Methane Abatement in Sustainable Taxonomies

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CLIMATE POLICY INITIATIVE

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ABOUT CLIMATE POLICY INITIATIVE

CPI is an analysis and advisory organization with deep expertise in finance and policy. Our mission is to help governments, businesses, and financial institutions drive economic growth while addressing climate change. CPI has seven offices worldwide, in Brazil, India, Indonesia, South Africa, the United Kingdom, and the United States.

ABOUT CLIMATE BONDS INITIATIVE

Climate Bonds is an international investor-focused not-for-profit organization working to mobilize the bond market for climate change solutions. It promotes investment in projects and assets needed for a rapid transition to a low-carbon and climate- resilient economy. The mission is to help drive down the cost of capital for large-scale climate and infrastructure projects and to support governments seeking increased access to capital markets to meet climate and greenhouse gas emission reduction goals.

DESCRIPTORS

SECTOR

Energy Systems, AFOLU, Waste, Wastewater

REGION

Global

KEYWORDS

Methane, Super Pollutants, Sustainable Taxonomies

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EXECUTIVE SUMMARY

Methane is a high-impact pollutant with a global warming potential more than 80 times that of CO_2 over 20 years, and has accounted for roughly 30% of historical warming. Yet, finance for methane abatement—one of the most cost-effective mitigation opportunities currently available—remains low. Less than USD 14 billion was invested annually in methane abatement in 2021/22,[1] and preliminary results suggest this figure dropped to around USD 6 billion in 2023, falling far short of the estimated USD 48 billion required per year through to 2030.

Sustainable finance taxonomies are required to play a catalytic role in directing finance to methane mitigation. Financial frameworks like taxonomies are key to directing investment toward methane abatement. Beyond helping identify which projects can be classified as sustainable, they support financing mechanisms, such as green or sustainability-linked bonds, loans, and blended finance, to integrate methane mitigation into broader instruments. By ensuring environmental credibility, taxonomies help raise capital and build investor confidence. Over time, alignment across jurisdictions can also reduce transaction costs and facilitate cross-border investment in methane solutions. By embedding methane abatement activities and measures within their definitions of sustainable investments, taxonomies can accelerate deployment in mature abatement applications, prioritize harder-to-finance solutions in diffuse sectors, and create consistent signals that reduce perceived risks and funding costs.

This report presents a comparative analysis of how each selected taxonomy incorporates methane abatement activities within its sustainable finance framework. **Five taxonomies—those of Colombia, the European Union (EU), Indonesia, South Africa, and Thailand—are examined as case studies to provide a balanced sample reflecting different levels of maturity, complexity, and regional context.**

The aim is to identify gaps, highlight best practices, and offer practical guidance for taxonomy developers and policymakers on how to more effectively embed methane abatement in sustainable finance standards. By aligning financial definitions and criteria with methane reduction priorities, the report seeks to mobilize greater investment toward high-impact, cost-effective climate solutions.

The report offers unique added value to taxonomy developers and the sustainable finance community in general, particularly to Ministries of Finance, Treasuries, and Planning Ministries developing national sustainable finance taxonomies, by providing:

- The first cross-regional comparative analysis of methane abatement coverage in national/regional sustainable finance taxonomies.
- A methane sector-specific gap assessment comparing existing activities in taxonomies against a benchmark list to identify missing or insufficient efforts in methane abatement.
- Recommendations to improve the credibility and impact of green finance.
- Best-practice measures to support the integration of methane abatement into taxonomy frameworks.

1 Based on two-year average values to smooth out annual fluctuations.

KEY FINDINGS

The analysis reveals a consistent set of structural challenges that hinder the integration of methane abatement across these frameworks. While each taxonomy reflects distinct regional priorities and stages of development, they share three core weaknesses, explored below:

- **Incomplete sectoral and activity coverage.**
- **Trade-offs between usability and technical rigor.**
- **Lack of specificity in criteria and safeguards.**

1. INCOMPLETE SECTORAL AND ACTIVITY COVERAGE

Methane emissions originate from a relatively narrow set of sectors of economic activities—principally energy, agriculture, waste, and wastewater—but are inconsistently addressed within the taxonomies reviewed. Examined taxonomies show:

a. **Sector gaps**: entire sectors omitted or deferred (see Table ES1).

b. **Activity gaps**: key economic activities associated with methane emissions within covered sectors excluded.

c. **Missing TSC**: technical screening criteria (TSC) inconsistent or incomplete, e.g., no performance thresholds, eligible technologies, or compliance metrics.

Table ES1. Inclusion of methane-relevant sectors across taxonomies

Sector	Taxonomy				
	Colombia	EU	Indonesia	Thailand	South Africa
Energy					
Agriculture					
Solid waste					
Wastewater					

Key *- Green: Presence of relevant activities and TSC are developed; Blue: Presence of relevant activities but TSC are not developed; Gray: No relevant activities are covered.*

This inconsistency deprives investors of the guidance needed to identify and support impactful methane reduction measures. As a result, critical mitigation opportunities may remain unfunded, slowing progress on both national and global climate objectives. Beyond regulatory action, financial frameworks such as taxonomies play a critical role in channeling investment toward methane abatement. Aside from validating investments, taxonomies support the development of financing mechanisms and financial instruments—such as green and sustainability-linked bonds or loans, or blended finance structures—that integrate methane abatement activities within broader thematic instruments. They can also support the raising of capital for methane mitigation in financial markets, providing investors with confidence that these activities meet robust environmental criteria. Over time, consistent taxonomy treatment across jurisdictions

could also foster international alignment, reduce transaction costs for investors, and open opportunities for cross-border investment in methane solutions.

2. FOCUS ON USABILITY OVER PRESERVING TECHNICAL ACCURACY

Taxonomy developers need to maintain ease of use while providing technical accuracy. While user-friendliness is essential for financial institutions to adopt and apply taxonomies in decision-making, this bears the risk of leading to over-simplification of criteria, especially for complex pollutants like methane. For methane specifically, this balance often tilts toward detailed, science-based thresholds being replaced with generic requirements such as "monitoring" or "contingency" plans when new taxonomies adapt established frameworks such as the EU taxonomy.

An example is shown in Table ES2: The EU refers to relevant legislation or implementation timelines to restrict landfills opened after a specific date, reinforcing the principle of limiting further methane generation, and its associated technical annexes, which prescribe specific monitoring frequencies, performance thresholds, and control mechanisms. Thailand's taxonomy, while aligned on core safeguards and mirroring the EU approach in requiring closed landfills, biogas valorization, and methane control plans, omits restrictions based on landfill opening dates, relying on a higher-level requirement of the presence of monitoring or contingency plans, rather than prescriptive, measurable thresholds, contributing to the simplification observed in methane-related TSC.

Table ES2. Example of over-simplification in TSC for landfill gas capture and utilization

Taxonomy	EU Taxonomy	Thailand Taxonomy
Sector	Water supply, sewerage, waste management and remediation	Waste management
TSC for substantial contribution to mitigation	*Methane emissions from the landfill and leakages from the landfill gas collection and utilization facilities are subject to control and monitoring procedures set out in Annex III to Council Directive 1999/31/EC.*	*A monitoring and contingency plan is in place in order to minimize methane leakage at the facility.* [No further technical guidance given.]

Presenting only high-level requirements could compromise the effectiveness of methane-related safeguards, particularly when detailed mitigation pathways or science-based thresholds are replaced by generic descriptors. This trade-off poses a serious risk: if usability overrides rigor, the taxonomy may fail to deliver real-world environmental outcomes. Scientific credibility should not be sacrificed for accessibility, especially in relation to methane, where precision for high-integrity abatement is critical.

3. LACK OF SPECIFICITY IN CRITERIA AND SAFEGUARDS

Methane-related TSC are sometimes qualitative or implicit, especially for activities where methane abatement is treated as a safeguard rather than the primary objective. For example:

- In the agriculture sector, both Colombia and Thailand list sustainable practices such as pasture management, biodigesters, or crop rotation. However, these lists typically lack

methane-specific metrics, such as emission thresholds, leakage rates, or quantified performance benchmarks.

- In the waste sector, while biogas capture or utilization is often promoted, terms like "productive use" remain undefined, and acceptable methane leakage rates are rarely specified.

The absence of clear thresholds, monitoring requirements, and enforcement mechanisms reduces accountability. It creates a risk that activities labeled as "green" could result in minimal or even negative net methane outcomes, undermining the environmental credibility of taxonomies.

RECOMMENDED WAY FORWARD: BEST-PRACTICE MEASURES

This report provides a framework for incorporating methane abatement into sustainable finance taxonomies in ways that are clear, science-based, and interoperable to maximize integrity and investment potential.

To address the identified challenges, this report introduces best-practice measures for methane abatement, consolidating evidence-based, activity-specific criteria drawn from the findings of this report, and sectoral criteria developed by Climate Bonds. These best practices provide a structured reference point for identifying, assessing, and integrating effective methane reduction measures within sustainable finance taxonomies.

Designed as a practical roadmap for policymakers, taxonomy developers, and industry stakeholders, the best practices support more consistent and transparent embedding of methane reduction objectives across jurisdictions. In addition to guiding the enhancement of national and regional taxonomies, they also underscore opportunities for international harmonization, promoting alignment with science-based targets and enabling more ambitious global methane mitigation strategies.

Recognizing that implementation capacity, regulatory readiness, and technological maturity vary across countries, the provided list of best practices encourages flexibility in adoption. This may involve phased implementation, the gradual tightening of performance thresholds, or alternative approaches that uphold alignment with long-term climate goals. Such flexibility allows jurisdictions to tailor the framework to their specific contexts while maintaining coherence with emerging global standards.

1. INTRODUCTION

Methane (CH_4) is a key driver of near-term global warming, with a warming potential more than 80 times greater than carbon dioxide (CO_2) over 20 years (IPCC 2023). Mitigating methane emissions therefore offers one of the fastest ways to slow near-term global temperature rise, with the existing bankable abatement measures able to avoid an estimated 0.3°C of warming by 2040 (UNEP and CCAC 2021; 2022).

Methane cannot be offset by CO_2 reductions due to differing atmospheric lifetimes and warming dynamics (Mar et al. 2022). This means that rapid and targeted methane reductions are critical to limiting near-term temperature rise in addition to reducing CO_2. Historically, methane has accounted for roughly 30% of global warming since pre-industrial times, and emissions continue to grow (IEA 2025a). The core sectors where methane emissions reduction is imperative are energy (accounting for 37% of anthropogenic methane emissions in 2024), agriculture (44%), and waste (19%) (IEA 2025a).[2]

Methane abatement is one of the most cost-effective climate actions available today. Many mitigation opportunities are either low-cost or yield net financial benefits using existing technologies (IEEFA 2024). Advances in monitoring and detection have dramatically reduced barriers to identifying and addressing leaks, enabling more targeted and efficient regulation. Considering methane reductions deliver faster and greater climate benefits per dollar spent than CO_2 mitigation, early action on methane can buy critical time to advance deeper decarbonization efforts and free up resources for long-term CO_2 reduction strategies (Riishojgaard and Tarasova 2024).

Methane abatement measures have not yet attracted the required levels of financial support. CPI's Landscape of Methane Abatement Finance 2023 shows that methane abatement finance totaled less than USD 14 billion annually in 2021/22, against an estimated annual need of USD 48 billion by 2030 (CPI 2023).[3] The growth potential for investment can only be realized if stakeholders across corporates, finance, and policy-making have a greater understanding of credible abatement measures and how to integrate them into investments. Aside from the direct benefits of limiting global warming, methane abatement also has multiple socioeconomic benefits, as outlined in Box 1.

Despite the urgency and opportunity associated with methane mitigation, it remains largely absent from sustainable finance frameworks. CO_2 continues to dominate policy agendas and climate-aligned investment strategies, but methane's distinct profile—its potency, short atmospheric lifespan, and sectoral sources—demands targeted attention. This oversight is especially evident in sustainable finance taxonomies, which are critical tools for guiding capital toward climate and environmental objectives. Most taxonomies provide limited or inconsistent treatment of methane abatement. As a result, they underrepresent viable climate solutions.

2 These percentages may differ among geographies and the predominant methane-generating activities therein. For example, in Brazil and India, 70% and 59% respectively of the methane comes from agriculture (including livestock) while in Indonesia, agriculture and energy account for 40% and 39% respectively.

3 Preliminary estimates by CPI, indicate that methane abatement finance may have totalled approximately USD 6 billion in 2023.

Box 1. Methane abatement socioeconomic benefits

Methane abatement delivers immediate co-benefits in the form of cleaner air, improved public health, enhanced food security, and local employment—alongside their critical role in climate change mitigation. Rapid and targeted action by 2050 could avert nearly 1 million premature deaths, prevent 90 million tonnes in crop losses linked to climate impacts, and cut 85 billion hours of labor lost to extreme heat—collectively delivering an estimated USD 260 billion in direct economic benefits (IEA et al. 2023).

Health benefits: Methane abatement is connected to benefits from the reduction of ground-level ozone, a harmful air pollutant formed when methane reacts with nitrogen oxides (NO_X) in sunlight. Ozone at ground level is a powerful oxidant that damages lung tissue, worsens respiratory diseases, and contributes to premature mortality. It is also toxic to plants, reducing photosynthesis and yields of staple crops such as wheat, rice, and maize. Scientific assessments estimate that methane-driven ozone formation is responsible for hundreds of thousands of premature deaths annually and tens of millions of tonnes of crop losses worldwide (UNEP and CCAC 2021; Shindell et al. 2012).

Economic benefits: In the energy sector, the largest source of methane emissions, reducing leakage through detection and repair offers direct efficiency and commercial gains that align with oil and gas companies' profit incentives (IEA 2021). Captured methane can be monetized as energy (e.g., biogas) and improve incomes through more efficient and resilient production of livestock and rice. More broadly, methane abatement across the fossil fuel and waste sectors also reduces the risk of fires and explosions (UNEP and CCAC 2021).

Just transition: Methane-intensive activities such as smallholder agriculture and informal waste management are deeply tied to livelihoods in developing economies. Inclusive approaches that ensure fair distribution of the costs and benefits of abatement are critical. Scaling up anaerobic digestion and biogas deployment can generate millions of local "green" jobs, particularly in rural areas, while boosting circular, low-carbon economies (WBA 2021).Supporting affected communities with finance, technology transfer, and capacity building can strengthen resilience and help deliver a just transition.

Unlocking these benefits at scale will require robust financing frameworks to channel investment toward methane solutions.

Taxonomies can play a catalytic role in directing finance to methane mitigation by clearly embedding methane abatement activities and measures within their definitions of sustainable investments. In sectors like energy, where technologies such as leak detection and repair are already mature and cost-effective, the inclusion of methane abatement solutions could accelerate deployment. Taxonomy inclusion is even more essential in sectors like agriculture and waste, where methane solutions such as improved livestock feed, anaerobic digestion of manure, or organic waste diversion are more diffuse, face weaker market incentives, and carry higher investment risk (European Parliament 2021; Interreg Europe 2021; European Commission 2020). The clear recognition of these solutions in taxonomies can validate their climate contributions and make them eligible for green finance, helping scale their adoption.

Aligning taxonomies with methane mitigation is not just a technical fix—it supports broader policy goals. Over 150 countries have signed the Global Methane Pledge, committing to a 30% reduction in emissions by 2030 (Global Methane Pledge 2025). Meeting this target requires a coordinated push from governments, investors, and financial institutions—beginning with investment frameworks that prioritize methane alongside carbon dioxide. See Box 2 for examples of recent regulatory frameworks.

Box 2. Bridging regulation and investment in methane mitigation

Some jurisdictions are already pushing more ambitious regulatory frameworks. For example, the **European Union's new Methane Regulation 2024/1787** (EU 2024), effective 4 August 2024, sets binding rules for measurement, monitoring, reporting, and verification (MMRV), mandates leak detection and repair (LDAR), and prohibits non-emergency venting and flaring across upstream, transmission, distribution, storage, and liquefied natural gas operations—including in global supply chains.

While the EU represents a more mature and legally binding example of integrating methane into regulation, policy momentum is emerging globally. Countries such as Colombia and Brazil are examples of national efforts to adopt targeted methane policies.

Colombia stands out in Latin America as one of the few countries with explicit methane regulation in the oil and gas sector. It has adopted rules restricting flaring and venting, requiring twice annual LDAR, and imposing equipment standards for fugitive emissions. Colombia was among the first countries in South America to regulate methane emissions from upstream operations (Clean Air Task Force 2022).

Brazil has launched its "Zero Methane Program" (Federal Government of Brazil 2022) which encourages the development of biogas and biomethane, promotes measures to cut flaring and leaks in the oil and gas sector, and includes waste management initiatives to reduce landfill methane. The cross-sectoral scope of these measures is notable, as it seeks to integrate abatement opportunities in both energy and waste while also fostering a growing biomethane market.

Beyond regulatory action, financial frameworks such as taxonomies play a critical role in channeling investment toward methane abatement. Besides validating investments, taxonomies support the development of financing mechanisms and financial instruments—such as green and sustainability-linked bonds or loans, or blended finance structures—that integrate methane abatement activities within broader thematic instruments. They can also support the raising of capital for methane mitigation in financial markets, providing investors with confidence that these activities meet robust environmental criteria. Over time, consistent taxonomy treatment across jurisdictions could also foster international alignment, reduce transaction costs for investors, and open opportunities for cross-border investment in methane solutions.

Research shows that companies with higher shares of taxonomy-aligned revenues enjoy a valuation premium in equity markets, confirming that investors actively reallocate capital toward taxonomy-recognized activities (Bassen et al. 2025). The clear recognition of these solutions in taxonomies can validate their climate contributions and make them eligible for green finance, helping scale their adoption. Practical uptake is already visible: in 2023, 90% of green bonds

issued by EU public actors referenced the EU Taxonomy, proving that its definitions are being used to channel investment flows (European Commission 2024). Beyond Europe, evidence from China's green credit policy, which is explicitly guided by its national green taxonomy, shows that firms improved green investment efficiency and green innovation, underscoring that taxonomy-driven finance frameworks can successfully redirect capital toward low-carbon solutions in practice (Hu et al. 2021). Similarly, as a tangible indicator of adoption in Latin America, since Colombia's taxonomy launch the implementing project has reviewed portfolios totaling COP 10.8 trillion (USD 2.65 billion) to identify potential for issuing taxonomy-aligned instruments, resulting in COP 334.7 billion (USD 82.1 million) in labeled sustainable finance (Climate Bonds 2025).[4]

Explicitly integrating methane into sustainable finance taxonomies can therefore help to:

- Unlock capital for methane mitigation.
- Accelerate market adoption of proven technologies.
- Support innovation in methane-intensive sectors.

The integration of methane will guide issuers to prioritize climate friendly investment and strengthen an impactful emissions reduction lever.

1.1 PURPOSE AND APPROACH OF THIS REPORT

This paper examines how methane abatement is addressed in a representative set of sustainable finance taxonomies and offers actionable insights for taxonomy developers on integrating methane abatement into such frameworks. It provides comparative analysis of how methane abatement is treated in five taxonomies from Colombia (Gobierno de Colombia 2022), the EU (European Commission 2023), Indonesia (OJK 2025), South Africa (National Treasury 2022) Thailand (Thailand Taxonomy Board 2025). The analysis also provides further insights on best practice and available approaches from other taxonomies where relevant.

The report offers unique value to taxonomy developers and the sustainable finance community by providing:

- The first cross-regional comparative analysis of methane abatement coverage in national/regional sustainable finance taxonomies.
- A sector-specific gap analysis and recommendations to inform future taxonomies and improve the credibility and impact of green finance.
- Best practices to support the integration of methane abatement into taxonomy frameworks.

The remaining report is structured as follows:

- **Section 2** describes the methods used for this study.
- **Section 3** presents the core findings on how methane-relevant sectors and activities are covered across selected taxonomies and a gap analysis of their scope, depth, and ambition in supporting methane mitigation.
- **Section 4** summarizes key findings.
- **Section 5** concludes with actionable insights for taxonomy developers.

4 Note: Official FX conversion rate for COP to USD from the World Bank. Exchange rate (Year – COP/USD): 2024 – 4074.43

2. METHODOLOGY

This study employed a three-step methodology to assess the treatment of methane abatement measures in sustainable finance taxonomies.

1. **Selection of five sustainable finance taxonomies for review**, constituting a representative sample.
2. **Current-state mapping,** which required:
    a. Identification of taxonomy-relevant sectors and activities that are material to methane abatement.
    b. Classification of associated methane abatement measures.
    c. Mapping of identified activities and measures across taxonomies, and review of related technical screening criteria (TSC).
3. **Gap analysis**; the assessment of gaps in coverage, depth, and ambition of taxonomy coverage of methane abatement measures.

This approach integrated both top-down evidence from literature and a bottom-up analysis of taxonomy content.

2.1 SELECTION OF TAXONOMIES FOR REVIEW

Sustainable or green taxonomies are typically structured around a hierarchical framework that categorizes economic activities based on their environmental impact and contribution to sustainability goals. At the top level, they define broad objectives, such as climate change mitigation, climate adaptation, or biodiversity protection, followed by sectors or activity groups (e.g., energy, transport, agriculture, industry). Within each sector, specific technical criteria or thresholds are set to determine whether an activity qualifies as environmentally sustainable. Some taxonomies also incorporate a "do no significant harm" (DNSH) principle, ensuring that activities contributing to one environmental objective do not cause substantial negative impacts on others. These criteria often include measurable indicators, such as greenhouse gas (GHG) emissions thresholds, resource efficiency targets, or adherence to best practices, to ensure that only genuinely sustainable activities are recognized (UNDP 2024; Sustainable Banking and Finance Network and GIZ 2024).

Five taxonomies were selected as case studies from a diverse longlist based on the evaluation factors shown in Table 1. Annex 1 provides an overview of the taxonomies considered for the purpose of the analysis.

Table 1. Taxonomy selection factors

Factor	Description
Maturity	Priority was given to taxonomies that are publicly available and have been finalized from a technical perspective at the time of selection (Q4 2024). This also takes into account taxonomies that have been only partially finalized, e.g., certain phases.
Complexity	Comparison of taxonomies that have binary criteria and are threshold-based is more analytically feasible than comparison of those taxonomies that rely on interpretation and are principle-based (e.g., Bangladesh) (Bangladesh Bank - Sustainable Finance Department 2020) or that cross-reference national laws and regulations and require detailed knowledge of local regulations (e.g., China) (People's Bank of China (PBOC) et al. 2021).
Geographical coverage	The objective was to ensure that the selected taxonomies represented the widest geographical coverage possible, including Africa, Asia, Europe, and Latin America.
Transition score	The selection process considered the assessment carried out by the German Institute for Economic Research (DIW) that rated taxonomies' contribution to a transition toward net zero (Marchewitz et al. 2024). The analysis has only considered taxonomies listed in the DIW study, however the score that they have been assigned has not predetermined their inclusion for analysis as it had to be analyzed against other factors listed in Table 1.
Other	Factors such as inclusion of activities material for methane emissions (e.g., rice production, aquaculture) or aim to include the most diverse approaches to taxonomy design and the frameworks with distinctive features were also considered.

The five taxonomies selected as case studies through this process are listed below in alphabetical order. These collectively provide a representative cross-section for examining how methane abatement is—or is not—addressed in sustainable finance frameworks.[5]

- **The Colombian Green Taxonomy** (Gobierno de Colombia 2022), was the first to be launched in Latin America and now serves as a reference point for taxonomies that are being developed in the region. Its framework was structured based on the EU taxonomy, however it represents the sectoral focus of the region, such as the emphasis on land use, specifically on the management of soil and land by the forestry, agriculture, and livestock sectors, as these sectors contribute to 59% of the GHGs in Colombia (Azizuddin 2022).
- **The EU Taxonomy for Sustainable Activities** (European Commission 2023), a technically advanced, widely referenced mature model with detailed TSC. Best practices and lessons learned from its development process are commonly applied to all emerging taxonomy frameworks.
- **Indonesia Taxonomy for Sustainable Finance** (OJK 2025) prioritizes five nationally determined contribution (NDC) sectors. The preparation is done in stages, and sector-based taxonomies are released in each stage. The first, focusing on energy, emphasizes transition activities from fossil fuels. The second was released in February 2025, including transportation and storage, construction and real estate, and agriculture, forestry and other land use (AFOLU).[6] The third release is under development and will focus on waste (including water supply, sewage, and waste management), industry processes and product use, and remaining agriculture and AFOLU activities. Resembling the Association of Southeast Asian Nations (ASEAN) taxonomy (ATB 2024), it follows a traffic-light system. It also integrates an

5 This work is not intended to critically evaluate the national taxonomies of these countries but it rather aims to use them as case studies to inform anyone working on incorporating methane in sustainable finance taxonomies.
6 Agriculture is classified as a separate sector from Foresty and Other Land Use (FOLU).

emphasis on transition finance and adds an archipelagic context to the sample.

- **The South African Green Finance Taxonomy 1st Edition** (National Treasury 2022), while building on and ensuring interoperability with the EU taxonomy, provides a regional (African) perspective and is a binary taxonomy that classifies activities (including transition and enabling activities) as either green or not green.
- **The Thailand Taxonomy – Phase II** (Thailand Taxonomy Board 2025), reflects an emerging market viewpoint and acts as a reference point for the region. The activities are classified in a traffic-light system that applies lessons learned from the Singapore taxonomy development process, giving the taxonomy greater flexibility and broadening its potential user base.

2.2 BENCHMARKING METHANE ABATEMENT MEASURES

The second step employed two complementary approaches to establish a robust reference point for evaluating methane abatement coverage within sustainable finance taxonomies:

- **Top-down analysis**: Literature review identifying methane abatement activities and associated measures across relevant sectors. The analysis relies on the available systematic reviews of practices that enable reduction of methane emissions.
- **Bottom-up analysis**: Reviewing the five selected sustainable finance taxonomies to identify methane-related activities.

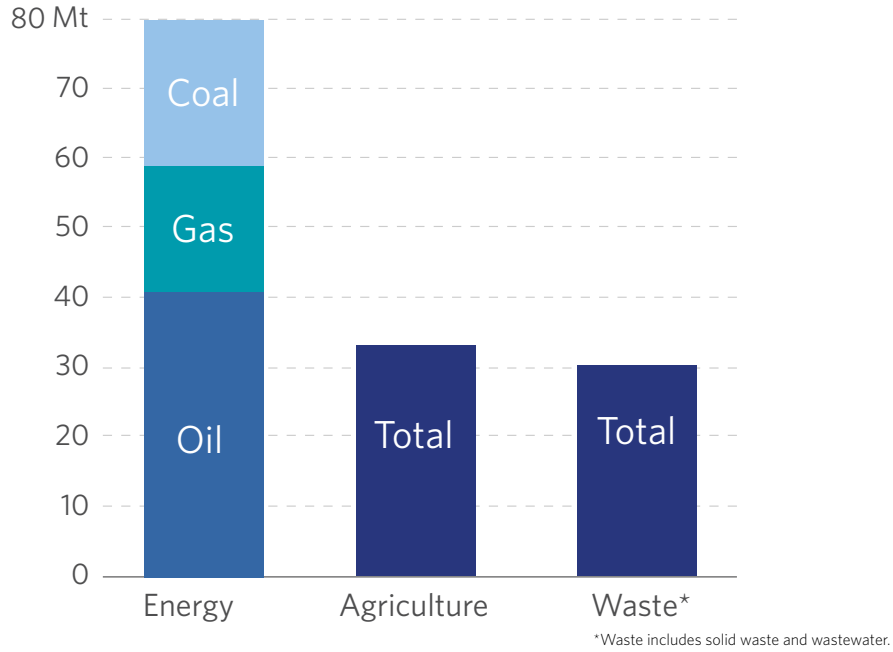
Findings were synthesized from the two streams into a **benchmark list of methane abatement activities and associated measures**. This list then served as a reference framework to determine the presence, absence, or variation in treatment of methane-relevant elements across the five taxonomies.

2.2.1 IDENTIFICATION

TOP-DOWN ANALYSIS

Our literature review (EU 2020; 2019; Höglund-Isaksson et al. 2020; Mundra and Lockley 2024) sought mature, impactful, and investable methane abatement measures across the four key sectors with the highest mitigation potential: agriculture, energy, solid waste and wastewater (see Figure 1).

Figure 1. Global methane abatement potential to 2030



Source: *(IEA 2024)*

The analysis included only activities with a Technology Readiness Level (TRL) of eight or above to ensure commercial viability and relevance to financial flows.[7] This focus on technologies and practices that could attract investment in the short- to medium-term aligns with the intent of taxonomies to direct capital toward market-ready climate solutions, though it may omit emerging solutions with long-term potential. Considering the specific requirements of sustainable finance taxonomy frameworks, during the literature review process only activities that make a significant contribution to climate change mitigation were included. These are defined as activities aligned with achieving reduction of GHG emissions in line with the Paris Agreement's temperature goals. Activities with only minor or indirect net GHG reduction impacts were excluded (e.g., methane abatement measures in the upstream fossil fuel-based activities). The result of this process is a methane abatement benchmark, which is a list of activities associated with material methane emissions and corresponding methane abatement measures, presented in Tables 4 and 5.

BOTTOM-UP ANALYSIS

Recognizing the importance of country-specific policy contexts, the benchmark was cross-checked with national taxonomies. This approach identifies methane-emitting activities that, while minor in global emissions inventories, have significant local economic relevance (e.g., aquaculture).

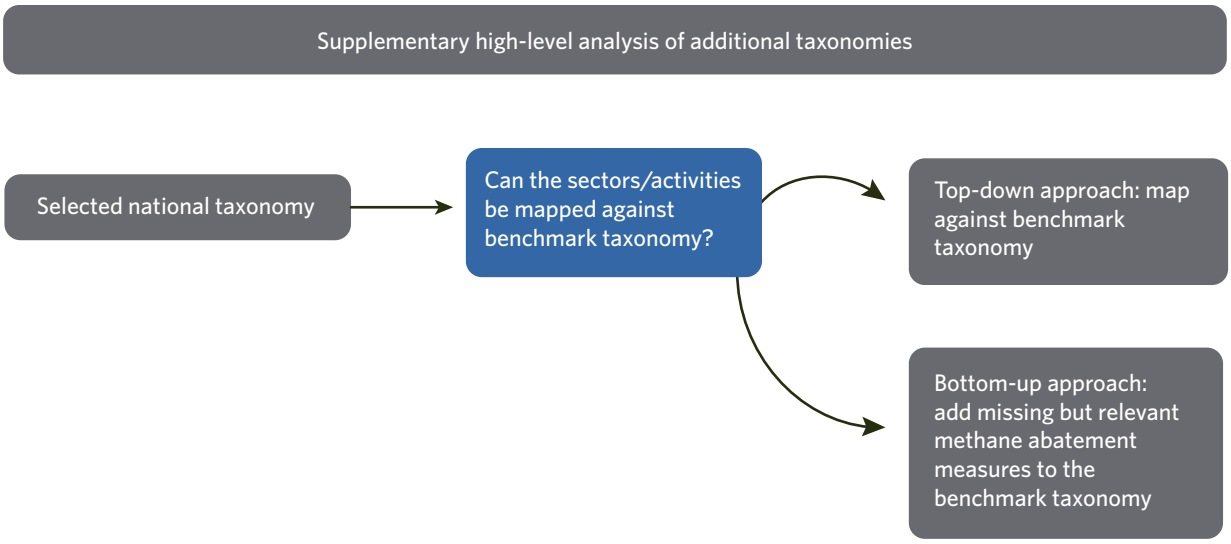
The bottom-up approach aimed to identify methane abatement-relevant activities included in taxonomies but not captured in the initial benchmark. This entailed a systematic review of each

7 TRL 8 – Technology completed and qualified through test and demonstration. Technology is fully functional, reliable, and compliant with the required regulations.

taxonomy's full activity list, without assuming alignment with the benchmark. Any activity that could generate methane emissions or contribute to their abatement, even when its global share was relatively small, was flagged for further analysis.

For each flagged activity, additional literature was reviewed to determine appropriate mitigation measures. Where these measures met the TRL ≥ 8 threshold, the activity and its abatement solution were added to the benchmark list. The sequential application of the top-down and bottom-up mapping strategies (illustrated in Figure 2) ensured that the benchmark was informed by both global literature and national priorities embedded in taxonomies.

Figure 2. Supplementary high-level analysis of additional taxonomies

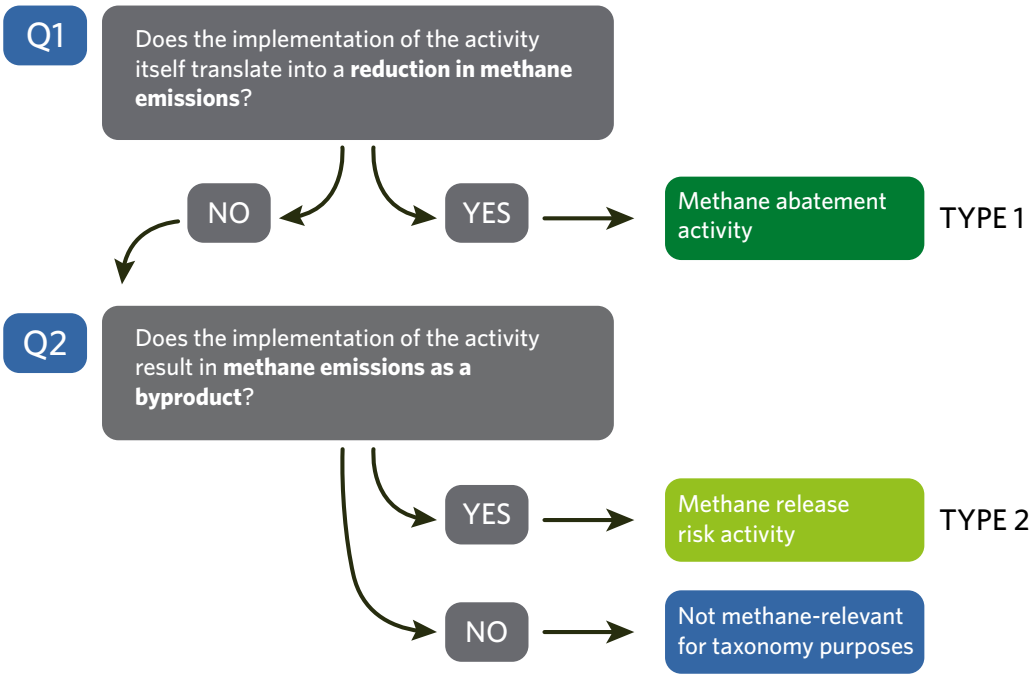


2.2.2 CLASSIFICATION

Activities were classified into two categories to capture the diverse treatment of methane across taxonomies:

1. **Methane abatement activities**: Activities were classified according to whether their implementation directly translated into methane emissions reduction in a given sector (e.g., anaerobic digestion of biowaste). Such activities are considered methane abatement activities, as they explicitly contribute to reducing methane within that sector.
2. **Methane release risk activities (risk activities)**: Activities were classified according to whether their implementation could result in methane emissions as a byproduct, requiring additional safeguards to mitigate such risks (e.g., rice production). These are considered methane release risk activities, which primarily contribute to general GHG mitigation (e.g., CO_2 reduction) but may lead to methane emissions unless safeguards are applied.

Figure 3. Methane abatement vs. methane release risk activities



A classification tool was developed to support the consistent assessment of activity types by taxonomy developers. Figure 3 presents a step-by-step guide to determine whether an activity should be considered methane abatement or as a methane release risk. The process considers the activity's impact on methane emissions and whether specific methane safeguards are included.

Table 2 outlines the characteristics of abatement and risk activities. The criteria are (1) their impact in terms of methane abatement potential, (2) the rationale for their eligibility, and (3) methane-emission risk.

Table 2. Abatement vs. methane release risk activities

Criteria	Abatement	Risk
Impact	Methane abatement potential	Activity contributes to general GHG mitigation, but methane emissions may be a byproduct
Eligibility rationale	Directly recognized as climate-aligned due to methane mitigation	Requires safeguards to avoid undermining climate benefits
Methane-emission risk	High without the activity	Conditional, dependent on how the activity is implemented

2.2.3 EXCLUSIONS AND SCOPE LIMITATIONS

To better define the scope of the exercise, the following methodological choices were made across all the steps taken to perform the assessment of the current state of methane abatement measures in taxonomies:

- **Some methane-relevant activities, such as the upstream extraction of fossil fuel-related activities (which can involve significant methane emissions from venting, flaring, and fugitive leaks), were excluded from the benchmark due to their incompatibility with the goals of the Paris Agreement, even when methane abatement measures are implemented during extraction.** While Indonesia's taxonomy conditionally includes oil and gas extraction and the early retirement of coal-fired power plants (OJK 2025), such activities do not meet the most prevalent definition of a substantial contribution to climate change mitigation. These activities may be deemed at best transitional in some contexts but fall outside the scope of this analysis.
- **Only activities included in the green categories of traffic-light taxonomies were considered, i.e., those activities consistent with the goals of the Paris Agreement.** By contrast, amber categories included in the traffic light taxonomies were excluded from the mapping exercise.
- **The assessment was restricted to TSC under the climate change mitigation objective.** Other elements, such as DNSH and adaptation criteria, may refer to methane, but were not assessed. This approach enabled consistent cross-taxonomy comparison but may omit some methane-related guidance.

2.3 GAP ANALYSIS

The third step was a sector-by-sector gap analysis, structured around three dimensions: coverage, depth, and ambition.

1. **Coverage: Inclusion of methane-relevant activities and measures**
    - Identification of economic activities missing from one or more taxonomies.
    - Assessment of whether methane abatement measures associated with selected activities were fully represented.
2. **Depth: Robustness of technical screening criteria**
    - Examination of whether methane-related criteria in the TSC were specific, measurable, and technically robust.
    - Evaluation of the precision of measures, distinguishing between clearly defined practices and overly general requirements.
    - Identification of any key methane abatement practices absent from the TSC.
3. **Ambition: Beyond common practices**
    - Identification of practices in taxonomies that extend beyond those recorded in the literature review.

Together, these dimensions enabled a detailed understanding of the shortcomings and strengths of existing representative taxonomies, offering a basis for improvements and the potential to guide policymakers and industry toward more effective and technically robust methane mitigation strategies.

2.3.1 COMPLEMENTARY FINDINGS FROM OTHER TAXONOMIES

In addition to the five selected taxonomies, the taxonomies of Australia, Kenya, Singapore, and New Zealand's draft publication of the agriculture and forestry sector were reviewed at a high level to extract supplementary insights.[8] These additional taxonomies were considered where they provided unique or sector-specific solutions or activities with associated criteria that could enrich understanding of taxonomy treatment of methane. These insights were used to contextualize the main findings and highlight potential directions for future taxonomy development, contributing to a deeper understanding of how methane abatement is addressed in emerging frameworks globally.

8 See Box 4 for Kenya insights. See Box 5 for Australia and New Zealand taxonomy insights. See Box 6 for Singapore taxonomy insights.

3. MAIN RESULTS

3.1 METHANE-RELEVANT SECTORS IN TAXONOMIES

Table 3 provides an overview of how the selected taxonomies address key methane-relevant sectors. The definitions of these sectors and their associated activities follow the methodology used in the taxonomies, which map activities to international economic classification codes—most commonly the International Standard Industrial Classification of All Economic Activities (ISIC). These classification systems ensure consistency across policy frameworks by assigning unique codes to activities such as crop and livestock production, wastewater treatment, and energy generation.

The energy sector is present across all five taxonomies. In contrast, the sectors of solid waste and wastewater are missing from Indonesia's taxonomy. Methane is addressed in relation to agriculture in the Colombia, Thailand, Indonesia, and South Africa taxonomies (though the latter lacks developed TSC) and is missing from the EU taxonomy.

Table 3. Methane-relevant sectors across taxonomies

Sector	Taxonomy				
	Colombia	EU	Indonesia	Thailand	South Africa
Energy					
Agriculture					
Solid waste					
Wastewater					

***Key** - Green: Presence of relevant activities and TSC are developed; Blue: Presence of relevant activities but TSC are not developed; Gray: No relevant activities are covered.*

3.2 METHANE ABATEMENT ACTIVITIES IN TAXONOMIES

Methane-relevant activities were classified into two types, as outlined in Section 2.1.2. Type 1 activities include all methane abatement measures in the waste and wastewater sectors, which are recognized by taxonomies as economic activities that can contribute to climate change mitigation (Table 4). Type 2 activities, found in the agriculture and energy sectors (Figure 4), are economic activities that may involve methane emissions unless appropriate structured additional requirements or safeguards are in place (Table 5), even when the activity may reduce CO_2 emissions (Table 5).[9]

9 These requirements are part of the TSC, not DNSH. However, they do act as a kind of safeguard within the same objective.

Figure 4. Methane abatement vs. methane release risk activities by sector

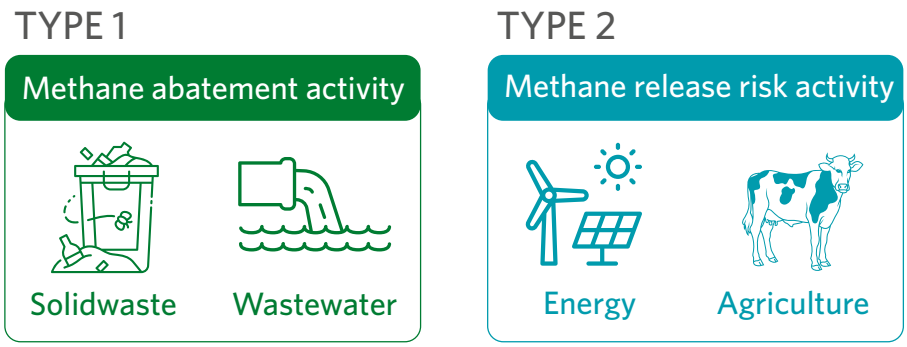


Table 4. Benchmark methane abatement activities/measures in taxonomies

Sector	Methane-emission abatement related activities/measures
Solid waste	Landfill gas capture and utilization
	Anaerobic digestion of biowaste
	Collection and transport of non-hazardous waste in source segregated fractions
	Material recovery from non-hazardous waste
	Composting of biowaste
	Waste-to-energy
Wastewater	Anaerobic digestion of sewage sludge
	Construction, renewal, extension, and operation of wastewater collection and treatment

Table 5. Benchmark methane release risk activities in taxonomies

Sector	Methane-emission related activities/measures	Safeguard activities
Energy	Electricity generation from bioenergy	Safeguards around biomass processing
	Cogeneration of heat/cool and power from bioenergy	
	Production of heat/cool from bioenergy	
	Manufacture of biogas and biofuels for use in transport, and of bioliquids contribution to climate mitigation	
	Transmission and distribution networks for renewable and low-carbon gases	LDAR; leakage threshold
	Electricity generation from fossil gaseous fuels	
	High-efficiency cogeneration of heat/cool and power from fossil gaseous fuels	
	Production of heat/cool from fossil gaseous fuels in an efficient district heating and cooling system	

Sector	Methane-emission related activities/measures	Safeguard activities
Agriculture	**Subsector:** Livestock	Enteric fermentation (dietary manipulation - plant alterations, feeding frequency, additives)
		Selective breeding to improve productivity and animal health/fertility
		Anaerobic digestion/composting/treatment in biogas digesters/manure to energy
		Slurry acidification (acidification in barns, in slurry tanks, during application to fields)
		Storage covers and manure management (decreased manure storage time; improve manure storage covering; improve housing systems and bedding)
	Subsector: Rice production	Change in irrigation practices (improved water management or alternate flooding/drainage wetland rice; direct wet seeding; midseason drying events, shallow flooding, phosphogypsum and sulfate addition to inhibit methanogenesis; composting rice straw)
		Controlled release of fertilizer
		Biochar derived from leftover rice straw
		Breeding of low-GHG and more resilient rice varieties
	Subsector: Perennial and non-perennial crops	Prevent peatland, forest, and biomass intentional burning
		Agricultural and forestry residues-to-energy
	Subsector: Aquaculture	Aeration
		Water exchange
		High quality feed
		Sludge removal
		Organic waste removal
		Dredging
Others	Manufacture of other organic basic chemicals[10]	LDAR

10 This activity category is identified in the South African Green Finance Taxonomy under the Industry sector. See Box 3 for more information.

3.3 ACTIVITY-LEVEL ASSESSMENT

3.3.1 ENERGY

Table 6. Coverage of methane-emission related economic activities in the energy sector

Subsector	Methane-emission related activities	Taxonomy				
		Colombia	EU	Indonesia	Thailand	South Africa
Energy generation from bioenergy	Electricity generation from bioenergy					
	Cogeneration of heat/cool and power from bioenergy					
	Production of heat/cool from bioenergy					
Manufacture of biofuels	Manufacture of biogas and biofuels for use in transport and of bioliquids					
Transmission and distribution	Transmission and distribution networks for renewable and low-carbon gases					
Energy generation from fossil gaseous fuels	Electricity generation from fossil gaseous fuels					
	High-efficiency cogeneration of heat/ cool and power from fossil gaseous fuels					
	Production of heat/cool from fossil gaseous fuels in an efficient district heating and cooling system					

Key *- Green: Activity is covered and TSC are developed; Blue: Activity is covered but TSC are not developed; Gray: Activity is not covered.*

The energy sector has the most extensive coverage of methane-related activities across the five taxonomies reviewed. In this sector, activities have methane release risks and would require additional safeguards to mitigate methane emissions (Type 2 activities).

The energy sector contributes approximately 37% of global anthropogenic methane emissions (IEA 2025a), largely from the extraction, processing, and transportation of fossil fuels. Despite their significant methane emissions, fossil fuel-related activities have limited coverage in green and sustainable taxonomies, as they fail to meet most sustainable finance framework substantial contribution criteria.

Table 6 presents the coverage of methane-emission-related economic activities in the energy sector. Energy generation from gaseous fossil fuels is included in the EU and Indonesia taxonomies, but only for certain applications, such as leak detection and repair, and where emission intensity thresholds exist. The Colombia and South Africa frameworks exclude it entirely, while Thailand only covers hydrogen retrofits. All taxonomies include bioenergy-related activities, which pose methane risks from anaerobic digestion and feedstock processing. The EU, Indonesia, and South Africa mention methane safeguards associated with anaerobic digestion,

while Colombia and Thailand cite lifecycle GHG thresholds or sustainable sourcing. Transmission and distribution of low-carbon gases is addressed by the EU, Thailand, and South Africa, with LDAR required. Colombia omits methane leakage and Indonesia only addresses it indirectly.

ACTIVITY: ENERGY GENERATION FROM BIOENERGY

Electricity generation from bioenergy involves producing power from biological feedstocks such as agricultural residues, energy crops, forest biomass, or biogas derived from organic waste. While bioenergy can contribute to decarbonization, it also presents a risk of methane emissions, especially when processes involve anaerobic digestion, biogas storage, or incomplete combustion.[11] Methane may also be emitted during the storage and handling of feedstocks or digestate. Key abatement measures for this activity include methane leak monitoring, digestate management, feedstock controls, and lifecycle GHG performance thresholds that implicitly account for methane impacts.

This activity is included across the selected taxonomies, but the treatment of methane abatement varies. Some taxonomies address methane emissions explicitly, requiring specific measures such as leakage monitoring or digestate standards. Others approach abatement more implicitly, for example, through lifecycle emissions thresholds or sustainable feedstock sourcing, without naming methane directly. Annex 2 summarizes how methane-related risks are addressed in the TSC each taxonomy.

The EU, South African, and Indonesian taxonomies incorporate explicit methane-specific safeguards, particularly when anaerobic digestion or biogas is part of the generation pathway. These safeguards include digestate management standards, methane leakage monitoring, and mandatory contingency planning. The South African taxonomy includes detailed methane-specific provisions for anaerobic digestion of biowaste and sewage sludge, requiring operators to have monitoring plans for methane leakage and ensuring digestate is properly treated or used.

The Colombian taxonomy relies on a lifecycle GHG emissions threshold (<100 gCO_2e/kWh) for electricity generation from bioenergy, without methane-specific provisions. This approach captures methane only to the extent that it affects total GHG intensity rather than addressing it directly. Additionally, often the intensity threshold is set at the default values which may not fully account for accurate scale of methane emissions.

The Thai taxonomy, while lacking methane-specific measures, partly mitigates methane risks by restricting eligible feedstocks. It explicitly excludes materials such as municipal solid waste, sewage sludge, and algae, which can be methanogenic during the anoxic decomposition process and requires feedstocks to meet sustainability criteria under recognized certification schemes. The EU taxonomy goes further by not only requiring sustainable sourcing of biomass (via Directive 2018/2001) but also by cross-referencing technical standards related to digestate management and methane control when anaerobic digestion is involved.

11 Incomplete combustion of biomass occurs when oxygen supply or combustion temperature is insufficient, preventing full oxidation of carbon and hydrogen. Under these conditions, methane (CH_4) can be formed alongside carbon monoxide (CO), volatile organic compounds (VOCs), and black carbon. Sources include inefficient household cookstoves, open burning of crop residues, poorly managed biogas flaring, and low-efficiency industrial boilers. Although bioenergy is often considered carbon-neutral, methane emissions from incomplete combustion can significantly reduce its climate benefits.

Similarly, the Indonesian taxonomy adopts a multi-faceted approach by including lifecycle GHG emission criteria, requiring bioenergy sustainability certifications and mandates sustainable management of biomass fuel supply for energy plantations. It also has specific requirements for biogas systems, including management, monitoring, and the presence of plans to minimize methane leakage. For anaerobic digestion of organic biowaste or sewage conducted on-site, the taxonomy mandates (i) an implementation and contingency plan to minimize methane leakage, (ii) segregation and separate collection of waste used in the anaerobic process, and (ii) evidence of methane abatement either during construction (e.g., LDAR) or operation (e.g., verified reporting of physical methane emissions with no leakage incidents).

ACTIVITY: MANUFACTURE OF BIOFUELS

Manufacturing biofuels involves the conversion of biomass, including crop residues, organic waste, and forest products, into liquid or gaseous fuels such as biodiesel, bioethanol, and biogas. Methane emissions can arise during feedstock decomposition, anaerobic digestion, and processing, particularly where biogas is produced and stored. Key methane abatement measures include feedstock selection and controls, anaerobic digestion safeguards, digestate management, and process emission capture.

The EU, Colombian and Thai taxonomies define specific criteria; others either omit this topic or have not yet developed TSC. The activity is listed in the industry sector in the South African taxonomy.

The EU taxonomy provides the most detailed methane-related guidance for biofuel manufacturing. It includes explicit safeguards such as defining eligible feedstocks through, requiring compliance with Directive (EU) 2018/2001 for sustainable biomass sourcing, and mandating that digestate from anaerobic digestion meets technical environmental standards.

In the Colombian taxonomy, eligibility is conditional on feedstocks complying with criteria established in the AFOLU and waste management sectors. While this indirectly contributes to methane mitigation, if feedstocks come from methane-prone sources such as manure or waste, there are no methane-specific operational requirements within the manufacturing activity itself.

While the Thai taxonomy follows similar logic with regards to determining eligibility of feedstocks through compliance with national or international guidelines and schemes, it is the only taxonomy that includes quantitative GHG intensity thresholds on lifecycle assessment (LCA) basis for biofuel/biomass produced/used.

Indonesia does not include manufacture of biofuels in the taxonomy. South Africa lists the activity in the industry sector, but without TSC.

Box 3. Manufacture of other organic basic chemicals

Manufacture of other organic basic chemicals is an eligible activity in the EU, South African, and Thai taxonomies under the industry sector. This activity carries methane-emission potential in production pathways involving organic feedstocks or intermediate compounds where methane can be released as a byproduct.

While none of the taxonomies entail TSC that would explicitly address methane emissions, the EU and Thailand include indirect provisions that could help to increase methane abatement from this activity. In both cases, the provisions are the same as those related to the use of biomass as a feedstock for energy generation when relevant to restricting the eligible feedstocks. Although further provisions are included in the energy sector criteria for processes including anaerobic digestion, there are no additional considerations aimed at methane abatement in manufacturing.

ACTIVITY: TRANSMISSION AND DISTRIBUTION NETWORKS FOR RENEWABLE AND LOW-CARBON GASES

This activity refers to the infrastructure used to transport and distribute renewable or low-carbon gases, such as biogas, biomethane, or hydrogen. While these gases may offer lower lifecycle CO_2 emissions, their distribution via pipelines poses a significant risk of methane leakage, particularly for systems carrying biogas or synthetic methane. Methane emissions may occur at valves, joints, compressors, and during maintenance or accidental releases. Abatement measures in this context include leak detection and repair programs, pipeline integrity monitoring, and emission performance benchmarks.

This activity is explicit in three of the five reviewed taxonomies, with methane abatement measures generally framed around operational requirements such as LDAR. Approaches differ in terms of depth, scope, and whether lifecycle GHG reductions or environmental management systems are required in addition to leakage control.

The EU, Thai, and South African taxonomies include explicit methane abatement requirements for gas transmission and distribution infrastructure. All three require leak detection and repair programs as a core condition for eligibility, directly targeting methane leakage. The Thai taxonomy further qualifies eligible gases based on lifecycle GHG intensity, indirectly reinforcing the methane mitigation imperative.

Indonesia's taxonomy does not directly reference methane but requires infrastructure operators to achieve at least 12.5% lifecycle GHG emissions reductions from a business-as-usual baseline by 2030. This must be supported by a validated emissions reduction roadmap, the implementation of an energy management system, and consistent achievement of environmental performance standards under the PROPER rating system. Colombia's taxonomy does not include this activity, representing a gap in sectoral coverage of methane-relevant infrastructure.

ACTIVITY: ENERGY GENERATION FROM FOSSIL GASEOUS FUELS

While considered lower-carbon alternatives to coal or oil, technologies using fossil gaseous fuels pose significant methane risks throughout the value chain. **Abatement measures typically include leak detection and repair programs, installation of monitoring equipment, and mandatory emissions reporting.** Lifecycle GHG performance thresholds may also implicitly drive methane control.

Among those analyzed, only the EU and Indonesian taxonomies include explicit methane abatement provisions for energy generation from fossil gaseous fuels. Both require either the installation of methane monitoring systems or LDAR programs during construction, and reporting of methane emissions during operation. Both frameworks require methane leaks to be identified and eliminated as a condition of eligibility. Indonesia goes further by combining methane-specific operational requirements with consistently applied quantitative lifecycle GHG emissions thresholds: <100 gCO_2e/kWh for electricity generation and <28 gCO_2e/MJ for heat/cooling production. The EU taxonomy includes lifecycle considerations (<100 g CO_2e/kWh) as a requirement but exempts entities for which construction permits are granted by 31 December 2030. These can be assessed based on the direct GHG emissions threshold (<270g CO_2e/kWh per output energy or annual average over 20 years of <550kgCO_2e/kW).

Colombia and South Africa do not include fossil gaseous fuel-based energy generation in their taxonomies. Thailand addresses only the conversion of existing gas plants to green hydrogen, with no methane-related conditions for the continued use of fossil gas.

Box 4. Fossil fuel transition and methane abatement in Indonesia's taxonomy

Most frameworks aim to identify activities that make a substantial contribution to climate change mitigation, but the definition of "substantial contribution" varies. Many taxonomies require such activities to align with a decarbonization pathway consistent with the goals of the Paris Agreement (e.g., the EU, Singapore). In contrast, the Indonesian taxonomy conditionally includes certain activities—such as oil and gas extraction or coal-fired power plants equipped with carbon capture and storage (CCS) or high-efficiency coal technologies—that, when assessed against Paris Agreement targets, would be expected to be phased out. However, they are still included in the taxonomy due to their potential to deliver short- and medium-term GHG emission reductions and are seen as a bridging technology, particularly for hard-to-abate sectors, to accelerate the transitional period.

Indonesia's approach is aligned with national priorities, allowing high-emitting sectors that remain important for methane and overall GHG reduction goals to be included under specific criteria, while gradually steering them to lower emissions.[12] While this may support national targets, the inclusion of activities such as oil and gas extraction—which are not aligned with science-based decarbonization pathways—risks creating friction at the international level and could limit the inflow of sustainable finance from global markets.

12 The oil and gas sector is responsible for approximately 20% of global anthropogenic methane emissions, 85% from upstream activities and 15% from gas transportation and downstream operations (IEA 2025b). These activities are major sources of fugitive methane, particularly venting, flaring, and leaks during extraction (Gallagher 2024).

Improvement opportunity: Given the inclusion of oil and gas within Indonesia's taxonomy, there is scope to embed robust, comprehensive methane abatement measures that will enhance its contribution to national and global decarbonization goals.

These could be informed by internationally recognized approaches such as mandatory LDAR programs, performance-based methane targets, limits on routine flaring and venting, and transparent monitoring, reporting, and verification (MRV) frameworks. For example, in both fossil gas-based power generation and the transmission and distribution of low-carbon gases, the Kenya Green Finance Taxonomy (KGFT) (Central Bank of Kenya 2025) requires installation of measurement equipment at the construction stage, reporting of physical emissions during operation, and implementation of LDAR protocols. A list of relevant methane emissions sources in oil and gas sector and associated potential abatement measures has been developed by the Methane Finance Working Group and could serve as a reference point (Methane Finance Working Group 2025). It could also benefit from clearer criteria to ensure that coal phase-out pathways deliver genuine and irreversible emission reductions, particularly in the context of planned new capacity.

3.3.2 AGRICULTURE

Table 7. Coverage of methane-emission related economic activities in the agriculture sector

Subsector	Methane-emission related activities	Taxonomy				
		Colombia	EU	Indonesia	Thailand	South Africa
Livestock	Livestock					
Crops	Rice production					
	Perennial and non-perennial crops					
Aquaculture	Aquaculture					

Key: *Green: Activity is covered and TSC are developed; Blue: Activity is covered but TSC are not developed; Gray: Activity is not covered.*

Agriculture is responsible for approximately 44% of global anthropogenic methane emissions (IEA 2025a). Major sources include enteric fermentation in livestock, anaerobic decomposition in rice paddies, and mismanagement of organic waste in croplands and aquaculture. These emissions are diffuse but technically addressable through well-established practices, making agriculture central to methane abatement efforts.

Agriculture is unevenly covered in the taxonomies analyzed (Table 7). Only Colombia and Thailand include all major subsectors (livestock, crops). The EU omits agriculture entirely, while Indonesia includes AFOLU activities that are mainly focused on forestry. Similarly, South Africa includes agricultural activities but has yet to develop corresponding TSC. Methane abatement measures are largely structured as eligibility conditions or good practices rather than a core focus, and most taxonomies frame them in broad or implicit terms.

ACTIVITY: LIVESTOCK PRODUCTION

Livestock production is one of the most methane-intensive activities in the agriculture sector. Methane is primarily emitted through enteric fermentation (especially from ruminants such as cattle and sheep) and manure management. Abatement measures include improved feed and diet strategies, anaerobic digestion of manure/biodigesters, pasture and grazing management, and manure composting. In taxonomies, these mitigation measures appear as eligible practices for sustainable livestock systems.

The EU and Indonesian taxonomies do not include livestock production. South Africa includes the activity, but has not yet developed TSC, meaning methane abatement considerations remain undefined.

The Colombian and Thai taxonomies provide lists of eligible sustainable livestock practices, several of which have indirect or potential methane mitigation benefits. However, the sustainable livestock production practices lack the detail necessary to verify whether the end-result will help to reduce methane emissions. This is especially problematic in cases where depending on the implementation of the given practice, the methane emissions can either increase or decrease.

From the eligible practices that have been identified by both taxonomies, there is only one set of practices that can directly be identified as having positive impact on methane emissions reduction: "Biodigesters, aquatic plant and aquaculture channels, oxidation ponds, composting and vegetative systems." The Thai taxonomy has listed an additional practice that can be associated with conclusive positive impact: "Reducing methanogens and improving animal diet."

Table 8 identifies additional practices present in both taxonomies and some that are specific to a given country framework. These practices can either abate or increase methane emissions, depending on their implementation—e.g., the species selected, the management practices or environmental conditions.

Table 8. Eligible practices in Colombian and Thai taxonomies

Common practices	
Practice	**Notes**
Pasture and forage management	E.g., if the practice is focused on rotational grazing it allows pastures to recover and through improved plant quality reduces methane per unit of digestible intake. Alternatively, use of certain legumes can promote methanogenic bacteria.
Organic and green manure, use of manure and fertilizers	E.g., composting manure before application can reduce methane emissions; however, application of raw manure increases them.
Intensive silvopastoral systems	Impact on methane emissions depends on management practices, species selection, and environmental conditions.
Forage/fodder hedges	Impact on methane emissions depends on forage quality, digestibility, and management practices.

Individual practices	
Colombia	**Thailand**
• Mixed fodder banks • Division and rotation of paddocks • Animal welfare	• Compliance with agricultural standards • Capacity building on sustainable livestock models • Crop residues utilization • Improved breeds

ACTIVITY: RICE PRODUCTION

Rice production, particularly under continuously flooded conditions, is a major source of methane emissions. Anaerobic conditions in paddy fields promote methane generation from decomposing organic matter. Proven abatement practices include alternate wetting and drying, dry direct-seeded rice, varietal selection, straw and stubble management, and use of organic fertilizers or biodigesters. These interventions reduce anaerobic conditions, improve soil aeration, or treat methane-producing waste, leading to measurable reductions in methane emissions.

Rice production is not covered in the EU or Indonesian taxonomies. South Africa includes the activity, but without relevant TSC.

The Colombian and Thai taxonomies address some key measures from a methane emissions abatement perspective in their list of sustainable rice production practices, as shown in Table 9.

Two activities in the Colombian taxonomy lack sufficient detail to determine how they will impact methane emissions. The results for activities related to precision agriculture and agrosilvopastoral systems depend on factors such as species selection or management practices. The Thai taxonomy has a more robust and granular approach as it identifies practices such as alternative wetting and seeding practices, which have direct methane abatement impacts.

Table 9. Eligible practices in Colombian and Thai taxonomies

Colombia	Thailand
• Water resource management • Organic or green manures • Biodigesters • Breeding of genetic material in seed and reproductive material	• Water resources management • Composting, organic and biofertilizers • Biodigesters • Rice variety diversification • Alternative wetting and drying • Crop diversification and rotation • Dry direct-seeded rice • Reduction of waste-burning of agricultural residues • Straw and stubble management

ACTIVITY: PERENNIAL AND NON-PERENNIAL CROPS PRODUCTION

Methane can be emitted indirectly through the management of organic waste, effluents, and soil amendments, particularly when residues are left to decay anaerobically or irrigation systems lead to waterlogged soils. Abatement measures for this activity may include composting and biodigesters, management of agricultural waste and effluents, and conversion of organic residues into biofertilizers.

Some of the most material activities from methane emissions reduction perspective – namely the management and processing of agricultural residues as well as biodigesters are only present in the Thai taxonomy. Abatement measures for this activity may include composting and biodigesters, management of agricultural waste and effluents, and conversion of organic residues into biofertilizers.

Across both Colombian and Thai taxonomies, additional practices that are likely to have a positive impact on methane emissions reduction focus on crop rotation, waste management, and management of organic manure/fertilizers. Table 10 presents additional practices that are likely to affect methane emissions, whose implementation will determine whether emissions increase or decrease.

Table 10. Sustainable perennial and non-perennial crop production practices in respective taxonomies

Colombia	Thailand	Indonesia
Likely positive impact		
▪ Waste management and treatment of water contaminated with organic wastes ▪ Organic or green manure	▪ Waste management and treatment of water contaminated with organic wastes ▪ Management and processing of agricultural residues ▪ Biodigesters ▪ Soil conservation	N/A
Description too vague to determine impact		
▪ Shift from transient crops or pasture to agroforestry systems	▪ Shift from transient crops or pasture to agroforestry systems ▪ Compliance with agricultural standards ▪ Implement precision agriculture technologies and practices	▪ Compliance with sustainability certification standards

The Indonesian taxonomy includes the activities of traditional charcoal production and oil palm fruit plantations in this classification, which can release methane emissions. Methane is released in traditional charcoal production often through a process called pyrolysis (Sparrevik et al. 2015)and is often termed "biochar" in this case. Charcoal may be produced in various types and scales of systems, but for rural tropical areas, traditional kiln technologies without treatment of the pyrolysis gases dominate. The traditional charcoal industry is considered to be both inefficient and polluting, emitting harmful off-gases containing methane, carbon monoxide, and particles.

Retort kilns, which recirculate and combust the pyrolysis gases internally, have been put forward to overcome this problem. Even though retort technology has frequently been discussed, this paper is the first study determining gas emission factors for operational retort kilns in rural tropical areas. The mean emission factors for the retort kilns found in this study using identical feedstock were in g kg−1 charcoal. Similarly, the production of palm oil produces wastewater known as palm oil mill effluent (POME) emits methane (Valverde et al. 2024). Indonesia requires recognized sustainability certifications for these activities from bodies such as the FSC, RSPO, and ISPO. However, there are no methane-specific abatement requirements within the TSC.

ACTIVITY: AQUACULTURE

Aquaculture can generate methane emissions under certain conditions, particularly in freshwater pond systems where anaerobic decomposition of organic matter occurs in sediments. The use of uneaten feed, accumulation of organic waste, and limited oxygenation in intensive systems can amplify methane generation. Abatement measures in aquaculture include the use of closed systems with wastewater management, recirculating aquaculture systems (RAS), efficient feed conversion, low-emission species, and integrated multi-trophic systems that minimize waste buildup.

Among the five taxonomies, only Thailand's includes aquaculture with identified practices. Some of these practices are likely to abate methane emissions, notably those that support water exchange and those focused on organic waste removal:

- Closed-system aquaculture technology with recirculating water and wastewater management.
- Integrated multi-trophic aquaculture system.
- Production and feeding to produce low-carbon aquatic animals (e.g., filter feeders; organisms that thrive in recirculating aquaculture systems like tilapia, etc.).

However, the following included practices lack detail to assess their impact on methane emissions:

- Production of microorganisms for biological aquaculture.
- Improving aquatic animal breeds.
- Precision aquaculture system.

3.3.3 WASTEWATER

Table 11. Coverage of methane-emission related economic activities in the wastewater sector

Subsector	Methane-emission related activities	Taxonomy				
		Colombia	EU	Indonesia	Thailand	South Africa
Wastewater treatment	Anaerobic digestion of sewage sludge					
	Wastewater collection and treatment					

Key: *Green: Activity is covered and TSC are developed; Gray: Activity is not covered.*

The wastewater sector—together with landfill, as covered in Section 3.3.4 below—accounts for about 19% of global anthropogenic methane emissions (IEA 2025a), primarily from anaerobic decomposition of organic matter in sewage and industrial wastewater under oxygen-limited conditions. Methane is produced during anaerobic digestion of organic matter in wastewater and sludge, particularly where biogas is not captured or is improperly managed.

All five taxonomies reviewed include wastewater as a relevant sector, with varying scope and ambition of methane-related measures. Anaerobic digestion of sewage sludge is treated as an independent activity by the EU, Colombia, South Africa, and Thailand, with explicit methane safeguards such as leakage monitoring and biogas valorization (Table 11).

Wastewater collection and treatment is more broadly defined across taxonomies, though performance benchmarks and methane-specific provisions differ. Colombia and Thailand adopt the most comprehensive safeguards, while the EU and South Africa emphasize energy performance and legacy system replacement. Indonesia includes this sector under construction, but its TSC focus on water and energy efficiency, without methane-specific abatement requirements.

ACTIVITY: ANAEROBIC DIGESTION OF SEWAGE SLUDGE

Anaerobic digestion of sewage sludge is widely used for stabilizing wastewater biosolids, reducing waste volume, and recovering energy in the form of biogas. This process can lead to fugitive methane emissions from biogas production, storage, and digestate handling if not properly controlled. Methane abatement requires a combination of leak detection and monitoring plans, controlled use or upgrading of biogas, and sustainable digestate management.

Anaerobic digestion of sewage is classified in EU, Colombian, Thai, and South African taxonomies as an independent economic activity eligible as substantially contributing to climate change mitigation. All taxonomies among the alignment criteria list the requirements for methane leakage monitoring. They also mandate or encourage the productive use of biogas for energy generation or upgrading to biomethane, preventing methane release through venting or inefficient combustion.

Colombia presents the most granular provisions, explicitly requiring a transition plan if biogas is only flared, and detailing the required end-use of digestate. It also explicitly allows for supporting infrastructure (e.g., biogas drying or compression) to facilitate methane recovery.

Thailand adopts a similarly comprehensive approach. It specifies that sludge-derived digestate must not be landfilled and outlines acceptable alternative uses such as incineration with energy recovery or post-processing for resource recovery. It also distinguishes between sludge and other biowastes and emphasizes source segregation. The EU and South African taxonomies both include core methane safeguards, including leakage monitoring and biogas utilization, but do not elaborate further on digestate handling or enforcement mechanisms for continuous improvement.

ACTIVITY: WASTEWATER COLLECTION AND TREATMENT

Upgrading or expanding wastewater infrastructure can significantly reduce methane emissions by replacing outdated, high-emitting systems such as septic tanks, pit latrines, and anaerobic lagoons. These legacy systems often create uncontrolled anaerobic conditions, leading to methane generation and release. By contrast, centralized or advanced decentralized wastewater treatment systems can limit anaerobic zones, capture and utilize biogas, and integrate energy-efficient processes. Additional mitigation opportunities arise through methane leakage monitoring, productive use of biogas, and treatment of digestate, all of which help to ensure that methane generated during treatment is either avoided or controlled.

Four taxonomies reviewed include one or more activities under wastewater collection and treatment, as a directly eligible activity provided it is substituting more GHG-intensive treatment systems. However, the names and structure of the activities vary (see Table A.11).

The EU and Thailand adopt a performance-based approach, requiring compliance with net energy-consumption thresholds across three plant capacity tiers. Both also require an assessment of direct GHG emissions when replacing high-emitting systems such as anaerobic lagoons or septic tanks. Furthermore, they include provisions for energy generation within the system (e.g., from hydraulic or solar sources) as part of energy performance calculations. The EU additionally introduces a separate activity focused on renewal of systems, requiring at least a 20% reduction in energy consumption relative to a three-year baseline.

Colombia's taxonomy takes a more detailed process- and safeguard-oriented approach, particularly where anaerobic systems are involved. It explicitly mandates methane leakage monitoring, productive biogas utilization (e.g., for power, vehicle fuel, or chemical feedstock), and appropriate digestate treatment. Projects that flare biogas without productive use must include a transition plan toward value-added uses within three years. These requirements apply to both centralized and decentralized systems and cover the full project lifecycle, from construction through to biogas valorization. Colombia also permits supporting infrastructure like biogas compression or drying.

South Africa includes the activity under centralized wastewater treatment, with eligibility conditional on the replacement of GHG-intensive systems. However, it does not provide additional TSC such as methane monitoring, energy thresholds, or biogas utilization, limiting the enforceability and depth of its methane abatement provisions.

3.3.4 SOLID WASTE

Table 12. Coverage of methane-emission related economic activities in the solid waste sector

Subsector	Methane-emission related activities	Taxonomy				
		Colombia	EU	Indonesia	Thailand	South Africa
Solid waste management	Landfill gas capture and utilization					
	Anaerobic digestion of biowaste					
	Collection, transport, and material recovery from non-hazardous waste					
	Composting of biowaste					

***Key** - Green: Activity is covered and TSC are developed; Gray: Activity is not covered.*

In the waste sector, methane is primarily emitted through anaerobic decomposition of organic waste in landfills or unmanaged dumps. Effective abatement strategies, including landfill gas capture, composting, anaerobic digestion, and waste diversion, are critical to reduce these emissions and are widely recognized as standalone climate-aligned activities across sustainable finance taxonomies.

All five taxonomies reviewed include at least one solid waste activity, with varying scope and specificity of methane safeguards. Landfill gas capture, anaerobic digestion of biowaste, and composting are the most consistently included activities, with Colombia, the EU, Thailand, and South Africa adopting methane-specific TSC. These typically mandate source segregation, methane leakage monitoring, and productive biogas use. Material recovery and waste collection

activities are also included in four taxonomies and contribute to methane mitigation by diverting organics from landfill. Indonesia is the only framework that does not yet cover any of the key methane-relevant solid waste activities.

ACTIVITY: LANDFILL GAS CAPTURE AND UTILIZATION

Landfills are a major source of methane emissions due to the anaerobic decomposition of organic waste. Capturing and utilizing landfill gas, primarily methane, can significantly reduce these emissions while simultaneously generating energy. However, to be effective from a mitigation perspective, several safeguards are essential: the landfill must be closed to further waste intake, methane leakage must be monitored and controlled, and the captured gas must be used productively (e.g., for electricity, heat, transport fuel, or as chemical feedstock). Simply flaring or allowing passive release undermines the climate benefits.

All the reviewed taxonomies—bar Indonesia—include this activity and apply consistent methane abatement requirements, as shown in Table 12.

Colombia goes the farthest by explicitly disallowing flaring-only systems unless they are part of a time-bound transition plan (three years or less), and explicitly recognizes biogas infrastructure (e.g., compression, upgrading) as eligible. The EU and South Africa refer to relevant legislation or implementation timelines to restrict landfills opened after a specific date, reinforcing the principle of limiting further methane generation. The Thai taxonomy, while aligned on core safeguards, omits restrictions based on landfill opening dates, but otherwise mirrors the EU and South Africa's approach in requiring closed landfills, biogas valorization, and methane control plans.

ACTIVITY: ANAEROBIC DIGESTION OF BIOWASTE

This activity transforms biodegradable organic matter into biogas in a controlled, oxygen-free environment. This process can significantly reduce methane emissions that would otherwise occur from unmanaged decay in landfills or open dumping. The environmental benefit of anaerobic digestion depends heavily on methane capture and utilization, digestate management, and ensuring that input feedstocks are predominantly genuine waste and not purpose-grown crops.

Colombia, EU, South Africa, and Thailand all recognize anaerobic digestion of biowaste as an eligible activity and apply a consistent set of methane-related safeguards. These include:

- **Source segregation:** Requirements that biowaste be separately collected at source, which is essential to ensure efficient digestion and avoid contamination.
- **Methane leakage control**: Mandate monitoring and contingency plans to minimize fugitive emissions from the facility.
- **Biogas utilization:** Requirements for productive use of the generated biogas, either for heat, power, vehicle fuel, or as chemical feedstock. Passive flaring or non-use is not permitted unless part of a time-bound transition (specified by Colombia).
- **Digestate management:** Digestate must be utilized beneficially (e.g., as fertilizer or soil improver), with guidance on treatment depending on the taxonomy.

- **Feedstock composition:** Quantitative thresholds on the proportion of feedstocks. The EU limits food/feed crops to ≤10%, while Colombia and South Africa require biowaste to make up ≥70% of the feedstock by weight. These provisions safeguard against the misuse of dedicated energy crops, ensuring the activity genuinely targets methane avoidance from waste streams.

ACTIVITY: COLLECTION, TRANSPORT AND MATERIAL RECOVERY FROM NON-HAZARDOUS WASTE

Separate collection and material recovery of non-hazardous waste contributes to methane abatement by diverting organic fractions from disposal routes such as landfilling or open dumping, major sources of methane emissions. Effective segregation and recycling systems prevent the anaerobic decomposition of biodegradable waste and reduce demand for virgin resource extraction, indirectly avoiding emissions across the value chain.

All taxonomies except Indonesia include provisions for the separate collection and material recovery of non-hazardous waste. Thailand identifies the activity but does not define TSC. The EU, Colombia, and South Africa specify that the waste must be segregated at source and intended for reuse or recycling.

For material recovery, the EU, Colombia, and South Africa impose a common threshold: at least 50% by weight of the separately collected waste must be converted into secondary raw materials suitable for replacing virgin inputs in production processes. This benchmark ensures environmental credibility and resource efficiency of recovery operations.

Colombia's taxonomy is broader, including enabling infrastructure (e.g., transfer stations, compaction, crushing) and mechanized separation and transformation technologies that enhance sorting efficiency and feedstock quality. These provisions support scaling up recovery systems that can reduce the quantity of organic waste reaching methane-prone disposal routes.

ACTIVITY: COMPOST TO BIOWASTE

Composting is an aerobic process that can significantly reduce methane emissions compared to anaerobic waste treatment methods such as landfilling. When biowaste is composted under well-managed, oxygen-rich conditions, the risk of methane generation is minimal. As such, composting plays an important role in diverting organic waste from anaerobic environments and converting it into stable organic matter usable as fertilizer or soil improver, enhancing both emissions mitigation and circular resource use.

The EU, Colombia, Thailand, and South Africa recognize composting of biowaste as a directly eligible activity, requiring that biowaste be source segregated and collected separately, ensuring clean organic input streams that are better suited to composting and less likely to generate methane during the process.

The EU specifies that compost must meet the fertilizer standards outlined in EU Regulation 2019/1009, ensuring agricultural-grade quality. Thailand and Colombia similarly require that the produced compost be reused as a fertilizer or soil improver, also referencing operational practices that minimize methane emissions during composting. The South African taxonomy adds conditionality: composting is eligible only where anaerobic digestion is not technically and economically viable, implicitly promoting methane capture where possible.

OTHER: WASTE-TO-ENERGY ACTIVITIES

Some taxonomies also recognize other forms of waste-to-energy activities, which can contribute to methane mitigation indirectly by reducing the volume of organic waste sent to landfills or unmanaged dumps.

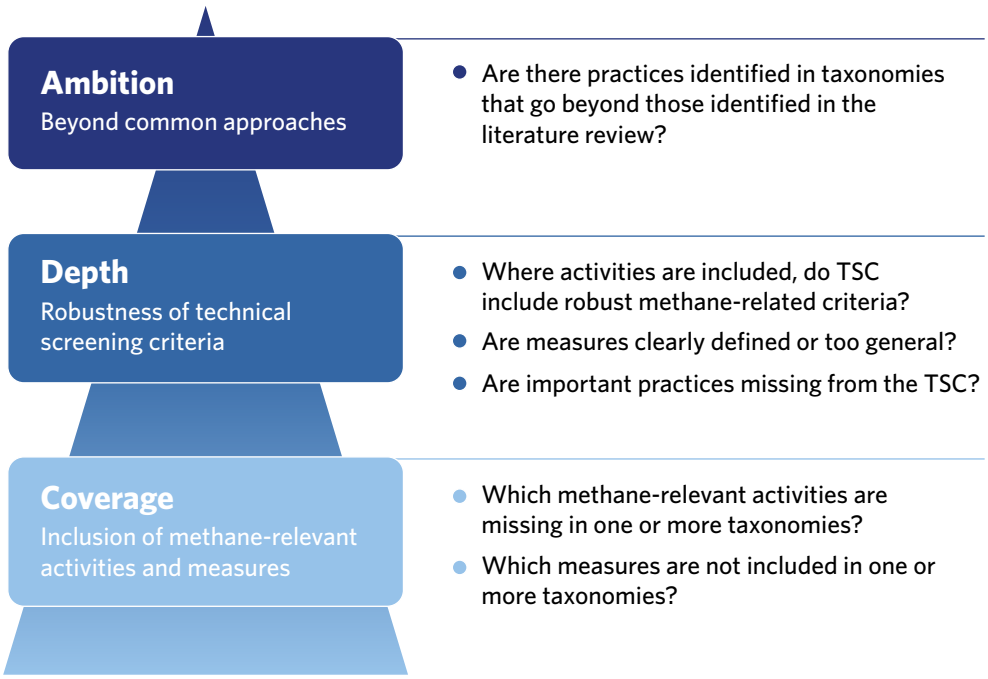
Colombia's taxonomy recognizes thermal energy generation from non-recyclable waste and waste incineration under the waste sector if they are included in local solid waste management plans and if the waste fraction used is non-recyclable or poses environmental risks if landfilled. By diverting such waste from anaerobic decomposition in landfills, these activities help mitigate methane emissions indirectly.

Thailand also includes waste-to-energy generation from residual non-recyclable waste via incineration, pyrolysis, or gasification. Methane mitigation is addressed through upstream source separation, requiring the removal of recyclable and hazardous waste prior to thermal treatment. This ensures only residual biodegradable waste enters the process, thus limiting uncontrolled anaerobic degradation. Additional safeguards include pre-operation environmental assessments and ongoing emissions monitoring, which support accountability for methane and other pollutants.

3.4 GAP ANALYSIS

This subsection presents a gap analysis of the selected taxonomies across three dimensions: **Ambition, Depth, and Coverage** (see Figure 5). The analysis draws on the findings in Section 3.3 to identify opportunities to strengthen the integration of methane abatement in future taxonomy iterations.

Figure 5. Gap analysis framework



3.4.1 ENERGY

COVERAGE OF METHANE-RELEVANT ACTIVITIES

Several methane-related abatement measures identified in the benchmark are either missing or only partly covered in existing taxonomies, as shown in Table 13. In particular, no framework includes safeguards for agricultural biomass processing—a key methane source in bioenergy and biofuel supply chains. Transmission and distribution is well covered except in Colombia, where this activity is missing, and Indonesia, where LDAR is not required. Fossil gas energy generation is addressed by the EU and Indonesia.

Table 13. Coverage gaps in energy sector

Activity	Key observations
Energy generation from bioenergy	▪ All taxonomies omit safeguards or enforcement against open burning of agricultural biomass, a significant methane source. ▪ Digestate use and anaerobic digestion safeguards are included, but agricultural biomass processing is unaddressed.
Manufacture of biofuels	▪ No taxonomy includes methane-specific measures for feedstock pre-processing or field burning. ▪ Biomass sourcing safeguards are addressed (EU, Thailand, Colombia), but do not cover methane emissions directly.
Transmission and distribution of low-carbon gases	▪ Colombia does not include the activity. ▪ Indonesia includes general energy management and emission reductions, but lacks specific LDAR (Leak Detection and Repair) requirements.
Energy generation from fossil gaseous fuels	▪ Colombia, Thailand, and South Africa do not include the activity.

DEPTH: EFFECTIVENESS OF METHANE ABATEMENT MEASURES WITHIN TSC

The EU taxonomy offers the most specific and enforceable methane-related energy criteria. In contrast, Colombia's and Indonesia's taxonomies often rely on general GHG thresholds or energy efficiency standards, which may not effectively capture methane leakage risks. LDAR provisions are well articulated in the EU, South Africa, and Thailand, but are missing or unclear elsewhere. For biofuels and bioenergy, safeguards around anaerobic digestion are present, but field-level methane sources remain unregulated. Table 14 below summaries the gaps by activity.

Table 14. Depth gaps in energy sector

Activity	Key observations
Energy generation from bioenergy	▪ Digestate management and methane leak monitoring are clearly defined and aligned with best practices (EU, South Africa, Indonesia). ▪ Feedstock standards are in place but do not address methane directly (e.g., no mention of biomass processing practices).
Manufacture of biofuels	▪ Colombia relies on cross-sectoral eligibility criteria without specifying methane-specific safeguards.
Transmission and distribution of low-carbon gases	▪ The EU, Thailand, and South Africa include explicit LDAR requirements. ▪ Indonesia uses indirect criteria like ISO 50001 and emission reduction targets, but lacks specificity on methane.
Energy generation from fossil gaseous fuels	▪ The EU and Indonesia provide direct LDAR and monitoring provisions during both construction and operation. ▪ Where the activity is included (EU, Indonesia), methane safeguards are well articulated. ▪ The EU lacks consistent provisions around the requirement of the lifecycle emissions analysis.

AMBITION: BEYOND COMMON APPROACHES

The EU taxonomy demonstrates the highest level of ambition through its integration of digestate quality standards, real-time methane leakage reporting, and optional CCS safeguards in biofuels. Indonesia's requirements for methane monitoring in fossil gas generation and lifecycle emissions limits in energy activities reflect alignment with international benchmarks, though innovation is limited. Notably, only the Thai taxonomy introduces quantitative GHG intensity thresholds on a LCA basis for biofuel/biomass produced/used (primary energy). Other taxonomies primarily adopt baseline safeguards without novel approaches or exceeding international best practices. Table 15 summarizes the observations by activity.

Table 15. Ambition in the energy sector

Activity	Key observations
Energy generation from bioenergy	▪ The EU includes mandatory digestate standards and lifecycle GHG thresholds.
Manufacture of biofuels	▪ The EU incorporates CCS integration and lifecycle emissions tracking. ▪ Thailand introduces quantitative GHG intensity thresholds on a LCA basis for biofuel/biomass produced/used (primary energy) for facilities producing liquid biofuel for heating and cogeneration, as well as facilities producing biofuel for transport.

Activity	Key observations
Transmission and distribution of low-carbon gases	• No innovation beyond baseline LDAR observed.
Energy generation from fossil gaseous fuels	• The EU includes real-time reporting and leak elimination. • Indonesia continuously requires lifecycle assessment.

3.4.2 AGRICULTURE

COVERAGE OF METHANE-RELEVANT ACTIVITIES

Methane-intensive activities such as livestock production and rice cultivation are either omitted (EU, Indonesia) or only partly covered. Where activities are included (Thailand, Colombia), benchmark abatement measures, such as enteric fermentation control, slurry acidification, irrigation improvements in rice, and manure management, are often absent or only vaguely referenced. Peatland and biomass burning and processing, another major methane source, is largely unaddressed. Aquaculture is only explicit in the Thai taxonomy but lacks methane-specific detail in other taxonomies. Table 16 summarizes the observations by activity.

Indonesia's taxonomy includes the methane-emitting activities of charcoal production and oil palm plantation under the agriculture, forestry, and other land uses (AFOLU) classification and requires sustainability certification. However, there are no methane-specific abatement requirements within the TSC.

Table 16. Scope gaps in the agriculture sector

Activity Name	Key observations
Livestock production	• The EU and Indonesia: Not included • South Africa: Included without TSC • Colombia and Thailand: Included with general references to pasture, manure use, and biodigesters. Key methane abatement measures like enteric fermentation control, slurry acidification, and manure storage covers are absent or too vague.
Rice production	• The EU, Indonesia, or South Africa do not include the activity. • Thailand includes multiple benchmark measures (e.g., Alternate Wetting and Drying (AWD), dry seeding, straw management), though some lack specificity. • Colombia mentions water management and breeding but omits detailed criteria on controlled fertilizer release or biochar.
Perennial & non-perennial crop production	• The EU: Not included • Colombia and Thailand: Provide general practices like composting, crop rotation, and agroforestry, but no clear TSC on methane-intensive practices like residue burning or energy-from-residue systems. • Indonesia and South Africa include only select subsectors (e.g., oil palm, forestry), without methane-focused criteria.
Aquaculture	• The EU, Colombia, and Indonesia: Not included • South Africa: Included with no TSC • Thailand: Included with general references to low-carbon feed, sludge management, and wastewater systems, but benchmark measures like aeration, dredging, and feed quality are not consistently addressed.

DEPTH: EFFECTIVENESS OF METHANE ABATEMENT MEASURES WITHIN TSC

Where agriculture-related activities are included, the methane-related TSC are often vague and incomplete. Descriptions such as "pasture management" or "fodder banks" appear without guidance on methane impact. In livestock, key abatement techniques (e.g., dietary manipulation, manure treatment, and selective breeding) are missing. Thailand offers the most specificity for rice cultivation (e.g., alternate wetting and drying), but without quantitative performance thresholds or verification methods. Enforcement and monitoring systems to ensure methane reduction are not included for any crop-related activities. Table 17 summarizes the observations by activity.

Table 17. Depth gaps in the agriculture sector

Activity	Key observations
Livestock production	▪ Practices like "animal welfare" or "fodder banks" lack methane relevance or technical detail. ▪ No screening criteria specify enteric additives, housing changes, or acidification. ▪ Digesters mentioned, but without implementation quality or leakage controls in some taxonomies.
Rice production	▪ Thailand includes detailed measures (e.g., AWD, dry direct-seeded rice), but lacks quantifiable benchmarks or monitoring, reporting, and verification (MRV). ▪ Colombia's "water management" and "manure use" references are vague. ▪ No clear methane leakage safeguards for digesters.
Perennial & non-perennial crops	▪ Composting and biodigester use referenced, but criteria do not address methane leakage, scale, or system design. ▪ Peat or residue burning is not explicitly prohibited or monitored. ▪ The Indonesian taxonomy requires activities such as traditional charcoal production and oil palm fruit plantations to obtain recognized sustainability certifications, however there are no methane-specific abatement requirements within the TSC. This represents a gap, as certifications may encourage best practices but do not guarantee methane capture or monitoring, particularly for sources like POME or inefficient pyrolysis processes.
Aquaculture	▪ Thailand mentions water recirculation and precision aquaculture but lacks linkage to methane. ▪ No clear methane sources or abatement methods described in criteria.

AMBITION: BEYOND COMMON APPROACHES

The selected taxonomies mostly reflect basic or common practices without alignment with emerging international best practices. Likewise, safeguards against methane leaks from biodigesters, composting, or manure storage are not consistently addressed. Only Thailand's rice production criteria hint at broader ambition, integrating water management, crop rotation, and organic fertilizers, though still without methane performance indicators or thresholds.

Box 5. Australia and New Zealand taxonomies

The taxonomies of Australia (Australia Sustainable Finance Institute 2025) and New Zealand (Centre for Sustainable Finance 2025) demonstrate higher ambition in agricultural methane mitigation than others, particularly through the integration of emerging technologies, performance thresholds, and verification requirements.

New Zealand's draft taxonomy includes a dedicated section on methane reduction in livestock, requiring the development and implementation of a feed management plan tailored to herd needs, detailing additives, dosage, and rationing methods. It mandates at least a 10% methane reduction in treated animals, certified through an industry assurance program or a qualified expert, and aims for progressive adoption targets (20% of herd initially, scaling to 80% within five years). Additives must either be agricultural compounds and veterinary medicines (ACVM)-approved or demonstrate methane reduction efficacy through peer-reviewed publications and minimum effective inclusion levels. Supporting practices include monitoring and evaluation, such as assessments of emissions reductions, feed conversion ratios, and animal health impacts. This makes it one of the few taxonomies to integrate quantitative effectiveness thresholds, verification procedures, and performance tracking.

Australia's taxonomy, while less prescriptive, also demonstrates ambition by requiring that feed additives used to reduce enteric methane be approved for use and supported by peer-reviewed scientific evidence of efficacy. It further requires measurement of methane emissions at the farm level, and practices must result in either reduced methane intensity or absolute emission reductions.

Both taxonomies refer to broader mitigation levers like manure management, precision feeding, and animal health improvements, though without always tying them to enforceable outcomes. Notably, Australia includes safeguards related to the efficacy of methane inhibitors, and New Zealand's criteria also cover the regulatory compliance and safety of additives, which adds a critical governance dimension.

Their inclusion of herd coverage targets, monitoring protocols, additive efficacy requirements, and third-party verification represent higher ambition in taxonomy design for agricultural methane mitigation.

3.4.3 WASTEWATER

COVERAGE OF METHANE-RELEVANT ACTIVITIES

Methane-relevant activities in the wastewater sector are covered in most taxonomies, except Indonesia. The transition from methane-intensive systems (e.g., latrines, lagoons) is included in several taxonomies (EU, Colombia, Thailand), but leakage safeguards and energy recovery specifications are inconsistently applied. Where anaerobic digestion is covered, criteria are more aligned, though still lacking thresholds or performance metrics in most cases. Table 18 summarizes the observations by activity.

Table 18. Coverage gaps in wastewater sector

Activity	Key observations
Anaerobic digestion of sewage sludge	▪ Covered by all except Indonesia ▪ The rest four taxonomies include methane leakage monitoring and biogas utilization ▪ Colombia and Thailand also mention digestate reuse ▪ No taxonomy mentions two-stage treatment for industrial wastewater
Wastewater collection and treatment	▪ Covered by all except Indonesia ▪ Colombia, the EU, and Thailand include substitution of methane-intensive systems (e.g., septic tanks, latrines) ▪ South Africa includes system replacement but with no detail ▪ No taxonomy includes pre-treatment for high-load methane sources (e.g., industrial fats, dairy wastewater)

DEPTH: EFFECTIVENESS OF METHANE ABATEMENT MEASURES WITHIN TSC

Where included, abatement measures for anaerobic digestion are relatively well-defined, with leakage control plans and biogas utilization specified across most taxonomies. Colombia and Thailand offer the most complete and explicit criteria. However, quantitative performance thresholds (e.g., methane capture efficiency, digestate quality, or leakage rates) are missing. In broader wastewater treatment, energy efficiency benchmarks are included (the EU, Thailand, Indonesia), and replacement of high-emission systems is acknowledged, but no taxonomy quantifies methane reductions, or requires monitoring beyond energy or general GHG indicators. Additionally, maintenance and long-term methane containment post-operation are rarely considered. Table 19 summarizes the observations by activity.

Table 19. Depth gaps in the wastewater sector

Activity	Key observations
Anaerobic digestion of sewage sludge	▪ Monitoring plans and biogas utilization generally included ▪ Colombia includes fallback rules (e.g., burning transition plan) ▪ Digestate use required but often lacks quality or application controls ▪ No methane recovery efficiency or leakage thresholds defined
Wastewater collection and treatment	▪ The EU and Thailand set energy use thresholds; Indonesia sets thresholds for energy-efficient systems and water-saving fixtures ▪ Colombia requires replacement of high-GHG systems, with some methane-related language ▪ No criteria for methane monitoring during storage or from primary sludge ▪ MRV systems absent across taxonomies

AMBITION: BEYOND COMMON APPROACHES

The wastewater sector includes some of the strongest methane-related technical criteria among all sectors, particularly in anaerobic digestion. The Colombian, Thai, and EU taxonomies specify pathways for biogas and treatment of digestate. Benchmark techniques such as two-stage anaerobic-aerobic sequencing for industrial wastewater, advanced methane capture systems, or real-time leak detection are not addressed.

3.4.4 SOLID WASTE

COVERAGE OF METHANE-RELEVANT ACTIVITIES

Most methane-relevant waste sector activities are included across all taxonomies except Indonesia. However, composting, material recovery, and waste transport are inconsistently covered, and benchmark measures (e.g., source separation, methane capture thresholds) are often missing or only partly reflected in TSC. Activities like CO_2 transport and storage are generally covered, but LDAR is not always required. Table 20 summarizes the observations by activity.

Table 20. Coverage gaps in the waste sector

Activity	Key observation
Landfill gas capture and utilization	▪ Covered by all except Indonesia ▪ All cover biogas utilization and methane monitoring ▪ No taxonomy includes capture efficiency thresholds
Anaerobic digestion of biowaste	▪ Covered by all except Indonesia ▪ All others require biogas use, source separation, and methane leakage plans ▪ Co-digestion limits and input composition vary
Collection, transport, and material recovery	▪ Covered by all except Indonesia ▪ TSC not developed in Thailand ▪ Material recovery and transport addressed in the EU, Colombia, and South Africa ▪ Source separation not consistently emphasized
Compost of biowaste	▪ Covered by all except Indonesia ▪ Methane avoidance via operational safeguards not consistently elaborated

DEPTH: EFFECTIVENESS OF METHANE ABATEMENT MEASURES WITHIN TSC

TSC in the waste sector generally include basic methane control elements such as source separation, biogas utilization, and leakage monitoring. However, quantitative criteria are lacking across all taxonomies, with no methane capture efficiency benchmarks, gas leak thresholds, or digestate emissions metrics. In composting, only Thailand and Colombia directly reference methane control during processing. Material recovery criteria (e.g., 50% output to secondary material) are present but not explicitly linked to methane abatement. CO_2 transport and storage rules are often general and vary in their attention to methane risk during transport or injection. Table 21 summarizes the observations by activity.

Table 21. Depth gaps in the waste sector

Activity	Key observation
Landfill gas capture and utilization	▪ Monitoring plans included in all taxonomies except Indonesia ▪ No performance metrics or capture thresholds defined

Activity	Key observation
Anaerobic digestion of biowaste	▪ Biogas utilization and methane monitoring consistently included ▪ Only Colombia and South Africa include fallback scenarios for flaring ▪ Digestate use is widely required but without emissions quality criteria
Collection, transport, and material recovery	▪ EU and Colombia require 50% recovery output ▪ Methane relevance is indirect, no explicit landfill diversion targets or leak control during transport
Composting of biowaste	▪ Source segregation required by all taxonomies that include this activity ▪ Thailand and Colombia explicitly require methane minimization in operations ▪ No quantitative methane avoidance targets

AMBITION: BEYOND COMMON APPROACHES

There is little evidence of technological or performance-based ambition across taxonomies in the waste sector. For instance, no taxonomy incorporates advanced MRV (e.g., satellite or remote sensing), performance-based metrics, or incentives for maximizing methane capture/utilization efficiency. Provisions for biogas flaring as fallback exist but are not tied to time-bound improvement paths, except in Colombia. Composting criteria remain conventional; none address low-oxygen hot-spot control or real-time fermentation management. Similarly, CO_2 transport and storage activities remain focused on structural eligibility rather than technological excellence or methane leakage interaction.

Box 6. Singapore-Asia taxonomy

Singapore's taxonomy (Monetary Authority of Singapore 2023) demonstrates a technically advanced approach to methane abatement in the waste sector, particularly in landfill gas capture and solid waste treatment. It requires the installation of real-time methane monitoring at vent stacks, continuous methane monitoring systems, and the documentation of methane leak events and annual emission inventories. Additionally, methane release thresholds must trigger corrective action, ensuring that issues are addressed promptly. These requirements go beyond conventional safeguards by embedding response mechanisms into waste facility management.

Further, the taxonomy sets a methane recovery system collection efficiency target of at least 75%, and mandates that methane flaring comply with thermal efficiency standards. Facilities must have backup power for methane capture systems, and methane mitigation strategies must be integrated into operational plans. It also requires annual third-party verification of methane data, reinforcing accountability and integrity.

4. SUMMARY AND RECOMMENDATIONS

4.1 SUMMARY OF FINDINGS

A comparative analysis of the sustainable finance taxonomies of Colombia, the EU, Indonesia, South Africa, and Thailand reveals that a consistent set of structural challenges hinders the integration of methane abatement across these frameworks. While each taxonomy reflects distinct regional priorities and stages of development, they share three core weaknesses:

1) Incomplete sectoral and activity coverage,
2) Focus on usability over preserving technical accuracy, and
3) Criteria that lack clarity and specificity.

4.1.1 INCOMPLETE SECTORAL AND ACTIVITY COVERAGE

Methane emissions originate from a relatively narrow set of sectors—principally energy, agriculture, waste, and wastewater. Yet, these are inconsistently addressed in the taxonomies reviewed.

Despite methane's outsized short-term climate impact, some key emitting sectors are either only partly included or entirely omitted. For example, Indonesia's taxonomy, still in early development, has only defined TSC for selected energy and construction activities. The agriculture and waste sectors remain unaddressed but will be developed in an upcoming Version 3 of the taxonomy.

Even when sectors are nominally included, important methane-relevant activities are inconsistently incorporated across frameworks. For example, Colombia includes agriculture, but aquaculture, a significant source of methane emissions, is not included as an eligible activity.

This inconsistency deprives investors of the guidance needed to identify and support impactful methane reduction measures (See Box 2). As a result, critical mitigation opportunities may remain unfunded, slowing progress on both national and global climate objectives.

In some cases, taxonomies identify methane-relevant sectors and activities but do not provide the TSC that specify performance thresholds, eligible technologies, or compliance metrics. For example, South Africa lists high-emitting activities such as livestock, rice, and aquaculture in its taxonomy, but has not yet published corresponding criteria, limiting the framework's practical utility.

It is important to note that, in some cases, exclusions are intentional to align with climate considerations. For example, taxonomies may exclude high-methane-emitting activities like coal or fossil gas infrastructure if they cannot be credibly aligned with 1.5°C pathways, and therefore would not include any corresponding abatement activities.

The consequences of inadequate sector and activity coverage are twofold:

- **Reduced methane abatement potential:** By failing to direct capital toward high-emission activities where mitigation is feasible, the taxonomy limits its own environmental impact.
- **Missed opportunities for finance mobilization:** In regulatory contexts, the absence of methane-relevant sectors or activities can discourage private investment in abatement solutions, particularly in emerging markets where taxonomies serve as critical investment signals.

4.1.2 FOCUS ON USABILITY OVER PRESERVING TECHNICAL ACCURACY

Taxonomy designers frequently face tensions between technical accuracy and ease of use. While user-friendliness is essential for financial institutions to adopt and apply taxonomies in decision-making, this can lead to the over-simplification of criteria, especially for complex pollutants like methane.

Taxonomy developers often draw upon established taxonomies such as the EU's; yet, in adapting these frameworks, the underlying scientific and technical details are omitted to make them more digestible. For example, Thailand's taxonomy adopts the EU landfill gas capture and utilization criteria for the waste sector, but replaces references to detailed EU methane monitoring procedures with a generic requirement for a monitoring and contingency plan. This could compromise the effectiveness of methane-related safeguards, particularly when detailed mitigation pathways or science-based thresholds are replaced by generic descriptors.

This trade-off poses a serious risk: if usability overrides rigor, the taxonomy may fail to deliver real-world environmental outcomes. Scientific credibility and environmental integrity should not be sacrificed for accessibility—especially in high-impact areas like methane abatement, where precision is critical.

4.1.3 LACK OF SPECIFICITY IN CRITERIA AND SAFEGUARDS

A third common weakness is the use of vague or qualitative language in TSC, particularly for methane. This is most apparent in Type 2 activities, where methane abatement is treated as a safeguard rather than the primary objective:

- **In agriculture**, both Colombia and Thailand list sustainable practices such as pasture management, biodigesters, or crop rotation. However, these lists typically lack methane-specific metrics, such as emission thresholds, leakage rates, or quantified performance benchmarks.
- **In the waste sector**, while biogas capture or utilization is often promoted, terms like "productive use" remain undefined, and acceptable methane leakage rates are rarely specified.

The absence of clear thresholds, monitoring requirements, and enforcement mechanisms reduces accountability. It creates the risk that activities labeled as "green" could yield minimal or even negative net methane outcomes, undermining the environmental credibility of the taxonomy.

The implications of the latter two challenges are significant. They signal a lack of methodological robustness, particularly when proven, cost-effective abatement technologies or practices are excluded or inadequately specified. They also undermine credibility and signal technical gaps or outdated guidance. The omission of certain measures might indicate that the taxonomy is not based on the latest scientific or technological understanding, reducing its relevance and effectiveness, eroding investor trust, and limiting its effectiveness as a climate policy tool.

4.2 BEST PRACTICES

Our systematic gap analysis revealed common structural challenges that, to date, have limited the integration of robust methane abatement approaches into taxonomies. Addressing these challenges requires a fundamental rethinking of how methane reduction is embedded within sustainable finance taxonomies. At the same time, the analysis showed that such rethinking is constrained by a practical limitation: the absence of a single point of reference or of an easily accessible set of guidelines with sufficient detail ensuring that taxonomy criteria consistently and effectively reflect methane abatement priorities across sectors and activities.

To address this gap, Annex 3 presents a table of best practices for methane abatement with comprehensive, clearly defined, evidence-based criteria tailored to each economic activity. These best practices are intended not only to guide taxonomy developers but also to offer a practical tool for policymakers and industry stakeholders seeking to operationalize methane abatement at scale.

The best practices were elicited from two main sources:

A. Results of the analysis:
    I. Results of the literature review,
    II. Review of the current state of inclusion of methane abatement measures across taxonomies, and
    III. Results of gap analysis.
B. Inputs from sectoral criteria developed by the Climate Bonds Initiative (Climate Bonds 2024a; 2024b).

This two-fold approach ensures that the listed methane reduction methods are both technically rigorous—as they rely on science-based evidence outlined in the literature and provided by Climate Bonds's technical working groups—and practically implementable—as Climate Bonds Criteria and most taxonomies are reviewed by industry representatives.

This table in Annex 3 serves as a roadmap for policymakers, taxonomy designers, and industry stakeholders, enabling them to embed methane reduction objectives more consistently across jurisdictions. Beyond informing the development of national and regional taxonomies, it also highlights opportunities for international harmonization, fostering alignment with science-based targets, and supporting more ambitious global methane mitigation strategies.

CONSIDERATIONS FOR USING THE BEST PRACTICES FRAMEWORK

While the table aims to provide a comprehensive framework for mitigating methane emissions across selected economic activities, the capacity to implement specific, more complex measures may vary significantly across jurisdictions. In such cases, adopting these measures may require additional time, phased implementation, or alternative approaches that allow flexibility, such as gradually increasing the level of stringency.

Additionally, the effectiveness of each measure can differ depending on local conditions, including regulatory frameworks, technological readiness, infrastructure, and sectoral characteristics. This variation highlights the importance of context-specific adaptation and implementation strategies.

Furthermore, the methane abatement potential of the measures listed in the table is not uniform, making some a greater priority than others. While this study provides a robust overview of market-ready methane abatement measures, further research is needed to better understand how to prioritize these measures effectively. Methodologies that assess their relative impact, cost-effectiveness, and feasibility will be particularly important for taxonomy developers and policymakers.

5. CONCLUSION

The ultimate objective of this work is to encourage improved integration and better refinement of methane mitigation criteria in taxonomies across jurisdictions (see Annex 3). To date, sustainable finance taxonomies have primarily focused on climate change mitigation through CO_2 abatement. While crucial, this has led to an underrepresentation of other potent GHGs, particularly methane, which has a significantly higher short-term global warming potential. As a result, methane abatement objectives have been inconsistently or superficially integrated into frameworks.

This gap is increasingly problematic for investors. With advances in satellite monitoring and greater public scrutiny, methane emissions are becoming more visible and reputationally risky. Taxonomies that do not incorporate methane mitigation may fall out of step with evolving investor priorities and expectations.

Therefore, this study has sought to highlight several positive national-level examples, such as Colombia's time-bound commitment to phase out flaring and Thailand's incorporation of methane safeguards in the biowaste and aquaculture sectors. However, such efforts remain isolated and uncoordinated, with no shared reference point or international consensus on what constitutes robust methane mitigation criteria in taxonomies.

This fragmentation creates challenges for both taxonomy developers and international investors, who may struggle to identify, compare, or prioritize investment opportunities that effectively contribute to methane reduction. **Without clear, consistent guidance, investments with high methane-mitigation potential may be overlooked, thereby limiting the overall climate impact of sustainable finance frameworks.**

This study's systematic gap analysis and in-depth literature review enable the identification of activity-specific methane abatement opportunities and a set of criteria per economic activity (see Annex 3). Integrating identified best practices across national taxonomies would enhance the credibility and environmental integrity of taxonomies, provide clarity and comparability for investors, and align sustainable finance more closely with global methane reduction goals, such as those set by the Global Methane Pledge. Ultimately, mainstreaming methane abatement across taxonomies is both an environmental imperative and a critical opportunity to unlock high-impact climate finance.

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ANNEX 1: LONGLISTED TAXONOMIES

Table A.1. Assessment of long-listed taxonomies (status for Q4 2024)

Taxonomy	Maturity	Complexity	Geographical coverage	Transition score
European Union (EU)	Published	Low	Europe	3.6
Singapore	Published	Low	Asia	3.2
Colombia	Published	Low	LATAM	3
Georgia	Published	Low	Europe	3
South Korea	Published	Low	Asia	3
Sri Lanka	Published	Low	Asia	3
Mexico	Published	Low	LATAM	2.8
Thailand	Phase I Published	Low	Asia	2.8
Indonesia	Phase II Published	Low	Asia	2.6
Kazakhstan	Published	Low	Asia	2.6
Latin America and Caribbean	Published	Low	LATAM	2.6
Mongolia	Published	Low	Asia	2.6
Russia	Published	Low	Asia	2.4
South Africa	Published	Low	Africa	2.2
Uzbekistan	Published	Low	Asia	2
ASEAN	Published	High	Asia	3.2
Bangladesh	Published	High	Asia	2.8
China	Published	High	Asia	2.8
Philippines	Published	High	Asia	2.8
Malaysia	Published	High	Asia	2.4
Hong Kong	Phase II Published*	-	Asia	2.8
Brazil	Published*	-	LATAM	2.8
Vietnam	Published*	-	Asia	2.8
Rwanda	Published*	-	Africa	2.6
Israel	Under development	-	Asia	2.4

* *Indicates taxonomies whose official publication occurred after the analysis phase had concluded.*

ANNEX 2: SUMMARY OF METHANE ABATEMENT MEASURES IN SELECTED TAXONOMIES

Table A.2. Methane abatement measures in electricity generation from bioenergy

Taxonomy	Methane abatement measures in TSC	Coverage*
Colombia	Requires lifecycle emissions threshold (<100 gCO_2e/kWh) demonstrated via ISO 14067 or GHG protocol methodologies.	Implicit
EU	Requires compliance with sustainability criteria under Directive (EU) 2018/2001 (EU 2018); where anaerobic digestion is used, digestate must meet specific standards.	Explicit
Indonesia	Requires lifecycle emissions threshold (<100 gCO_2e/kWh); methane leakage monitoring and contingency plans are mandated when biogas is used.	Explicit
South Africa	Requires methane leakage monitoring for anaerobic digestion systems; includes digestate use conditions.	Explicit
Thailand	Requires certified sustainable sourcing of biomass feedstocks; excludes high-risk methane feedstocks such as municipal solid waste, algae, and sewage sludge.	Implicit

***Explicit:** Methane-specific measures are directly stated in the TSC; **Implicit:** A broader provision (e.g., requirement of emissions assessment throughout life cycle) may indirectly reduce methane but does not mention it explicitly.*

Table A.3. Methane abatement measures in manufacturing biofuels

Taxonomy	Methane abatement measures in TSC	Coverage*
Colombia	Requires feedstocks to meet eligibility criteria from the AFOLU and waste sectors.	Implicit
EU	Requires compliance with biomass sourcing standards; bans use of food and feed crops; digestate from anaerobic digestion must meet technical criteria; captured CO_2 must be stored under specified conditions.	Explicit
Thailand	For feedstocks it requires compliance with national/international guidelines and schemes as well as introduces quantitative GHG intensity thresholds on LCA basis for biofuel/biomass produced/used (primary energy) for facilities producing liquid biofuel for heating and cogeneration – 57.6g CO_2e/ kWh, facilities producing biofuel for transport – 67.7g CO_2e/ kWh.	Implicit
Indonesia	Not covered	
South Africa	Activity included but TSC not yet developed; classified under the Industry sector.	

***Explicit:** Methane-specific measures are directly stated in the TSC; **Implicit:** A broader provision (e.g., requirement of emissions assessment throughout life cycle) may indirectly reduce methane but does not mention it explicitly.*

Table A.4. Methane abatement measures in transmission and distribution of renewable and low-carbon gases

Taxonomy	Methane abatement measures in TSC	Coverage*
Colombia	Not covered	
EU	Requires leak detection and repair of pipelines and other network components to reduce methane leakage.	Explicit
Indonesia	Requires lifecycle GHG emissions reductions (≥12.5% by 2030); mandates environmental management and energy efficiency systems; no direct mention of methane leakage control.	Implicit
South Africa	Requires leak detection and repair for pipelines and network infrastructure.	Explicit
Thailand	Requires leak detection and repair for existing infrastructure; defines low-carbon gases based on lifecycle GHG intensity.	Explicit

***Explicit:** Methane-specific measures are directly stated in the TSC; **Implicit:** A broader provision (e.g., requirement of emissions assessment throughout life cycle) may indirectly reduce methane but does not mention it explicitly.*

Table A.5. Methane abatement measures in energy generation from fossil gaseous fuels

Taxonomy	Methane abatement measures in TSC	Coverage*
Colombia	Not covered	
EU	Requires installation of measurement equipment or LDAR at construction; and mandatory reporting and elimination of leaks during operation.	Explicit
Indonesia	Requires lifecycle emissions thresholds for electricity (<100 gCO_2e/kWh) and for heating/cooling (<28 gCO_2e/MJ); mandates methane monitoring or LDAR at construction and leak-free operation with reporting.	Explicit
South Africa	Not covered	
Thailand	Not covered	

***Explicit:** Methane-specific measures are directly stated in the TSC; **Implicit:** A broader provision (e.g., requirement of emissions assessment throughout life cycle) may indirectly reduce methane but does not mention it explicitly.*

Table A.6. Methane abatement measures in livestock production

Taxonomy	Methane abatement measures in TSC	Coverage*
Colombia	Lists a broad set of eligible practices	Implicit
EU	Not covered	
Indonesia	Not covered	
South Africa	Activity included but TSC are not yet developed	
Thailand	Lists a broad set of eligible practices	Implicit

***Explicit:** Methane-specific measures are directly stated in the TSC; **Implicit:** A broader provision (e.g., requirement of emissions assessment throughout life cycle) may indirectly reduce methane but does not mention it explicitly.*

Table A.7. Methane abatement measures in rice production

Taxonomy	Methane abatement measures in TSC	Coverage*
Colombia	Lists a broad set of eligible practices	Implicit
EU	Not covered	
Indonesia	Not covered	
South Africa	Included but TSC not developed	
Thailand	Lists a broad set of eligible practices	Implicit

***Explicit:** Methane-specific measures are directly stated in the TSC; **Implicit:** A broader provision (e.g., requirement of emissions assessment throughout life cycle) may indirectly reduce methane but does not mention it explicitly.*

Table A.8. Methane abatement measures in perennial and non-perennial crop production

Taxonomy	Methane abatement measures in TSC	Coverage*
Colombia	Lists a broad set of eligible practices	Implicit
EU	Not covered	
Indonesia	Forestry and oil palm plantation activities required to meet sustainability certification standards from bodies such as Timber Legality and Sustainability Certification System Forest Stewardship Council (FSC), Roundtable on Sustainable Palm Oil (RSPO) or Indonesian Sustainable Palm Oil (ISPO).	Implicit
South Africa	Included but TSC not yet developed	
Thailand	Lists a broad set of eligible practices	Implicit

***Explicit:** Methane-specific measures are directly stated in the TSC; **Implicit:** A broader provision (e.g., requirement of emissions assessment throughout life cycle) may indirectly reduce methane but does not mention it explicitly.*

Table A.9. Methane abatement measures in aquaculture

Taxonomy	Methane abatement measures in TSC	Coverage*
Colombia	Not covered	
EU	Not covered	
Indonesia	Not covered[13]	
South Africa	Included but TSC not yet developed	
Thailand	Lists a broad set of eligible practices	Implicit

***Explicit:** Methane-specific measures are directly stated in the TSC; **Implicit:** A broader provision (e.g., requirement of emissions assessment throughout life cycle) may indirectly reduce methane but does not mention it explicitly.*

13 The Indonesian taxonomy does not list aquaculture as a stand-alone activity and classifies dredging under the construction sector. For this reason, we did not tag aquaculture as being present in the Indonesian taxonomy, as the reference to dredging falls under the broader construction sector.

Table A.10. Methane abatement measures in anaerobic digestion of sewage sludge

Taxonomy	Activity name	Summary of TSC
Colombia	Sewage sludge treatment	Requires methane monitoring plans, productive use of biogas (electricity, heat, biomethane, fuel, or chemical feedstock), and criteria for digestate handling (e.g., fertilizer, soil improver, or other uses)
EU	Anaerobic digestion of sewage sludge	Requires methane leakage monitoring; mandates productive biogas use (electricity, heat, biomethane, fuel, or chemical feedstock)
Indonesia	Not covered	
South Africa	Anaerobic digestion of sewage sludge	Requires methane leakage monitoring and productive use of biogas
Thailand	Anaerobic digestion of biowaste or wastewater	Requires leakage control, biogas use, and detailed criteria for digestate handling (e.g., no landfilling of sewage sludge digestate, energy recovery allowed)

Table A.11. Methane abatement measures in wastewater collection and treatment

Taxonomy	Activity name	Summary of TSC
Colombia	• Sanitary and combined sewage systems • Wastewater treatment systems	Mandates methane leakage monitoring, productive biogas use, digestate handling; transition plan required for flaring-only systems
EU	• Construction, extension and operation of wastewater collection and treatment • Renewal of systems	Net energy thresholds: GHG emissions assessment required when replacing high-emission systems
Indonesia	Not covered[14]	
South Africa	• Centralized wastewater treatment	Requires replacement of GHG-intensive systems (e.g., septic tanks, anaerobic lagoons), but lacks performance thresholds or safeguards
Thailand	• Centralized wastewater collection and treatment • Renewal of centralized system, decentralized wastewater systems (no TSC yet)	Net energy thresholds by plant size; GHG assessment required for upgrades; renewal requires 20% energy efficiency improvement

14 Indonesia's taxonomy includes the installation of clean water, wastewater, and drainage systems as a distinct activity for buildings, including installation, maintenance, and repair of waterline systems. This falls under the construction and real estate sector and the associated TSC focuses primarily on water and energy efficiency, not methane mitigation. As such, this has not been included in our analysis as the criteria are more aligned with building performance than methane-specific outcomes.

Table A.12. Methane abatement measures in landfill gas capture and utilization

Taxonomy	Summary of TSC
Colombia	Requires closed landfill/cells, methane monitoring, and productive biogas use; flaring allowed only with time-bound transition.
EU	Requires closed landfill, productive use of biogas, and methane control per Directive 1999/31/EC.
Indonesia	Not covered
South Africa	Requires closed landfill/cells, methane leakage monitoring, productive biogas use, and excludes landfills opened post-taxonomy adoption.
Thailand	Requires closed landfill/cells, methane leakage monitoring, and productive biogas use.

Table A.13. Methane abatement measures in anaerobic digestion of biowaste

Taxonomy	Summary of TSC
Colombia	Requires source segregation, methane monitoring, productive biogas use, digestate valorization, and mandates ≥70% organic waste input.
EU	Requires source segregation, methane leakage control, biogas use, digestate recovery, and limits food/feed crops to ≤10% of feedstock.
Indonesia	Not covered
South Africa	Requires source segregation, methane monitoring, biogas use, digestate use, and ≥70% biowaste input (with legal compliance for energy crops if used).
Thailand	Requires source segregation, methane leakage control, biogas valorization, and digestate processing standards.

Table A.14. Methane abatement measures in collection, transport, and material recovery from non-hazardous waste

Taxonomy	Summary of TSC
Colombia	Requires source segregation and ≥50% material recovery rate; includes supporting infrastructure (e.g., mechanized sorting, pre-processing) in eligibility scope.
EU	Requires source segregation for non-hazardous waste collection; ≥50% material recovery rate required for reuse of waste as secondary raw material.
Indonesia	Not covered
South Africa	Requires source segregation for collection; ≥50% material recovery threshold for reuse as secondary raw material.
Thailand	Included but TSC not yet developed

Table A.15. Methane abatement measures in compost to biowaste

Taxonomy	Summary of TSC
Colombia	Requires source segregation; compost must be reused; explicitly calls for minimization of methane emissions.
EU	Requires source segregation; compost must meet EU fertilizer standards.
Indonesia	Not covered
South Africa	Requires source segregation and compost reuse; only eligible where anaerobic digestion is not viable.
Thailand	Requires source segregation and compost reuse; operations must avoid methane leakage.

ANNEX 3: RECOMMENDED BEST PRACTICES

Table A.16. Benchmark and best-practice measures for methane abatement – Energy

<table>
<tr><th>Subsector</th><th>Methane-emission related activities</th><th>Safeguard activities</th><th>Best-practice abatement measures</th></tr>
<tr><td rowspan="3">Bioenergy</td><td>Electricity generation from bioenergy (ISIC: D3510)</td><td rowspan="3">Safeguards around biomass processing</td><td rowspan="3">Monitoring and detection:
• Leakage detection and repair (LDAR), including contingency planning and monitoring, reporting, and verification plans that meet minimum requirements outlined in Annex 4.
Emissions performance standards:
• Lifecycle GHG emission thresholds taking into account the following maximum specific GHG emissions expressed as CO_2eq per MJ of bioenergy:
Maximum specific Green House Gases emissions (gCO_2eq per MJ)
<table><tr><th>Final product</th><th>Fossil baseline gCO_2e/MJ</th><th>Minimum % reduction</th><th>Maximum gCO_2e/MJ</th></tr><tr><td>Heat/cooling generation*</td><td>80 (124 for proved coal substitution)</td><td>80</td><td>16 (37.2 for proved coal substitution)</td></tr><tr><td>Electricity generation*</td><td>183</td><td>80</td><td>36.6</td></tr><tr><td>Cogeneration (CHP)*</td><td>80 (heat) /
183 (electricity)</td><td>80</td><td>16(heat) /
36.6 (electricity)</td></tr></table>* MJ of final product (heat, cooling, or electricity)</td></tr>
<tr><td>Cogeneration of heat/cool and power from bioenergy (ISIC: D3510/D3530)</td></tr>
<tr><td>Production of heat/cool from bioenergy (ISIC: D3530)</td></tr>
</table>

<table>
<tr><th>Subsector</th><th>Methane-emission related activities</th><th>Safeguard activities</th><th>Best-practice abatement measures</th></tr>
<tr><td></td><td></td><td></td><td>
To demonstrate compliance, it is necessary to conduct a life cycle assessment (LCA) of GHG emissions. The following GHG calculation tools ensure compliance with best practices:
<table>
<tr><th>Name</th><th>Technical scope</th><th>Origin</th></tr>
<tr><td>BIOGRACE II[1]</td><td>Biomass for electricity, heating, and cooling</td><td>EU</td></tr>
<tr><td>RSB GHG Calculator[2]</td><td>Liquid biofuels</td><td>International</td></tr>
<tr><td>UK Solid and Gaseous Biomass Carbon Calculator[3]</td><td>Solid biomass and biogas used for heat and electricity generation</td><td>UK</td></tr>
<tr><td>GREET[4]</td><td>Alternative fuels in transport</td><td>US</td></tr>
<tr><td>RenovaCalc[5]</td><td>Ethanol, biodiesel, aviation biokerosene, and biogas from waste</td><td>Brazil</td></tr>
</table>
The scope of the LCA should include:

Feedstock production
Feedstock processing
Biomass-based fuel/bioenergy production
Biomass-based fuel storage and blending
Intermediate and final transport steps: transportation of feedstock to processing facilities, and transportation of biomass-based fuel to the point of consumption (final step for transport)
Use of the biomass-based fuel (final step for heat/cooling and electricity generation)
*For guidelines on Specific Methane emissions calculation guidelines for biogas and biomethane value chain see Climate Bonds Criteria for bioenergy

Best practices for methane management in biogas and biomethane value chain

Biogas processing:

automatically activated flare connected to all pressure release valves and venting systems; and
installation of leak detection alarms or other detecting devices in closed environments.

Digestate management:

Storage:

keeping the feedstock or digestate in an airtight environment (combined time in digester and closed digestate storage) for at least 50 + x days, where “50” represents the minimum retention time of 50 days and “x” is the number calculated as additional 2 days for each mass percent of non-manure-based feedstock (max 150 days); or

</td></tr>
</table>

<table>
<tr><th>Subsector</th><th>Methane-emission related activities</th><th>Safeguard activities</th><th>Best-practice abatement measures</th></tr>
<tr><td></td><td></td><td></td><td>
♦ storage with remaining methane potential (RMP) measurement below the proposed default emission factor, expressed in percentage of produced methane, for standard digestate management when the temperature inside the digestate storage remains below 20 °C during the whole storage period.
○ Composting: the whole process is done in complete closed environment, actively aerated cells in a closed environment, direct mixing, and cooling of digestate with substrate at the exit of the airtight section, monitoring and measurement of methane content in the off-gas.
▪ Raw biogas upgrading:
○ off-gas oxidation: combustion of off-gas is performed; or
○ no off-gas emitted: the CO_2 separated from the biogas is captured and no off-gases are released.
Feedstock and resource sustainability:
▪ Sustainable feedstock sourcing. Best-practice standards include:
<table>
<tr><th>Type of biomass feedstock</th><th>Pre-approved best-practice standards</th></tr>
<tr><td>1. Agricultural biomass</td><td>ISCC, CORSIA, RSB, SBP and Better Biomass</td></tr>
<tr><td>2. Forest biomass</td><td>ISCC, FSC, PEFC and SBP</td></tr>
<tr><td>3. Waste from processing</td><td>NA</td></tr>
<tr><td>4. Aquatic biomass</td><td>ASC-MSC and JAS (Japanese Agricultural Standard for algae)</td></tr>
</table>
▪ Sustainable management of biomass fuel supply
▪ Compliance with digestate standards (see anaerobic digestion of sewage sludge and biowaste)
</td></tr>
<tr><td>Manufacture of biofuels</td><td>Manufacture of biogas and biofuels for use in transport and of bioliquids contribution to climate mitigation
(ISIC: D3520)</td><td></td><td>
All as above, but taking into account the following emissions performance standards
Maximum specific Green House Gases emissions (g CO_2eq per MJ)
<table>
<tr><th colspan="2">Final product</th><th>Fossil baseline gCO_2e/MJ</th><th>Minimum % reduction</th><th>Maximum gCO_2e/MJ</th></tr>
<tr><td rowspan="3">Transport*</td><td>Road</td><td>94</td><td>50</td><td>22.75</td></tr>
<tr><td>Shipping</td><td>91</td><td>70</td><td>27.3</td></tr>
<tr><td>Aviation</td><td>89</td><td>70</td><td>26.7</td></tr>
</table>
*MJ of energy contained in the fuel
</td></tr>
</table>

Subsector	Methane-emission related activities	Safeguard activities	Best-practice abatement measures
Transmission and distirbution	Transmission and distribution networks for renewable and low-carbon gases (ISIC: 3520/D4930)	Leak detection and repair (LDAR)	**Monitoring and detection:** • Leakage detection and repair (LDAR), including contingency planning and monitoring, reporting, and verification plans that meet minimum requirements outlined in Annex 4. **Emissions performance standards:** • Lifecycle GHG emission thresholds **Transport of biogas:** • Methane mitigation in pipeline infrastructure involves the systematic reduction of emissions across transmission, storage, and distribution systems. Effective mitigation strategies include the deployment of advanced leak detection and quantification technologies such as continuous monitoring sensors, optical gas imaging, and satellite-based surveillance. Preventive maintenance programs, combined with rapid leak detection and repair (LDAR) protocols, are essential to minimize fugitive emissions. Equipment upgrades—particularly replacing high-bleed pneumatic devices, valves, and compressors with low- or zero-emission alternatives—further enhance system performance. Comprehensive data collection, transparent reporting, and third-party verification are also critical to ensure the credibility and effectiveness of methane mitigation actions in line with global reduction commitments.
Energy generation from fossil gaseous fuels	Electricity generation from fossil gaseous fuels (ISIC: D3510)	Leak detection and repair (LDAR)	**Monitoring and detection:** • Leakage detection and repair (LDAR), including contingency planning and monitoring, reporting, and verification plans that meet minimum requirements outlined in Annex 4. **Emissions performance standards:** • Lifecycle GHG emission thresholds
	High-efficiency cogeneration of heat/cool and power from fossil gaseous fuels (ISIC: D3510/D3530)		
	Production of heat/cool from fossil gaseous fuels in an efficient district heating and cooling system (ISIC: D3530)		

[1] http://www.biograce.net/home

[2] http://rsb.org/services-products/ghg-calculator/

[3] https://www.ofgem.gov.uk/guidance/uk-biomass-and-bioliquid-carbon-calculator

[4] https://greet.es.anl.gov/

[5] https://www.gov.br/anp/pt-br/assuntos/renovabio/renovacalc

Table A.17. Benchmark and best-practice measures for methane abatement - Agriculture

Subsector	Safeguard activities	Best-practice abatement measures
Livestock (ISIC: A014)	• Enteric fermentation (dietary manipulation - plant alterations, feeding frequency, additives) • Selective breeding to improve productivity and animal health/fertility • Anaerobic Digestion/ composting/treatment in biogas digesters/manure to energy • Slurry acidification (acidification in barns, in slurry tanks, during application to fields) • Storage covers and manure management (decreased manure storage time; improve manure storage covering; improve housing systems and bedding)	**Improved feed and diet strategies:** • Enteric fermentation mitigation (dietary manipulation - plant alterations, feeding frequency, additives) • Selective breeding to improve productivity and animal health/fertility - improved breeds • Feed management plans with peer-reviewed/verified additives to achieve ≥10% methane reduction per treated animal, with progressive adoption targets and ongoing monitoring **Manure and waste management:** • Anaerobic Digestion/composting/treatment in biogas digesters/manure to energy • Slurry acidification (in barns, in slurry tanks, during application to fields) • Storage covers and manure management (reduced storage time, improved covers, improved housing systems and bedding) • Crop residue utilization **Pasture and forage management:** • Organic and green manure, use of manure and fertilizers, where demonstration of compliance should include: ○ a farm management plan which evidences the significance of the measure to reduce emissions, including the following: 1. Volume of on-farm organic fertilizer or compost/biochar produced, AND 2. Sustainability of source and volume of farm residues utilized, AND 3. Intended use of the organic fertilizer production, OR ○ Measurable reduction of GHG emissions relative to a baseline of at least 1.5%20 per year (measured following GHG Protocol guidance). ○ Intensive silvopastoral systems where stocking density is reduced and that production is increased while emissions do not increase. ○ Improved forage systems (e.g., forage quality and composition, mixed forage/fodder hedges) to improve digestibility and reduce enteric fermentation, hence reducing methane emissions per kilo of product. **Animal welfare and capacity building:** • Animal welfare incl. vaccination • Compliance with agricultural standards • Capacity building on sustainable livestock models **Livestock systems transition** • Reduced livestock operation to be at least 50% of LSU, OR • Measurable reduction of CH_4 emissions relative to a baseline of at least 1.5% per year (measured following GHG Protocol guidance[15])

15 This target value is based on the previous Climate Bonds Criteria that had a yearly 2% GHG reduction 2020-2030 and 1.5% reduction 2030-2050 (in-line with EU Taxonomy TEG recommendation).

Subsector	Safeguard activities	Best-practice abatement measures
Rice production (ISIC: A0112)	• Change in irrigation practices (improved water management or alternate flooding/ drainage wetland rice; direct wet seeding; midseason drying events, shallow flooding, phosphogypsum and sulfate addition to inhibit methanogenesis; composting rice straw) • Controlled release of fertilizer • Biochar derived from leftover rice straw • Breeding of low-GHG and more resilient rice varieties	**Water and irrigation management:** • Change in irrigation practices (improved water management, alternate flooding/drainage wetland rice, midseason drying events, shallow flooding) - implementing practices aimed at reducing days of flooding by at least 10% • Direct wet seeding - planting rice directly in the field for improved establishment • Water resource management • Alternative wetting and drying - alternating between wet and dry conditions to conserve water and improve rice quality, OR • Measurable reduction of CH_4 emissions relative to a baseline of at least 1.5% per year (measured following GHG Protocol guidance) **Soil and nutrient management:** • Controlled release of fertilizer • Biochar derived from leftover rice straw • Phosphogypsum and sulfate addition to inhibit methanogenesis • Organic or green manures • Composting • Straw and stubble management – incl. off-season straw management: properly managing straw during the off-season to benefit soil health • Reduction of waste-burning of agriculture residues **Crop and genetic improvements:** • Breeding of low-GHG and more resilient rice varieties • Rice variety diversification and rotation—short-duration, high-yielding varieties: selecting varieties that mature quickly while maximizing yield **Waste and residue utilization:** • Biodigester • Composting rice straw

Subsector	Safeguard activities	Best-practice abatement measures
Perennial and non-perennial crops (ISIC: A011/ A012)	▪ Prevent peatland, forest, and biomass intentional burning ▪ Agricultural and forestry residues-to-energy	**Fire prevention and biomass utilization:** ▪ Prevent peatland, forest, and biomass intentional burning ▪ Agricultural and forestry residues-to-energy ▪ Management and processing of agricultural residues **Soil and nutrient management:** ▪ Organic or green manure, where demonstration of compliance should include: ○ A farm management plan which evidences the significance of the measure to reduce emissions, including the following: 1. Volume of on-farm organic fertilizer or compost/biochar produced, AND 2. Sustainability of source and volume of farm residues utilized, AND 3. Intended use of the organic fertilizer production, OR ○ Measurable reduction of GHG emissions relative to a baseline of at least 1.5% per year (measured following GHG Protocol guidance). ○ Soil conservation ○ Crop rotation ○ Improved harvest, post-harvest, and/or storage must aim at achieving a level of food loss no higher than 10% of total food production from post-harvest to distribution, except for cereals and grains which should aim toward less than 5% food loss). **Waste and water management (see waste criteria)** ▪ Waste management and treatment of water contaminated with organic wastes ▪ Biodigesters **Sustainable practices and standards:** ▪ Shift from high methane emitting systems (rice, intensive livestock) to low methane alternatives (alternative crops, agroforestry, silvopastoral systems) ▪ Compliance with agricultural standards and sustainability certifications
Aquaculture (ISIC: A032)	▪ Aeration ▪ Water exchange ▪ High-quality feed ▪ Sludge removal ▪ Organic waste removal ▪ Dredging	▪ Closed-system aquaculture technology with recirculating water and wastewater management ▪ Integrated multi-trophic aquaculture system ▪ Production and feeding to produce low-carbon aquatic animals ▪ Dredging

Table A.18. Benchmark and best-practice measures for methane abatement: Solid Waste and Wastewater

Sector	Methane-emission related activities	Best-practice abatement measures
Solid Waste	Landfill gas capture and utilization or energy recovery (ISIC: E3821/E3822)	▪ Landfill gas capture or energy recovery ▪ The landfill implements a minimum "working face" approach that considers technical indicators such as daily waste tonnage, waste types, and site-specific design conditions to minimize odor control, pest control, litter, fire risks, and fugitive CH_4 emissions. ▪ Restricting ability to closed landfills or cells no longer receiving waste ▪ Productive use of captured methane through energy recovery or industrial applications ▪ Monitoring and control plans to minimize methane leakage (see requirements in Annex 4) ▪ Flaring systems disallowed (unless part of time-bound transition plan) ▪ Real-time methane monitoring at vent stacks
	Anaerobic digestion of biowaste (ISIC: E3821)	▪ Source segregation ▪ The solid and liquid products are not landfilled and replace non-waste materials in the market. ▪ **Methane leakage control** ○ Methane leakage monitoring and leakage control (see requirements in Annex 4). For anaerobic or anoxic components of the treatment plants, a monitoring and mitigation plan must be in place to identify and manage possible GHG emissions from the treatment process. ○ The project must provide a yearly quantification of GHG emission intensity (ton CO_2e/ton of treated wastewater), compared against baseline results. This may be achieved using carbon accounting methodologies like the GHG Protocol, the ISO 14067:2018 or a life cycle assessment (LCA). ▪ **Productive biogas utilization:** ○ Investment in biogas infrastructure ○ Flaring-only systems must transition to value-added use within 3 years ○ Upgrade to biomethane ▪ **Digestate management:** ○ No landfilling of biowaste digestate ○ Energy recovery allowed ○ Detailed plan on end-use of digestate

Sector	Methane-emission related activities	Best-practice abatement measures
		Storage: ○ Keeping the feedstock or digestate in an airtight environment (combined time in digester and closed digestate storage) for at least 50 + x days, where "50" represents the minimum retention time of 50 days and "x" is the number calculated as additional 2 days for each mass percent of non-manure-based feedstock (max 150 days); or ○ Storage with RMP measurement below the proposed default emission factor, expressed in percentage of produced methane, for standard digestate management when the temperature inside the digestate storage remains below 20°C during the whole storage period. ▪ Feedstock composition thresholds limiting share of food and feeds crops used as input feedstock.
	Collection and transport of non-hazardous waste in source segregated fractions (ISIC: E3811)	▪ Source separation with recycling/reuse ▪ Material recovery of non-hazardous waste (at least 50% by weight of the separately collected waste must be converted into secondary raw materials).
	Material recovery from non-hazardous waste (ISIC: E3830)	
	Composting of biowaste (ISIC: E3821)	▪ Monitoring and control plans to minimize methane leakage (see requirements in Annex 4) - no measurable methane emissions are desired. ▪ An aeration or a composting pile mixing plan has been established to avoid anaerobic pockets in the pile. ▪ Source segregation ▪ Composting and reuse ▪ Compost must meet fertilizer standards
	Waste-to-energy (ISIC: E3821/E3822)	▪ Waste incinerators ▪ Upstream source separation – removal of recyclable and hazardous waste prior to thermal treatment ▪ Pre-operation environmental assessments ▪ Ongoing emissions monitoring (see requirements in Annex 4)

Sector	Methane-emission related activities	Best-practice abatement measures
Wastewater	Anaerobic digestion of sewage sludge (ISIC: E3821) ▪ *Residential:* Upgrade to secondary/ tertiary anaerobic treatment with biogas recovery and utilization ▪ *Industrial*: Anaerobic treatment with biogas recovery followed by aerobic treatment	**Methane leakage monitoring & control:** ▪ Methane leakage monitoring and leakage control (see requirements in Annex 4). For anaerobic or anoxic components of the treatment plants, a monitoring and mitigation plan must be in place to identify and manage possible GHG emissions from the treatment process. ▪ The project must provide a yearly quantification of GHG emission intensity (ton CO_2e/ton of treated wastewater), compared against baseline results. This may be achieved using carbon accounting methodologies like the GHG Protocol, the ISO 14067:2018 or a life cycle assessment (LCA). **Productive biogas utilization:** ▪ Investment in biogas infrastructure ▪ Flaring-only systems must transition to value-added use within 3 years. ▪ Upgrade to biomethane **Digestate management:** ▪ The generated digestate is stabilized and used as a soil fertilizer and/or soil improver, or as feedstock for biochar production. ▪ No landfilling of sewage sludge digestate ▪ Energy recovery allowed ▪ Detailed plan on end-use of digestate **Storage:** ▪ keeping the feedstock or digestate in an airtight environment (combined time in digester and closed digestate storage) for at least 50 + x days, where "50" represents the minimum retention time of 50 days and "x" is the number calculated as additional 2 days for each mass percent of non-manure-based feedstock (max 150 days); or ▪ storage with RMP measurement below the proposed default emission factor, expressed in percentage of produced methane, for standard digestate management when the temperature inside the digestate storage remains below 20 °C during the whole storage period.
	Construction, renewal, extension and operation of wastewater collection and treatment (ISIC: E3700)	**Methane leakage monitoring and biogas utilization:** ▪ Methane leakage monitoring (see requirements in Annex 4), productive biogas use, digestate handling ▪ Transition plan for flaring-only systems **Energy and emissions performance standards:** ▪ Net energy thresholds (by plant size) ▪ GHG emissions assessment required when replacing high-emission systems ▪ Renewal requires 20% improvement in energy efficiency **Replacement of high-emission systems:** ▪ Wastewater treatment plants instead of latrines and disposal

ANNEX 4: MONITORING AND DETECTION MINIMUM REQUIREMENTS

Table A.19. Leakage detection and repair (LDAR) that meet minimum requirements

Area	Minimum requirement
Ownership and purpose of the voluntary system	▪ The voluntary system should have clear ownership. ▪ The voluntary system should have a clear purpose.
System boundaries	▪ The accepted boundaries of the system should be well described.
Performing leak detections	▪ Self-control should be the focus of leak detection. Install detection systems for increased indoor methane concentrations and for pressure relief valve openings. ▪ Third-party revision for credibility is required.
Quantifying emissions	▪ At least one monthly visual inspection (with no detecting instruments) of high-risk components (pressure relief valve, moving components). ▪ At least once a year, regular leak detection (and quantification) by an external professional. The methods to quantify emissions should be well described.
Remedying of found leaks	▪ A maintenance and repair plan defining the intervals when components need maintenance and how to repair components that show leaks. ▪ If the leaks exceed 2% of the annual production or 50 tonnes per year, a mandatory repair should be scheduled, and an additional test within 6 months of the leak detection should confirm the effectiveness of the repair.
Reporting of emissions data	▪ A documentation system to report each inspection, leak detection, maintenance, and repair. ▪ There should be an easy access to annual or periodical results with benchmark possibilities. ▪ Short- and long-term goals on leak detection performance and emission reduction should be set.
Knowledge buildup and skills development	▪ Training courses for introducing and maintaining leak detection programs should be organized or a written best management practice document available.

climatepolicyinitiative.org