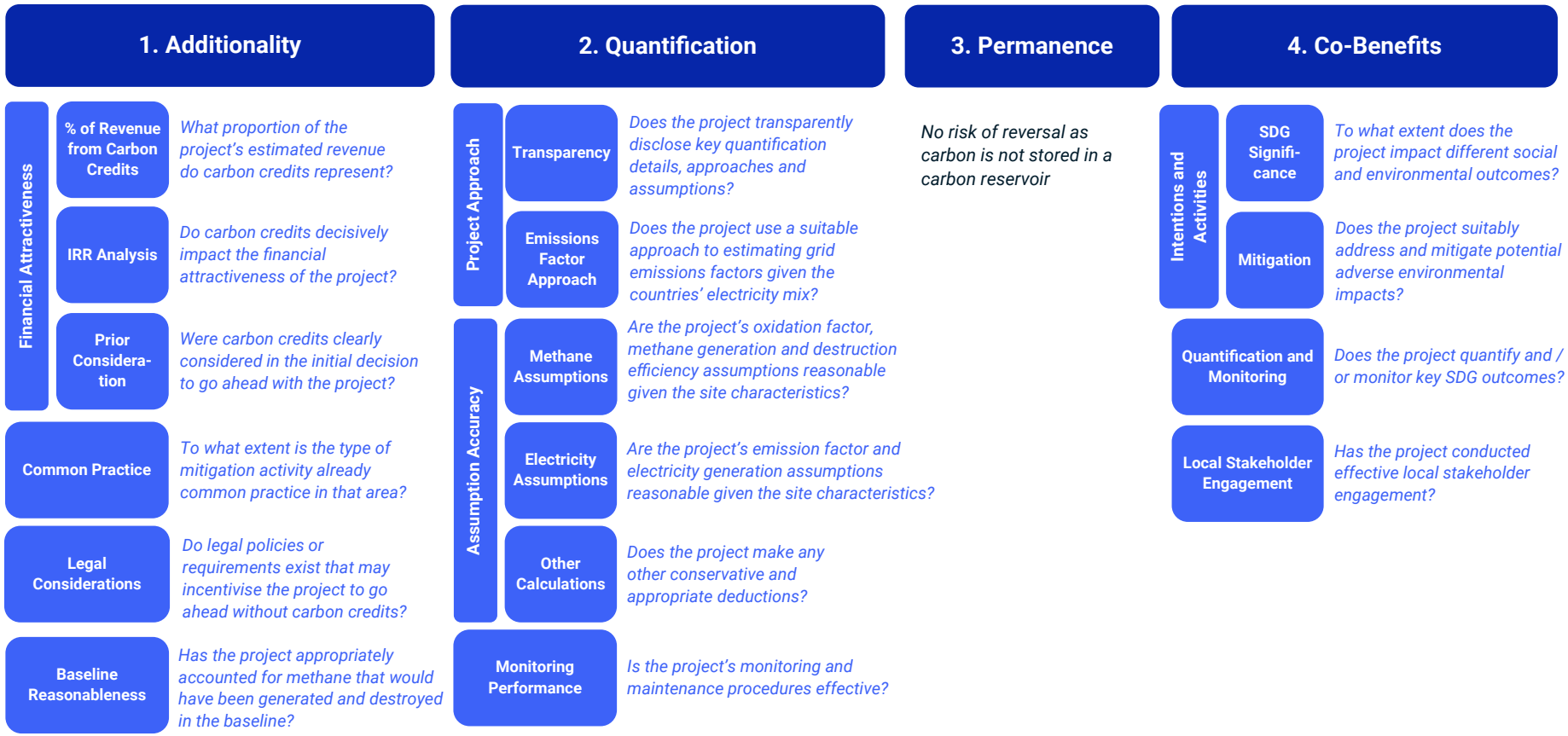


Figure 4: Sub-criteria and metrics that differ in the landfill gas assessment approach



Assessment of all other criteria and sub-criteria, for example, Criterion 5, Legal and Ethical Risks, within the landfill gas analysis use the same metrics and methodology as in the overall MSCI Carbon Project Ratings methodology framework. The granularity of the overarching framework for those sub-criteria, and the fact that their assessment is consistent across all project types (i.e., with no landfill gas-specific characteristics), means that no further enhancement is required.

For a detailed explanation of MSCI ESG Research's approach to data quality and update processes — including measures to ensure data accuracy, handle missing data, and update data in a frequent and recurring manner — please refer to the overall methodology note. This document outlines the steps MSCI ESG Research takes to verify data reliability and address any data gaps, ensuring consistency and accuracy across all project types.

Criterion 1 – Additionality

If a mitigation activity is not additional, then purchasing carbon credits has not led to any additional reduction or removal of emissions. Additionality is therefore a crucial component of the integrity of carbon credits. A non-additional carbon credit has no direct net positive environmental impact given that the emissions reductions/removals would have occurred anyway. However, it is worth noting that funding a non-additional credit may still indirectly help stimulate further investment in the same activity by raising its return.

The additionality of landfill gas projects is primarily determined through an analysis of the financial and legal context in which the project takes place. Many landfill gas projects have been developed without any support from the voluntary carbon markets, particularly for projects that can achieve profitability without carbon credits through selling electricity or where government support or subsidies exist to incentivize the developers of the activity to go ahead. For a landfill gas project to be additional, demonstrating that this same project would not have gone ahead without carbon credits is therefore crucial. The additionality risks differ significantly between flaring and utilization landfill gas projects. For flaring projects, there are few financial reasons why the project might have been implemented without carbon credits.

Further, the additionality of landfill gas projects is not necessarily binary. Projects may be partly additional, where only a portion of emission reductions are additional. For example, if, in the counterfactual scenario, some emission reductions would have been achieved through a partial destruction of methane, but not as much as was achieved by the project, then only this difference is additional.

Figure 5 illustrates the sub-criteria through which MSCI ESG Research assesses the additionality of the emissions reductions achieved by landfill gas projects, and the overall MSCI Carbon Project Ratings methodology sub-criteria that they correspond to. The detailed sub-criteria are described in Figure 6.

Figure 5: Landfill gas additionality assessment approach

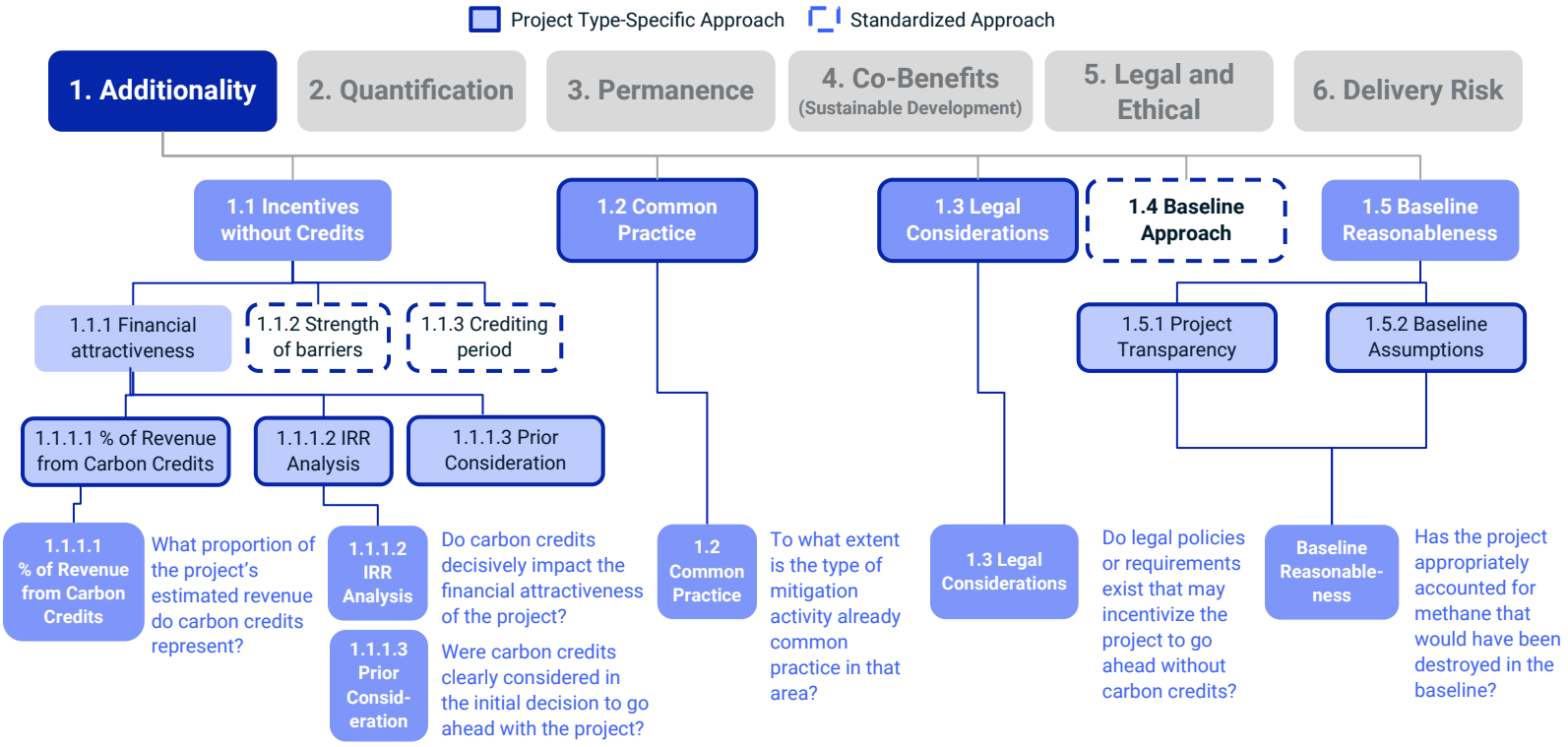


Figure 6: MSCI ESG Research Additionality integrity assessment framework

Sub-criteria		Metrics	Rationale	REDD+	Renewables	ARR	Cookstoves	Biochar	Landfill Gas	Safe Water	IFM	Waste Mgmt.	Blue Carbon
1.1 Incentives without Carbon Credits	1.1.1 Financial Additionality	1.1.1.1 % of Revenue from Carbon Credits	The higher the proportion of a project's revenue that comes from carbon credits, the greater the importance of credits to its financial attractiveness.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		1.1.1.2 IRR Analysis	Credits should play a decisive role in making a project financially attractive that would otherwise have not been.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		1.1.1.3 Prior Consideration	Carbon credits should have been clearly considered at the time the decision to go ahead with a project was taken.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	1.1.2 Barrier Analysis	Strength of Barriers	Projects that face high barriers to implementation would be less likely to go ahead without the added incentives of carbon credits.	✗	✓	✗	✓	✓	✗	✓	✗	✓	✓
1.2 Common Practice		Market Penetration	If a practice is already common within a market, it indicates that these types of projects will go ahead without the introduction of carbon credits.	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.3 Legal Considerations		Legal Requirements	Projects that are legally required or incentivized are unlikely to be additional. However, if laws are not enforced, they may still be additional.	✗	✗	✗	✗	✗	✓	✗	✓	✓	✓
1.4 Baseline Approach		Baseline Approach	Each project methodology is scored on the extent to which it mitigates the key risks associated with establishing a baseline scenario.	✓	✗	✗	✗	✗	✗	✗	✓	✗	✓
1.5 Baseline Reasonableness		Baseline Transparency	Transparent detail on a project's assumptions is required to make an objective assessment of a project's performance and additionality.	✓	✗	✓	✗	✗	✗	✗	✓	✗	✓
		Baseline Assumptions	MSCI ESG Research assesses the key baseline scenario assumptions for each project type.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.6 Red and Green Flags		News scanning	Review of academic papers, industry sources and the news for Red or Green Flags to project's additionality.	✓ *Standardized approach*									

✓ *Assessed* ✗ *Not Assessed*

1.1.1 Financial Attractiveness

Carbon credits fundamentally act as an incentive mechanism. The ability to sell credits should financially incentivize actors to implement mitigation activities that they would not normally pursue. MSCI ESG Research's landfill gas assessments consider three main topics that determine whether carbon credits play a critical role in incentivizing the implementation of mitigation activities:

- **1.1.1.1 % of Revenue from Carbon Credits:** Whether carbon credits contribute a significant proportion of expected and secured revenue.
- **1.1.1.2 IRR Analysis:** Whether carbon credits play a decisive role in making the project financially attractive.
- **1.1.1.3 Prior Consideration:** Whether carbon credits were considered prior to the project start.

The overall score for 1.1.1 Financial Attractiveness is then determined through weighting 1.1.1.1 % of Revenue from Carbon Credits 50%, 1.1.1.2 IRR Analysis 25% and 1.1.1.3 Prior Consideration at 25%.

For landfill gas flaring projects that have no other revenue sources outside of carbon credits, only criteria 1.1.1.1 % of Revenue from Carbon Credits and 1.1.1.3 Prior Consideration are considered, as an IRR analysis with and without carbon credits is less relevant.

1.1.1.1 % of Revenue from Carbon Credits

The proportion of expected and secure revenues that carbon credits represent can be an important indicator of the likelihood that a project went ahead because of carbon credits. Two key sub-criteria are used to evaluate this:

- **1.1.1.1.1 Secure Revenue Sources:** Whether the project already has preferential agreements to guarantee future electricity revenue.
- **1.1.1.1.2 % of Expected Revenue:** The proportion of expected revenue that carbon credits represent.

The overall score for 1.1.1.1 % of Revenue from Carbon Credits is determined by weighting Secure Revenue Sources as 33% and % of Expected Revenue as 67%.

1.1.1.1.1 Secure Revenue Sources

Secure revenue sources relate to whether the project already has any preferential agreements (such as Power Purchase Agreements) in place that guarantee future revenue.

Rationale	Projects that have secure revenue agreements in place have more visibility and security over their long-term revenue outside of carbon credits, and are therefore more likely to be able to access financing for the project even without carbon credits.					
Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑					
Scoring Definition	Each project is scored on a 1-5 scale, where 1 indicates that the project has a very secure revenue agreement in place and 5 indicates that it has no secure revenue sources in place prior to the project start.					

Scoring Approach	Through a review of project documentation, MSCI ESG Research assesses whether the project has any agreements in place to benefit from power purchase agreements, preferential tariffs, subsidies or grants. Projects are then scored based on the level of preferential security they provide in the following way: - 1 = Preferential Tariff - 1.5 = Power Purchase Agreement - 2 = Subsidies and/or grants - 5 = No Revenue Sources

1.1.1.1.2 % of Expected Revenue

% of Expected Revenue relates to the proportion of a project's total revenue that is expected to come from carbon credits.

Rationale	The higher the proportion of revenue that carbon credits represent, the greater the importance of carbon credits to the overall financial outlook of the project. If carbon credits represent only a small proportion of revenue, then the project may have been financially viable even without carbon credits.

Key Sources

Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
☑				☑	☑

Scoring Definition	Each project is scored on a 1-5 scale, where 1 indicates that a very low proportion of revenue comes from carbon credits and 5 indicates a material proportion of revenue comes from carbon credits.
Scoring Approach	Landfill gas projects are categorized as flaring only or utilization, based on whether they utilize methane to generate and sell electricity. Projects that only flare methane have no other available revenue sources for this activity, and therefore score an automatic 5 given that 100% of revenue will come from carbon credits. For each utilization project, MSCI ESG Research estimates the expected revenue based on estimating both electricity generation revenue and carbon credit revenue. Electricity generation revenue is determined based on the amount of annual electricity generation multiplied by the tariff price in that country (at the time the project was initiated). Carbon credit revenue is approximated by multiplying the amount of estimated annual credits by the price of carbon credits. Data on the amount of annual electricity generation and the estimated amount of annual credits is extracted from project documentation. Data on the tariff price is primarily extracted from project documentation but, if that is not available, third-party data for the relevant tariff price in that country is used instead. The price per carbon credit is based on MSCI Carbon Markets' own estimates (rather than any price stated in a project's documentation). These use the average realized carbon credit price since the project started for landfill gas projects based on MSCI Carbon Markets' historic pricing data. Using these four inputs, the estimated revenue from each source is

determined, as well as what proportion of total revenue was expected to come from carbon credits at the time the project started.

The % of revenue is then converted into a continuous 1-5 score for the sub-criteria based on the following scale:

- 5 = 100% of a project's revenue comes from carbon credits
- 4 = 90% of a project's revenue comes from carbon credits
- 3 = 50% of a project's revenue comes from carbon credits
- 2 = 10% of a project's revenue comes from carbon credits
- 1 = Less than 1% of a project's revenue comes from carbon credits

1.1.1.2 IRR Analysis

Internal Rate of Return (IRR) analysis refers to the likelihood that carbon credits played a decisive role in impacting the financial attractiveness of a project, as measured by a project's internal rate of return. Three key sub-criteria are used to evaluate this:

- **1.1.1.2.1 Transparency:** Whether financial details and assumptions are transparently disclosed.
- **1.1.1.2.2 Accuracy of Assumptions:** Whether project assumptions appear accurate and reasonable.
- **1.1.1.2.3 IRR Attractiveness:** Whether carbon credits decisively impacted a project's internal rate of return.

The overall score for 1.1.1.2 IRR Analysis is determined by weighting 1.1.1.2.1, 1.1.1.2.2 and 1.1.1.2.3 by 20%, 40% and 40% respectively.

1.1.1.2.1 Transparency

Transparency relates to whether the project is transparent in its approach to determining financial additionality.

Rationale	Projects that do not provide transparent information regarding their financial additionality prevent a detailed validation and assessment of a project's assumptions and approaches. It is not possible to be as confident in the project's additionality without sufficient transparency.					
Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑					
Scoring Definition	Each project is scored on a 1-5 scale, where 1 indicates that the project provided no supporting evidence for its financial additionality and 5 indicates that the project disclosed key assumptions behind its approach.					
Scoring Approach	MSCI ESG Research reviews project documentation to understand the type of financial additionality approach used and extract information on seven key input assumptions: pre-credit IRR, post-credit IRR, IRR benchmark, assumed carbon credit price, energy					

tariff price, total investment cost ('CapEx') and annual operating and maintenance costs ('O&M).

The type of financial additionality approach is then scored from 1 to 5 based on the rigour and comprehensiveness of the project's approach:

- 1 = No financial additionality disclosed
- 3 = Investment analysis only
- 4 = IRR analysis only
- 4.5 = IRR and sensitivity analysis
- 5 = IRR and sensitivity analysis, supported by disclosure of the WACC (weighted average cost of capital)

Transparency of key assumptions is then scored from 1 to 5 based on how many of the seven key assumptions the project disclosed.

- 1 = No assumptions disclosed
- 2 = Pre-credit IRR and IRR Benchmark only
- 3 = Pre-credit IRR and IRR Benchmark with evidence
- 4 = Pre-credit IRR, IRR Benchmark, CapEx and O&M costs
- 5 = Pre-credit IRR, Post-credit IRR, IRR Benchmark, CapEx, O&M, energy tariff and assumed carbon credit price

The total score for 1.1.1.2.1 Transparency was then determined through an equal weighting of both of these sub-components.

1.1.1.2.2 Accuracy of Assumptions

Accuracy of assumptions relates to whether the project's key financial assumptions appear appropriate and reasonable given the project's characteristics.

Rationale	Projects that use assumptions that appear higher than benchmark figures within their financial additional analysis may over-state their financial additionality.

Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑				☑	

Scoring Definition	Each project is scored on a 1-5 scale, where 1 indicates that there is a very high risk that project's key assumptions are significantly overestimated compared to benchmark values, and 5 indicates that there is a very low risk that project's key assumptions are inaccurate.
Scoring Approach	MSCI ESG Research extracts the values for key financial assumptions from project documentation and compares these assumptions against a combination of averages for similar projects (i.e., projects of the same subtype located in the same country that started at a similar time) and third-party country-specific benchmarks. The reasonableness of five key assumptions are assessed: IRR benchmark, total investment cost, annual operating and maintenance costs (O&M), energy tariff price

and carbon credit price. The reasonableness of each of these five key assumptions is scored on a 1 to 5 scale based on a comparison of a project's assumption against benchmark values.

The overall score for 1.1.1.2.2 Accuracy of Assumptions is then determined by weighting the score of the five assumptions in the following way: 60% weighting for IRR benchmark; 10% for each of total investment cost, O&M, energy tariff price and carbon credit price.

1.1.1.2.3 IRR Attractiveness

IRR Attractiveness refers to the likelihood that carbon credits played a decisive role in impacting the financial attractiveness of a project, as measured by a project's IRR.

Rationale	Carbon credits should incentivize actors to implement mitigation activities that would not otherwise have been financially attractive without those revenues. Ideally carbon credits will make a mitigation activity that would otherwise have been financially unattractive into a financially viable one. Assessing a project's internal rate of return is therefore an important indicator of the likelihood of additionality.

Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑				☑	

Scoring Definition	Each project is scored on a 1-5 scale where 1 indicates low likelihood that carbon credits decisively changed the IRR attractiveness of the project, and 5 indicates very high likelihood that carbon credits decisively changed the IRR attractiveness of the project.
Scoring Approach	Data on the three components of IRR are extracted (see below) from project documentation and analyzed against an independent benchmark value. Each of these components is then categorized into high, medium, or low bands. High scores on these indicators suggest higher financial additionality. There are three components of IRR analysis: **Financial attractiveness without carbon credits (Pre-credit IRR as a % of the IRR Benchmark).** Projects that are not financially attractive without carbon credits are unlikely to have gone ahead without them. A project's internal rate of return without carbon credits is compared to a benchmark rate of return relevant to that project type and country. If the pre-credit IRR is significantly lower than the required benchmark, then this indicates that the project would not otherwise have taken place. **Financial attractiveness with carbon credits (Post-credit IRR as a % of the IRR Benchmark).** Carbon credits should make mitigation activities that would have been unattractive into financially viable projects. Comparing a project's post-credit IRR (IRR with carbon credit revenues) to the required benchmark indicates whether a project is financially viable with carbon credits. The likelihood that the activity is additional is high if the post-credit IRR clearly exceeds the benchmark. **Change in financial attractiveness due to carbon credits (Absolute Difference between Post-Credit and Pre-Credit IRR).** If the proceeds from carbon credits

materially change the financial attractiveness of an activity, it is more likely that the carbon credits have played a decisive role. Alternatively, if carbon credits only mildly impact the financial attractiveness of a project, then higher uncertainty exists. A project's post-credit IRR is compared to the pre-credit IRR to determine the magnitude of the impact that carbon credits likely have on the project's profitability.

The overall IRR score for each project is then determined based on the scores for each relevant indicator. A high score is needed on each indicator to achieve a high overall score. The overall score is determined on a 1 to 5 scale:

- 5 = 'High' score achieved on all three indicators
- 4 = 'High' score on two indicators, and 'Medium' score on one indicator
- 3 = 'Medium' score on at least two indicators, with no 'Low' scores
- 2 = 'Low' score on at least one of the indicators
- 1 = 'Low' score on at least two of the indicators

1.1.1.3 Prior Consideration

Projects that can demonstrate that carbon credits were considered prior to their decision to start, provide more evidence that credits acted as an important incentive in starting mitigation activities.

Two key sub-criteria are used to evaluate this:

- **1.1.1.3.1 Evidence of Consideration:** Whether any evidence exists that credits were considered prior to the project start.
- **1.1.1.3.2 Registration Gap:** Whether a significant gap exists between the start of the project's activities and the initial registration and issuance date.

The overall score for 1.1.3 Prior Consideration is determined by an equal weighting of these sub-criteria.

1.1.1.3.1 Evidence of Consideration

Evidence of consideration refers to whether the project has specific evidence that demonstrates that the use of carbon credits was considered prior to the project start date.

Rationale	Evidence that carbon credits were considered prior to the project start date indicates that credits played an important role in this decision process. On the other hand, if no evidence of prior consideration exists, there is a higher likelihood that the decision to go ahead with the project occurred without any expectation of carbon credits.					
Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑					
Scoring Definition	Each project is scored on a 1-5 scale, where 1 indicates that no evidence has been made available, and 5 indicates that good quality evidence of prior consideration exists.					

Scoring Approach	MSCI ESG Research identifies whether any evidence exists that carbon credits were considered prior to the project start date. This evidence may include a letter or notification of intent sent to a registry (such as CDM or Verra), the employment of a carbon credit consultant, or board meeting minutes indicating that carbon credits were analyzed. The date of any evidence of carbon credit consideration is then compared to the project start date to determine whether credits were considered prior to the start date or not.

1.1.1.3.2 Registration Gap

Registration gap evaluates the gap between the start date of the project activity and the project being registered with a crediting standard and able to issue credits.

Rationale	A longer gap between the start of project activity and the project's registration suggests the project was able to maintain, at least to an extent, activities, and investment even in the absence of carbon credits. If credits were required for the project to go ahead, then a project would be expected to ensure this time taken in the registration process is minimized.

Key Sources

Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
☑					☑

Scoring Definition	Each project is scored on a 1-5 scale, where 1 indicates a very significant gap between the initial decision date and the registration date and 5 indicates a short or inconsequential gap.
Scoring Approach	MSCI ESG Research assesses the project's start date, the type of start date used and the project's registration date. Firstly, the type of start date used by the project is assessed. Project start dates are meant to represent the actual start of the mitigation activity and initial decision date, but landfill gas methodologies do allow some flexibility in the type of start date used. Start dates that represent closer indicators of the initial decision date are scored higher, while start dates that clearly occurred after the initial decision date are scored lower. For example, the type of start date is scored on a 1 to 5 scale as follows: - 5 = Investment decision date - 4 = Construction contract signed or project equipment contract signed - 3 = Construction start date or first commissioning date - 1 = Plant fully operational or project registered with a registry Secondly, the project stated start date is compared to the registration date. This gap is then categorized into a 1 to 5 scale: - 5 = 2 years or fewer - 4 = 3-4 years - 3 = 5 to 6 years

- 2 = 7 to 9 years
- 1 = 10 years or higher

Each of these scores for the type of start date and gap between project start date and registration date are then equally weighted to reach an overall score for Registration Gap.

1.2 Common Practice

If a technology or mitigation activity was already common practice within a region at the time a project started, then it suggests that the project's activities could have been implemented without carbon credits. Two main sub-criteria within common practice are considered:

- **1.2.1 Third-Party Common Practice:** The extent to which that project technology was already common practice in that country's energy mix.
- **1.2.2 Evidenced Common Practice:** Whether the project provides evidence that the project was not common practice in that region.

The overall score for 1.2 Common Practice is calculated by weighting 1.2.1 Market Penetration by 75% and 1.2.2 Evidenced Common Practice by 25%.

1.2.1 Third-Party Common Practice

Third-Party Common Practice relates to how prevalent that technology or practice was within a region at the time of a project's inception.

Rationale	If a technology or practice was already common within a particular area, then this indicates that that type of project had high likelihood of happening even without the introduction of carbon credits; i.e., there is a high probability that the project's credits are not additional. Market penetration assessments evaluate the extent to which a type of mitigation activity or technology was already implemented in the relevant area. Low market penetration of a particular technology indicates higher additionality.

Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
					☑	

Scoring Definition	Projects are scored on a 5-point scale from 1 to 5, where 1 indicates that the mitigation activity technology was common in that region and 5 indicates that it had very low market penetration.
Scoring Approach	The availability of accurate data on landfill gas practices varies by region. Therefore, three different approaches are used to assess common practice to ensure at least one measure is available for each individual project. The three approaches are: 1. **Landfill Site Penetration:** Evaluating the proportion of landfill sites in that region that are already implementing the project's activity using carbon credits. 2. **Proportion of MSW:** Evaluating the proportion of municipal solid waste generated in a region that is stored in landfill sites that are voluntary carbon market projects, as a proxy for landfill gas site penetration.

3. **MSW Electricity Generation:** Evaluating the proportion of electricity generation within a region that comes from landfill gas sites.

Data is used from a range of sources to analyze each of these three factors by region and by year. For the United States, state-level data from the Landfill Methane Outreach Program (LMOP) database is used on the practices of every landfill site to determine landfill site penetration. For MSW electricity generation, data from the International Renewable Energy Agency (IRENA) is used on the amount of electricity generation from landfill gas sites in each country in the year that the landfill gas project started.

Scores of 1 to 5 are then assigned to each project based on the market penetration bandings. The higher the market penetration of a specific technology, the lower the likelihood of additionality.

For example, for landfill site penetration, the following scoring table is used based on the proportion of landfills in the region currently performing the activity, and the proportion of those that already utilize carbon credits:

		% of Landfills Performing Activity that are in VCM				
		Very Low (<20%)	Low (20-30%)	Medium (30-40%)	High (40-50%)	Very High (50%+)
% of Landfills in Region Performing Activity	Very Low (<10%)	4	4.25	4.5	4.75	5
	Low (10-30%)	3.5	3.75	4	4.25	4.5
	Medium (30-50%)	3	3	3	3.5	4
	High (50-70%)	2	2.5	2.5	3	3.5
	Very High (70%+)	1	1.5	2	2.5	3

1.2.2 Evidenced Common Practice

Evidenced common practice refers to whether the project provides an evidenced justification that its mitigation activity is not common practice within that region.

Rationale	By providing an effective justification and evaluation that the specific mitigation activity is not common practice in that specific region, projects can demonstrate that the nuances of their activities are unique and uncommon.

Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑					

Scoring Definition	Each project is scored on a 1-5 scale, where 1 indicates no common practice analysis was conducted and 5 indicates a rigorous common practice was conducted that revealed no similar projects exist in that region.

Scoring Approach	MSCI ESG Research reviews project documentation to assess what type of common practice analysis is performed and, if any, how many similar projects were identified. The type of common practice analysis conducted is then scored on a scale of 1 to 5, where 1 indicates no common practice was performed, 2 indicates common practice analysis was a simple attestation or statement, 4 indicates that country analysis was conducted and 5 indicates that a country and industry analysis was performed. The number of similar projects identified is scored from 1 to 5, where 1 indicates over 1,000 similar projects were identified and 5 indicates no similar projects were identified. The overall score for this sub-criterion is then determined by weighting the type of common practice analysis 30% and the number of similar projects score 70%.

1.3 Legal Considerations

Legal Considerations assesses the extent to which legal regulations or policies exist that incentivize the project to go ahead even without carbon credits.

Rationale	Governments may seek to reduce the emissions coming from landfill sites as part of wider environmental strategies. Particularly given that many landfill sites are government-owned or -managed, the effect of government policies can be particularly important for landfill gas sites. In their extreme, policies may mandate the implementation of certain activities, therefore making any carbon credit claims un-additional (assuming appropriate policy enforcement). Other policies may exist that do not mandate an activity, but still incentivize it, and therefore may influence a project to go ahead even without carbon credits.

Key Sources

Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
☑			☑	☑	

Scoring Definition	Each project is scored on a 1-5 scale, where 1 indicates that the project's activities are mandated by legal regulations, and 5 indicates that no legal policies exist that incentivize the project to go ahead.
Scoring Approach	MSCI ESG Research conducts anassessment of each country's regulations and policies regarding landfill gas methane generation and electricity utilization. In particular, the analysis focuses on identifying the presence of six main types of policy: i) direct requirements for all landfill sites; ii) direct requirements for large landfill sites; iii) feed-in tariffs for electricity generated from landfill gas projects; iv) tax credits; v) grants or funding support for landfill gas projects; vi) technical assistance for the implementation of landfill gas projects. These types are categorized based on their significance to projects, with i) all landfill mandates categorized as High; ii) large landfill requirements, iii) feed-in tariffs, iv) tax credits, v) grants or funding support categorized as Medium, and vi) technical assistance categorized as Low.

Where direct requirements exist for large landfill sites within a region, the relevance of these to each individual project is then evaluated based on how close its site characteristics are to being covered by the regulation. For example, some regulations may exist that only impact very large landfill sites. Projects that are close to being covered by these large landfill site regulations therefore receive a lower score than those sites that are significantly below the regulatory thresholds.

Projects are then scored on a scale of 1 to 5 based on deducting 4 points for the presence of any High factors, 0.75 points for each Medium factor, and 0.5 points for each Low factor from the maximum score of 5. In this way, projects located in areas covered by direct mandates receive a 1, projects located in areas where the reduction in landfill methane is supported by tax credits and feed-in tariffs receive a score of 3.5, and projects located in areas where only large landfills are mandated to reduce their methane emissions receive a score of 4.5.

1.5 Baseline Reasonableness

Landfill gas projects must appropriately account for the amount of methane that would have been destroyed in the baseline scenario without their activities.

Two main topics are considered:

- **1.5.1 Baseline Scenario Appropriateness:** Whether a project's baseline scenario is appropriate given the site history and legal considerations.
- **1.5.2 Baseline Methane Reasonableness:** Whether the amount of methane destroyed in the baseline scenario is appropriate given the site history and legal considerations.

The overall score for 1.5 Baseline Reasonableness is then determined through an equal weighting of these two factors.

1.5.1 Baseline Scenario Appropriateness

Baseline Scenario Appropriateness refers to whether the project's baseline scenario is appropriate given the site history and legal considerations.

Rationale	Projects that have clearly considered an appropriate baseline scenario will ensure a lower probability of overestimating the baseline emissions.
Key Sources	Project Documentation ☑ | Geospatial | Project Methodology Documentation | Academic Literature | Third-party Data ☑ | MSCI Carbon Markets
Scoring Definition	Each project is scored on a 1-5 scale, where 1 indicates that its baseline scenario is highly unlikely and 5 indicates that the baseline scenario is highly appropriate.
Scoring Approach	In determining the baseline scenario, landfill gas projects must assess whether any methane would have been destroyed even without carbon credits, and, if so, what proportion would have been destroyed. Registries have different mechanisms for projects to determine their baseline scenario, but all mechanisms rely on evaluating two factors: i) whether an existing collection and destruction system was already in place at the project's site; ii) whether any legal

requirements exist within that region. Both Verra and CAR create four different baseline scenarios for projects based on the presence and absence of these two factors.

MSCI ESG Research reviews project documentation to determine which baseline scenario the developer considered. This is then independently validated against whether a previous collection system existed, and whether legal requirements exist.

Projects are then scored on a scale of 1 to 5 based on the following:

		Baseline Scenario			
		No Destruction	Destruction from Existing System	Destruction due to Legal Requirements	Destruction due to Both
Project Type	No previous system or legal requirements	5	5	5	5
	Previous collection system	4	5	4	5
	Previous destruction system	3	5	4	5
	Legal requirements	2	4	5	5
	Both destruction system and legal requirements exist	1	3	3	5

1.5.2 Baseline Methane Reasonableness

Baseline Methane Reasonableness relates to whether the amount of methane destroyed in the baseline scenario is appropriate given the site history and legal considerations.

Rationale	Projects that have appropriately estimated the amount of methane that would have been destroyed in the baseline scenario will ensure a lower probability of overestimating the baseline emissions.

Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑					

Scoring Definition	Each project is scored on a 1-5 scale, where 1 indicates that the project appears to have significantly underestimated its baseline amount of methane destroyed, and 5 indicates that the baseline amount of methane destroyed appears appropriate.
Scoring Approach	MSCI ESG Research review project documentation to determine what proportion of total emission reductions the project assumes would have been achieved in the baseline scenario, for example, through an existing destruction device. MSCI ESG Research also assess the project's justification for this assumption.

Projects are then scored on a scale of 1 to 5 based on two factors: i) the strength of evidence provided to justify the amount of baseline destruction; ii) the reasonableness of this assumption when benchmarked against projects with similar characteristics.

		Strength of Evidence				
		None Provided	Very Low (Attestations)	Low (e.g., Default Values)	Medium (e.g., Modelled)	High (e.g., Historic Records)
Difference vs Benchmark	Significantly Below (20% or more lower)	1	1.5	2	2.5	3
	Below (5-20% lower)	1.5	2	2.5	3	3.5
	In-line (within 5%)	2	2.5	3	3.5	4
	Above (5-20% higher)	2.5	3	3.5	4	4.5
	Significantly Above (20% or more higher)	3	3.5	4	4.5	5

Criterion 2 – Quantification

Quantification refers to the likelihood that the emissions reduction or removals claimed by the project are accurate, assuming the baseline scenario is correct. It includes both emissions reductions or removals within a project area, and those that have occurred outside the project area, known as leakage.

Along with the strength of baseline assessment, Quantification is a key determinant of the risks of over-crediting: whether the number of credits issued by the project is equal to the CO_2e actually reduced/removed. In theory, all carbon credits are worth the equivalent of 1 tonne of CO_2e reduced or removed. A low carbon quantification score means that the emissions reductions or removals delivered by the credit is likely to be less than 1 tonne. In this case, buyers should be cautious in using one credit to offset 1 tonne of their own CO_2e emissions, as they are unlikely to be equivalent.

The quantification of a landfill gas project's emission reduction is primarily split into two components: i) the emission reductions from the avoided methane release; ii) the emission reductions from the displacement of electricity. For flaring projects, only the first of these components is relevant.

- **i) Avoided Methane:** Estimating the emission reductions from avoided methane release requires a complex calculation that accounts for the methane generated, the proportion of methane that would not have been oxidized (determined by the oxidation factor) and the global warming potential of methane.
- **ii) Displaced Electricity:** To evaluate the accuracy and conservativeness of a project's quantification of the emission reductions from the displacement of electricity, the approach focuses on estimating the emissions impact from the electricity that was displaced. This comes from two main assumptions: first, the amount of electricity generated; second, the emissions factor of each unit of displaced electricity.

Figure 7 illustrates the sub-criteria through which MSCI ESG Research assesses the quantification of the emissions reductions achieved by landfill gas projects, and the overall MSCI Carbon Project Ratings methodology sub-criteria that they correspond to. The detailed sub-criteria are described in Figure 8.

Figure 7: Landfill Gas quantification assessment approach

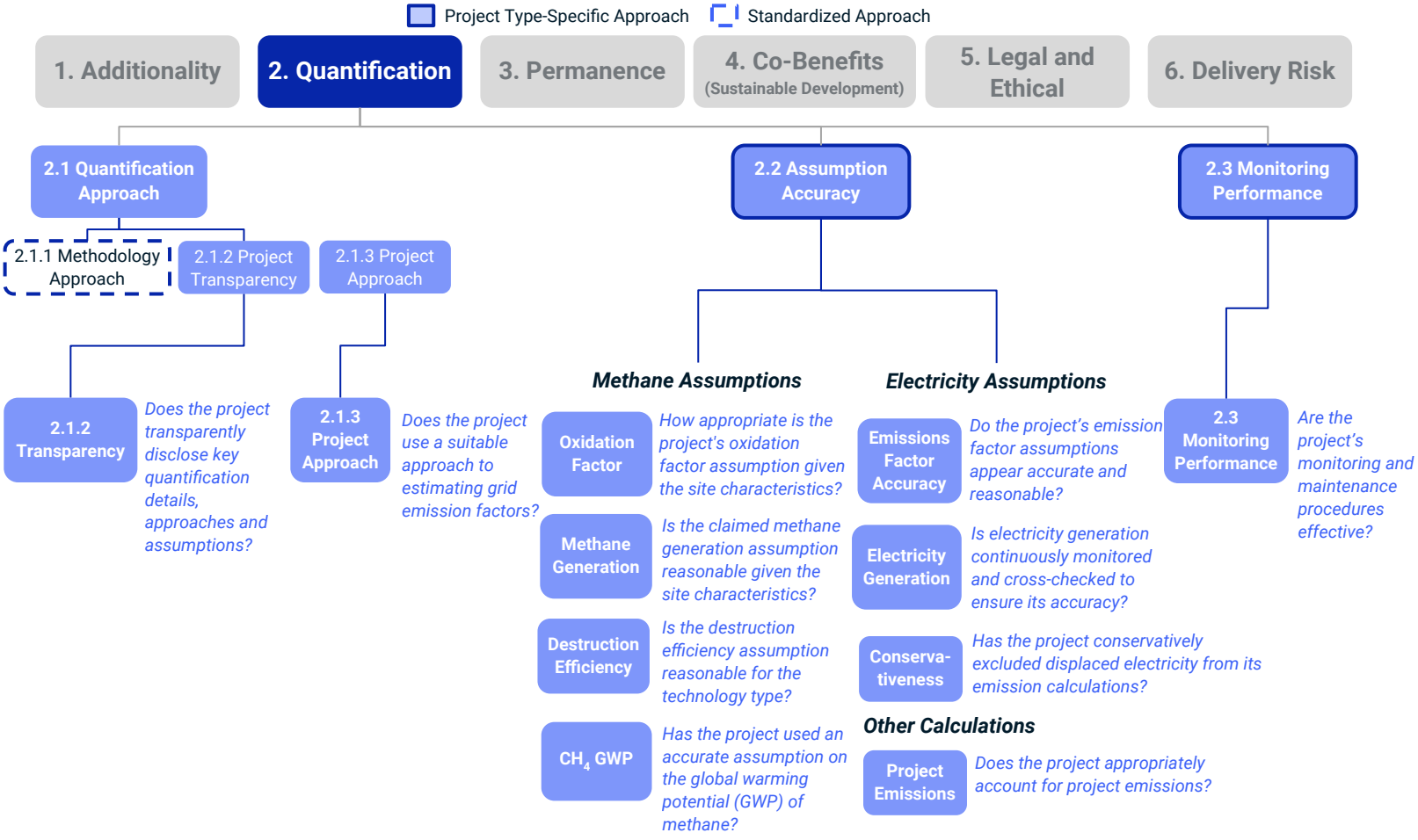


Figure 8: MSCI ESG Research Quantification integrity assessment framework

Sub-criteria	Metrics	Rationale	REDD+	Renewables	ARR	Cookstoves	Biochar	Landfill Gas	Safe Water	IFM	Waste Mgmt.	Blue Carbon
2.1 Quantification Approach	2.1.1 Methodology Approach	Through setting the assumptions that projects must make, and the sources that can be used to estimate them, crediting program methodologies can play an important role in reducing or even increasing the level of quantification risk.	✓ *Standardized approach*									
	2.1.2 Project Transparency	Transparent documentation and detail on a project's assumptions are required to make an objective assessment of its approach to carbon quantification.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	2.1.3 Project Approach	Two projects with the same methodology may carry different quantification risks depending on the approach that each uses.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2.2 Assumption Accuracy	Quantification Accuracy	Each project type has a set of key assumptions that determine the accuracy of their carbon quantification. Evaluating the reliability and accuracy of these key assumptions shows whether a project has over- or understated their emissions reductions or removals.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2.3 Monitoring Performance	2.3.1 Monitoring Plan	Projects that have effective processes in place to regularly monitor and measure key quantification inputs and assumptions are more likely to accurately estimate and update their emissions impact.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	2.3.2 VVB Analysis	Projects that use a mix of well-regarded verification and validation bodies (VVBs) will improve the likelihood that key quantification details are accurately checked and validated.	✓ *Standardized approach*									
2.4 Red and Green Flags	News scanning	Review of academic papers, industry sources and the news for Red or Green Flags relating to project's quantification.	✓ *Standardized approach*									

2.1.2 Project Transparency

Transparency relates to whether the project transparently discloses key quantification assumptions.

Rationale	It is more difficult to gain confidence in the accuracy of a project's quantification if it is not transparent with either its quantification approach or assumptions. Projects should transparently disclose these key details of information.
Key Sources	Project Documentation; Geospatial; Project Methodology Documentation; Academic Literature; Third-party Data; MSCI Carbon Markets

	☑
Scoring Definition	Each project is scored on a 1-5 scale, where 1 indicates that the project provides no key quantification details and 5 indicates that the project provides information on all key quantification inputs.
Scoring Approach	Through a detailed review of key project documentation, MSCI ESG Research collects information on a number of key parameters regarding a project's quantification approach and assumptions. There are four types of quantification inputs that are assessed: the oxidation factor; destruction efficiency; the emission factor calculations; and electricity generation calculations. Projects are then scored on a scale of 1 to 5 based on the number of these four paramaters that are transparently disclosed. For example, projects that provide transparent information on all four topics (or all two topics for those that are flaring only) receive the maximum score of 5.

2.1.3 Project Approach

Projects that employ more accurate methods to estimate their emissions impact minimize their risk of inaccuracy. Methodologies usually allow for multiple approaches to be used to make these estimations, though some methods are more reliable than others.

In particular, MSCI ESG Research's scoring approach focuses on two factors that the project takes to estimating its emissions factor and electricity generation. As part of this, two main factors are considered:

- **2.1.3.1 Operating Margin Method:** Whether the project uses an appropriate method to calculate the operating margin emission factor given its electricity mix.
- **2.1.3.2 Electricity Generation Approach:** Whether the project uses best-practice techniques for estimating and validating the ongoing electricity generation.

Each sub-criterion is assessed independently and scored on a 3 to 5 scale. The overall score for 2.1.3 Project Approach is then calculated by giving an equal weighting to these two factors.

2.1.3.1 Operating Margin Method

Whether the project uses an appropriate method to calculate the operating margin emissions factor, given its electricity mix.

Rationale	There are several methods available to projects to estimate their operating margin (OM) emissions factor. Projects that use more appropriate methods given the electricity mix within their country will improve the accuracy and reliability of this assumption.					
Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑			☑	☑	

Scoring Definition	Each project is scored on a 3 to 5 scale, where 3 indicates that the simple OM method was used in which low-cost/must-run sources were excluded, 4 indicates that the simple adjusted OM method was used, 4.5 indicates that the average OM method was used and 5 indicates that the dispatch data method was used, in which data is based on measured grid data and no default values are allowed.
Scoring Approach	MSCI ESG Research reviews project documentation to identify which approach method it used to estimate its operating margin emissions factor. This is then complemented with insights from academic studies on the scientific representativeness of these different methods. Methods are then classified based on their scientific best-practice. In order of best-practice, the different operating margin methods can be ranked as followed from most to least best-practice: dispatch data OM, average OM, simple adjusted OM and simple OM. As simple OM still requires the usage of some national data, projects that used this method received a score of 3, meaning the sub-criterion was based on a 3 to 5 scale.

2.1.3.2 Electricity Generation Approach

Electricity Generation Approach relates to whether a project estimates its electricity generation from the power plant on an ongoing basis using measured and monitored grid data.

Rationale	Projects that use metered grid data to estimate and monitor the electricity generated by the power plant increase the certainty and accuracy of this estimate.					
Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑					
Scoring Definition	Each project is scored on a 4 to 5 scale, where 4 indicates that no information on the electricity generation approach is provided, and 5 indicates that metered grid data is used.					
Scoring Approach	MSCI ESG Research conducts a detailed review of project documentation to understand how each project estimates and monitors its electricity generation. Projects are then categorized on a scale of 4 to 5 based on their approach. Given that all power plant projects will monitor electricity generation through multiple methods, the lowest score assigned to this sub-criterion is 4, reflecting the relative low levels of uncertainty here. Projects that used metered grid data as part of these calculations received a score of 5.					

2.2 Assumption Accuracy

Quantification of landfill gas projects is estimated based on two main components: the amount of methane avoided and the emissions impact from the electricity displaced. Other calculation steps that are not relevant to only one of these components are also considered in the evaluation.

In total, three components are considered:

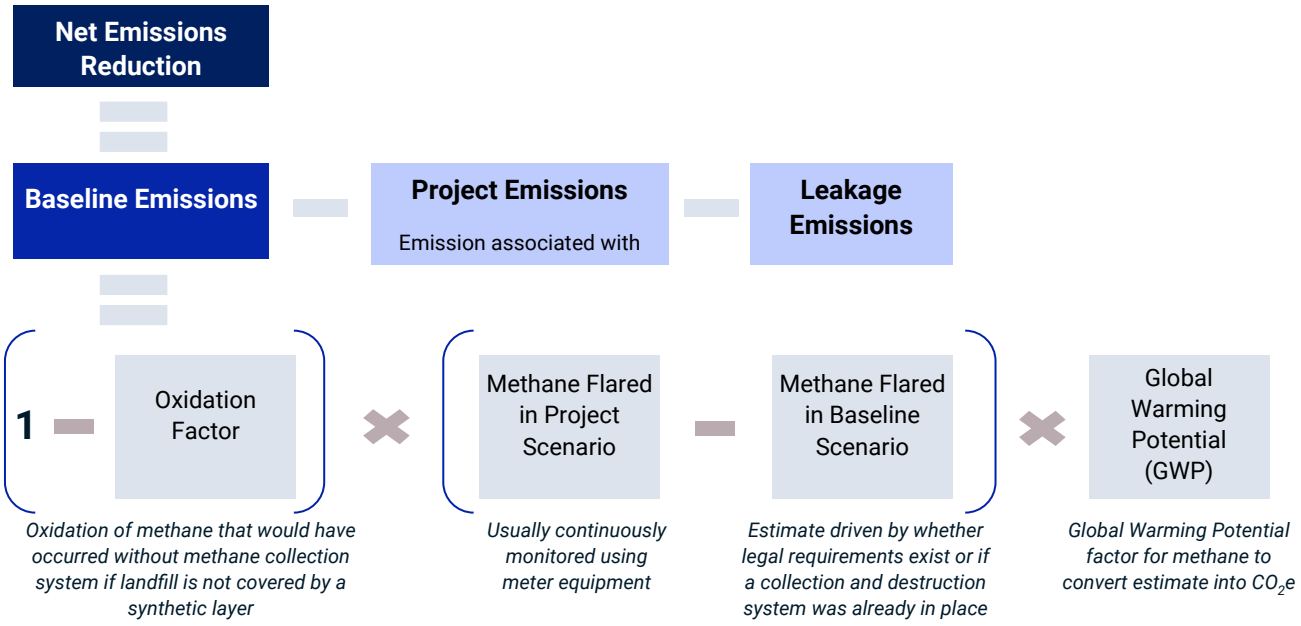
- **2.2.1 Avoided Methane:** Whether the project's estimation of the CO_2e impact of avoided methane is appropriate given the site's characteristics.
- **2.2.2 Displaced Electricity:** Whether the project's estimation of the CO_2e impact of the energy generated is appropriate.
- **2.2.3 Other Calculations:** Whether the project makes any other conservative and appropriate deductions.

Each sub-criterion is assessed independently and scored on a 1 to 5 scale. The overall score for 2.2 Accuracy of Assumptions is then calculated by weighting 2.2.1 Avoided Methane at 40%, 2.2.2 Displaced Electricity at 40% and 2.2.3 Other Calculations at 20%. For 'flaring only' projects, 2.2.1 Avoided Methane is weighted at 75% and 2.2.3 Other Calculations at 25%.

2.2.1 Avoided Methane

The quantification of the emission reduction impact from avoiding the release of methane into the atmosphere is calculated using four primary inputs as illustrated in **Figure 9.**

Figure 9: Methane Avoidance Quantification Equation



Therefore, in total, four components are considered:

- **2.2.1.1 Oxidation Factor:** Whether the project's oxidation factor assumption appears reasonable given the site characteristics.
- **2.2.1.2 Methane Generation:** Whether the project's methane generation estimation appears reasonable given the site characteristics.
- **2.2.1.3 Destruction Efficiency:** Whether the project's estimation of the destruction efficiency of the project equipment is reasonable given the technology type.
- **2.2.1.4 CH_4 GWP:** Whether the project uses an accurate assumption on the global warming potential of methane.

Each sub-criterion is assessed independently on a 1 to 5 scale. The overall score is then based on weighting 2.2.1.1 Oxidation Factor at 40%, 2.2.1.2 Methane Generation at 15%, 2.2.1.3 Destruction

Efficiency at 20% and 2.2.1.4 CH_4 GWP at 25%. These weightings reflect the relative significance of each component in contributing to over/underestimations.

2.2.1.1 Oxidation Factor

Oxidation Factor refers to whether the project's oxidation factor assumption appears reasonable given the site characteristics.

Rationale	Methane generated in a landfill site's interior passes through a topsoil layer before being released into the atmosphere. For landfills not covered by a synthetic layer, as methane passes through the topsoil layer, the methane will be partly oxidized to carbon dioxide by microorganisms. The avoided methane impact therefore depends on the amount of methane generated and on how much would have been oxidized in the topsoil. Projects that underestimate the amount of oxidation that would have occurred will overestimate the avoided methane compared to the baseline scenario.

Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑	☑		☑	☑	

Scoring Definition	Each project is scored on a 1 to 5 scale, where 1 indicates that a project's emission factor appears between 75% and 100% higher than the modelled value, and 5 indicates that a project's oxidation factor is within 5% of the modelled value.
Scoring Approach	Oxidation factors vary considerably across landfills. The rate is driven by numerous factors, such as the landfill type; the type, thickness, moisture, and organic content of the soil; climatic conditions such as temperature; and the methane flux rate, which in turn is driven by the age of the landfill and type of waste. Therefore, estimating the appropriate oxidation factor for an individual landfill site requires complex modelling of these drivers. The impact of these key drivers on the oxidation rate is summarized below: - *Type of Landfill:* Closed landfills can result in oxidation rates 3-11% higher than active or open landfills. - *Soil Type:* The type of soil impacts the oxygen levels and concentration; coarse sand can result in oxidation rates 20% higher than clay soil types. - *Soil Organic Content:* Higher organic content soils generally result in higher oxidation rates. - *Soil Moisture:* Both extremely high (>35%) and extremely low moisture contents (<10%) result in lower oxidation rates. - *Soil Temperature:* Higher oxidation rates are reported at locations where the soil temperature is between 20°C and 35°C. Geospatial inputs are leveraged for each of the key drivers of a project's oxidation for each specific landfill gas site. These inputs are then processed through an internally built oxidation factor model that determines an expected range of oxidation factors given the relevant inputs for each individual site. This modelled oxidation factor is then compared to the oxidation factor assumed by the project, which is collected through a detailed evaluation of project documentation.

Projects are then categorized on a scale of 1 to 5 based on the similarity of their assumption to the modelled oxidation factor, as follows:

- 1 = Project assumption 50%+ higher than the modelled factor
- 2 = Project assumption 30-50%+ higher than the modelled factor
- 3 = Project assumption 20-30%+ higher than the modelled factor
- 4 = Project assumption 5-20%+ higher than the modelled factor
- 5 = Project assumption within 5% of the modelled factor

2.2.1.2 Methane Generation

Methane Generation refers to whether the project's methane generation estimation appears reasonable given the site characteristics.

Rationale	Methane emissions from landfill sites come from landfill gas generated by the decomposition of waste in the landfill. The amount of methane generated by a landfill site may not be easy for a project to measure and is driven by a number of other factors. Projects without monitored estimates of the methane generated may not accurately measure this input.

Key Sources

Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
☑	☑			☑	

Scoring Definition	Each project is scored on a 1 to 5 scale, where 1 indicates that a project's methane generation assumption appears between 75% and 100% higher than the modelled value, and 5 indicates that a project's methane generation assumption is within 10% of the modelled value.
Scoring Approach	Estimating the methane producing capacity of a landfill site requires complex modelling of a multitude of factors. Seven main factors are assessed: (i) age of the landfill; (ii) fraction of degradable organic carbon in the waste; (iii) oxidation factor; (iv) waste decay rate; (v) fraction of methane in the landfill gas (LFG); (vi) model correction factor; and (vii) methane correction factor. Through the development of a methane estimation model based on these inputs, the reasonableness of a project's methane generation assumptions is then evaluated. A combination of geospatial inputs and third-party data is leveraged for each of the key drivers of a project's methane generation to identify the most appropriate input given the specific site location of the landfill project. These inputs are then combined within a methane generation model to determine an expected range of methane generation for the individual site characteristics. Given that the amount of methane generated varies by age of the landfill, the expected range of methane generation is calculated in both the first year of the landfill and the year of the project start. The modelled methane generation at the project start date is then compared to the project estimate for methane generated, which is identified through an evaluation of the project's key documentation.

Projects are then categorized on a scale of 1 to 5, which reflected the similarity of the project's assumption with the modelled methane generation value:

- 1 = Project assumption 75%+ higher than the modelled factor
- 2 = Project assumption 50-75%+ higher than the modelled factor
- 3 = Project assumption 25-50%+ higher than the modelled factor
- 4 = Project assumption 10-25%+ higher than the modelled factor
- 5 = Project assumption within 10% of the modelled factor

2.2.1.3 Destruction Efficiency

Destruction Efficiency refers to whether the project's estimation of the destruction efficiency of the project equipment is reasonable given the technology type.

Rationale	Methane destruction devices may not destroy 100% of the methane generated. Projects must therefore appropriately account for the efficiency of the destruction device to ensure they accurately measure the amount of methane destroyed.
Key Sources	Project Documentation ☑ | Geospatial | Project Methodology Documentation | Academic Literature | Third-party Data | MSCI Carbon Markets
Scoring Definition	Each project is scored on a 4 to 5 scale, where 4 indicates that a project's destruction efficiency factor is more than 5% higher than the benchmark for the technology type, and 5 indicates that a project's destruction factor is appropriate.
Scoring Approach	Through a review of project documentation, including design documents and monitoring reports, the project's assumption on the efficiency of the device used is identified. The project assumption is then compared to the assumption of similar projects that used the same type of destruction device. For example, projects that used utility flares are benchmarked against other projects that used the same type of destruction device. Projects are then categorized on a scale of 4 to 5, which reflected whether their assumption appeared in-line with benchmark projects, as follows: - 4 = Project assumption 5%+ higher than the benchmark value - 4.5 = Project assumption 2-5%+ higher than the benchmark data - 5 = Project assumption in-line or below the benchmark value As the benchmark value for most destruction types are regularly close to 95%, the lowest score a project could receive is a 4.

2.2.1.4 CH_4 GWP

CH4 GWP refers to whether the project uses an accurate assumption on the global warming potential of methane.

Rationale	To convert the emissions impact of avoided methane into a CO_2 value, projects use an estimate of the global warming potential (GWP) of methane from the most recent

	Intergovernmental Panel on Climate Change (IPCC) assessment reports. As these values are updated regularly, the use of a low GWP figure may lead to an underestimation of the project's emission impact.

Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑				☑	

Scoring Definition	Each project is scored on a 5 to 6 scale, where 5 indicates that a project's CH_4 GWP assumption is the current IPCC value, and 6 indicates that a project's CH_4 GWP assumption is 25% or more lower than the current IPCC value.
Scoring Approach	Through a review of project documentation, including project design documents and monitoring reports, the project's assumption on the GWP of methane is identified. The project assumption is then compared to the latest CH_4 GWP value from the IPCC. Projects are then scored on a 5 to 6 scale, where 5 indicates the project uses the latest assumption from the IPCC, 5.5 indicates that the project uses a GWP factor 10% lower than the current IPCC value, and 6 indicates that the project uses a GWP factor 25% below the current IPCC value.

2.2.2 Displaced Electricity

In general, the biggest uncertainty in this quantification equation comes from a project's emissions factor calculation given that this requires an assessment of what electricity sources will be displaced and what the emissions factor of these sources are. The amount of electricity generated is usually a very reliable measure given that it comes from ex-post metered and measured data. However, projects can enhance this reliability through using multiple methods to cross-check and validate measurement accuracy.

To validate the accuracy of assumptions, these two assumptions are evaluated, but the project load factor and estimation of project and/or leakage emissions are also considered.

In total, the following four metrics are considered:

- **2.2.2.1 Emissions Factor Accuracy:** Whether the project's emissions factor assumptions appear accurate and reasonable compared to other benchmarks.
- **2.2.2.2 Electricity Measurement Accuracy:** Whether the accuracy of the project electricity measurement is cross-checked and validated on an ongoing basis using multiple methods.
- **2.2.2.3 Conservativeness:** Whether the project conservatively excludes the emissions impact from displaced electricity from its emission calculations.
- **2.2.2.4 Project Emission Accuracy:** Whether the project appropriately accounts for project emissions.

Each of the first two sub-criteria are assessed independently and scored on a 1 to 5 scale. The overall score is then calculated by giving a weighting of 50% for 2.2.2.1 Emissions Factor Accuracy and 50% for 2.2.2.2 Electricity Measurement Accuracy. If the project has conservatively excluded the emissions impact from displaced electricity, then the score of 2.2.2.3 Conservativeness is added onto the total score for 2.2 Accuracy of Assumptions.

2.2.2.1 Emissions Factor Accuracy

Emissions Factor Accuracy refers to whether the emissions factor used by the project appears appropriate and accurate when compared to relevant third-party data.[3]

Rationale	Given that utilization projects are displacing grid electricity, the emissions factor used by the project should broadly resemble the emissions factor of the grid that it is a part of. Projects that use an emissions factor significantly higher than that of the grid are likely overestimating this displacement impact.
Key Sources	Project Documentation ☑ | Geospatial | Project Methodology Documentation | Academic Literature | Third-party Data | MSCI Carbon Markets
Scoring Definition	Each project is scored on a 1 to 5 scale, where 1 indicates that a project's emissions factor appears between 75% and 100% higher than the third-party value, and 5 indicates that a project's emissions factor is within 10% of the third-party value.
Scoring Approach	Using a range of national grid data sources (such as India's Central Electricity Authority) and international databases on countries (such as that provided by IRENA), MSCI ESG Research builds up a database of the grid emissions factors across major grid systems over time. Where possible, multiple input sources are used, with an average of these sources taken. The project's combined margin emissions factor assumption is then compared to the relevant third-party grid data for the associated grid at the time that the project started. Projects are then categorized on a scale of 1 to 5, which reflected the size of the difference between the project estimate and third-party estimate: - 1 = Project assumption 75%+ higher than the third-party data - 2 = Project assumption 50-75%+ higher than the third-party data - 3 = Project assumption 25-50%+ higher than the third-party data - 4 = Project assumption 10-25%+ higher than the third-party data - 5 = Project assumption within 10% of the third-party data

2.2.2.2 Electricity Measurement

Electricity Measurement relates to whether the accuracy of the project's electricity measurement estimate is supported by cross-checks and validation.

Rationale	Projects that use multiple methods to cross-check and validate the metered data on electricity generation increase the likelihood that this data is accurately estimated.

[3] Greenhouse Gas Emissions from Energy Data Explorer – Data Tools - IEA; IRENA – International Renewable Energy Agency

Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑					

Scoring Definition

Each project is scored on a 3.5 to 5 scale, where 3.5 indicates that no information on the project measurement approach is provided, and 5 indicates the use of electricity meters with continuous or hourly monitoring that are cross-checked by multiple sources.

Scoring Approach

Through a review of project documentation, the measurement and monitoring procedures for electricity generation of each individual project is identified. In particular, the frequency of electricity generation monitoring and the usage of cross-checks to validate the metered estimates are assessed.

The amount of electricity generation may be cross-checked using invoice data or electricity sales information.

Projects are then categorized on a scale of 3.5 to 5 based on the following categorizations:

		Electricity Cross-check	
		No	Yes
Frequency of Monitoring	Not Found	3.5	4.25
	Annually	3.5	4.25
	Monthly	4	4.5
	Continuously	4.5	5

2.2.2.3 Conservativeness

Conservativeness refers to whether the project excludes the emissions impact from displaced electricity due to the project from its overall calculations of the emission reductions.

Rationale

The impact of displaced electricity can represent a significant proportion of the total emission reduction from landfill gas utilization projects. Projects that exclude this source of emission impact from their calculations can therefore significantly underestimate their overall emissions impact.

Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑					

Scoring Definition

Projects that exclude the emissions impact from displaced electricity receive 2 points, otherwise this criterion is not scored.

Scoring Approach	Through a review of methodological requirements and project documentation, MSCI ESG Research determine whether the project does generate electricity that would displace existing grid electricity, and whether the project includes this displaced electricity within its emission reduction calculations. For example, landfill gas projects under the Climate Action Reserve protocol are not allowed to claim emissions reductions from this displaced electricity. Projects that do exclude the emissions impact of displaced electricity even though they are utilization projects receive a score of 2 points.

2.2.2.4 Project Emissions Accuracy

Project Emissions Accuracy relates to whether the project appropriately accounts for project emissions.

Rationale	Landfill gas projects may create emissions during their operation through the usage of fossil fuels to operate the plant (known as project emissions), or lead to fossil fuel usage outside of the project boundary (known as leakage emissions). Though these emissions are usually relatively small, it is important that these emissions are appropriately considered and accounted for. Emissions during construction are not assessed as part of landfill gas methodologies and are not assessed in the Integrity Assessment framework for landfill gas projects.

Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑			☑		

Scoring Definition	Each project is scored on a 2 to 5 scale, where 2 indicates that the project does not account for project and/or leakage emissions despite their high relevance to that project subtype, and 5 indicates that it does appropriately account for project and/or leakage emissions.
Scoring Approach	Through a review of documentation, MSCI ESG Research assesses whether each project considered and accounted for project emissions as part of their emission reduction calculations. For project emissions, whether emissions have been accounted for within four emission source components are considered: - Combustion of fossil fuel. - Electricity consumption. - Residual emissions from flaring. - Transportation emissions associated with LFG distribution. Projects are then scored on a 1 to 5 scale based on the relevance and accounting of these emission sources for the project: - **1** = Does not account for four relevant project emission sources. - **2** = Does not account for three relevant project emission sources. - **3** = Does not account for two relevant project emission sources.

- **4** = Does not account for one relevant project emissions source.
- **5** = Includes all appropriate project emission sources.

2.3 Monitoring Performance

Effective monitoring procedures ensure that key quantification inputs are reliably updated and measured on an ongoing basis. More effective monitoring procedures will capture the project's measured data through regular site visits, while providing adequate and regular maintenance resources to ensure that it is operating reliably and consistently.

As part of this, three factors are considered:

- **2.3.1 Monitoring Frequency:** The frequency of which the project conducts monitoring procedures and site visits to ensure the effective operation of the landfill gas plant.
- **2.3.2 Maintenance and Technical Assistance:** Whether the project includes adequate maintenance and technical assistance to ensure the plant continuously operates.
- **2.3.3 Flow and Methane Monitoring:** Whether the project frequently monitors LFG flows, temperatures and methane fractions.

Each of the above sub-criteria is scored individually. The overall score is determined through an equal weighting of the relevant factors for that project type.

2.3.1 Monitoring Frequency

Monitoring Frequency relates to whether the project conducts effective monitoring procedures and site visits to ensure the effective operation of the landfill gas site.

Rationale	More frequent monitoring increases the likelihood that key inputs represent the most accurate and up-to-date estimates, and the plant will continue to operate in a consistent and reliable way going forwards.
Key Sources	Project Documentation ☑ | Geospatial | Project Methodology Documentation | Academic Literature | Third-party Data | MSCI Carbon Markets
Scoring Definition	Each project is scored on a 3 to 5 scale, where 3 indicates that no information on monitoring procedures is provided and 5 indicates that site visits are conducted on a monthly basis.
Scoring Approach	The monitoring procedures of each project are assessed, including the extent to which frequent site visits take place. Projects are then assigned one of 5 scores between 3 to 5 based on the following scale: - 3 = Monitoring frequency not provided or greater than once every 5 years - 3.5 = Monitoring frequency is once every 4 or 5 years

- 4 = Monitoring frequency is once every 2 or 3 years
- 4.5 = Monitoring frequency is annual
- 5 = Monitoring frequency is at least monthly

2.3.2 Maintenance and Technical Assistance

Maintenance and Technical Assistance relates to the extent to which the project includes adequate maintenance and technical assistance to ensure the plant continuously operates.

Rationale	Projects that more frequently provide available technical and maintenance support improve the reliability of the power plant, reducing the risk that problems arise.					
Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑					
Scoring Definition	Each project is scored on a 3 to 5 scale, where 3 indicates that no information on maintenance and technical procedures is provided and 5 indicates that frequent maintenance and technical support is provided as part of the project.					
Scoring Approach	Through a review of project documentation, MSCI ESG Research assess the maintenance and technical support procedures of each project. Projects then receive a score of either 3 or 5 based on the transparency of this information and whether plans were in place to provide maintenance and technical support as required. Projects that provided technical support on an ongoing basis receive a score of 5. Projects that did not disclose that they provided any technical support receive a score of 3.					

2.3.3 Flow and Methane Monitoring

Flow and Methane Monitoring relates to whether the project frequently monitors LFG flows, temperatures, and methane fractions.

Rationale	Projects that more frequently monitor key methane factors improve the reliability of these estimates and assumptions.					
Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑					
Scoring Definition	Each project is scored on a 1 to 5 scale, where 1 indicates that no key methane factors are monitored and 5 indicates that the project continuously monitors all key methane factors.					
Scoring Approach	Through a review of project documentation, MSCI ESG Research assess whether three key factors are monitored by the project: i) LFG flow; ii) temperature; iii) methane fraction in LFG flow.					

Projects are then scored depending on how frequently each of these three factors are monitored. Projects are scored as follows:

- 5 = All three factors are continuously monitored.
- 4 = At least two of the three factors are monitored.
- 3 = At least one of the three factors are monitored.
- 1 = None of the three factors are clearly monitored.

Criterion 4 – Co-benefits

Co-benefits reflect the sustainable development benefits (and safeguards) of a project beyond the CO_2e it saves; in other words, its "externalities." These environmental and societal externalities are typically positive but can, on occasion, be negative.

Carbon projects have the potential to reduce/remove CO_2e, and simultaneously have a broader positive societal impact via issues such as development, adaptation and biodiversity.

In general, the sustainable and environmental positive impacts of landfill gas projects are limited to their economic effects. Through their construction and then operation, landfill gas projects can create employment and training opportunities within local communities, supporting the development of the local economy.

Some landfill gas projects risk having some negative environmental consequences due to their impact on local fauna and flora. It is important that these projects, to the greatest extent possible, properly mitigate these risks.

MSCI ESG Research's approach to co-benefit assessment builds on the United Nations' Sustainable Development Goals (SDG) framework. The assessment focuses on understanding both the SDG significance of a project and the extent to which it provides evidence of these outcomes being achieved through effective monitoring.

Figure 10 illustrates the sub-criteria through which MSCI ESG Research assesses the co-benefits of landfill gas projects, and the overall MSCI Carbon Project Ratings methodology sub-criteria that they correspond to. The detailed sub-criteria are described in Figure 11.

Figure 10: Co-benefits integrity assessment approach

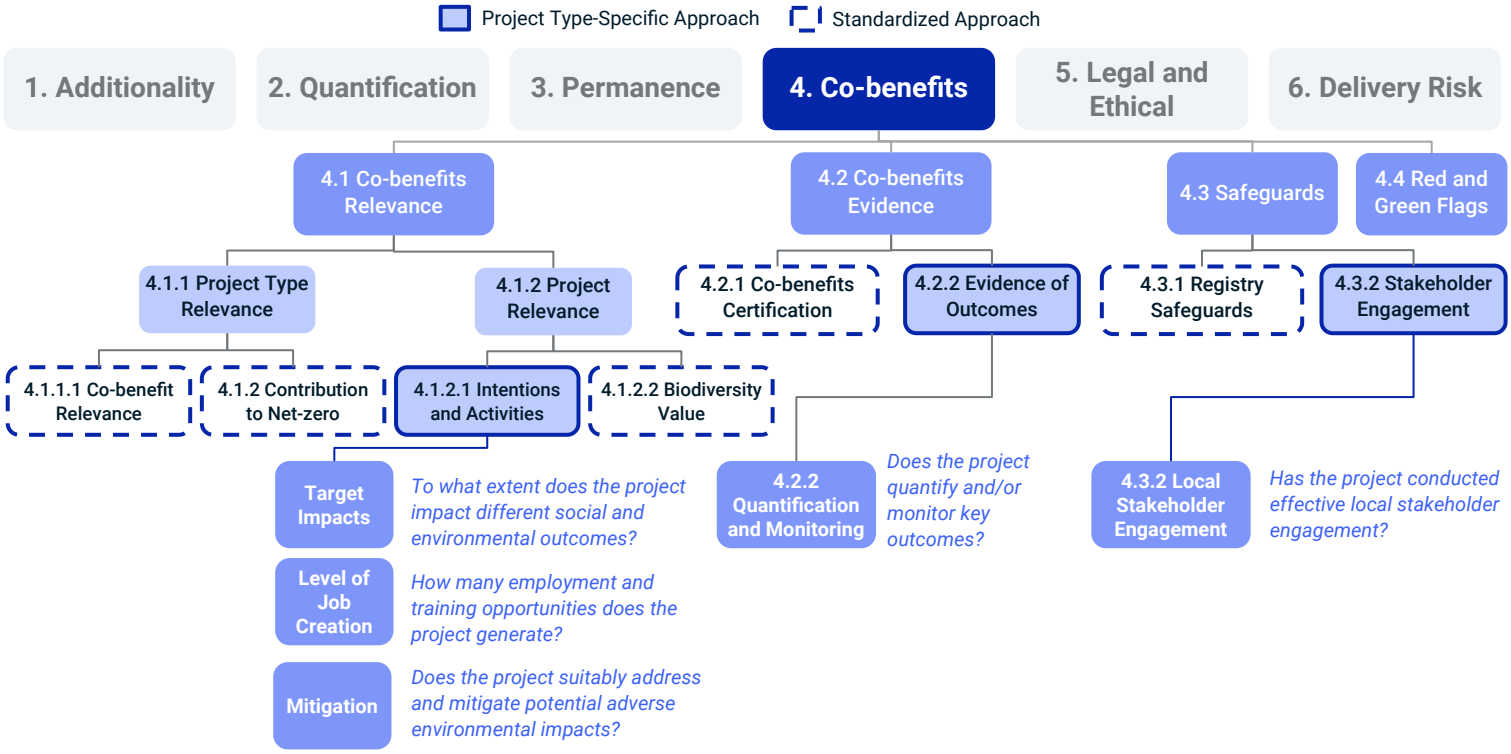


Figure 11: MSCI ESG Research Co-benefits integrity assessment framework

Sub-criteria		Metrics	Rationale	REDD+	Renewables	ARR	Cookstoves	Biochar	Landfill Gas	Safe Water	IFM	Waste Mgmt.	Blue Carbon
4.1 Co-benefits Relevance	4.1.1 Project Type Relevance	4.1.1.1 Relevance to Project Type	Different project types have an inherently different impact on each sustainable development impact.	✓ *Standardized approach*									
		4.1.1.2 Contribution to Net-zero	Some project types create "carbon lock-ins" of technologies or practices that are not compatible with a net-zero economy.	✓ *Standardized approach*									
	4.1.2 Project Relevance	4.1.2.1 Project Intentions to Activities	The specific design and implementation of a project's activities are critical drivers for whether a project generates positive sustainable development impact.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		4.1.2.2 Biodiversity Value	Nature-based projects that enhance or protect areas of rich biodiversity have greater environmental value.	✓		✓					✓		✓

4.2 Co-benefits Evidence	**4.2.1 Certification**	Achieving certification involves more stringent project verification. This improves the likelihood that a project's co-benefits have been realized.	✓ *Standardized approach*								
	4.2.2 Evidence of Outcomes	Projects can increase the confidence that co-benefits are attributed to their actions through measuring, monitoring, and quantifying the outcome.	✓		✓	✓	✓		✓	✓		✓
4.3 Safeguards	**4.3.1 Registry Safeguards**	More effective environmental and social safeguards required by registries reduce the likelihood of projects causing harm.	✓ *Standardized approach*								
	4.3.2 Local Stakeholder Engagement	Projects that successfully engage with local stakeholders reduce the likelihood of any negative impacts occurring.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4.4 Red and Green Flags	**News scanning**	Review of academic papers, industry sources and the news for Red or Green Flags relating to project's co-benefits.	✓ *Standardized approach*								

4.1.2.1 Project Intentions to Activities

The specifics of a project's design and implementation play an important role in determining both the relevance and significance of each sustainable development impact of the project. Projects that target certain impacts through additional activities increase the positive co-benefits that they create.

There are three metrics used to evaluate this sub-criterion:

- **4.1.2.1.1 Target Impacts:** The social and environmental benefits that the project explicitly identifies and targets through its activities.
- **4.1.2.1.2 Level of Job Creation:** The number of temporary and permanent jobs that the project creates as a proportion of their credit generation.
- **4.1.2.1.3 Mitigation:** Whether the project appropriately mitigates for the risk of any negative environmental consequences.

4.1.2.1.1 Target Impacts and 4.1.2.1.2 Level of Job Creation are both scored on a 1 to 5 scale, and then weighted 80% and 20% respectively to create a combined score. The score for 4.1.2.1.3 Mitigation (scored on range -1 to 0) is then added to this combined score.

4.1.2.1.1 Target Impacts

Target Impacts refers to whether the project explicitly or implicitly targets specific SDGs with their project activities.

Rationale	Projects which implement specific activities targeted at a sustainable development impact or SDG increase the likelihood that this SDG is relevant and significant.					
Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑					

Scoring Definition	Each project is scored on a scale of 1-5, where 1 indicates that the project's activities do not target any sustainable development goals and 5 indicates the project's activities targets seven or more SDGs.
Scoring Approach	The number of SDGs both explicitly and implicitly impacted and targeted by the project are identified through a review of the project's activities. For projects that do not reference the SDGs themselves, all of the sustainable development impacts mentioned by the project (such as improved air pollution and local economic development) are identified and mapped onto the number of SDGs that they relate to. The overall score is then based on both the quantity of SDGs or sustainable development impacts identified by the project.

4.1.2.1.2 Level of Job Creation

Level of Job Creation relates to the amount of permanent and temporary jobs created by the project, in proportion to its emissions reduction impact.

Rationale	Projects which generate more permanent employment and training opportunities will have a larger and longer-term impact on the local economy. Employment opportunities can have multiplier effects on the economy as a whole, as supporting businesses and infrastructure are developed to support this employment, and cater to the local income it generates.

Key Sources

Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
☑					

Scoring Definition	Each project is scored on a 1 to 5 scale, where 1 indicates no quantified job information is provided by the project and a 5 indicates that at least 5 jobs are created per thousand tonnes of estimated annual emissions reductions.
Scoring Approach	MSCI ESG Research reviews key project documentation in detail to assess how many permanent and temporary jobs were expected to be created from the project. The number of jobs is then divided by the project's estimated annual emissions reductions. This ratio is then categorized into scoring bands as shown below, which reflected higher scores for the greater proportion of job creation.

Points Scoring	# Jobs per kiloton CO_2e
1	0
2	0-1
3	1-2.5
4	2.5-5
5	5+

4.1.2.1.3 Mitigation

Mitigation refers to whether the project has effectively mitigated any risks that the project creates negative environmental consequences.

Rationale

The construction of landfill gas projects may impact local ecosystems and wildlife. It is important that projects located in areas of high biodiversity consider and address these risks to ensure that no adverse harm is caused.

Key Sources

Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
☑	☑				

Scoring Definition

Each project is scored on a -1 to 0 scale, where -1 indicates that the project has high potential adverse biodiversity consequences that have not been mitigated, and 0 indicates that any adverse consequences have been appropriately mitigated.

Scoring Approach

Firstly, the level of adverse environmental risk is assessed through understanding if the project is located within a biodiversity ecoregion through geospatial analysis. The location of each individual landfill gas project is assessed against data from the WWF on the world's top 200 ecoregions to identify if a project's boundaries sit within them.

Then key project documentation is reviewed in detail to assess whether the project has conducted an environmental impact assessment (EIA) and if key risks have been mitigated.

Projects are then scored based on both the size of this risk and the level of mitigation as shown in the table below.

		Mitigation		
		No EIA	EIA without Mitigation	EIA with Mitigation
Biodiversity Ecoregion	No	-0.50	-0.25	0.00
	Yes	-1.00	-0.50	0.00

4.2.2 Quantification of Outcomes

Quantification of outcomes relates to whether the project monitors and/or quantifies the impact of the project on targeted sustainable development goals.

Rationale

Assessing the evidence of co-benefit impacts is crucial to evaluating the degree to which co-benefits are achieved and can be attributed to a project. Projects that measure, quantify, and monitor their co-benefit impacts provide greater evidence in support of the targeted social and environmental benefits being achieved.

Key Sources

Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
☑					

Scoring Definition	Each project is scored on a scale of 1 to 5, where 1 indicates there is no quantification or monitoring of SDGs and 5 indicates that benefits are quantified and monitored.
Scoring Approach	MSCI ESG Research reviews each individual project's key documentation, such as its design document and monitoring reports, to assess the level to which both specific sustainable development goals and other economic indicators, such as job creation, have been quantified or monitored by the project. Scores ranging from 1 to 5 are assigned to each projected based as per the scoring matrix below:

		Economic Benefits Quantified		
		None	Single Metric	Multiple Metrics
SDG Metric Quantification	None	1	2	3
	Identified	2	3	4
	Quantified and Monitored	4	5	5

4.3.2 Local Stakeholder Engagement

When landfill gas projects are developed, it is important that developers engage with the local community to understand any local context or concerns. Projects with high levels of stakeholder engagement are more likely to avoid harm (and instead positively contribute) to the local community or environment.

MSCI ESG Research evaluates this through the following sub-criteria:

- **4.3.2.1 Effective Consultation:** How effective is the consultation conducted?
- **4.3.2.2 Representation and Inclusivity:** Has the project ensured proper and inclusive representation of stakeholders?
- **4.3.2.3 Access to Information:** Has the project relayed the relevant information to the stakeholders?
- **4.3.2.4 Feedback and Grievances:** Does the project display effective feedback and grievance redressal mechanisms?
- **4.3.2.5 Worker Relations:** Whether the project provides training and employment opportunities to stakeholders.

Each project is scored on a 1 to 5 scale for each of these sub-criteria and an overall score is reached through a straight average of these five scores. Projects scoring a 5 will represent projects with a detailed stakeholder consultations which are representative of the target users. These stakeholders will be informed on the project and provided with the opportunity to voice their opinions and have an influence on the project.

4.3.2.1 Effective Consultation

Effective consultation relates to whether the project uses effective techniques to engage and consult with stakeholders.

Rationale	Projects that use multiple methods of in-person consultation provide more open and effective channels to engage with stakeholders and receive any feedback.

Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑					

Scoring Definition

Each project is scored on a scale of 1 to 5, where 5 indicates that the project conducts multiple in-person engagements and 1 indicates that very limited in-person stakeholder consultation is performed.

Scoring Approach

MSCI ESG Research assesses the types and range of consultation conducted. The types of consultation may include surveys/questionnaires, in-person meetings, signed documents or interview calls.

Projects then receive a score from 1 to 5 based on both the type and in-person level:

		In-person Consultation	
		No	**Yes**
Number of Consultation Activities	0	1	1
	1-2	2	4
	3-5	3	5

4.3.2.2 Representation and Inclusivity

Representation and Inclusivity relates to whether the project has ensured that it consults with a representative and inclusive range of stakeholders.

Rationale

Projects which consult a greater number of stakeholders tend to have a lower permanence risk as more of the local community are involved in the planning process. This allows more end users to voice their opinions on the project and have greater involvement.

Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑					

Scoring Definition

Each project is scored on a scale of 1 to 5, where 5 indicates that the project transparently consults with a representative group of stakeholders, including women, while 1 indicates that no information is provided on the which stakeholders were consulted.

Scoring Approach

MSCI ESG Research assesses if the number of stakeholders in attendance has been provided. In particular, if the total number of stakeholders and the gender breakdown of attendees is disclosed. This is then scored as shown in the table below.

		# Stakeholders Consulted		
		Unknown	**<50**	**50+**
Transparency of Disclosures	Total, with gender breakdown disclosed	3	4	5

			Total	2	3	4	
			None	1	n/a	n/a	

4.3.2.3 Access to Information

Access to Information refers to whether the project provides transparent information to stakeholders regarding the project's activities.

Rationale	Through providing greater access to information, stakeholders will be informed on the project's activities and more able to provide feedback to the project to ensure the project meets their needs.
Key Sources	Project Documentation ☑ | Geospatial | Project Methodology Documentation | Academic Literature | Third-party Data | MSCI Carbon Markets
Scoring Definition	Each project is scored on a scale of 1 to 5, where 5 indicates that the project provides very transparent access to information through both documentation and in-person meetings, and 1 indicates that limited access to information is provided to stakeholders.
Scoring Approach	MSCI ESG Research assesses whether in-person meetings were conducted to present project information or whether clear documentation is provided. For in-person meetings, projects receive a score of 2 if they have conducted meetings to present information on the projects, and 0 otherwise. For documentation, MSCI ESG Research assesses if any documentation has been provided to local communities, and projects receive a score of 3 if Project Design Documents and/or pamphlets are provided, and 1 otherwise. The overall scores are based on adding each of these to reach a score from 1 to 5.

4.3.2.4 Feedback and Grievance

Feedback and Grievance refers to whether the project has procedures in place to receive and act on feedback received from stakeholders.

Rationale	Projects are more likely to satisfy the needs of stakeholders if there is a clear feedback mechanism and projects disclose and take actions as a result of the feedback.
Key Sources	Project Documentation ☑ | Geospatial | Project Methodology Documentation | Academic Literature | Third-party Data | MSCI Carbon Markets
Scoring Definition	Each project is scored on a scale of 1 to 5, where 5 indicates that the project transparently discloses and acts on stakeholder feedback and has an ongoing feedback mechanism in place, and 1 indicates that no feedback procedure has been disclosed either at the project start or during its operation.

Scoring Approach	Three aspects of a project's feedback procedure are assessed: - **Feedback Mechanism:** Whether the project has a feedback and grievance procedure in place. - **Feedback Disclosure:** Whether the project transparently discloses any feedback received. - **Feedback Response:** Whether the project has clearly taken action on any feedback received. Projects receive a score of 3 if they have a feedback mechanism in place, and 1 otherwise. Projects receive a score of 1 if they satisfy the other 2 factors. The overall scores are then based on adding each of these components to reach a score from 1 to 5.

4.3.2.5 Worker Relations

Worker Relations refers to whether the project provides training and/or employment opportunities to stakeholders.

Rationale	Through the provision of training opportunities there may be more benefits to the local community through increased employment opportunities and improved knowledge.					
Key Sources	Project Documentation	Geospatial	Project Methodology Documentation	Academic Literature	Third-party Data	MSCI Carbon Markets
	☑					
Scoring Definition	Each project is scored as a 1 or a 5, where 5 indicates training opportunities are provided to local stakeholders and 1 indicates there is no mention of training opportunities.					
Scoring Approach	MSCI ESG Research assesses whether the project will employ and provide training opportunities for local stakeholders. Projects are then scored as either 1 or 5, based on the presence and type of training opportunities provided.					

Appendix – Key References

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Change log

Date	Key Changes
01-Dec-2024	Initial publication
	-

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