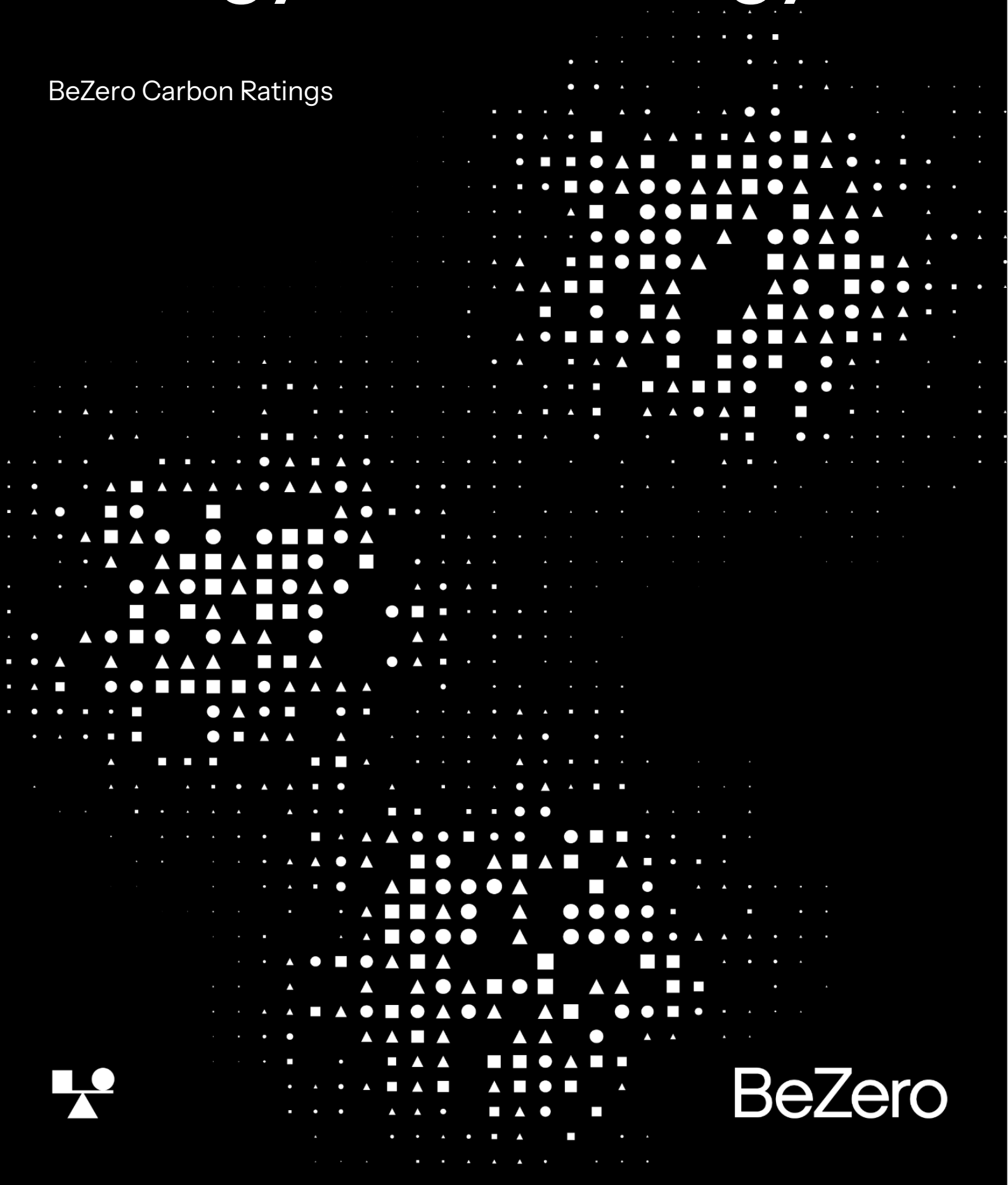
Non-Renewable Energy methodology

BeZero Carbon Ratings



BeZero

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Glossary

BeZero Carbon Rating (BCR): The BeZero Carbon Rating is a hybrid analytical framework that fuses financial, scientific, and policy-based analysis. It provides an opinion on the likelihood that a given credit achieves a tonne of CO_2e avoided or removed.

Carbon finance: Financial resources allocated to carbon project activities that reduce or avoid greenhouse gas emissions. It is an additional source of revenue that seeks to make such activities more financially viable.

Commitment period: The duration of time over which a project plans its activities to take place.

Emission factor (Operating margin; EF_{OM}): The emission factor reflecting existing marginal generators on the grid who decrease their own production as a result of the additional electricity made available through a project.

Emission factor (Build margin; EF_{BM}): The emission factor reflecting prospective marginal generators that may no longer be required or may have a reduced specification as a result of the additional output made available through a project.

Emission factor (Combined margin; EF_{CM}): The weight averaged marginal emission factor considering both the operating margin emission factor and build margin emission factor.

Methodology: A framework that sets out a process and parameters for quantifying the carbon benefits of a project. Methodologies enable project developers to quantify baselines, assess key aspects like additionality, and define necessary monitoring practices to ensure the greenhouse gas emission reductions are verifiable, additional, and quantified.

Project area: The geographical boundaries within which project activities take place.

Rating Committee: A group of members with extensive experience within and across all sectors who discuss and debate the assignment of BeZero Carbon ratings. The Rating Committee oversees the analytical process and ensures consistency in the application of ratings criteria, methodologies, and comparability of ratings across sectors and countries.

Stakeholders: Individuals and/or groups of people who may be affected by the implementation and activities of a project.

Standards bodies: Organisations that develop and revise methodologies to determine the greenhouse gas benefits of various types of carbon projects, and inform when and how many credits projects can issue.

Vintage: The vintage year refers to the period of time when the emission reduction or removal associated with a credit occurred.

Voluntary carbon market (VCM): Carbon markets that exist outside of the regulation and frameworks of international agreements, and are fuelled by commitments of individuals, as well as private and public organisations, to reduce GHG emissions through the trading of carbon credits.

Introduction

BeZero Carbon is a global ratings agency for the voluntary carbon market. Our ratings are a publicly available, risk-based framework for assessing carbon efficacy. We rate qualifying carbon credits in all sectors.

We take a research-first mindset, fusing traditional capital markets research practices with expertise in environmental sciences and technology. We think creatively about climate problems and build solutions that the whole market can use.

We have developed extensive analytical frameworks to rate carbon credits on their likelihood of delivering on their promised carbon emissions avoidance or removal. These analytical frameworks are deeply sector nuanced and bring to the fore our extensive experience in rating hundreds of projects across dozens of sub-sectors.

Our ratings team is made up of over 70 analysts who create the models and perform the analysis for every rating. They combine expertise in climatic and Earth sciences, in disciplines from remote sensing, forest ecology, ecosystem disturbance, peatlands and blue carbon through to statistics, machine learning, artificial intelligence, sell-side financial research, industrial engineering, and public policy. They hold over 20 PhDs, have published over 200 academic papers and have been cited over 10,000 times in peer-reviewed, scientific academic literature.

The market's number one risk metric, our ratings are available on our website and dozens of marketplaces, alongside extensive analysis and research on our BeZero Carbon Markets platform.

What is Non-Renewable Energy?

BeZero Carbon's Non-Renewable Energy methodology is a tool for users of the BeZero Carbon Rating to better understand our multifaceted ratings approach to the sector. We present select case studies to showcase the various parameters through which we assess risk to the carbon quality of credits and show how the sector relates to our overarching ratings methodology. For more details on the overall ratings methodology and other methodology documents, please see here.

Non-Renewable Energy projects issue avoidance credits by producing energy that has a lower emission intensity relative to a baseline alternative. Non-Renewable Energy projects differ from Renewable Energy projects since the fuel sources are considered to be finite. In addition, typically, Renewable Energy projects have near-zero marginal emissions, which is not the case for Non-Renewable Energy projects. In the BeZero Sector Classification system, Non-Renewable Energy is one of four sectors within the Energy sector group.

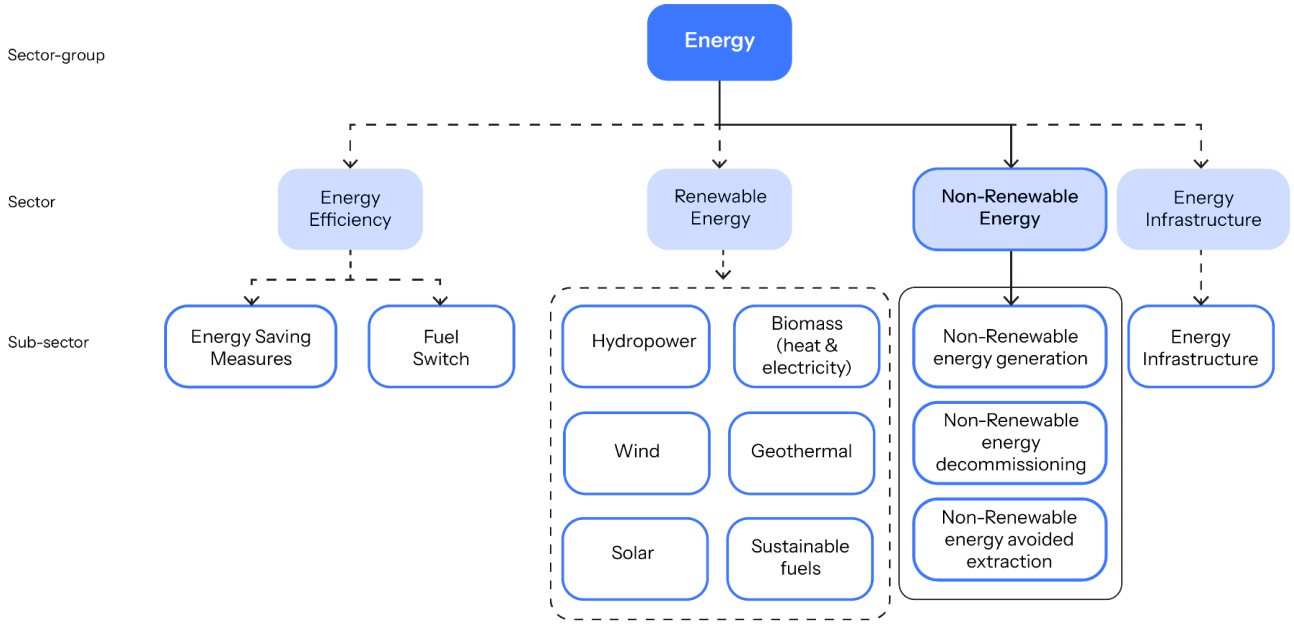


Figure 1. The Non-Renewable Energy sector within BeZero's Sector Classification System.

Additional sub-sector qualifiers for Non-Renewable Energy

In addition to our sector classification, each sector can have additional unique qualifiers to enable project labelling and grouping. These labels can help further characterise use cases, baselines and other nuances. Additional qualifiers may or may not be mutually exclusive. Below we describe such labels for the Non-Renewable Energy sector.

Table 1. Attributes of sub-sectors within the Non-Renewable Energy sector.

Additional qualifier	Options	Definition
Activity type	Generation	Projects that involve the production of energy
	Decommissioning	Projects that involve the decommissioning of energy assets
	Avoided extraction	Projects that avoid the emissions that would have arisen from the planned extraction of new fossil fuel reserves
Grid-connection	Grid-connected	Projects connected to an existing, centralised power grid
	Off-grid	Projects that operate independently of an organised electrical power grid
Grouping	Grouped	Projects that span multiple project sites in a given area
	Un-grouped	Projects that consist of a singular project site
Scale	Small scale	Project sites with a rated capacity of 10 MW or less
	Large scale	Project sites with a rated capacity of over 10 MW
Fuel source	Gas	Projects that use gas for their fuel source
	Oil	Projects that use oil for their fuel source
	Coal	Projects that use coal for their fuel source

Market context

In this section, we continually refer to the entire voluntary carbon market (VCM) data as of January 2025. Data here are collected from four major standards bodies (American Carbon Registry, Climate Action Reserve, Gold Standard, and Verra), and reflect a sample of 9,408 projects for which BeZero has individually assessed sector classification. These projects reflect 77.7% of total VCM issuance.

There are 283 Non-Renewable Energy projects across the BeZero sector-classified database, distributed across 29 countries, with projects primarily located in China and India.

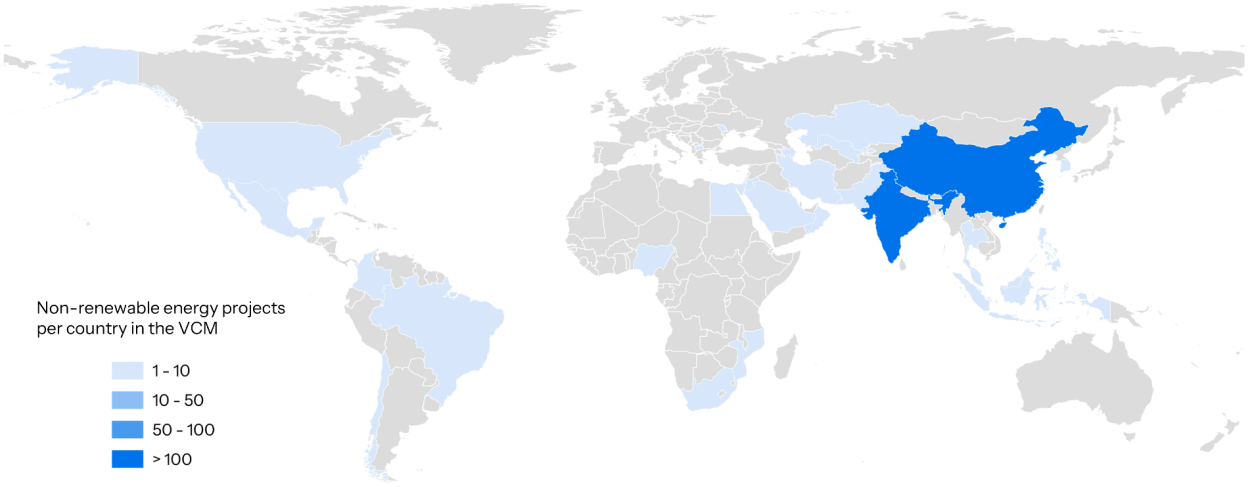


Figure 2. The global distribution of Non-Renewable Energy projects within our sector-classified database.

In the case of the Non-Renewable Energy sector, the number of projects also translates to the outstanding issuance for each country. Therefore, China has the largest number of projects and the highest outstanding issuance. Across our sector-classified database, credits emanating from the Non-Renewable Energy sector (163.7 million) account for 4.4% of total issuance, and 15.8% of total issuance within the Energy sector group.

There are 18 methodologies currently used by the 283 projects across our sector-classified database. The most frequently used is AM0004, which is used by nearly 50% of Non-Renewable Energy projects.

Table 2. Methodologies applied by Non-Renewable Energy projects[1].

Methodology	Number of projects
ACM0004	138
AM0029	94
ACM0002	48
ACM0013	12
AM0107	11
AM0014	8
AM0048	7
AMS-II.K.	4
ACM0025	2
AM0009	2
ACM0026	1
AM0015	1
AM0018	1
AM0084	1
AM0099	1
AMS-I.D.	1
AMS-III.BI.	1

[1] Some projects apply multiple methodologies meaning that the total from this table > total number of projects.

BeZero Carbon Rating analytical framework and process for Non-Renewable Energy

We have designed an approach to assessing the carbon efficacy risk for issued carbon credits. This framework is applicable to any project type in any sector accredited by any standards body, and leverages a blend of qualitative and quantitative factors; financial, environmental, and policy assessment techniques; and primary and secondary data sources.

Our BeZero Carbon Rating Methodology details our risk based assessment for understanding and interrogating carbon credit performance of any type, in any sector and country.

This document provides an extension to our overarching rating methodology. It presents BeZero's detailed analytical framework and process for Non-Renewable Energy projects. Using select case studies, it showcases the various parameters through which we assess risk to the carbon quality of these credits, and how this sector relates back to our overarching ratings methodology.

Holistic assessment

The assessment of a carbon credit's efficacy includes detailed project-specific, bottom-up, and top-down analysis, to provide a comprehensive assessment of risk. Further details on the risk factor definitions, the rating process, and the overall risk assessment can be found in our BeZero Carbon Rating Methodology. For pre-issuance ratings please consult the BeZero Carbon Ex ante Rating Methodology.

Important elements of the BeZero Carbon rating process that are applicable to all project types are described in detail in these documents (but not repeated in this document). These include:

- The steps in the rating process
- The project governance assessment
- Project boundary auditing
- Assessing the risks of double counting
- The integrity of reported issuance
- Assessing rating eligibility (whether projects meet our three primary qualifying criteria)
- The rating assignment process
- The role of the BeZero Carbon Rating Committee
- Ongoing monitoring and 'rating watch' process

Sector and country analysis

Our assessments are based on all available project documentation in combination with our in-house models, frameworks, and databases. These include geospatial and Earth observation evidence and techniques where relevant, and a curated database from peer-reviewed literature, industry research, and third-party datasets totalling more than 12,000 sources as of January 2025.

Specific to the Non-Renewable Energy sector, the number of relevant top-down sources runs to over 160 as of January 2025.

Standards and methodology screening

Our analytical approach evaluates the rules of each standards body and each methodology on an individual basis. This screening includes an assessment of methodology development and consultation (for an overview of why this is important, see our Insight on VCM methodologies). Further to this, we consider all deviations from methodologies. We also consider the risks associated

with projects that apply older or invalid methodologies, for example, due to outdated emission factors and Global Warming Potentials.

We also assess the renewal of project baselines to estimate the effectiveness and integrity of Non-Renewable Energy projects. Whilst some methodologies require projects to renew baselines at various defined intervals, this may not be adhered to, or the intervals may not be frequent enough to capture factors that can affect the baseline's validity.

Monitoring of registry operations and credit tracking also form part of our analytical process. We screen registry and standards body rules and processes, and take account of any strengths or weaknesses, in our assessment of relevant risk factors.

Project- and vintage-specific analysis

Our bottom-up assessment considers all publicly available project documentation and data, including that provided by the standards body, registry, or project developer, any information from third-party sources, and data sourced using our internal models, notably proprietary geospatial and Earth observation evidence and techniques where relevant.

Vintage-level assessments are made on two fronts:

1. Project reporting and crediting: Our analysis ensures that, across each ratable vintage for a project, we identify whether projects correctly issued credits towards the market and buffer pool, and that where credits are transferred, vintage labelling correctly maps onto cancellation certificates.

2. Risk factor assessments: For each of our carbon efficacy risk factors, our analysis spans each ratable vintage of a project. This allows us to incorporate relevant changes; for instance, in a project's baselines or issuance. It also enables a dynamic process for assessing the role of policy, changes in investment landscapes, and other exogenous factors influencing broader renewable and non-renewable energy trends.

Carbon efficacy assessment

Additionality

'The risk that a credit purchased and retired does not lead to a tonne of CO_2e being avoided or sequestered that would not have otherwise happened.'

Our view of a project's additionality can fundamentally limit the rating we assign to credits issued by that project. This functions in two major ways:

1. Additionality is fundamental to any project being eligible for a rating. Projects that do not provide evidence to demonstrate additionality may not pass our rating eligibility process.
2. Poor additionality constrains the overall carbon rating, reflecting its preeminence in our analytical framework.

Whilst the foundational questions that underpin a BeZero Carbon Rating converge at the risk factor level, the inputs that are used to answer these questions show increasing specificity at the sub-sector and project levels.

In Table 4, we highlight sub-components of our assessment of additionality for Non-Renewable Energy projects. In the sections that follow, we detail the key parameters that factor into each level of risk assessment, and illustrate with case studies where relevant.

Table 4. Sub-components of additionality assessed.

Risk factor	Risk driver category	Risk driver
Additionality	Activity analysis	Common practice
		Alternatives to the proposed project
	Financial analysis	Prior consideration of carbon finance
		Investment analysis
		Barrier analysis
	Legal and policy	Policy support

Activity analysis

Common practice

Our assessment of common practice examines the pervasiveness of the project activities or technology applied by the project within the region and sub-sector, with and without access to carbon finance. BeZero's assessment also looks beyond point-in-time assessments, which are often performed for the process of accreditation, by exploring common practice trends that emerge beyond a project's implementation. We also combine both quantitative and qualitative characteristics for a more holistic perspective. A justification for this is that project activities may correlate with a recent policy intervention (i.e. the implementation of a gas pipeline) that quantitative, historically defined metrics may overlook.

Through this approach, we are able to collate project-specific information (i.e. capacity, technology, and location) across the market to provide an overview of the frequency with which comparable

activities occur with and without access to carbon finance. We leverage our internal markets data to assess the prevalence of all other voluntary carbon market projects in the area that are registered on five major standards bodies: American Carbon Registry, Clean Development Mechanism, Climate Action Reserve, Gold Standard, and Verra. To the extent that it is possible and relevant, we also check other standards bodies such as Cercarbono, CSA, and the Global Carbon Council (GCC), and combine this with other essential datasets. As with all our analysis, exhaustive literature reviews are conducted to unearth any programmes or interventions conducting similar activities that may have otherwise been overlooked. In addition to this, we evaluate the robustness of other additionality assessments that may have enabled frequent access to the carbon market and are therefore excluded from the scope of common practice.

Additionality relies on the premise that activities would not occur independently. It is our opinion that this cannot necessarily be concluded by only considering the context that existed at the point of a project's conception, particularly when a project's implementation can occur with relative ease and periodically. In these circumstances, BeZero also considers common practice trends as they emerged during credited periods.

Example 1. Limited common practice may not indicate barriers to implementation

China

To illustrate our assessment of common practice, we take the example of a Non-Renewable Energy project in China.

The project asserts that natural gas is not commonly used to generate power for the grid. This could strengthen claims of additionality since technical, logistical, and financial barriers can be greater when other initiatives have not previously attempted a similar activity. However in this case, we find that there is relevant context that suggests that the lack of common practice is not driven by ongoing barriers to implementation.

For instance, our analysis reveals that the proportion of liquified natural gas (LNG) in China's energy mix has been increasing, and that LNG was already a priority for the Chinese state in 2006 (when the project began). The use of natural gas in the Southern China Power Grid reportedly increased more than fifteen-fold between 2004 and 2006. According to the literature, China wanted to expand its use of LNG in the early 2000s to support economic growth, diversify the energy mix, improve energy security, and reduce the air pollution and emissions from coal. The country began its LNG power plant research in the late 1980s and started to plan LNG imports in the 1990s. Increasing natural gas use was also an aim of China's 10th Five Year Plan, which covered 2001-2005 - a time when the project was getting certified and beginning its operations. The Guangdong Dapeng LNG Terminal was the first of China's LNG terminals to be built by the Chinese state. Surveys searching for appropriate locations for this initial LNG venture began in 1995. This terminal is integral to the project's operations, and is often referenced in the project's documentation. The project was one of only two LNG plants receiving fuel from the terminal when the terminal was first opened (the other is also a carbon project, registered under a different code), probably meaning that this plant was integral to the government's planned LNG initiatives. In our opinion, this all increases the likelihood that an LNG plant would have been built in a similar place and time to the project irrespective of carbon finance.

In this case, the historical lack of common practice is more likely a function of barriers such as access to pipelines, which had recently been overcome and directly enabled the project, as opposed to the financial challenges that carbon finance aims to alleviate.

In summary, BeZero's assessment of common practice with regard to additionality combines quantitative and qualitative context to arrive at a rounded perspective on the diffusion of project

activities, the prevalence of carbon finance, and the robustness of additionality tests. BeZero generally finds that, whilst a lack of common practice can support additionality claims and may substantiate barriers to a project, it is often not sufficient to form an assessment of a project's additionality. This is particularly pertinent in the case of Non-Renewable Energy projects, where there can be substantial incentives for project activities.

Alternatives to the proposed project

Another key aspect of additionality assessments is understanding the likelihood and extent of alternative scenarios that may occur in the absence of a project. For Non-Renewable Energy projects, these scenarios often include the grid's continued use of other more emission-intensive assets, or the installation of an additional emission-intensive asset. It is important to examine the credibility of each scenario to assess whether one is more likely to occur, as this necessarily influences the baseline.

This component of our analysis is interlinked with our assessments of common practice and the barriers faced by the project. However, our analysis of alternative scenarios requires an even more nuanced approach, as there may be specific characteristics within the project area that make regional or even local common practices less favourable.

Financial Analysis

Prior consideration of carbon finance

We also assess other factors that are fundamental to the additionality of Non-Renewable Energy projects, such as the prior consideration of carbon finance. Without this, the ability to pass a financial additionality test, and demonstrate the presence of barriers and a lack of common practice may be redundant, were the activities already occurring in a business-as-usual scenario.

See Example 3 of the BeZero Renewable Energy methodology

Investment analysis

Our assessment also seeks to consider the investment barriers that project activities may face. To enable this, we corroborate the validity of the data underlying a project's additionality assessment using independent data sources, industry data, peer-reviewed research, and in-house expertise. Factors assessed include reported internal rates of return, reported payback periods, and trends of investment and capital flow prior to a project's implementation.

We also screen methodologies to assess risk associated with applying outdated or overestimated investment benchmarks, and subjectivity around future costs.

Example 2. Informed and verifiable inputs reduce additionality risk

China

To illustrate how we conduct a revenue assessment of a project, we can use the example of a natural gas project in China.

In the case of this project, its claim to additionality is primarily on account of its investment analysis, where the rate of return without carbon finance (5%) is below an industry benchmark (8%). When offset revenue is considered, the project states that its IRR rises to 12%. Such a substantial improvement in IRR would typically support claims of additionality. Despite this, we note that inputs used to derive these values appear to be both optimistic and unsubstantiated. For instance, the revenues associated with the sale of carbon credits appear to have been significantly overestimated. This is the combined result of two factors: (1) the modelled number of credits issued per unit of electricity appears to be overestimated by 50%, and (2) a price per credit of USD 15 per tCO_2e (a value notably above average market rates) is applied. In addition, uncertainty stems from inconsistent assumptions between the 'with' and 'without' carbon revenues scenario. For instance, in the CDM revenue scenario, production costs in years 19-23 are modelled as zero. However, in the 'without CDM' scenario these equate to RMB 610,000 per year. This assumption is not actively disclosed within the project documents, nor noted by verifiers and we find little rationale to justify why this would be the case. Finally, validators note that the received tariff by the project is in fact 13% greater than anticipated, although this is partially offset with incrementally higher gas prices and investment costs. The revision to each of the components discussed above (depicted in the figure below) presents a significantly different picture to the case for additionality than initially presented and raises additionality risk, in our view.

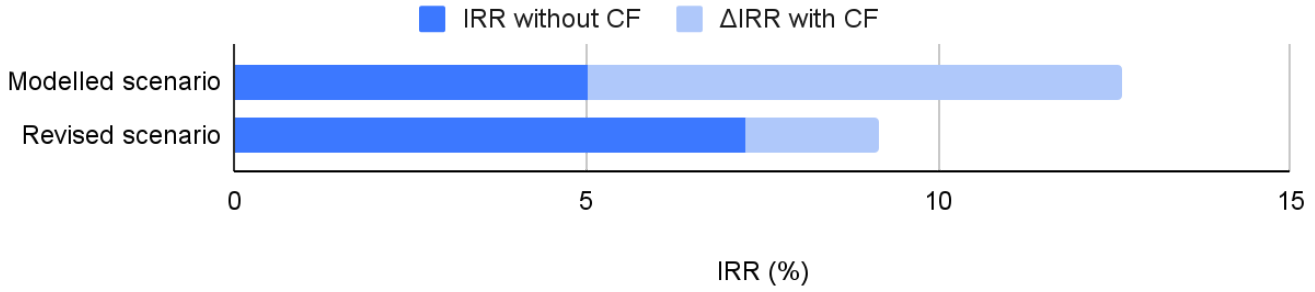


Figure 3. Chart showing the influence of carbon finance (CF) on the project's IRR in its modelled scenario, and in a revised scenario with potentially more realistic inputs.

For most Non-Renewable Energy projects, the role of carbon finance is to supplement primary revenues. However, in some instances, there are other revenue streams and funding schemes that need to be taken into account. This is to ensure that project interventions are dependent on carbon finance and activities would not have otherwise occurred.

Since primary revenues and the sale of carbon credits are typically parallel income streams for Non-Renewable Energy projects, the role of carbon finance relative to a project's broader revenues can be compared. To conduct this assessment, BeZero uses credit price information collated from periodic market reports. Since credit prices can diverge from average values, BeZero uses scenario analysis to assess the sensitivity of carbon-related revenues at various reasonable carbon pricing scenarios to maintain objectivity.

The estimated revenues from carbon finance are then compared with the revenues expected from the sale of electricity over the project's economic lifetime. Where tariff information is unavailable through direct sources, we rely on our curated database of international tariff structures and prices to establish a reasonable estimate (see section on Tariff Schemes and our Bespoke dataset insight to

learn more). Our analysis includes both a nominal and discounted approach to understand the impact that carbon finance had within the context of a project's overall financials.

Once the materiality of carbon finance has been gauged, we then contextualise this with regard to its significance at the stage of a project's investment decision as well as the project's ongoing financial success. In general, where we conclude that the role of carbon finance is likely small, we find that this is unlikely to be the factor upon which a project's investment decision was contingent. That being said, this is not prescriptive and small contributions, in some instances, can prove to be crucial.

Relative to Renewable Energy projects, in the case of revenue assessments for Non-Renewable Energy projects, we often find that the significance of carbon-based payments relative to broader revenues are often further diluted. This relates to the fact that the quantity of credits issued per MWh are not simply based on the baseline emission intensity but also the emission intensity of the project scenario. For instance, whilst a renewable energy generator may issue one credit per MWh, a gas generator may only issue half as many due to project emissions.

Example 3. Other revenues and cost savings can introduce additionality risk

China

To illustrate how we conduct a revenue assessment of a project, we can use the example of a natural gas project in China.

This project's claim to additionality is primarily on account of its investment analysis, where the rate of return without carbon finance is below an industry benchmark of 8%. Despite this claim, our revenue assessment finds that carbon finance is likely to contribute between 1% and 3% to total project revenues. Even in a scenario where credits garner prices up to USD 10 per tCO_2e, revenue contributions remain at approximately 5%. This is presented in the chart below. Considering this, it is our opinion that the role of carbon finance was unlikely to have been materially significant at the point of the project's investment nor would it appear to be crucial to the project's ongoing financial success. Thus, we conclude that there is a significant risk of non-additionality.

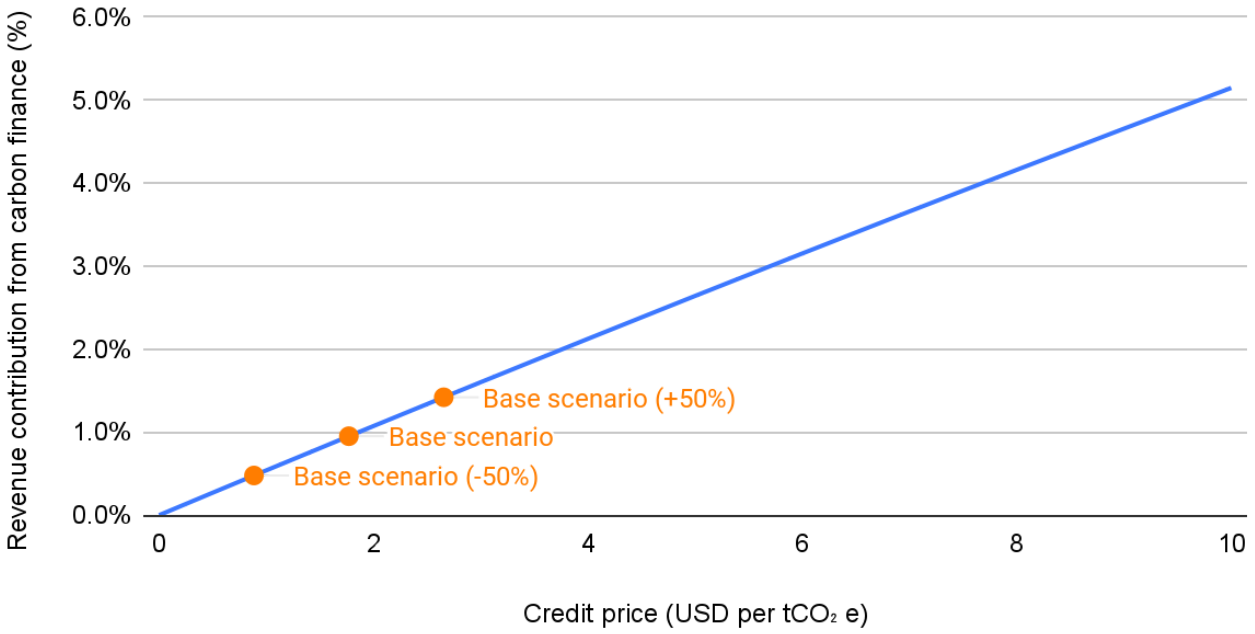


Figure 4. Our analysis reveals that the sale of carbon credits is likely to contribute less than 5% of total project revenues even with the credit price at USD 10 per tCO_2e. Given that non-renewable energy credits have typically garnered low prices, the likely revenue contribution is less than 2%.

Another characteristic that BeZero assesses within our financial analysis is how a project's performance and costs may benchmark against others, which may be indicative of a project being a weaker or stronger investment.

See Example 7 of the BeZero Renewable Energy methodology

As with BeZero's sector-specific analysis for Non-Renewable Energy, we also consider the context of a project's conception (which is related to the tariff scheme that supports it). The economics behind the electricity market is vast and complex with several possible schemes depending on the market that the project is operating in. The general types and mechanisms can be found in the table below.

Table 5. Tariff structure specificity and stability matrix.

Structure	Definition	Stability	Competition
Feed-in Tariff (FIT)	A government-backed, long-term contract to purchase electricity from a producer at a specific price; a similar mechanism to a PPA but through government policy.	High	Low
Power Purchase Agreement (PPA) through private agreement	A long-term contract to purchase electricity from a producer at a specific price without market-based price discovery.	High	Medium
Power Purchase Agreement (PPA) through public auction	A long-term contract to purchase electricity from a producer at a specific price with market-based price discovery conducted through an auction.	High	High
Open-market	Electricity is sold at a variable price depending on supply and demand at the time of generation.	Low	High

Considering the advantages and disadvantages of the various revenue structures, BeZero believes that each may demonstrate nuance related to additionality which needs to be considered. These include how widespread and successful the tariff structure has been, the specificity of the tariff to the individual project site, the price discovery mechanism, and overall interest in the project itself.

See Examples 8 and 9 of the BeZero Renewable Energy methodology

Barrier analysis

Our assessment of additionality takes into account other variables that impede a project's implementation that a project may or may not disclose and may be inside or outside of the project boundaries. To assess the presence and scale of these barriers, our analysis for Non-Renewable Energy projects is driven by data, academic literature, and industry reports. Not only does our assessment consider the existence of barriers, but also the role of carbon finance in alleviating them. The latter aspect is pivotal since some barriers may be fundamentally unrelated to the benefits afforded through voluntary financing. These challenges can be varied and so our assessment is not necessarily prescriptive.

Barriers can span several different categories; some of these are tabled below.

Table 6. Potential barriers that may impede a project's implementation.

National barriers	We find that barriers to energy investments can often exist at a national level, which can help to substantiate claims of additionality. To assess this, BeZero conducts in-depth literature reviews considering the context of a country's energy environment, whilst also relying on other independent forms of national classification; an example being the United Nations' (UN) least developed countries (LDCs). As defined by the UN, these are low-income countries confronting severe structural impediments to sustainable development. Other potential national barriers may include poor transmission and distribution infrastructure that may disincentive investment in grid generators, or poor renewable integration that may incur curtailment and potentially forgo revenues.
Investment barriers	Whilst the cost savings can give a strong incentive for the implementation of project activities, this may be countered by the lack of access to upfront capital to implement project activities. This may be more difficult for activities in developing or low-income countries where the financing mechanisms that exist are generally seen as riskier investments in comparison to more developed markets. As part of our larger assessment of additionality, we consider how having access to carbon finance can aid a project in accessing the capital required to be implemented.
Technical and operational barriers	Technological and operational challenges may similarly prevent a project's implementation where insufficient investment and financing exist. An example may be access to technical expertise, which a formalised structure such as the carbon market may facilitate. Alternatively, where unfavourable climatic events present a reasonable threat, a project may require safeguards that come at the expense of greater capital costs or more frequent maintenance and downtime cycles.

Example 4. Carbon finance may not alleviate all project barriers

India

To illustrate our assessment of investment barriers, we take the example of an India-based natural gas project.

Whilst we note the existence of barriers to the project, we find that these are likely to be too significant to be addressed by the provisions of carbon financing. According to studies, the Krishna Godavari river basin in Andhra Pradesh was one of India's largest suppliers of natural gas, accounting for 35% of the country's total consumption. This peaked around 2010, then reportedly fell by around 86% by December 2014, leading to cuts in the allocations of natural gas previously guaranteed by the Gas Authority India Limited (GAIL). Multiple studies also indicate that the priority for natural gas allocation was fertiliser production and liquefied natural gas over power generation, leading to even less gas allocated to the power sector. In 2018, the project proponent issued a public statement announcing that they had filed for insolvency. In a later release, they detailed that the reason for the insolvency was the unavailability of natural gas for the power plant. In culmination, this suggests that the project's allocation of natural gas supply from GAIL was cut following shortages. In our view, this indicates that the main barrier to the uptake of natural gas in the power sector in India is a shortage of supply, resulting in unmet demand; a barrier that even contributions from carbon finance would

be unable to overcome.

Legal and Policy

Our assessment of policy considers the risk to carbon efficacy from the policy and political environment in which the project operates. This incorporates an assessment of the extent to which the policy backdrop is supportive of project activities and will consider the existence, relevance and effectiveness of such policies. A very supportive policy environment could somewhat undermine the carbon efficacy of a project. Conversely, successfully operating in an unsupportive policy environment may reinforce carbon efficacy.

Project entities with limited barriers to entry (such as high market penetration in the country) and government assistance would typically indicate policy risk. In contrast, a project entity that is not eligible for government assistance and faces substantial barriers to implementing project activities would typically face lower risk in our framework.

Targets can also serve as an explicit means of observing the priority afforded to a non-renewable energy project. The Nationally Determined Contributions (NDCs) of the project's host country is a factor in our top-down policy analysis for non-renewable energy projects. This refers to the commitment made by each participating country to mitigating greenhouse gas emissions and adapting to the impacts of climate change. Beyond NDCs, we also consider other national, regional, and technology-specific targets.

Example 5. Conformance with government objectives imply a supportive environment China

To illustrate our assessment of the interplay of project activities and government targets, we take the example of a China-based natural gas project in Guangdong province.

The strategic importance of LNG, and natural gas in general is emphasised in China's 10th FYP, covering the period 2001 to 2005. The plan highlighted the importance of increasing natural gas provision to reduce China's reliance on coal and discussed LNG facilities specifically as part of that broader aim. According to the national strategic energy plan at the time, China planned to build 10 LNG receiving terminals in the Yangtze River Delta, Bohai Rim region and the Pan-Pearl River Delta region. In addition, the 10th FYP discussed trying to develop large combined-cycle units (the technology used by the project) and various clean coal initiatives. The 10th FYP was the first plan to recognise the environmental risks posed by coal and present strategies to reduce them. The aims of the 10th FYP increase policy risk for this project, in our view, as they evidence the political and logistical support for the project that was available at the time and will likely have positively supported the project's implementation without the carbon market.

Our assessment of regulatory surplus interrogates whether there are existing laws, regulations, statutes, legal rulings, or other regulatory frameworks that require the implementation of project activities (either directly or indirectly). For non-renewable energy projects, this typically involves investigating regulations related to the energy market which aim to increase grid capacity. The impact of this on our rating is closely related to our assessment of government effectiveness, whereby we analyse the implementation, enforcement, and overall effectiveness of policy regulations and initiatives as well as additionality. Where we find evidence of regulations that

mandate project activities in combination with high levels of government effectiveness, we would consider this to increase policy risk, as it is likely that the political environment will undermine the project's effectiveness. In some instances, targets can become increasingly encouraged to the point that may indirectly incentivise renewable energy projects for regulatory compliance.

Example 6. Regulatory encouragement may incentivise activities

India

To illustrate our assessment of regulatory surplus we take the example of an India-based 'Fuel switch' project.

As an alternative, the project notes the continued use of naphtha as its fuel for power generation. Considering that naphtha was the designed fuel for the power station and has reportedly been used in special circumstances during the crediting period, we find that the fuel may reflect a logically consistent alternative.

That being said, we find that these aspects do not present the full picture of the regulatory environment that the project experienced. Our analysis highlights that the planning for the power plant occurred during the 1990's in a period of historically low prices for naphtha. However, as the project became operational, naphtha prices began to rise dramatically. Whilst the proponent was safeguarded from this, the off-taker would still have to bear the rising cost. Reportedly, converting from naphtha to gas would require USD 13 million from the proponent, which is offset by a slight rise in the tariff, resulting in a negative NPV of USD 4.2 million. The costs saved by the off-taker would be substantially more than this. The escalating costs of power production from naphtha were such that the position of the off-taker became untenable, with orders to convert naphtha power plants with short gestation periods in development to convert to natural gas. Whilst we find that the off-take did not mandate conversion from natural gas to naphtha for existing power plants, we believe that there was likely significant encouragement to undertake the conversion voluntarily. Were activities not undertaken, we believe a mandate may have been likely. This echoes India's fertiliser industry, which had historically been users of naphtha and was similarly shielded from its rising costs by government subsidies but was later mandated to switch to natural gas.

For non-renewable energy projects, we also assess investment opportunities and activities related to climate change mitigation and adaptation within a specific country. These may include supportive policies, regulations, and incentives such as tax relief, grants, subsidies, and the market potential for these projects in the country. We also identify the potential risk associated with investments, such as policy and regulatory risk, market volatility, and climate change impacts. These considerations are made on a standalone basis and are assessed relative to a baseline, which may further indicate government encouragement.

Example 7. Supportive investment landscapes introduce policy risks

India

To illustrate our assessment of a supportive investment landscape we take the example of an India-based Fuel Switch project.

The government's allocation of gas supply encouraged the establishment of private-sector plants during the 1990s, increasing policy risk for these credits, in our view. Before this, gas was produced and sold by the state-owned Gas Authority of India Ltd (GAIL), although reforms reduced the monopoly that GAIL held on the market. In order to liberalise the grid and encourage investment, the

government implemented the New Exploration Licensing Policy in 1999, which granted licences to private companies for exploration and use and encouraged the construction of private gas plants to increase gas production. After a surge of gas discovery, artificially low prices were implemented to encourage the use of natural gas. In this policy environment, the government encouraged power generation from natural gas by allocating gas to priority users, including the electric power sector. As a result, electricity generation accounted for approximately 35% of Indian natural gas consumption in 2005. This suggests a policy environment that was favourable to natural gas power plants at the time the project plant was being set up, which in our view results in increased risk to the project from a policy perspective.

Carbon accounting

'The risk that the carbon accounting underlying a credit does not fully achieve a tonne of CO_2e avoided or removed.'

In Table 7, we highlight sub-components of our assessment of carbon accounting for Non-Renewable Energy projects. In the sections that follow, we detail the key parameters that factor into each level of risk assessment, and illustrate with case studies as relevant.

Table 7. Sub-components of our carbon accounting assessment.

Risk factor	Risk driver category	Risk driver
Carbon accounting	Direct accounting	Baseline scenario
		Project scenario
		GHG conversions
	Leakage accounting	Activity displacement
		Market leakage

Direct accounting

Baseline scenario

In the case of many Non-Renewable Energy projects, an equivalence is drawn between energy flows in the project and baseline scenarios. In these cases, BeZero assesses the accuracy of monitoring techniques since energy inputs or outputs are accounted for by using directly metered values. As output is often corroborated by verifiers against invoices, this variable is likely to be accurate and is unlikely to introduce associated risk of over-crediting.

See Example 17 of the BeZero Renewable Energy methodology

For some projects (particularly off-grid systems), it may not necessarily be as simple as assuming a linear connection between energy flows in the baseline and project scenarios. There could be several reasons for this; some examples include transmission and distribution losses, as well as potential rebound effects. In these nuanced cases, BeZero considers whether there are methodological safeguards, how these tools are applied, and their contextual appropriateness.

For some other Non-Renewable Energy projects, baselines are not determined using monitored inputs but instead reflect modelled trends. In these cases, since a 'without' project scenario is not observable by design, we view that a forecast scenario should be conservative, using values that are historically representative and have implicit safeguards to account for trends that may later emerge.

Project scenario

The emissions that arise from Non-Renewable Energy projects relate to the combustion of the project fuel. In accounting for project emissions, similar to our assessment of monitoring baseline variables, BeZero explores the robustness and accuracy of the monitoring techniques used. Since energy inputs and outputs are accounted for by using directly metered values and output is often corroborated by verifiers against invoices, this variable is likely to be accurate and is unlikely to introduce associated risk of over-crediting.

As with the baseline scenario, monitored variables are often converted to project emissions using several parameters. BeZero similarly delves into these underlying parameters to assess their robustness versus comparable values found in academic literature and those reported by credible organisations to quantify potential threats of over-issuance.

Example 8. Informed and specific inputs reduce carbon accounting risk

China

To illustrate our assessment of the data inputs used to quantify a project's emission we take the example of a Non-Renewable Energy project in China.

The project determines energy content from the combustion of natural gas by incorporating factors that appear to be both specific to the project and appropriate. For instance, the emission factor for natural gas and its net calorific value are monitored independently by the suppliers to the plant, allowing for any material fluctuations in the fuel to be captured. The figure below shows the monitored net calorific value that has been reported in fortnightly intervals, which we have compared to defaults reported independently by the Intergovernmental Panel on Climate Change (IPCC). In our view, this demonstrates the use of an input that is both specific and appears to be verifiable, imparting confidence as to the project's emission calculations.

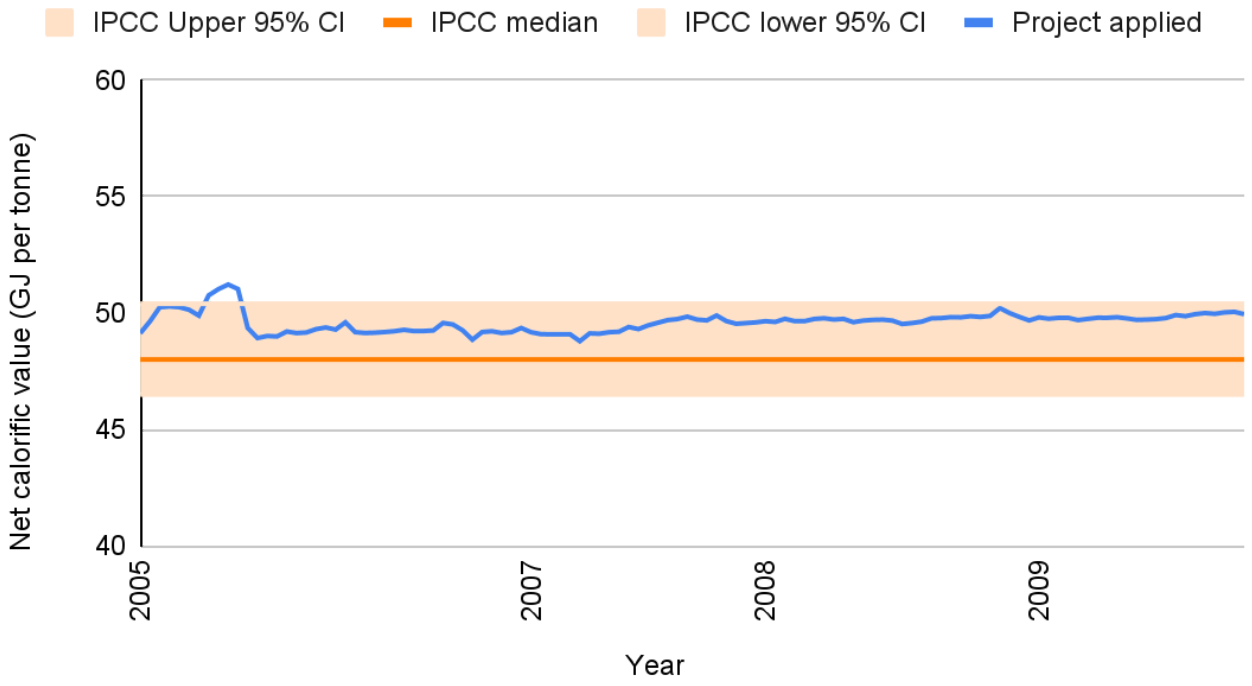


Figure 6. Chart displaying the net calorific value for the combustion of natural gas according to measurements by the project supplier, compared to the IPCC median. The chart demonstrates the variability in the project's measured values over time, and that they are broadly consistent with the IPCC.

GHG conversions

Quantity-driven inputs are often converted to avoided emissions using various parameters and emission factors. BeZero delves into these underlying parameters used to quantify baseline

emissions rates to assess their appropriateness. In practical terms, this means considering how the individual parameters employed in a project's accounting compared with values found in academic literature and those reported by credible organisations. Where notable inconsistencies are identified, we evaluate any logical justifications and subsequently quantify the potential threat of over-crediting. Where this aspect concerns grid emission factors, please also see our Renewable Energy methodology.

Example 10. The use of a conservative baseline reduces carbon accounting risk

India

To illustrate BeZero's assessment of baseline data inputs, we take the example of a Non-Renewable Energy project in India.

In order to calculate its baseline emissions, the project models several scenarios, tabled below.

Scenario	Description
Build margin	The emission intensity of prospective future grid generators that are no longer required or have a reduced specification as a result of the project activities.
Combined margin	The emission intensity considering the dual effect of power supplied by the project on: (1) the existing grid generators that are moderated to balance supply and demand (operating margin: OM), and (2) the potential future grid generators that are no longer required or may have a reduced specification (build margin: BM). The weighted average of the EF_{OM} and EF_{BM} is taken assuming a 50:50 split.
Most likely	The emission intensity of the grid generator that is most likely to be installed in lieu of the project. In this case, this is assumed to be a coal-fired power plant.

The project quantifies the emission factor of each scenario, displayed in the figure below. Conservatively, the project opts to model the baseline scenario as the least emission intensive, an approach we find to be best practice. As the project opts to apply this intensity statically throughout its crediting period, we find that carbon accounting risk could however arise since relevant grid trends are not captured. However, when we quantify how the project's baseline emission intensity would shift temporally (in the modelled scenario and across the alternatives described above), we note that risk remains low (fluctuating by less than 5%), with the assumed baseline remaining the most conservative.

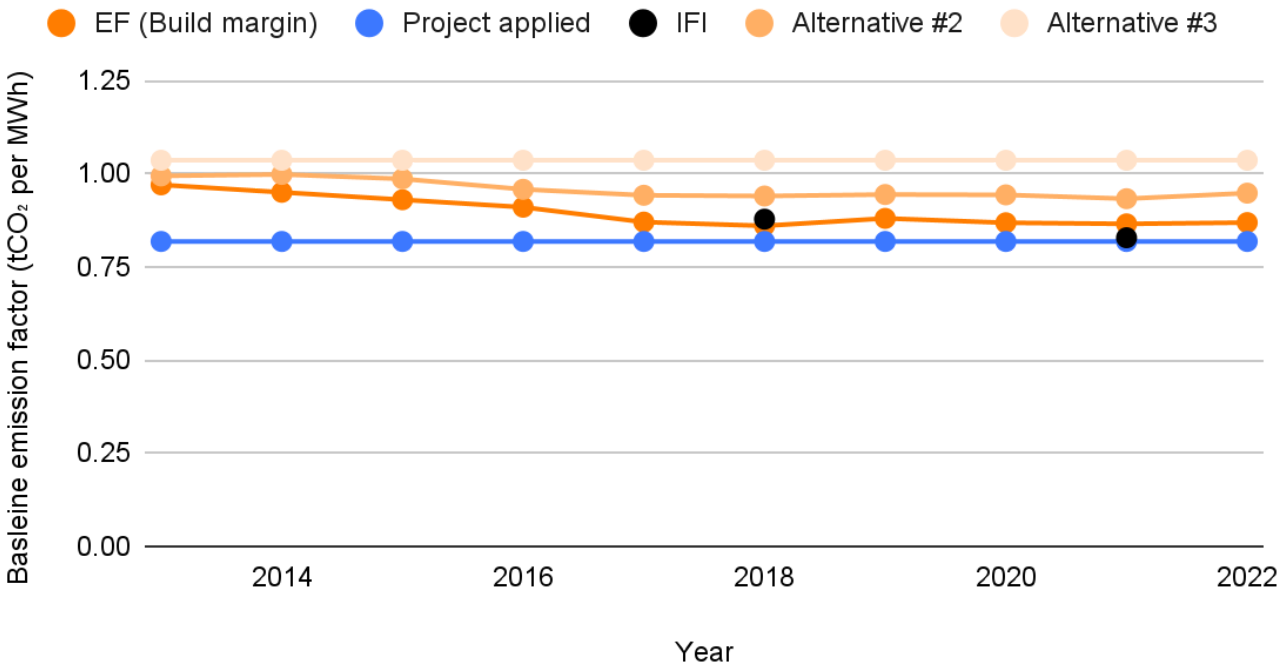


Figure 5. Comparison of the project's applied grid emission factor with alternative values, such as the build margin, combined margin, and most likely alternative. The project's baseline emission factor remains below most alternative values throughout the crediting period, and thus is conservative, reducing carbon accounting risk, in our view.

Leakage

We believe that considering leakage is essential in providing a comprehensive evaluation within the broader BeZero Carbon Rating framework since it is a factor that is often neglected in carbon accounting.

Activity displacement

Leakage may arise through the displacement or transfer of activities that generate emissions outside of the scope of the project due to the project's enforcement. To assess risk of activity displacement in Non-Renewable Energy projects, we interrogate the likelihood that the scope for emission reductions is sufficiently broad to account for all impacts.

For non-renewable energy forms, emissions leakage may relate to the lock-in emissions associated with installing another fossil-fuel generator that may, over the technological lifetime, become a more emissions-intensive asset than a viable alternative. A theoretical example would be a scenario in which carbon finance has facilitated a transition from coal power generation to natural gas. However, were project activities not undertaken, and considering the precipitous cost decline of renewable energy forms, such as solar PV, this may instead have been implemented at some point within the baseline technologies' lifetime. Therefore, the project activities may have locked-in emissions above another realistic baseline. In these instances, BeZero considers alternative baselines and relevant trends inside and outside the scope of a project's crediting period.

Example 11. Emissions lock-in may lead to carbon accounting risk

China

To illustrate our assessment of emissions lock-in, we take the example of a Non-Renewable Energy project in China.

In the case of energy projects, we find that emissions lock-in can occur when carbon revenues are used to aid in the implementation of a project that may avoid emissions in the short term, but could incur net emissions over a project's lifetime. Though theoretical, this scenario is visualised below, where the emission intensity of the project technology - in this case, a gas generator - rises above the grid's build margin emission factor. In this case, since the baseline assumed by the project is the EF_{BM}, emissions in the project scenario may now exceed those in the counterfactual. In part, this is due to conservatism on behalf of the inputs used in the project's baseline. That said, we find that this trend is likely to extend in future, compounding over the remaining years of the site's 20-year lifetime, which is outside of the scope of the project's crediting period.

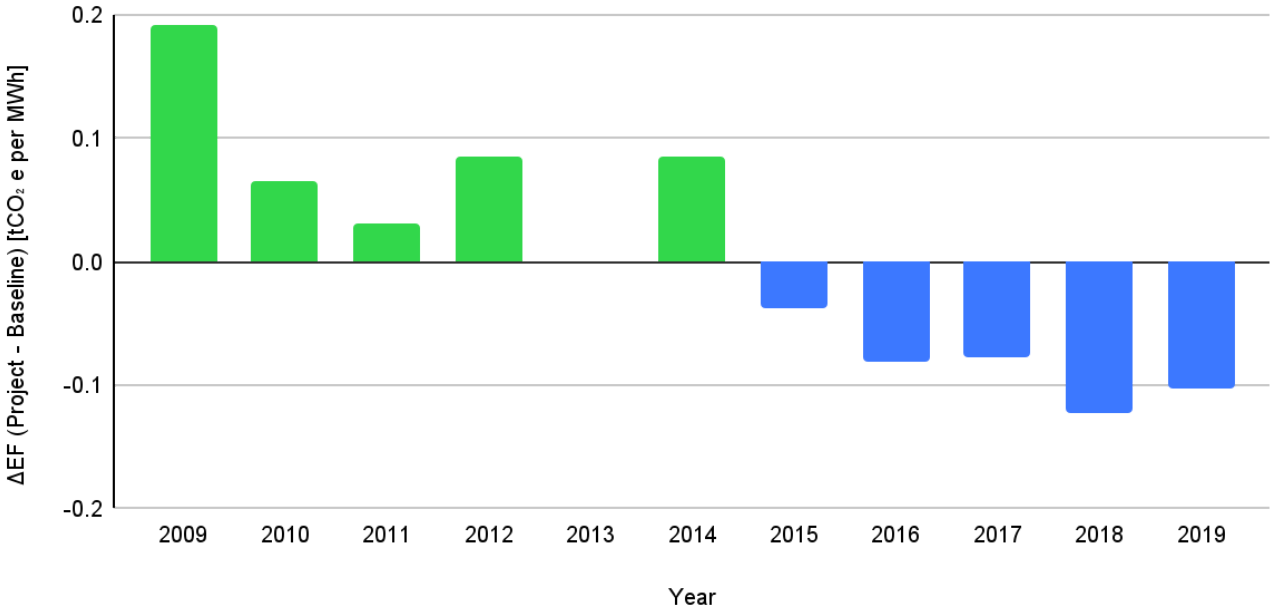


Figure 8. The net effect on emissions from a non-renewable energy project in China. Between 2009 and 2014, the project's emission factor was lower than the grid's (data from 2013 is unavailable). Subsequently, the emission factor of the grid reduced sufficiently that the net effect of the project was to increase emissions compared to the baseline. Our analysis therefore reveals that wider trends of emission reductions and fuel use changes can lead to inflated baselines and carbon accounting risk for non-renewable energy projects.

Market leakage

Market leakage can occur when a project's activities alter the supply and demand equilibrium, which may depress foreseen emission reductions. In the case of some projects, utilising certain fuels may render them unavailable for other activities. These (other) activities may no longer be able to occur and will therefore be pushed to utilise other more emission-intensive substitutes. In these cases, BeZero aims to assess the credibility and likelihood of this scenario, as well as the existence and adequacy of methodological and project-specific safeguards.

Example 12. Market impacts require a holistic perspective

India

To illustrate our assessment of market leakage, we take the example of a Non-Renewable Energy generation project in India that utilises natural gas as its fuel source.

During the 2000-2010 period, incentives to use natural gas in industries such as fertiliser production were strong. Not only did the fuel have substantial cost benefits, relative to a baseline alternative such as naphtha, but the fuel also came with the stoichiometric advantage of a high hydrogen to carbon ratio. In fact, the benefits of natural gas for the fertiliser industry were noted to be a foregone conclusion. However, despite the strong rationale for adopting natural gas for this application, its uptake was impeded by insufficient supply. Even with mandates from the Indian government for urea manufacturers to adopt natural gas as opposed to liquid fuels in 2010, the transition was still slow, again due to availability and connection issues. As fertilisers began to undergo their mandated transition, availability for power users was limited. Ultimately, this resulted in the liquidation of some natural gas plants. In our view, the interplay between the competing demand for natural gas in the power and fertiliser sectors demonstrates that, whilst the use of natural gas in the context of the project may have prevented the use of more emission-intensive fuels in the power sector (described as the baseline), it may also have propagated the use of naphtha in other industries. In our view, the latter concept is evidence of potential market leakage effects related to the project's impact on supply and demand dynamics. Since this aspect is not addressed by the project, we find this to introduce carbon accounting risk.

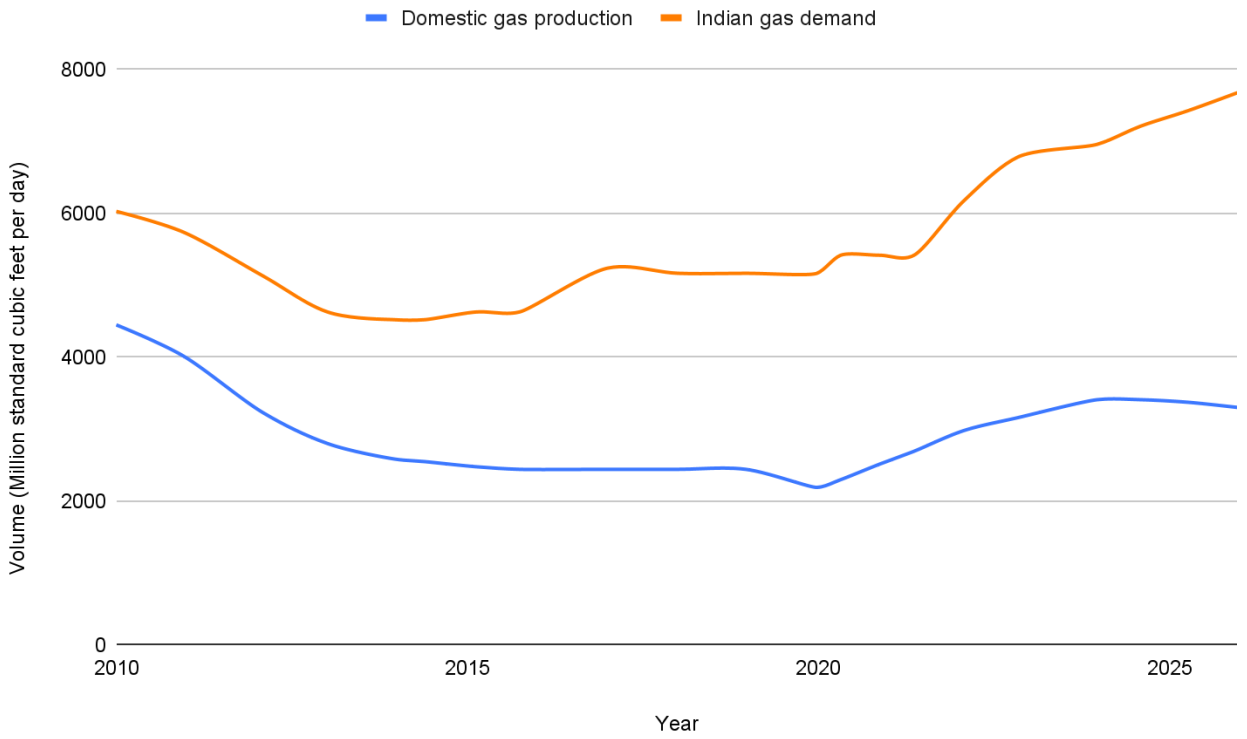


Figure 7. Chart displaying India's natural gas production and demand. The chart demonstrates that since 2010 the gap between domestic supply and demand has widened. We find this to be evidence of likely market leakage effects whereby insufficient supply may have prevented other industries from transitioning away from emission-intensive fuels to natural gas as a cleaner alternative.

Permanence

'The risk that the carbon avoided or removed by the project will not remain so for the time committed.'

Our analysis of this risk factor considers the permanence of the contractual commitment of a given project and its proposed credits. In order to assess a credit's permanence risk, it is necessary to determine the time a credit commits to and whether the credit faces reversal risk within that period. Commitment periods are the duration over which sequestration or abatement activities have permanence horizons, and differ from crediting periods (during which reductions or removals are eligible for issuance as verified carbon credits).

In Table 9, we highlight subcomponents of our assessment of permanence for non-renewable energy projects. In the following sections, we detail the key parameters that factor into each level of risk assessment and illustrate with case studies as relevant.

Table 9. Sub-components of permanence assessed.

Risk factor	Risk driver category	Risk driver
Permanence	Technical risks	Carbon stock integrity
		Forward crediting structure

Carbon stock integrity

Carbon stock integrity refers to the relative permanence of the carbon stocks saved or sequestered by the project activity. In the cases where project activities conserve carbon that is stored in an impermanent form, natural phenomena may reverse carbon benefits. For example, whilst a cookstove project may conserve forest carbon stocks, these stocks could still be released by fire. In any case, this is generally not a concern from projects in the Non-renewable energy sector[2].

Forward crediting structure

Some projects issue all their credits upon validation, as the project activity itself is completed in the initial year of operation (considered the reporting period for these projects). However, the actual emission reductions may not all have been achieved at this point, in our view, depending on the specific project activity and its emission profile throughout the project's crediting period. Given this discontinuity, we may assess increased permanence risk of the project's credits, as we believe there is a risk that the emission reductions do not proceed as modelled and therefore that some credits may not represent achieved emission reductions.However, this is generally not the case for projects in the Non-renewable energy sector and hence is generally not a risk. For an example, see BeZero's Industrial Processes methodology.

[2] As a repeat, this stance does not reflect emerging credit types, such as the early decommissioning of coal fired assets, where a permanence risk could theoretically emerge if the asset was brought back into service.

Impact of co-benefits and SDGs on carbon efficacy

Co-benefits and carbon efficacy

The BCR only assesses credit quality as it relates to carbon efficacy, and is not an assessment of any other element of the credit's quality, such as potential co-benefits from broader ecological and social impacts. These could include biodiversity effects; social, health or economic impacts on local communities; or actual or potential Sustainable Development Goal (SDG) claims.

To the extent that social or biodiversity effects may compromise carbon efficacy, they are taken into consideration - e.g. when considering stakeholder relations and their effect on permanence or project execution risk.

Data and reporting on co-benefits and SDG claims vary widely in the carbon market. In many cases, evidence pertaining to co-benefits is subject to less rigorous reporting, disclosure, and independent oversight than is the case for the carbon accreditation process.

Sustainable Development Goals

The UN SDGs are commonly used in the carbon market to illustrate the co-benefit impacts of carbon projects. Their use is becoming increasingly popular; over half of all projects in the carbon market made SDG claims in 2022.

According to BeZero's internal database, no Non-Renewable Energy projects have claimed to support SDGs.

Appendix I: Analytical independence

BeZero Carbon acts as an independent third party and is not conflicted in delivering the BCR for the following reasons.

- BeZero Carbon's analysis and the resulting rating is limited to our assessment of the risks associated with the information provided in the public domain and expressed as a risk metric.
- BeZero Carbon does not provide any recommendations or advice on how to change or improve the project.
- BeZero Carbon does not create standards for, develop, invest, or transact in carbon projects. The only exception is the retirement of carbon credits for the explicit purpose of compensating for its own carbon footprint.
- BeZero Carbon does not verify, validate, sanction or in any way influence the number of credits issued by the project.
- BeZero Carbon is not incentivised commercially or in any other sense to deliver a specific rating outcome at the time of the assignment or at any time in the future.
- All members of BeZero's analytical team, including the committee members, are commercially independent of the assigned ratings - i.e. their compensation, benefits, or performance measures are not in any manner linked to the ratings assigned.
- All BeZero staff, including all members of the ratings team, adhere to strict compliance procedures, including, inter alia, prohibition from holding and/or dealing in carbon credits and annual reporting. These standards are akin to standards practised by financial market rating agencies.
- BeZero Carbon has implemented a Rating Committee process, which mitigates the undue influence of individuals on the overall ratings process outcome.

Appendix II: Risk factor definitions and analytical framework matrix

Risk factor	aaa	aa	a	bbb	bb	b	c	d
Likelihood	*Highest*	*Very high*	*High*	*Moderate*	*Moderately low*	*Low*	*Very low*	*Lowest*
Additionality The likelihood that a credit purchased and retired leads to a tonne of CO_2e being avoided or sequestered that would not have otherwise happened.	The credit has the highest likelihood of being additional.	The credit has a very high likelihood of being additional.	The credit has a high likelihood of being additional.	The credit has a moderate likelihood of being additional.	The credit has a moderately low likelihood of being additional.	The credit has a low likelihood of being additional.	The credit has a very low likelihood of being additional.	The credit has the lowest likelihood of being additional.
Carbon Accounting The likelihood of having carbon accounting consistent with fully achieving a tonne of CO_2e avoided or removed.	The credit has the highest likelihood of having carbon accounting consistent with achieving a tonne of CO_2e avoided or removed.	The credit has a very high likelihood of having carbon accounting consistent with achieving a tonne of CO_2e avoided or removed.	The credit has a high likelihood of having carbon accounting consistent with achieving a tonne of CO_2e avoided or removed.	The credit has a moderate likelihood of having carbon accounting consistent with achieving a tonne of CO_2e avoided or removed.	The credit has a moderately low likelihood of having carbon accounting consistent with achieving a tonne of CO_2e avoided or removed.	The credit has a low likelihood of having carbon accounting consistent with achieving a tonne of CO_2e avoided or removed.	The credit has a very low likelihood of having carbon accounting consistent with achieving a tonne of CO_2e avoided or removed.	The credit has the lowest likelihood of having carbon accounting consistent with achieving a tonne of CO_2e avoided or removed.
Permanence The likelihood that the carbon avoided or removed by a project will remain sc for the time committed.	The carbon avoided or removed by the credit has the highest likelihood of remaining permanent for the time committed.	The carbon avoided or removed by the credit has a very high likelihood of remaining permanent for the time committed.	The carbon avoided or removed by the credit has a high likelihood of remaining permanent for the time committed.	The carbon avoided or removed by the credit has a moderate likelihood of remaining permanent for the time committed.	The carbon avoided or removed by the credit has a low likelihood of remaining permanent for the time committed.	The carbon avoided or removed by the credit has a low likelihood of remaining permanent for the time committed.	The carbon avoided or removed by the credit has a very low likelihood of remaining permanent for the time committed.	The carbon avoided or removed by the credit has the lowest likelihood of remaining permanent for the time committed.

Appendix III: Sources as of January 2025

Other third-party datasets

We also incorporate many other third-party or industry datasets and sources into our assessments of individual risk factors. These include but are not limited to:

Literature sources

Our curated database of literature sources spans all types of peer-reviewed literature and industry research, with hundreds of entries for every sector, region or risk factor.

The number of relevant literature-based sources specific to the Non-Renewable Energy sector runs to 160 as of January 2025. In Figure 9, we show how these sources are split by carbon risk factor.

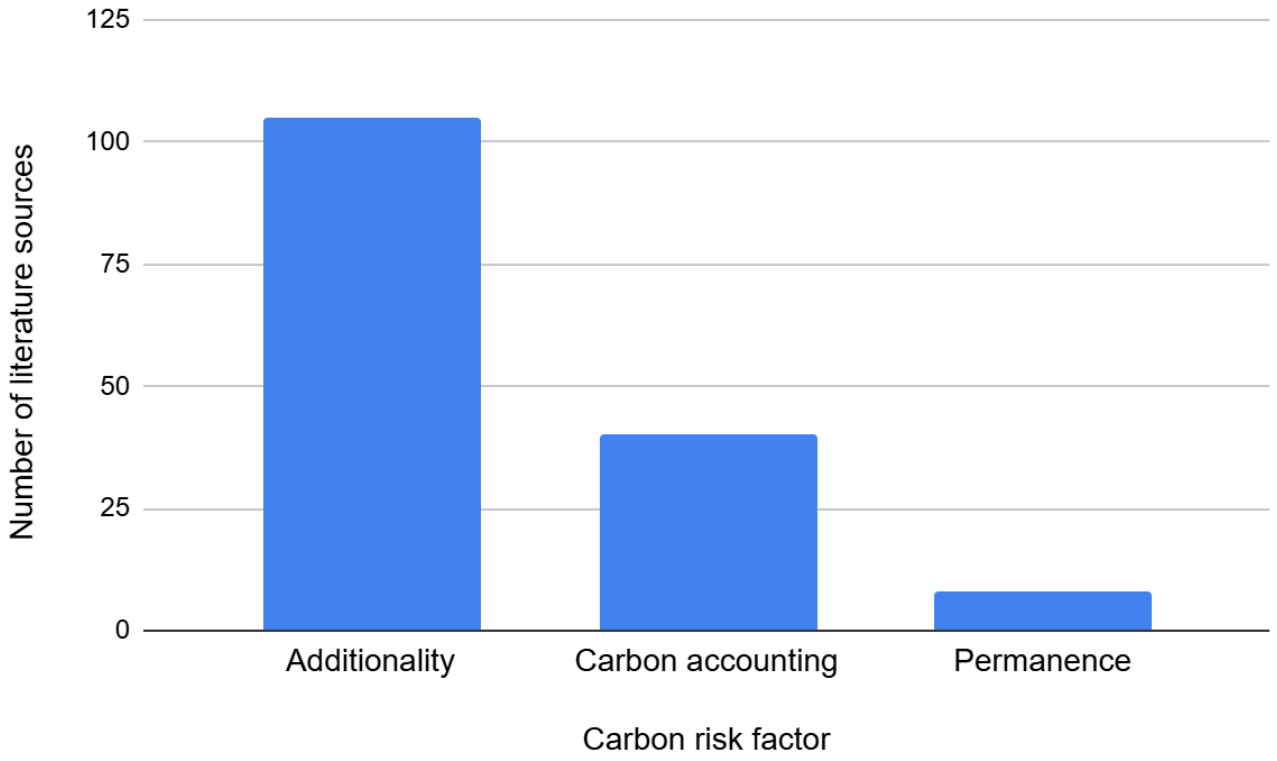


Figure 9. Number of literature sources relevant to the Non-renewable energy sector used by BeZero Carbon Ratings as of January 2025.

Sample of academic literature sources

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Appendix IV: Additional reading

Check out the ratings resources page on our website to find links to all of our published methodologies, in addition to our series of risk factor assessment frameworks, our frameworks for assessing project methodologies and country-level risks, deep dives on factors influencing the carbon efficacy of projects in various sectors, and more.

Appendix V: Sustainable development goals

Applying the equality SDGs to the carbon market
A focus on climate action: Sustainable Development Goal 13 claims in the carbon market
Transparency is key for SDG claims to be an effective asset in the carbon market
Interpreting SDG claims in voluntary carbon projects
Time to rethink biodiversity: SDG 14 & 15
Eye for detail: buyers want to know the evidence behind SDG claims
Lost in translation: SDG claims are more than meets the eye
How robust are SDG 3 & 7 claims in the carbon market?
Mapping the SDG claim lifecycle: 2023 update
Applying the equality SDGs to the carbon market
How economic SDG claims can be impactful in the carbon market

Updates and reviews

Version number	Date	Description
1.00	22/03/24	Initial release
1.01	03/10/24	Clarification on additionality as a limiting factor
2.0	17/02/25	Updated risk factor framework
2.01	05/03/2025	Update to sector classification

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