The Landscape of Methane Abatement Finance

July 2022

CLIMATE POLICY INITIATIVE

Global Methane Hub

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AUTHORS

Paul Rosane

Baysa Naran

Angela Ortega Pastor

Jake Connolly

This report was led under the guidance of Dharshan Wignarajah.

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 six offices around the world in Brazil, India, Indonesia, the United Kingdom, and the United States.

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CONTACT

Paul Rosane
paul.rosane@cpiglobal.org

MEDIA CONTACT

Caroline Dreyer
caroline.dreyer@cpiglobal.org

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EXECUTIVE SUMMARY

Sharp and rapid reductions in methane emissions this decade are essential to limiting global warming to 1.5°C. While carbon dioxide has a longer lasting effect, methane has 80 times the warming power of CO2 in the first 20 years after emissions reach the atmosphere, meaning methane is setting the pace for near-term global warming. Reducing human-caused methane emissions by 30% this decade from 2020 levels, as set out in the Global Methane Pledge, would avert at least 0.2°C in global warming by 2050 (CCAC and UNEP, 2021).

Even though methane is responsible for nearly half of net global warming to date, our findings show that finance for methane abatement measures represented less than 2% of total climate finance flows, or just over USD 11 billion, in 2019/2020[1]. **At least a ten-fold increase in methane abatement finance is necessary to meet the estimated more than USD 110 billion needed from private and public sources annually.**

This first-of-its-kind report on methane mitigation finance aims to assess global investment in methane abatement activities and create a baseline against which investment needs and progress can be measured. This work focuses on existing and established abatement solutions in three broad sectors: fossil fuels, waste (solid waste and wastewater), and agriculture, forestry and land use (AFOLU). Together, these sectors account for 95% of human-made methane emissions.

Our findings show that **current investment in targeted methane abatement is not enough to limit global warming to 1.5°C** and that the limited existing investment flows are not being directed to the geographies or sectors of highest abatement potential. Key takeaways from this analysis include:

- **Methane abatement solutions are severely underfunded considering their climate change mitigation potential.** While also underfunded, other climate change solutions with similar mitigation potential, such as low-carbon transport, received 15 times the investment of methane abatement measures, while solutions such as solar and wind received 26 times the investment.
- **The fossil fuel sector has the highest potential for methane mitigation potential by 2030, yet by far received the lowest amount of methane abatement finance**. Eighty-two percent of anthropogenic methane emissions originated from activities in the fossil fuel and agriculture sectors, yet the fossil fuel sector received less than 0.5% of methane abatement finance (USD 0.1 billion). Almost two-thirds of methane abatement funding was directed towards the waste sector.
- **Regionally, most methane emissions originate in the East Asia and Pacific region, and most of the methane abatement finance in 2019/2020 was concentrated there.** However, significant abatement potential exists in other regions, particularly in Latin America and the Caribbean and Sub-Saharan Africa, respectively the second and third largest methane emitters, which combined attracted only 6% of methane abatement finance.

1 CPI reports two-year averages (2019 and 2020) to smooth out annual fluctuations in data.

- **The private sector accounted for the majority of tracked financial flows,** particularly in more mature segments (e.g., certain waste-to-energy technologies) where commercial viability at scale is well established.
- Within the public sector, **development finance institutions were a key source of financing**, accounting for 13% of all methane abatement flows in 2019/2020.

Despite the availability of cost effective and market ready abatement solutions, business and policy strategies for methane reduction are not prioritized by policymakers and investors. The Global Methane Pledge has brought together nearly 120 countries in support of methane emissions reductions. Building on this momentum, countries should develop concrete methane reduction plans, as well as financing strategies, to leverage methane abatement's fast mitigation benefit and unique impact opportunity.

To ensure key stakeholders adequately invest in methane mitigation, **we recommend that public actors:**

- Cultivate a strong enabling environment for methane mitigation projects by providing enhanced regulatory signals and binding policy that are tailored to key sectors and specify minimum standards, and penalties, for methane emissions.
- Work to set sector-specific benchmarks and catalogue best practices and investment needs across the key methane-relevant sectors.
- Develop common approaches to track the finance for, and impact of, methane abatement interventions, including through improved methane emissions measurement approaches to quantify methane reductions impact of climate finance.
- Build a dedicated pipeline of investable methane reduction projects across sectors, including through existing development and climate finance structures.
- Incentivize the uptake of existing technologies, redirect capital from energy intensive activities to methane reducing activities, and direct spending towards methane abatement research and development.

We recommend that private sector financial and corporate actors:

- Incorporate ambitious and rapidly escalating methane reduction targets in interim net-zero goals.
- Monitor Scope 1,2, and 3 methane emissions and improve transparency on methane-related capital expenditures.
- Promptly deploy existing methane abatement solutions and provide catalytic finance support to innovate methane abatement solutions.
- Annually report on progress towards meeting abatement and finance goals.

Methane abatement finance has one of the highest ratios of global warming benefit per dollar of capital invested. The world cannot avoid the worst impacts of climate change without sufficient finance flows towards methane abatement. Both public and private actors have an essential role to play in closing the methane abatement finance gap.

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1. INTRODUCTION

Sharp and rapid reductions in methane emissions this decade are essential to limiting global warming to 1.5°C. While carbon dioxide has a longer lasting effect, methane has 80 times the warming power of CO2 in the first 20 years after emissions reach the atmosphere, meaning methane is setting the pace for near-term global warming. About 60% of global methane emissions are due to human activities and reducing human-caused methane emissions by 30% this decade from 2020 levels, as set out in the Global Methane Pledge, would avert at least 0.2°C in global warming by 2050 (CCAC and UNEP, 2021).

Methane abatement finance has one of the highest ratios of global warming benefit per dollar of capital invested, and many interventions bring multiple co-benefits including improved food security, and air and water quality (CCAC and UNEP, 2021).

Box 1. Beyond climate: The benefits of reducing methane emissions

- **Improved air quality.** Many methane reducing interventions also reduce emissions of volatile organic compounds, hazardous air pollutants, and other local air pollutants. Methane reduction projects at landfills and wastewater treatment plants also reduce odors.
- **Improved health outcomes.** Methane is an important precursor of tropospheric ozone, reducing methane also reduces ozone-related health impacts. Ozone attributable to anthropogenic methane emissions causes approximately half a million premature deaths per year globally.
- **Improved agricultural outcomes.** Ozone can harm ecosystems and crops by suppressing growth and diminishing production. Methane abatement interventions in this sector can control manure, protect local ecosystems, and reduce odors.
- **Improved employment outcomes.** The Climate and Clean Air Coalition (CCAC) estimates that every million ton of methane reduced avoids the annual loss of approximately 400 million hours, equivalent to 180,000 years, globally due to extreme heat.[2]
- **Improved industrial safety.** Capturing methane from fossil fuel exploration and extraction processes (particularly in coal mines) reduces leaks and the risk of explosions thereby improving industrial safety.

Source: (Global Methane Initiative, 2015; CCAC and UNEP, 2021)

To date, nearly 120 countries – covering almost half of all anthropogenic methane emissions and 70% of global GDP - have pledged to collectively reduce methane emissions by 30% by 2030 from 2020 levels, as part of the Global Methane Pledge (White House, 2022). Some voluntary efforts, often industry-led, are similarly attempting to reduce methane emissions. Some key initiatives across sectors include:

2 There is a statistically significant linear decrease in the time allocated to labour with increasing temperatures based on an empirically established exposure-response function for the United States (Graff Zivin and Neidell 2014)

- **Oil and gas:** Oil and Gas Climate Initiative, Oil and Gas Methane Partnership 2.0, China Oil and Gas Methane Alliance
- **Agriculture, forestry, and land use:** Global Dairy Platform's Pathways to Dairy Net Zero, Global Research Alliance on Agricultural GHG Gases
- **Waste and wastewater sector:** Zero Waste Cities
- **Cross-sectoral:** Methane Guiding Principles

However, without an understanding of baseline methane mitigation investment, it will be difficult to measure progress and assess investment needs and gaps.

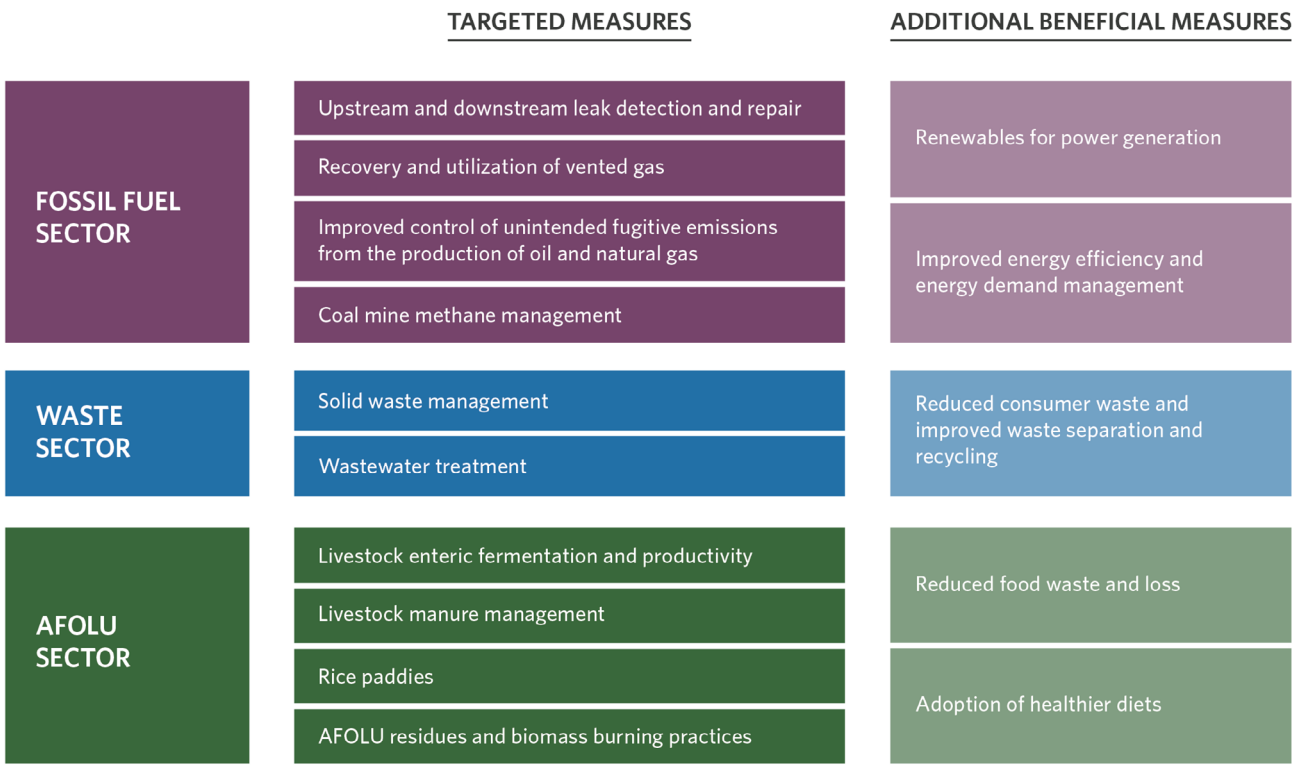
This first-of-its-kind report aims to assess global primary investment in methane abatement activities in 2019/2020 to create a baseline against which investment needs and progress can be measured.

2. APPROACH AND DATA LIMITATIONS

This report focuses on existing and established abatement solutions in the three broad sectors that together account for 95% of human-led methane emissions: fossil fuels, waste (solid waste and wastewater), and agriculture, forestry, and land use (AFOLU). We define the methane abatement finance universe as primary, project-level, investments in targeted and additional beneficial measures[3] that contribute to reducing methane emissions.

Beyond the three sectors mentioned above, these abatement solutions[4] fall into sub-categories adapted from the Global Methane Assessment undertaken by the Climate & Clean Air Coalition (CCAC) and the United Nations Environmental Program (UNEP) (Figure 1). Measures that directly contribute to reducing methane emissions are labeled as targeted measures (e.g., feed additives that reduce livestock's methane emissions), whereas interventions that can indirectly result in methane abatement are labeled as additional beneficial measures (e.g., mass adoption of low-meat diets). Therefore, **the phrase targeted methane abatement finance, used throughout this report, refers to investments in targeted measures only.**

Figure 1. Classification used to report methane abatement finance



Reported investment figures are reported using the above classification. Three sectors are presented: Fossil Fuel (purple), Waste (blue), AFOLU (green).
Source: (CCAC and UNEP, 2021)

3 Targeted and additional beneficial measures as defined per the CCAC's classification of abatement solutions. See Annex for more details.
4 Solutions and measures are used interchangeably.

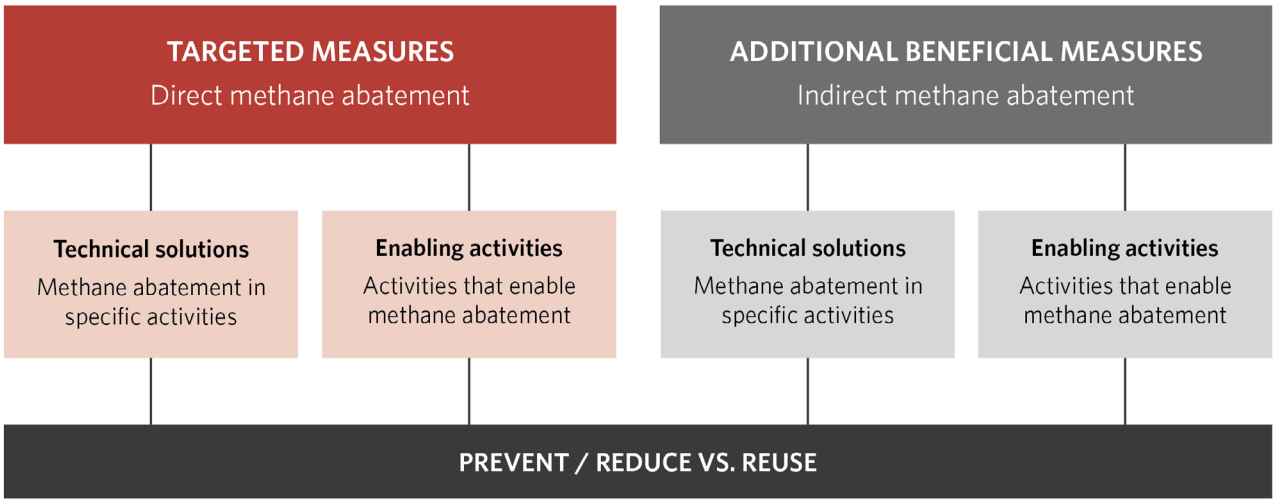
Our approach to this report includes developing our own taxonomy (Annex II) of eligible methane abatement solutions, creating a framework for tracking methane abatement finance, and building a first-of-its kind database of methane abatement finance flows and underlying projects. While acknowledging several data limitations, discussed later in this section, we analyze tracked finance flows in methane reduction activities by source of finance, intermediaries, sectors, activities, and geography of origin and destination. To enhance our analysis, we have also conducted several stakeholder and expert interviews for the purpose of collecting key literature, existing methodologies and sense checking our assumptions and framework. Finally, we have assessed investment gaps and impact opportunities in key sectors and provided recommendations across sectors and actors.

2.1 PROPOSED TAXONOMY FOR METHANE ABATEMENT FINANCE TRACKING

In this report we classify intervention as either targeted or additionally beneficial, as outlined above. This classification, in line with the Global Methane Assessment, offers a practical breakdown of methane abatement finance.

The first tier of our taxonomy aligns with the classification proposed by Global Methane Assessment and differentiates targeted interventions, where objectives cannot be dissociated from methane reduction, and additional beneficial measures, solutions which achieve methane mitigation as an indirect objective. However, this categorization alone does not capture the impact, nature, or approach to reducing emissions of the different abatement solutions.

Figure 2. Proposed taxonomy for methane abatement finance tracking



Adequately tracking methane abatement finance requires additional nuance. As such, we propose further tracking investment in technical solutions versus enabling activities.

- **Technical solutions** involve changes in machines, processes, and materials that are used in emitting industries.
  Example: Replacing pneumatic pumps with electrical ones in oil and gas operations.

- **Enabling activities** refer to courses or principles of action adopted or proposed that provide the means for either technological solution implementation or direct methane abatement. These can include policies, technical assistance, and capacity building.
  Example: Creating a legal framework that require dairy corporations to report on Scope 1 & 2 methane emissions.

Distinguishing between these two activities offers a way to understand the actors better suited to provide finance. In many cases, private sector actors will be better able to effectuate emissions reductions through the application of technology than governments. Conversely, public sector actors can provide an additional role by creating a strong enabling environment.

Further, we propose tracking whether interventions seek to prevent or reduce methane or conversely whether they seek to reuse captured gas.

- **Prevent/Reduction** interventions either prevent methane emissions from occurring or lower methane emissions.
  Example: Feed additives can be used to reduce ruminants' enteric fermentation and therefore reduce methane emissions

- **Reuse** interventions give a new use to captured methane gas.
  Example: In landfills, the decay of organic matter in the absence of oxygen generates methane emissions. Projects that capture this gas then use it to generate power or inject it into gas networks ***reuse*** *an existing source of methane.*

The latter is particularly important to the tracking of climate finance in this space as, while reusing captured gas is a cost-effective mitigation measure, when this reuse involves burning methane it will result in CO2 emissions. Due to its larger global warming potential, preventing methane from being released into the atmosphere by capturing and reusing it is advantageous from a climate change mitigation standpoint even if it results in CO2 emissions. However, we caution against seeing these CO2 as the lesser of two evils. Greenhouse gas emission cuts required under a net zero by 2050 scenario are so stringent that these emissions also ought to be abated.

2.2 FINANCE FLOWS AND ABATEMENT PROJECTS DATABASE

Our analysis relies on datasets collected from various sources, including: the Organization of Economic Co-operation and Development's Development Assistance Committee (OECD-DAC), Bloomberg New Energy Finance (BNEF), Climate Bonds Initiative (CBI), Convergence Blended Finance, Climate Funds Update (CFU), International Energy Agency (IEA), IJ Global, and biannual surveys of development finance institutions conducted by CPI. In addition to these, CPI analyzed further data sources including the International Aid Transparency Initiative (IATI), World Bank PPI, GMI International Coal Mine Methane database, AgSTAR, data on voluntary and compliance Carbon Markets from the Berkley Carbon Trading Project, and UNFCCC Clean Development Mechanism (CDM), as well as impact and sustainability reports by major fossil fuel industry corporates and grant awarding public bodies.

2.3 DATA LIMITATIONS

Our analysis is subject to several limitations that should be considered when interpreting the findings from this work. However, even with these limitations factored in, our work still provides key insights on the state of methane abatement finance.

Gaps in fossil fuel and AFOLU use sectors. Significant gaps concern public domestic financial flows as well as domestic and international finance flows from private sector actors in the fossil fuel sector, including corporates and commercial financial institutions. There is little information on methane reduction expenditures by corporate actors, and often where actors are taking measures to abate methane this information is included under business-as-usual scenarios (e.g., to comply with legislation on preventing flaring). This lack of visibility into corporate expenditure on methane abatement is particularly problematic for sectors, such as fossil fuels, where mitigation interventions can be most effectively deployed by corporate actors.

In the AFOLU sector, while there is some information available for public actors, available data does not provide a standardized measure to capture and report expenditure in methane abatement activities, there is little data available on private sector flows.

As a result of the limited domestic level data of both public and private finance, we underestimate investment in methane mitigation in the fossil fuel sector and private investment in AFOLU.

Temporal snapshot. Our tracking exercise has focused on finance flows and projects executed in 2019 and 2020. Notably, the COVID-19 pandemic in 2020 had some severe repercussions on both private and public sector financing operations. As a result, we have limited visibility over temporal investment trends and our analysis does not capture new flows announced or committed following the 2021 Global Methane Pledge.

Intentionality. The method we used to screen relevant projects and financial flows does not permit to assess whether all tracked projects purposely intended to reduce methane emissions. Our approach instead focused on extracting projects and project components which had an established or deliberate potential to reduce methane emissions, given the very nature of the implemented measure, according to the literature review that was conducted. While an interesting concept, assessing intentionality comes with great challenges including that projects' stated objectives – if mentioned at all – do not necessarily reflect actors' motivations.

Impact. This work cannot determine actual methane emission reductions associated with tracked finance. Our focus on 2019 and 2020 financial commitments does not support an assessment of actual methane cuts because many of the projects we tracked are not operational yet. The goal is instead to capture trends in recent financial decisions. Abatement potential and related limitations are highlighted throughout the report, when deemed relevant.

Accounted finance. Data sources and reporting entities may have different reporting practices. This is especially true when a climate-relevant amount is derived from the total cost of the project (e.g., in OECD-DAC). When available or straightforward to estimate, the climate-relevant amount was used in this report. Otherwise, the total cost of the project was

used. The same logic was applied to projects with multiple components that were not all relevant to methane abatement.

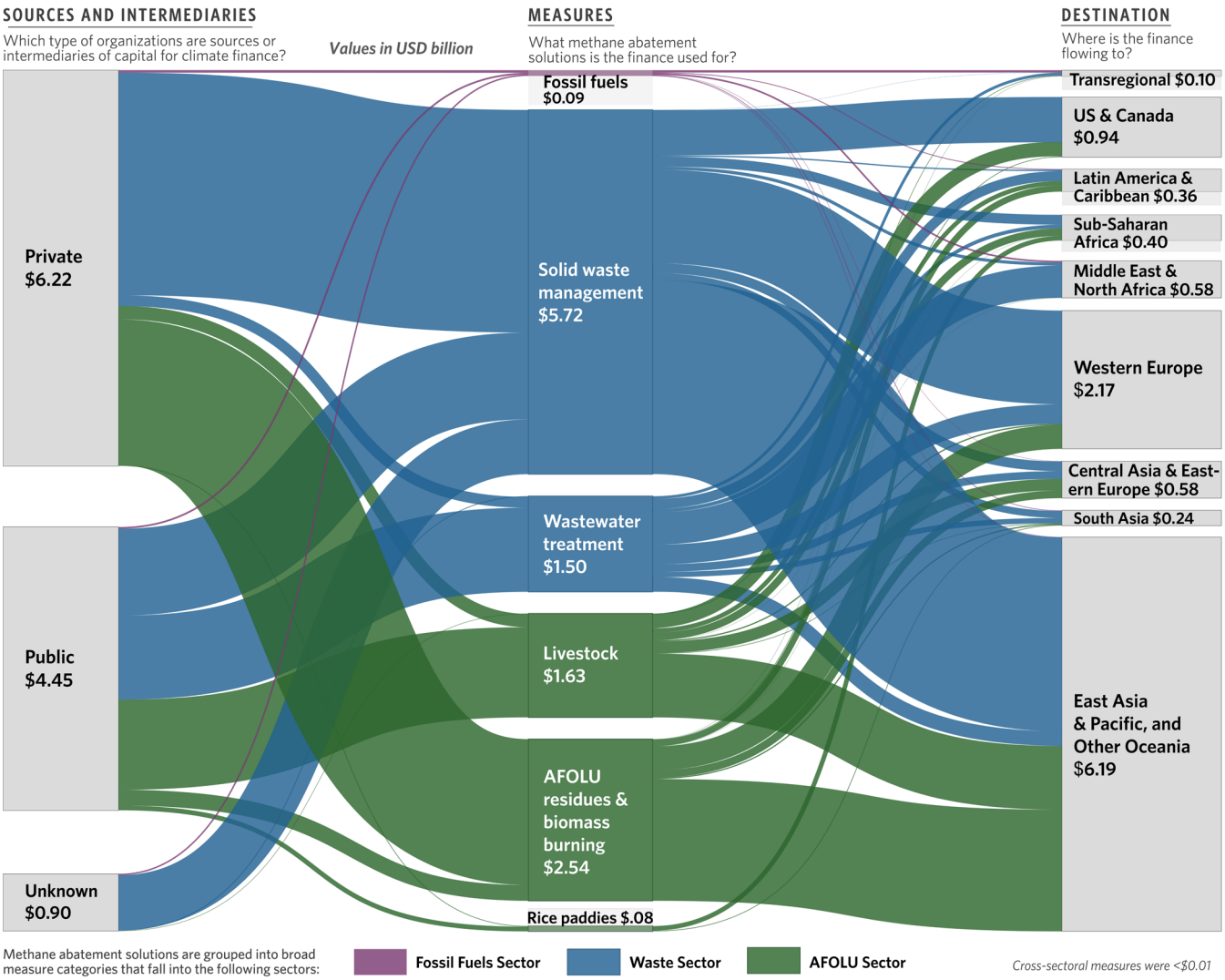
Needs. Understanding the investment needs is critical for investors to gauge the gap current and required finance levels. In this report, we rely on estimates of implementation costs by J.H.M Harmsen and colleagues. While other cost estimates exist (e.g. (IEA, US EPA, IIASA, McKinsey) we find the Harmsen study offers the closest to our sectoral definitions and primary investment focus. Nonetheless, further research efforts should be dedicated to estimating methane abatement finance needs in a way that aligns with the metrics and granularity (e.g., actors, geographies, etc.) that best suit investors' needs.

3. MAIN FINDINGS

3.1 HEADLINE FIGURES

Total tracked targeted methane abatement finance amounted to USD 11.6 billion in 2019/2020. Although methane emissions are responsible for almost half of global warming, targeted methane abatement finance represented about 2% of total climate finance tracked in CPI's Global Landscape of Climate Finance (Buchner et al., 2021). Even with data gaps factored in (see discussion on data limitations in Chapter 2), this initial stocktake indicates that actions to reduce methane are not in line with necessary actions to meet climate goals (Figure 3).

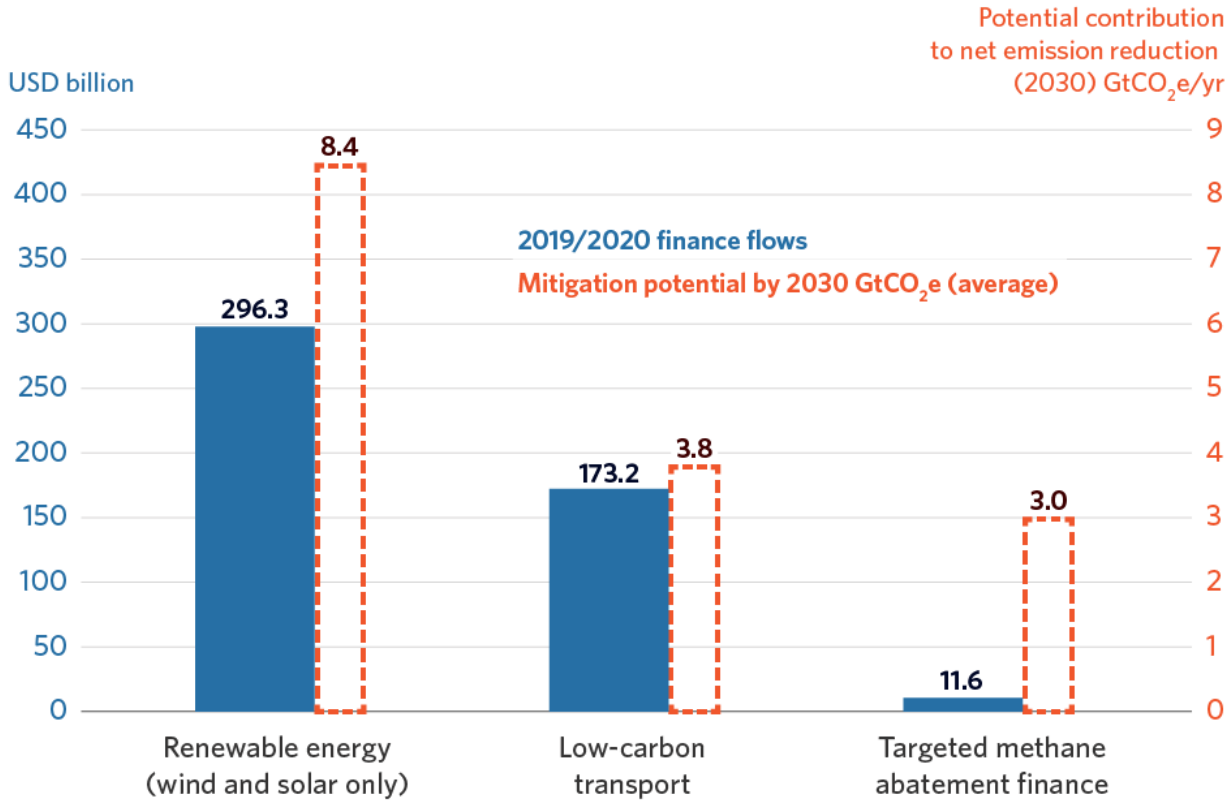
Figure 3. Global targeted methane abatement finance flows in 2019/2020[5]



5 CPI reports two-year averages (2019 and 2020) to smooth out annual fluctuations in data.

Methane abatement solutions are severely underfunded considering their climate change mitigation potential. While also underfunded, other climate change solutions with similar mitigation potential, such as low-carbon transport, received 15 times the investment of methane abatement measures, while solutions such as solar and wind received 26 times the investment. Wind and solar energy have an average of 8.35 GtCO2e mitigation potential (CO2) by 2030, and received USD 296 billion in 2019/2020, while targeted methane abatement solutions received only USD 6.3 billion with an average mitigation potential of 3.3 GtCO2e – the ratio of investment flows to mitigation potential was almost 20 times lower than that of the renewable energy sector (Figure 4). Estimated mitigation potential of methane abatement solutions is 3 GtCO2e by 2030 over a 100-year timeframe (GWP100). However, if a 20-year timeframe (GWP20) is considered, the mitigation potential would be substantially higher.

Figure 4. Finance flows in different sectors compared to their net emission reduction potential



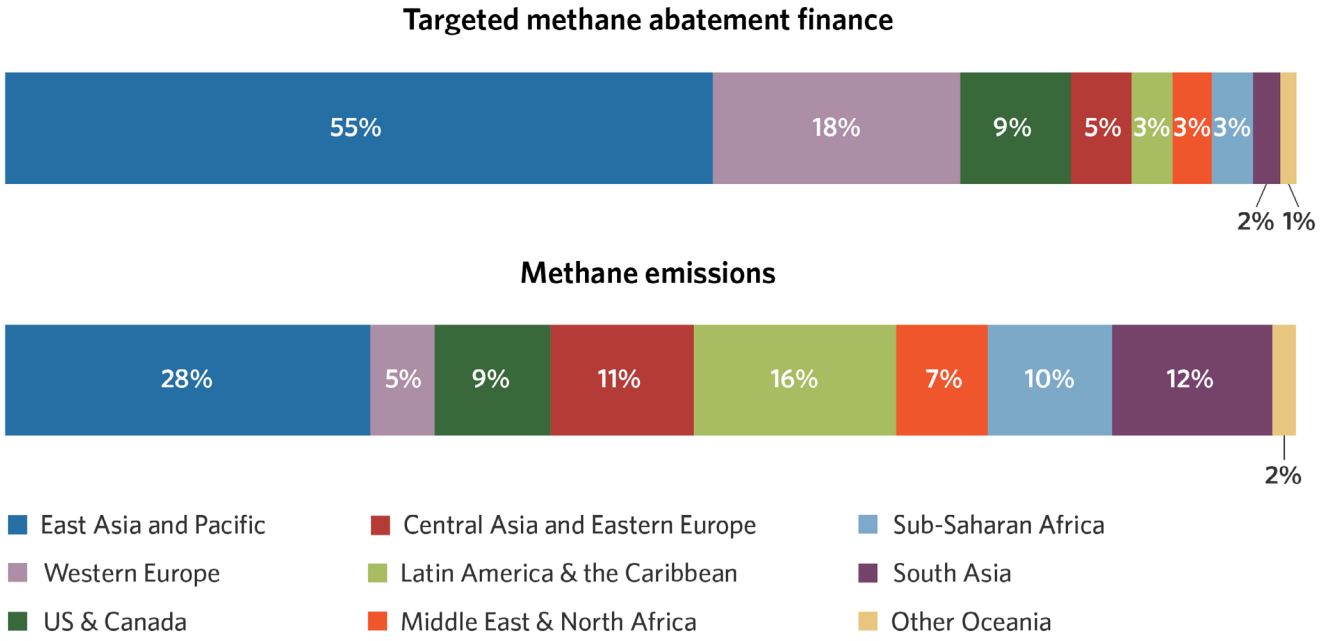
Source: *CPI Global Landscape of Climate Finance and IPCC AR 6 WG4 SPM.7 (Please refer to Annex II for further notes)*

Our findings show that current investment in targeted methane abatement is not enough to limit global warming to 1.5°C and that the limited existing investment flows are not being directed to the geographies or sectors of highest abatement potential.

Attributing methane emissions from various source categories is challenging and inventories of methane emission assessment may often underestimate the real magnitude (Allen D., 2016). However, based on the available estimates at a **regional level**, over 25% of methane emissions originated in the East Asia and Pacific region, primarily led by China (CEDS; Hoesly et al., 2018). This region also concentrated most of the methane mitigation finance

tracked in 2019/2020 (USD 6.0 billion, just over 50% of tracked abatement finance. In comparison, South Asia and Latin America & Caribbean, which combined weigh just as much in terms of methane emissions (28% of total), only received 5% tracked finance (USD 0.6 billion). Methane mitigation spending in the US & Canada was shy of USD 2 billion annually (representing around 7% of tracked finance), and only marginally above expenditures in Central Asia and Eastern Europe (US 1.86 billion).

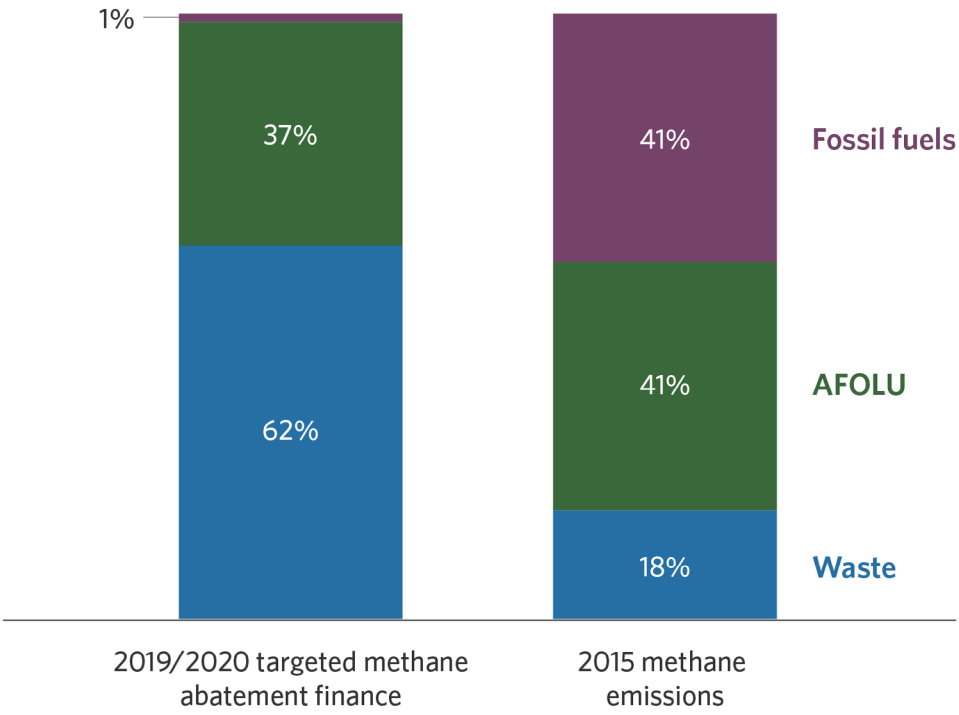
Figure 5. Total regional breakdown of methane emissions (2015) and of targeted methane abatement finance (2019/2020)



Source: *Emissions data is from the Community Emissions Data System (CEDS; Hoesly et al., 2018); Investment data from CPI.*

As shown in Figure 6, almost two-thirds of methane abatement funding is concentrated in the waste and water sector, whereas 82% of emission sources comes from the AFOLU and energy sectors which only received 33% of the total tracked funding.

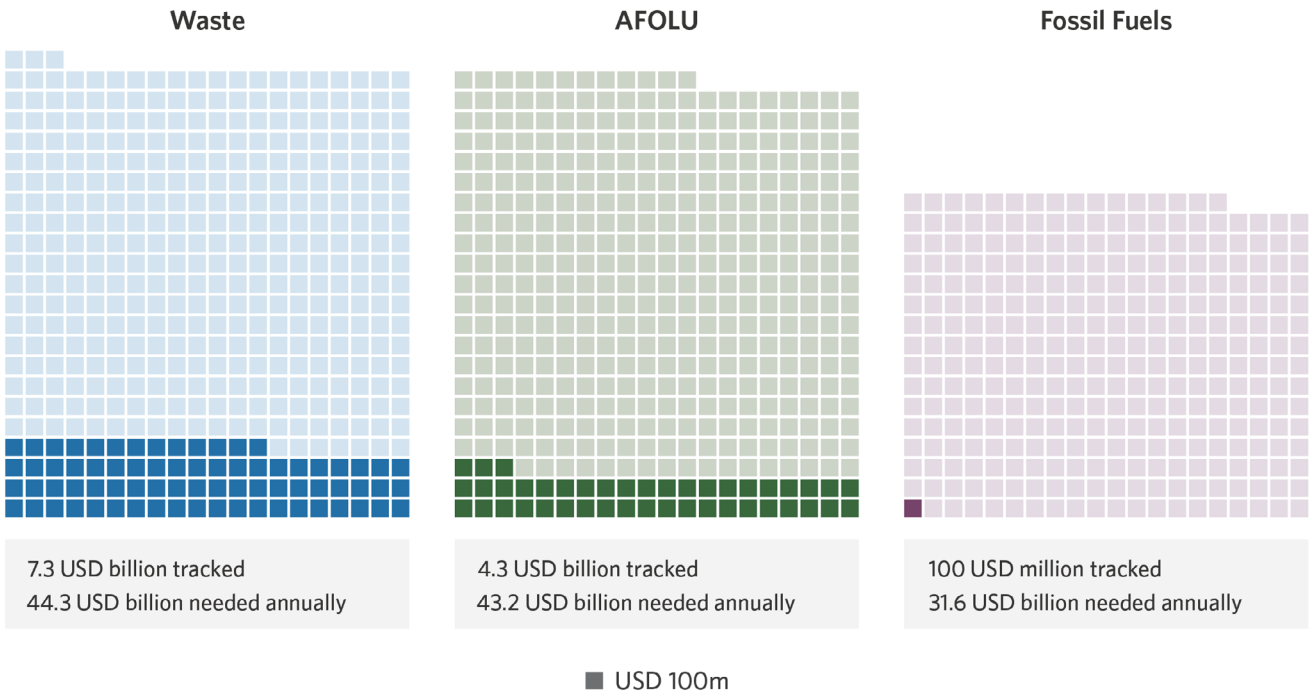
Figure 6. Finance flows and methane emissions by sector



Source: *Emissions data is from the Community Emissions Data System (CEDS; Hoesly et al., 2018); Investment data is from CPI.*

Estimates suggest targeted methane abatement finance falls well short of the average USD 119 billion needed each year through 2050 under a +2C of warming scenario (Harmsen et al., 2019)**: a 10-fold increase from currently tracked investments.** Fossil fuel, at USD 32 billion per year, and AFOLU, at USD 43 billion per year, are the two sectors where the gap with current levels is the greatest.

Figure 7. Tracked methane abatement investment compared to average annual needs through 2050 by sector



Average annual investment needed by sector over the 2021-2050 period under a +2C° of warming scenario, and current progress (dark-colored boxes) given 2019/2020 tracked investments. Source: 2050 needs come from Harmsen et al. 2019 and were linearly interpolated from 2019/2020 tracked levels to calculate average annual investment needs.

Box 2. Tracking methane reduction activities on Voluntary Carbon Offset markets.

To complement our data collection efforts, we also explored methane mitigation trends between 2015 - 2020 in voluntary carbon offset markets based on Berkeley Carbon Trading Project's Voluntary Registry Offsets Database. Since generating additional revenue streams through carbon credit mechanisms is typical in projects with mitigation benefits that seek commercial viability and face substantial upfront costs, carbon credit reporting is a good indicator of technologies' adoption rate, especially in the private sector. We did not aggregate finance flows for all projects recorded in the database as project cost information (a proxy for primary investment) was not always available. Such information related to total project cost could aid the efforts of tracking methane investment in the future subject to participants disclosing this data. Nonetheless, we were able to extract insights on the type of projects captured in the database. High-level results from this exercise reveal:

- Most projects (75%) focused on forestry, cookstoves, community boreholes, ozone depleting substances recovery, and destruction and renewable energy sectors. Only 13% of projects were related to methane abatement.
- Of these methane abatement projects, 72% were manure and mixed biowaste digesters, 13% were coal mine methane capture projects, 9% of landfill gas projects, and 2% of wastewater-to-energy assets. Leak detection and repair in gas networks, organic waste management (including

composting), livestock feed additives, and sustainable rice cultivation each represented around 1% of reported projects.

Well-designed and rigorous global carbon markets may enable private sector to direct capital to emission reduction activities at scale. Currently, methane abatement activities still represent a relatively small share within voluntary carbon market.

3.2 FINDINGS BY SECTOR

The following subsection presents findings across three broad sectors, which together accounted for 95% of human-made methane emissions: fossil fuels, waste (solid waste and wastewater), and agriculture, forestry, and land use (AFOLU).

3.2.1 FOSSIL FUEL EXTRACTION, PROCESSING, AND DISTRIBUTION

OVERVIEW

Fossil fuel extraction, processing, and distribution activities contribute to over (CCAC and UNEP 2021) 40% of human-led methane emissions and in 2019/2020 represented 0.4% of total tracked methane abatement finance[6], grossing USD 0.1 billion from public and private financiers (Hoesly et al., 2018; CCAC and UNEP, 2021).

The potential for methane abatement in this sector is vast both because it is relatively easy to reduce methane at the point of emission and along distribution channels, and because captured methane can be monetized (IEA, 2021a; CCAC and UNEP, 2021). For the oil and gas subsector in particular, the International Energy Agency (IEA) estimates that it is technically possible to avoid around 75% of today's downstream methane emissions, with a significant portion of these avoided at no net cost (IEA, 2021a).[7] We assess USD 31.6 billion is needed annually to 2050[8] to reap the methane abatement benefits from readily available targeted measures (Harmsen et al., 2019).

Table 1. Methane abating finance in the fossil fuel sector in USD million

Measure category	Abatement measures	2019/2020 tracked USDm
Targeted measures		
Oil & Gas	Upstream and downstream leak detection and repair	43.5
	Recovery and utilization of vented gas	37.5
	Improved control of unintended fugitive emissions from the production of oil and natural gas	0.6

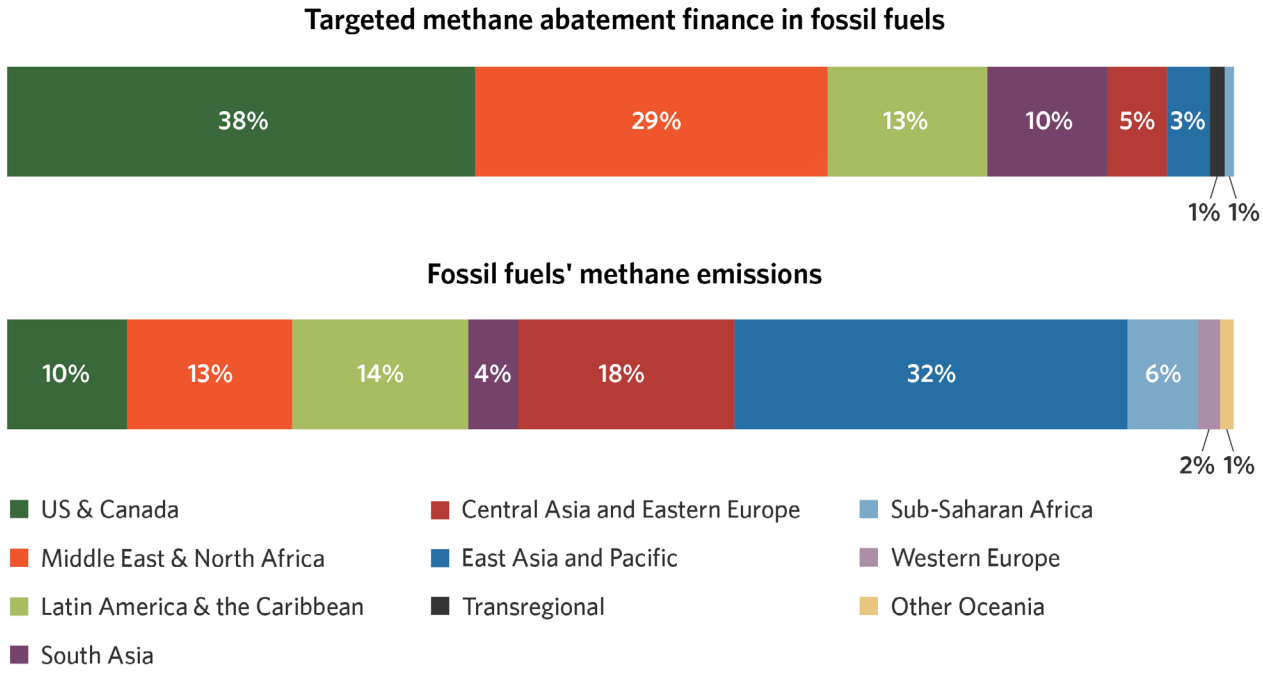
6 As discussed extensively in the data limitations section, there are significant data gaps for the fossil fuel sector.
7 Considering average natural gas prices from 2017-2021 the IEA estimates that almost 45% of current methane emissions from oil and gas operations could be avoided at no net cost.
8 We base our estimate on a linear extrapolation of implementation cost figures under a 2°C warming scenario from Harmsen et al (2019).

Measure category	Abatement measures	2019/2020 tracked USDm
Coal mining	Coal mine methane management	8.1
Additional beneficial measures		
Fossil fuel sector	Renewables for power generation	317.2[9]
	Improved energy efficiency and energy demand management	44.4[10]

The Middle East and North Africa region, responsible for 13% of anthropogenic methane emissions in 2015, concentrated the largest share of mitigation finance in this sector. East Asia and Pacific as well as Central Asia together account for almost two thirds of methane emissions yet received less than 10% of tracked methane mitigation finance.

Within the fossil fuel sector, coal mine methane, oil, and the extracting, processing, and transporting of natural gas each account for roughly one-third of methane emissions, yet the oil and gas subsector crowded most of the finance in this space (IEA, 2021a).

Figure 8. Regional breakdown of fossil fuel emissions (2015) and targeted methane abatement finance (2019/2020)



Source: *Emissions data is from the Community Emissions Data System (CEDS; Hoesly et al., 2018)*

9 This figure comes CPI's Global Landscape of Climate Finance (Buchner et al., 2021). This figure excludes any investment in renewable power already included in our targeted methane abatement finance numbers.
10 (Buchner et al., 2021)

Box 3. Blindspot: Private investment towards methane abatement in the fossil fuel sector

While deploying readily available mitigation technologies can already make a dent in methane emissions, additional measures will have to be developed to further drive the reductions needed. Private sector investment can play a significant role supporting R&D efforts, and in the case of corporations seeking to reduce methane emissions, providing the testing grounds and means to scale up technologies.

Organizations like the Oil and Gas Climate Initiative, an industry-led program, have set up investment funds to drive investment to technologies that detect, measure, and mitigate methane and to scalable projects that deliver substantive emission reductions (OGCI, n.d.). In 2020, the OGCI invested 10 million to accelerate pneumatic system replacement technologies, by 2021 the intiative's portfolio of investments represented around USD 160 million in equity investments mostly focusing on leak detection and repair start-ups (OGCI, n.d.).

Venture capital (VC) and private equity (PE) groups are important contributors to R&D spending and could play an important role in driving methane emission reductions. VC and PE groups tend to invest at different points in the scientific industry life cycle, usually focusing on solutions deemed as "high risk" by traditional funding avenues such as universities, governments, and even corporations. As such, the VC/PE landscape can play a role in supporting start-ups looking to apply innovative technologies to the methane reduction effort, for example deploying micro-technologies such as microturbines or mini-LNG facilities, that offer capacity for compression or liquefaction of associated gas in remote locations.

While deploying readily available mitigation technologies can already make a dent in methane emissions, additional measures will have to be developed to further drive the reductions needed. Private sector investment can play a significant role supporting research and development (R&D) efforts, and in the case of corporations seeking to reduce methane emissions, providing the testing grounds and means to scale up technologies.

OIL AND GAS

Oil and gas extraction, processing, and distribution accounted for 23% of fossil fuel related methane emissions, and in 2019/2020 tracked mitigation finance for this sector was USD 0.08 billion. While important caveats apply to the completeness of available fossil fuel financing data, the observed trends reveal a significant gap between available finance and mitigation needs in this sector.

Emissions from this sector are likely underestimated. A recent study in Nature found almost all fossil methane[11] in the atmosphere today originates from human-made emissions linked to the extraction and use of fossil fuels (Hmiel et al., 2020). The implication is that previous measurements based on "bottom-up" inventories, which estimate figures by multiplying the number of sources by their likely emissions, are "severely underestimating" emissions from fossil fuels, possibly by as much as 70% (IEA, 2021a).

Emissions in the oil and gas sector can either be accidental (fugitive) or the result of intentional venting in both daily and maintenance operations. Correspondingly, emissions from this sector are directly related to production rates and the number of new wells. Thus,

11 Unlike "biogenic" methane, which is produced from plants and animals, "fossil" methane is methane found in underground fossil deposits.

measures such as to detecting and repairing leaks, replacing compressors and pneumatic devices with low or zero emissions technologies, and installing emission control devices to reduce venting have some of the most significant abatement potential. In this sector, there is a significant opportunity to monetize the captured gas.

Under the IEA's Net Zero by 2050 scenario, USD 340 billion is still spent on average annually in existing oil and gas fields to maintain production levels and reduce the emissions intensity of production. Action on methane emissions is crucial to this goal (IEA, 2022).

Private sector actors, and in particular oil and gas companies, have a key role to play in closing the methane abatement finance gap in this sector. Domestic commercial financial institutions and corporations in the U.S. & Canada, where regulators have been active in tackling methane emissions from oil and gas operations, accounted for most of tracked investment. The latest assessment from the International Energy Agency reveals a wide range of investment strategies across the oil and gas industry. IEA analysis shows U.S. oil majors planning to increase overall upstream spending by more than 30% in 2022, while planned upstream capital expenditures by European oil majors is expected to remain flat (IEA, 2022). Some oil and gas corporates are under pressure to align their investments with the needs of the energy transition, with spending outside of traditional areas of oil and gas operations set to reach 5% of total corporate spending (IEA, 2022). However, tracking specific amounts dedicated to methane abatement within these planned expenditures as figures mask a wide range of strategic choices for spending and there is no standard for methane emissions or abatement spending disclosure. As a result, tracked methane abatement finance figures presented in this report likely underestimate investments made by energy companies.

Barriers to effective methane mitigation in this sector include significant information gaps in many companies about methane's environmental impacts, sources, and levels of emissions, as well as existing abatement technologies and related cost-effectiveness of abatement interventions (IEA, 2021b). Further, inadequate infrastructure or underdeveloped/saturated local markets make it difficult to match abated gas to a productive use. From a capital allocation perspective, misaligned investment incentives play an important role in exacerbating the lack of finance dedicated to methane abatement. These misaligned incentives arise from competition for capital within companies with a variety of investment opportunities, short payback periods, and in some cases split incentives as often the (Government of Canada, 2022) owner of the equipment does not directly benefit from reducing leaks (IEA, 2021b). Further, while the benefits of reductions in methane emissions are spread across society, the cost of implementing such measures falls solely on oil and gas companies, thus creating further scope for misaligned incentives. As an example of this misalignment – the Government of Canada estimates that complying with its current methane regulations will cost the oil and gas industry in Canada CAN 3.3. billion (approximately USD 2.5 billion) in direct costs to 2035[12]. The estimated societal benefits from mitigating methane in this sector over the same period are estimated at CAN 13.4 billion (approximately USD 10.4 billion)(Government of Canada, 2022).

Private corporations are best poised to sustain investments in methane abatement as these can be folded into regular maintenance and upgrade operations, but in some cases may lack incentives to do so on a voluntary basis. Indeed, in certain countries companies may be able

12 Net after accounting for non-vented gas.

to effectuate emissions reductions more quickly than the government can, particularly where regulatory capacity is limited. Moreover, there is a strong business case to be made for oil and gas companies to invest in methane abatement. In a high-price environment, oil and gas companies will be looking to focus on projects that can rapidly deliver new volumes. Investing in methane capture and reuse is estimated could bring an additional 80 bcm of natural gas online, which at 2022's prices would yield USD 20 billion in net income (IEA, 2022). Considering most abatement measures in this sector could be deployed at no net cost, there is no reason why methane leaks should continue to make up most of the sector's greenhouse gas footprint (IEA, 2022).

The public sector has a role to play in providing a strong enabling environment through regulatory and policy incentives to support the deployment of existing abatement technologies by private corporate actors (e.g. through leak repair and detection requirements and setting technology standards) (Forster et al. 2021; IEA 2021c). Currently, only a small fraction of global methane emissions is regulated (IPCC WG3, 2022). Overall, by reducing policy uncertainty and setting a strong set of guardrails public actors can encourage private actors in this subsector to allocate the needed resources to reduce methane emissions.

A suite of policy measures could be implemented to encourage investment in methane abatement and help internalize the cost of emissions, including policies targeting improved monitoring, reporting, and verification, and setting technology standards. The U.S., Canada, and the European Union have been increasingly announcing measures to target methane emissions in the oil and gas sector. In the U.S., new proposed regulations that would come in effect in 2023 are set to require that companies monitor 300,000 of their largest well sites every three months, ban non-emergency venting and flaring of methane, and require upgrades to compressors and pneumatic pumps. Canada has committed to a 75% reduction by 2030 and is implementing a CAD 750 million Emissions Reduction Fund to support workers and reduce emissions in Canada's oil and gas sector (Government of Canada, 2022). The EU has signaled its intention to support methane emission reductions in its natural gas trading partners. Under one proposal, the EU would set up a "you collect, we buy" scheme with partner countries, where the bloc would purchase otherwise vented or flared gas. However, stronger policy and regulatory incentives are needed to standardize and harmonize standards and practices across the globe.

Both domestic producers and major oil and gas importers can effectively contribute to reducing methane emissions. The role of importers should not be underestimated, as more than 80% of methane emissions from oil and gas operations occur downstream in refining, transmission, storage, and distribution operations, all of which are elements that major fuel importers can tackle (Bredariol and Michaels, 2021).

A sizeable problem. Methane emissions from coal mining worldwide are comparable to the vast carbon dioxide emissions from burning coal at over 1,100 coal-fired power plants in China over the near term according to the Global Energy Monitor.

COAL MINING

Coal mining accounts for 12% of fossil fuel related methane emissions (CCAC and UNEP, 2021)**, yet our analysis tracked only USD 0.02 billion towards methane mitigation in the sector.** Like the oil and gas sector, emissions from coal mining

operations are subject to undercounting. A recent study by the Global Energy Monitor estimates methane emissions from coal mines worldwide could well exceed those from the global oil and gas sector, making these emissions significantly higher than prior estimates (Driskell Tate, 2022).

There are three primary ways methane is emitted because of mining activities – through degasification or drainage systems at active underground mines, through ventilation systems that release ventilation air methane (VAM), and via closed or abandoned mines that emit methane (AMM) (EPA, n.d.).

The latest data from the IEA shows a 10% year-on-year increase in coal supply investments from 2020 to 2021 – driven by domestic capacity expansion in China and India – with further increases expected in 2022 (IEA, 2022). Coal use is on the rise in other markets as well, though increasingly restrictive financial and regulatory environments have succeeded in keeping new financing for coal supply at bay in regions like Europe (IEA, 2022). Recognizing that any new coal finance is at odds with global climate goals as set out by the IPCC and the IEA Net Zero by 2050 scenarios – public actors, rather than contribute finance, should set regulatory and policy mechanisms that continue to support the phase out of coal while ensuring that methane is mitigated across any remaining domestic and imported coal.

ADDITIONAL RECOMMENDATIONS FOR THE FOSSIL FUEL SECTOR

Some additional key actions to close the methane abatement finance gap and drive emission reductions in this sector include:

- Advocate, push for, and set industry specific sectoral emission standards for methane and volatile organic compounds within the wider fossil fuel sector (oil, gas, mining, etc.).
- Design, set, and promote methane mitigation targets to reduce and prevent fugitive methane emissions at a business and corporate level. State these targets publicly and track and report progress against them.
- Promote methane abatement measures within a wider decarbonization strategy, which includes acknowledging that methane abatement finance should be accompanied by strong efforts to phase out reliance on fossil fuels.
- Set a target date and timeline for the full reporting of fugitive non-CO2 emissions in terms of climate related financial disclosures.

3.2.2 SOLID WASTE AND WASTEWATER

OVERVIEW

In 2019/2020, the waste sector attracted the most targeted methane abatement finance, totaling USD 7.3 billion. With 66 Mt of methane emitted each year by from solid waste and wastewater management sources, the sector was the third largest source of human-led methane emissions in 2015 (Hoesly et al., 2018), around half of which has the potential to be abated by 2030 (CCAC and UNEP, 2021).

Table 2. Methane abating finance in the waste sector in USD million.

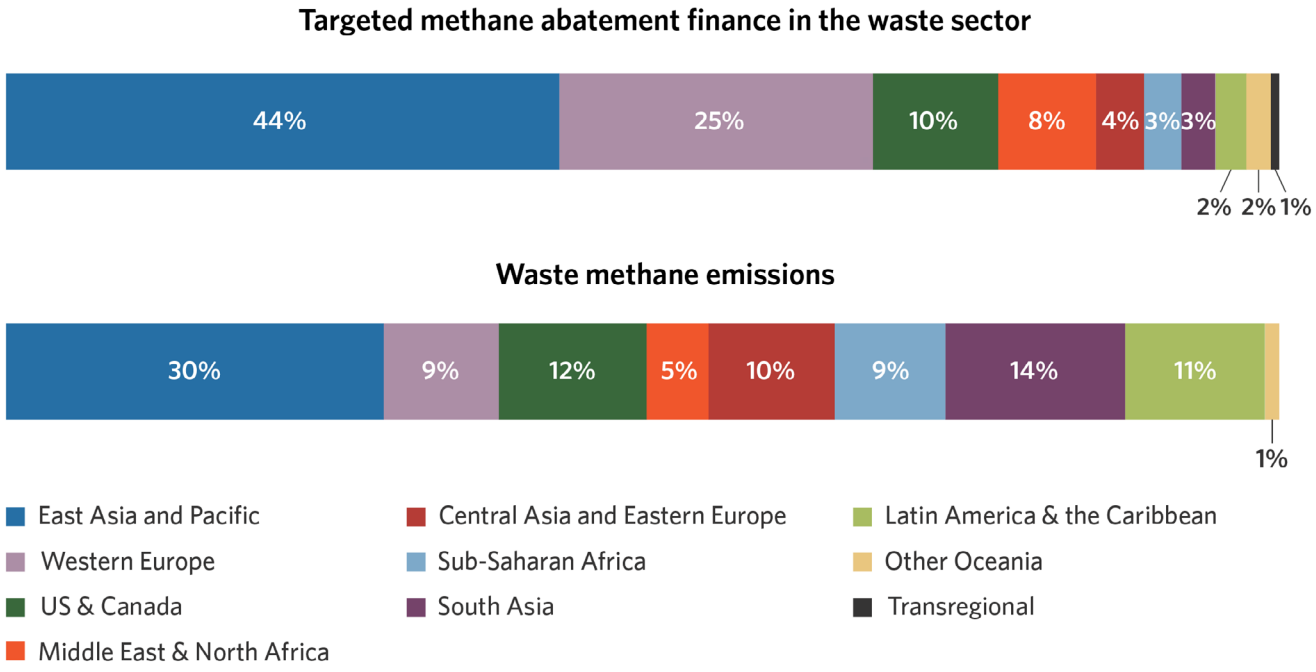
Measure category	Abatement measures	2019/2020 tracked USDm
Targeted measures		**7,259**
Solid waste management	Solid waste-to-energy – Landfill gas capture and organic waste separate treatment[13]	1,112
	Other organic waste management (including composting)	4
	Waste incinerators	4,601
Wastewater treatment	Advanced wastewater treatment	130
	Wastewater-to-energy	84
	Improved wastewater management practices	1,328
Additional beneficial measures		**1,341**
Improved waste separation and recycling	Improved solid waste management practices (collection, upgrades, separation, recycling)	1,341

East Asia and Pacific, the top emitting region in this sector (30%), was also the largest recipient of methane abating finance (43%). Conversely, investments flowing to South Asia, Central Asia, and Eastern Europe are underrepresented given these regions' weight in the sector methane emissions (Figure 9).

Solutions in solid waste management, boosted by waste-to-energy projects, are the largest segment of methane abatement finance we track, while wastewater management solutions crowded most public sector finance.

13 Energy projects that use agricultural waste as a feedstock (manure, agricultural residues, forestry residues) are included in the AFOLU section.

Figure 9. Regional breakdown of the waste sector targeted methane abatement finance (2019/2020) and emissions (2015)



Source: *Emissions data is from the Community Emissions Data System (CEDS; Hoesly et al., 2018)*

Overall, tracked investment (USD 7.3bn) is far from the USD 44 billion required each year on average between now and 2050 to implement the relevant waste sector measures under a +2°C of warming scenario (Harmsen et al., 2019).

SOLID WASTE MANAGEMENT

In 2019/2020, solid waste management was the largest sub-sector by investment volume with USD 5.7 billion with substantial investments in waste-to-energy projects, a well understood and mature technology that requires high capital expenditures (IPCC WGIII, n.d.). This still is insufficient to meet investment needs, estimated at USD 23 billion annually through 2050 (Harmsen et al., 2019).

However, some of these tracked investments yield uncertain climate change mitigation and environmental impacts. Indeed, investment in waste incineration[14] – a methane-free waste treatment option (Guendehou et al., 2006) – constituted the bulk of the sub-sector's finance (69%). Waste incineration contributes to avoiding methane emissions when allowing waste diversion from landfills (Pfadt-Trilling et al., 2021). While no assessment of the exact waste diversion enabled by each facility was conducted in this report, disposal in landfills and open dumps remains the overwhelming norm for waste that is not recycled or already incinerated (92% in 2016) (World Bank, n.d.). Moreover, waste incineration comes with a potential CO2 trade-off[15], and can carry air pollution concerns if plants are not properly operated (Mutz et al. 2017). In addition, methane abatement is most likely not the primary motivation behind these investment decisions, at least compared to the prospects of energy generation and waste volume reduction. Finance for these projects was primarily sourced

14 With energy recovery only.
15 Depending on the waste used by the incinerator.

domestically (60%), from private institutions (57%), and directed to projects in China (50%) and the UK (25%).

In comparison, targeted solutions with a clearer intention to abate methane and higher abatement potentials, like landfill gas capture and food waste anaerobic digestion (IPCC WGIII, n.d.) attracted smaller volumes of finance (USD 1.1 billion on average). Half of the finance for these solutions were U.S. projects, which heavily relied on private sector investments (75%), especially commercial financial institutions. Multilateral DFIs were the first source of finance in that segment with an annual average of USD 110 million.

Food waste in landfills: two mistakes end up in one place. One-third of food produced for human consumption is wasted. How food waste is then dealt with is just as serious. More than half of it is disposed in landfills in the U.S (56%) and China (51%), and an even greater shares in Brazil and India, leading to substantial methane emissions.

The data in this report tends to better capture investment in larger assets. Smaller yet crucial solutions, such as household-level or building-level composting, are not tracked in this work, but some preliminary studies suggest expenditure on such composters was already a billion-dollar market in 2020 (TechNavio, 2021).

From methane abatement to circular economy, not to mention landfill fires and odors, reasons to phase out business-as-usual landfilling are numerous. Each organic waste treatment alternative (composting, energy generation or recovery, etc.) offers a distinct trade-off, involving climate change mitigation, energy security, locally sourced fertilizers, and air quality (Nordahl et al., 2020). Decision to choose one technology over the other should be context-specific, rooted in local fertilizer and energy needs, and competing usages.

Additionally, we track a substantial amount (USD 1.3 billion) invested in projects that hold improving sustainable solid waste management practices as a primary objective, without clear evidence of methane abatement potentials. However, in many developing countries the implementation of formal and efficient waste collection and management systems constitute a first essential measure in the fight against methane emissions from uncontrolled landfilling. Projects with such scope are categorized as additional beneficial measures under CCAC's taxonomy.

WASTEWATER MANAGEMENT

USD 1.5 billion was invested in targeted methane abatement solutions in the wastewater sub-sector, falling short of the average USD 21 billion annually needed between now and 2050 to implement comparable abatement measures (Harmsen et al., 2019). Wastewater-to-energy projects and other advanced wastewater treatment solutions (upgrades to secondary and tertiary anaerobic treatment) concentrated 16% of this amount. Tracked investments were geographically concentrated in Bangladesh (37%) Egypt and Kenya (18%), and Western Europe (30%). The majority of tracked investments were captured through analyzing development finance flows and came from Multilateral DFIs (90%).

The largest segment (84%) of targeted finance in wastewater management served the implementation of formal and efficient wastewater management[16], a substantial share of which flowed to Middle East and North Africa (38%). These are mostly public development finance-backed projects (71%), with stated primary objectives to improve water sanitation (SDG 6) and resilience in developing economies (SDG 13). While likely not the main driver of investment decisions, upgrades to centralized wastewater collection and treatment can lead to substantial methane abatement (EPA, 2013). The methane abatement potential of these projects is likely to be insufficient to drive investment towards these interventions. Instead, fully recognizing the multi-benefits and opportunities associated with improved wastewater management would legitimize expensive investments in infrastructure-heavy projects.

ADDITIONAL RECOMMENDATIONS FOR THE WASTE AND WASTEWATER SECTOR

Some additional key actions to close the methane abatement finance gap and drive emission reductions in this sector include:

- Advocate, push for, and set industry specific emission standards for methane within the wider waste sector (solid waste and wastewater).
- Work closely with key local sources of organic waste (e.g., agriculture, K-12, hospitality) to promote circular economy and adapt organic waste treatment solutions (composting, anaerobic digestion) to support local fertilizer needs.
- Establish food waste diversion laws (e.g., food banking) to prevent landfilling.
- Tap methane abatement potential of all projects that upgrade wastewater treatment practices.
- Improve methane emission monitoring of waste treatment sites and explore adoption of carbon pricing in the sector (taxes or fees).

3.2.3 AGRICULTURE, FORESTRY, AND LAND USE

OVERVIEW

Targeted methane abatement finance in AFOLU projects reached USD 4.2 billion in 2019/2020, making it the second largest tracked sector behind waste. In 2015, methane emissions from the AFOLU sector were nearly level with those of fossil fuels at 155Mt. However, the AFOLU methane emissions are dominated by a few agricultural sub-sectors (i.e., enteric fermentation, manure, and rice) that are technically harder to abate than emission in other sectors. As a result, behavioral changes at scale– which are beyond the scope of this report, including mass adoption of low meat diets, would be needed to meet Paris agreement's objectives (CCAC and UNEP, 2021; Harmsen et al., 2019).

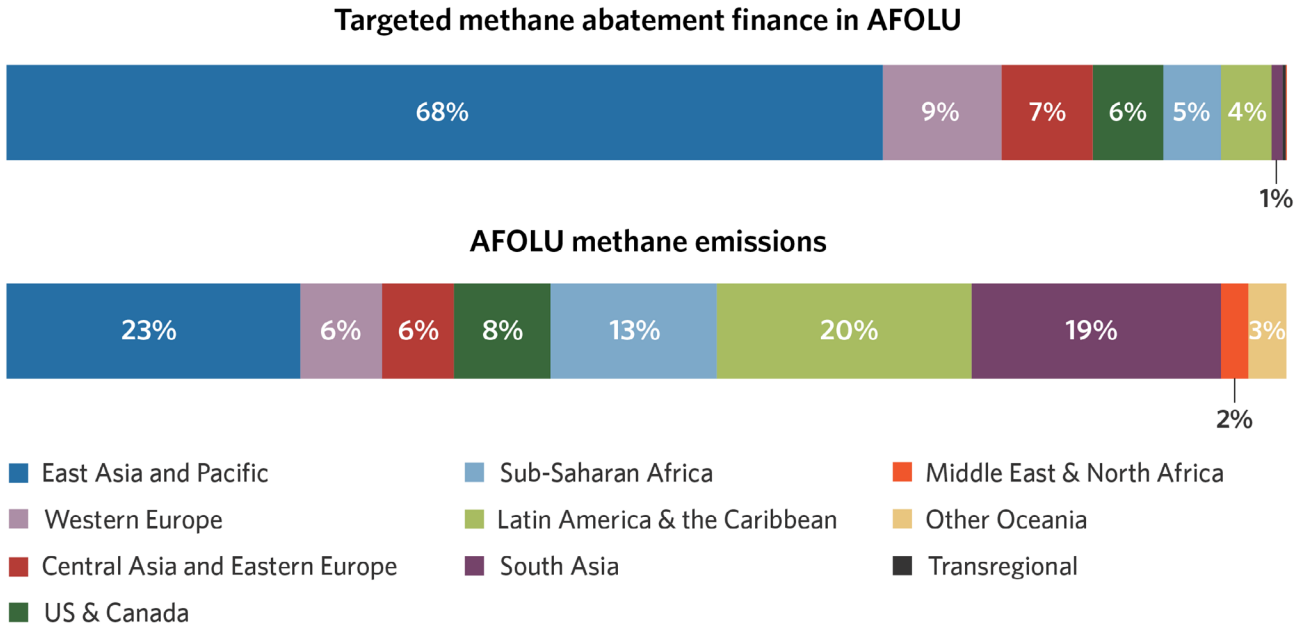
16 Often to displace latrines and septic tank disposal

Table 3. Methane-abating finance in the AFOLU sector in USD million.

Measure category	Abatement measures	2019/2020 tracked USDm
Targeted measures		**4,251**
Livestock manure management	Manure-to-energy and manure management	257
Livestock productivity and enteric fermentation	Reducing enteric fermentation emissions	9
	Livestock health and productivity	1,364
Rice paddies	Change in irrigation practices, breeding of low-GHG and more resistant rice varieties	83
Burning or disposal of biomass, agricultural residues, and forestry residues	Prevent peatland, forest, and biomass intentional burning	11
	Agricultural and Forestry residues-to-energy	2,526
Additional beneficial measures		**3**
Adoption of healthier diets	Promotion of low-carbon and low meat diets	3

Driven by China, the East Asia & Pacific region is the sector's top methane emitter (23%) and by far the largest arena for deployment of targeted methane abatement finance (68%). Only 5% of finance targeted projects in Latin America & Caribbean and South Asia while the two regions contribute to almost 40% of global AFOLU methane emissions.

Figure 10. Regional breakdown of the AFOLU sector targeted methane abatement finance (2019/2020) and emissions (2015)



Source: *Emissions data is from the Community Emissions Data System (CEDS; Hoesly et al., 2018)*

The implementation cost of the necessary AFOLU measures necessary to limit warming to +2.0°C is estimated at USD 43 billion per year over the 2021-2050 period (Harmsen et al., 2019)**, more than ten times the amount we tracked for 2019/2020.**

LIVESTOCK

In 2019/2020, methane abatement measures in livestock (manure management, enteric fermentation, livestock health & productivity) attracted USD 1.6 billion. This is far below the estimated USD 27 billion needed to address methane abatement in the livestock subsector every year between now and 2050 (under a 2.0°C warming scenario).

At USD 1.4 billion projects which target livestock health & productivity represent the bulk of this finance. With substantial data limitations on the private sector front, these projects only reflect the state of development finance in the domain (100% of tracked finance was public, 98% of which came from Multilateral DFIs). Tracked financial flows heavily supported programs in China (73%). In most cases, the methane abatement potential is not acknowledged as a primary objective of the project by funders; the emphasis is on food security, resilience, or livelihood benefits and outcomes. Improving cattle productivity[17] can lead to important methane emission intensity reductions (Chang et al., 2021). However, without herd size control, livestock growth can offset emissions drops achieved through efficiency gains. In the dairy sector, GHG emissions still grew by 18% while cattle emission intensities were reduced by 11% between 2005 and 2015 (FAO et al., 2019). In the EU, methane abatement potential associated with dairy cows' productivity gains between 2010 and 2018 was eroded by overall growing herds; only a selection of countries that experienced unintentional herd size reductions achieved absolute methane emission cuts (European Courts of Auditors, 2021). By acknowledging methane abatement as an objective of livestock productivity and health projects, DFIs could truly tap the mitigation potential of these projects and make emissions cuts more than accidental, while supporting food security and livelihoods.

> **Cattle belch climate bombs.** The average cow directly emits the equivalent of 2.7 tons of carbon dioxide each year through enteric fermentation (Quinton, 2019). Removing the emissions from two cows has a greater impact than taking one typical U.S. car off the road.

In comparison, investment targeting livestock enteric fermentation remains low (USD 9 million) – mostly in the form of pilot projects to monitor cattle methane emissions or test methane inhibiting feed additives. Enteric fermentation is a technologically hard-to-abate source of methane that could account for half of all the remaining methane emissions in 2100 under a +2C scenario (Harmsen et al., 2019). Nonetheless, low public investment in R&D and emerging solutions together with lack of engagement from the largest beef and dairy sector corporations is worrisome (FAIRR, 2022). Recent developments, including the approval of the first methane inhibiting feed additive in the EU, could unlock new private financing for such solutions (Fortuna, 2022). However, the inertia of regulatory frameworks and design, together with limited applicability in many livestock systems, prevent rapid mass rollout of these technologies (Hegarty et al., 2021).

17 A healthier and more productive (in terms of meat, dairy, etc.) livestock means less losses and more output with the same herd size.

Tracked manure-to-energy projects attracted USD 257 million in investment in 2019/2020. Data principally covers the U.S. market due to public-led efforts to both track and financially support such projects[18] (CDFA and California climate investments, 2021). Substantial grant funding from the state of California has led to a sharp increase in the number of manure biodigesters in recent years and California alone accounts for more than half of U.S. manure-to-energy project expenditure in 2019/2020.

RICE PADDIES

Targeted methane abatement finance for rice was low at USD 100 million and with only a handful of projects targeting capital expenditure on water management and rice varieties, the majority being pilots and research projects. Again, tracked investment is far from the USD 28 billion estimated cost of implementing mitigation measures compatible with limiting warming to +2°C. This is understandable as the sector still needs further innovation and R&D support to make the solutions market-ready and scalable, while the fragmented nature of its value chains make large scale transformations challenging. Being another hard-to-abate methane source, envisaged mitigation measures in rice come with a higher cost than in most other sectors (Harmsen et al., 2019).

MANAGEMENT OF AFOLU RESIDUES AND OTHER BIOMASS BURNING

At USD 2.5 billion annually, this sub-sector attracted the most AFOLU targeted finance in 2019/2020. However, this number groups different project types and masks diverging trends. Most of these finance flows capture projects that generate energy from forestry (USD 2.2 billion) and crop[19] (USD 0.3 billion) residues. Strikingly, this segment of finance flowed towards large projects in Japan (64%), China (11%), and the UK (9%), mainly backed by commercial financial institution funding (59%). The true methane abatement impact of these projects is uncertain as it is difficult to assess whether these crop and forestry residues would have been burnt on production site (leading to incomplete combustion and thus methane emissions), landfilled, or even disposed in rice paddies under a baseline scenario. Allocation to the relevant sector and methane source (solid waste, biomass burning, rice) is therefore also challenging, and at least some of these investments likely avoided methane emissions that would have taken place in landfills outside of agricultural and forestry system boundaries.

In parallel, we capture just a fraction (USD 11 million) of public finance for programs that try to prevent human-led peat, savannah, and forest burning, a widespread land use practice. Incomplete combustion of organic matter in open agricultural burning releases methane to the atmosphere and comes with severe air pollution impacts and related illnesses (CCAC, 2015).

18 EPA Agstar
19 Primarily from rice and maize crops.

ADDITIONAL RECOMMENDATIONS FOR THE WASTE AND WASTEWATER SECTOR

Some additional key actions to close the methane abatement finance gap and drive emission reductions in this sector include:

- Determine, set, and promote methane abatement potential of livestock productivity programs in addition to currently stated objectives of food security and resilience.
- Public and private investment to support hard-to-abate and less mature sectors (livestock enteric fermentation, rice paddies) through R&D, field validation of technically feasible options, and redirection of public support.
- Improve both livestock sector methane emission monitoring impact assessments of methane abating solutions and explore adoption of carbon pricing in the sector (taxes or fees).
- Work closely with local agricultural and waste sector actors to replace open field burning or landfilling of crop and forestry residues with low-methane alternatives (composting, energy recovery, etc.).
- Establish crop and forestry residues diversion laws to prevent landfilling and open field burning.

4. CONCLUSIONS

Methane mitigation offers a unique opportunity for policy makers and public and private investors to significantly advance efforts towards limiting global warming this decade. (CCAC and UNEP 2021). Overall, current volumes of methane abatement finance are not adequate to reduce methane emissions at the rate needed to avoid the worst impacts of climate change. Despite the availability of cost effective and market ready abatement solutions, current investment is not directed to geographies and sectors that need it most business, nor are policy strategies for methane reduction prioritized by policymakers and investors.

Key barriers to increasing finance for methane abatement include:

- **Policy and regulatory barriers.** Across all geographies and sectors the current policy and regulatory environment fails to support methane mitigation activities. For example, even though oil and gas methane emissions can often be reduced at minimal cost or net savings, policies and regulatory schemes to track leaks and require methane mitigation in the sector are patchy.
- **Measurement uncertainties.** Measuring methane emissions is complex and largely underestimated. Having a reliable methane emissions baseline is crucial to track progress and identify key levers for action. In addition, tracking methane emissions reductions is still more of an art than a science. Significant progress needs to be made in methane tracking to enable targeted methane mitigation finance.
- **Methane abatement finance data gaps.** Finance data is limited. This is partly because reporting on methane abatement activities by public and private actors is not standardized which increases the risk of over or underestimating the benefits of methane related investments. What data is available is convoluted, hindering the assessment of abatement investment gaps and needs.
- **Lack of support for innovation.** Some methane solutions with high mitigation potential such as feed additives and chemical inhibitors in the AFOLU sector are still early in their development cycle and require additional research and development support.

The Global Methane Pledge has brought together nearly 120 countries in support of methane emissions reductions. Building on this momentum, countries should next consider rapidly developing concrete methane reduction plans as well as financing strategies.

5. RECOMMENDATIONS FOR KEY STAKEHOLDERS TO CLOSE THE METHANE ABATEMENT FINANCE GAP

Methane abatement finance has one of the highest ratios of global warming reduction benefit per dollar of capital invested. The world cannot avoid the worst impacts of climate change without sufficient finance flows towards methane abatement. Both public and private actors have an essential role to play in closing the methane abatement finance gap.

Below we provide a list of recommendations to for key stakeholders in this space.

Actor	Recommendation(s)

Governments and regulators	• Develop legally binding methane mitigation targets at a national and/or sectoral level.
	• Establish emission standards that focus on monitoring, reporting, and verification of methane mitigation on a sectoral level.
	• Set a timetable this decade for enhanced and progressively binding policy and regulatory signals that are tailored to the key sectors by specifying minimum standards, regulations, and tailored penalties/ incentives for methane leakage and reduction.
	• Strengthen accurate and transparent emission measurement:
	  • Mandate reporting of scope 1 and 2 methane emissions actors in key sectors.
	  • Mandate scope 3 emissions reporting for companies that have methane intensive value chains, including livestock and rice production.
	  • Set clear guidelines to accurately report on methane emissions separate from other gases such as carbon dioxide.
	  • Foster enabling activities to support more accurate emission measurement including data collaboration across jurisdictions.
	  • Boost investment in innovative technologies to enhance real time emission measurement, including the use of emerging remote sensing platforms.
	• Incentivize the uptake of existing technologies for methane reduction through awareness-raising initiatives and fiscal incentives.
	• Invest in R&D with research institutions and private sector participation to improve industrial practices and further reduce technology costs, particularly in the agriculture sector.
	• Redirect capital from carbon intensive activities to methane abatement solutions in key sectors, enabling investors to pursue methane abatement at a greater speed and scale.
	• Financial regulators and international sustainability reporting bodies should agree on:
	  • A common framework and definition for methane abatement finance.
	  • A taxonomy of methane abatement solutions, by sectors, to guide public and private actors to track investment.
	  • Mandate fugitive emissions reporting in the oil and gas sector.
	• Set a timetable to explore and integrate carbon pricing in all its forms, including the social cost of carbon emissions, carbon taxes and methane fees, and emission trading schemes.
	• Use the Global Methane Pledge as a forum for building a knowledge base, dialogue with countries that are not yet part of the Pledge but are major emitters, exchange lessons learned on regulatory frameworks and reporting standards on methane abatement investments at a national level, and scale up action.

Actor	Recommendation(s)
Corporates	Scope 1 emitters: • Assess methane exposure risk and measure methane emissions and leakage. • Identify and set methane reduction targets in interim net zero goals and improve transparency on capital expenditure figures in sustainability reports. • Report transparently on: ▪ Capital expenditure on methane abatement activities. For example, corporates in the oil and gas sector could include targets for investment in leak detection and repair systems as part of investment goals and report on progress. • Annually report on progress towards meeting methane abatement and methane abatement finance goals. Scope 2 and 3 emitters: • Assess methane emissions exposure from purchased energy (Scope 2) and through value chains (Scope 3), including livestock and rice production. • Engage in dialogues with actors across their value chains to report and set targets to reduce methane emission.
Public development banks	• Provide proactive support to priority governments in adopting effective methane reduction policies through technical assistance and policy-based lending. • Engage with counterparts and intermediaries to implement methane reduction strategies and pursue project finance in methane abatement solutions. • Establish methane related climate finance targets and enable short-lived climate pollutant mitigation in key countries of operation with high methane exposure. • Build on existing reporting methodologies, e.g., Joint MDB methodology on climate mitigation finance and International Financial Institution (IFI) Framework for GHG accounting to further define methane mitigation activities in taxonomies and tracking of methane emissions separate from other gases. • Integrate lifecycle emissions assessments as part of due diligence for any new or ongoing natural gas generation projects. Include support for methane abatement measures as part of financing packages. • Take action against the Global Methane Pledge, for public development banks who are members, by determining and pursuing strategies for increased methane financing.
Private financial institutions	• Build an understanding of how to account for methane abatement finance across a variety of investment approaches, and financing products. Integrate into portfolio alignment tracking and temperature mapping of existing investments. • Evaluate involvement and exposure to the methane intensive sectors and push for action from corporates that receive funding. • Provide support to innovative methane abatement solutions which align with business activities.
Other organizations, initiatives, and enablers	• Agree on a timeline compatible with 2030 abatement targets and work program to set benchmarks and catalogue best practices across methane-relevant sectors. • Prioritize capacity building to address gaps in evidence on the practical application of existing approaches to methane abatement finance tracking given the still relatively limited pool of investments in this space. • Enhance, identify, and update investment needs by geography, actor, and sector following revised climate goals. • Establish annual tracking of methane emissions and related financing activity. • Participate in and enable R&D activities to further reduce methane abatement cost in livestock enteric fermentation, manure management, rice paddies among others.

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7. ANNEX I: TERMINOLOGY

Primary investment: new investment targeting methane-specific outcomes. Secondary market transactions (e.g., re-selling of stakes or public trading on financial markets) are not tracked because they do not represent new investment.

Methane abatement: activities with direct and indirect impacts that prevent and/or reduce methane emissions. Direct impact can be achieved through targeted measures, whereas indirect measures through additional beneficial measures

2019/2020: CPI reports two-year averages (2019 & 2020) to smooth out annual fluctuations in data.

Targeted measures: direct methane abatement solutions categorized as targeted in CCAC's taxonomy

Additional beneficial measures: interventions that can indirectly result in methane abatement as per CCAC's taxonomy.

Technical solutions: Involve changes machines, processes, and materials that are used in emitting industries.

Enabling activities: A course or principle of action adopted or proposed that provide the means for either technological solution implement or direct methane abatement, such as policies, technical assistance, and capacity building.

Prevent/Reduce: Interventions that keep methane emissions from occurring or make methane emissions less in amount.

Reuse: Interventions that give a new use to methane gas.

Large emitters (Both scope 1&2 and scope 3): Upstream and mid-stream oil and gas actors, Livestock and livestock feed producers.

Enablers: Research and intelligence organizations; Industry initiatives that aim at making actors join forces in methane emissions abatement.

Investors and solutions providers: abatement solutions' implementers highly involved in methane-relevant projects.

GtCO2e: gigatonnes of carbon dioxide equivalent. In this report, it refers to methane gas conversion over a 100 year (GWP100) unless otherwise stated.

8. ANNEX II: CLASSIFICATION AND DATA COVERAGE OF METHANE ABATEMENT SOLUTIONS

The CCAC classification of methane abatement solutions were adjusted to reflect the level of granularity projects' description usually provide. Although the CCAC classification was never intended to be a taxonomy to track investment, these solutions are a helpful starting point to develop such a taxonomy. Impact objectives are rarely technical in climate finance reported data, limiting the possibility of further solution categorization. In this report, CPI regrouped, cross-checked, and reconciled several data sources. Individually, these data sources typically cover only a portion of the sector, geography, or actor type score of this report. The table below summarizes the CCAC classification and CPI's coverage of solutions using these data sources.

Sector	CCAC categories	Main data sources and coverage
Targeted measures		
Fossil Fuel Sector (Oil, Gas, and Coal)	**Upstream and downstream leak detection and repair**	▪ Development finance projects covered by OECD CRS and IATI. ▪ Additional analysis of some MDBs' own reporting (WB, EBRD, EIB, ...) ▪ Projects reported through voluntary carbon markets (Berkley Carbon Trading Project and CDM) ▪ Analysis of the sector top emitters' sustainability reports and disclosure
	Recovery and utilization of vented gas: capture of associated gas from oil wells; blowdown capture; recovery and utilization of vented gas with vapor recovery units and well plungers; Installation of flares	
	Improved control of unintended fugitive emissions from the production of oil and natural gas: regular inspections (and repair) of sites using instruments to detect leaks and emissions due to improper operations; replace pressurized gas pumps and controllers with electric or air systems; replace gas-powered pneumatic devices and gasoline or diesel engines with electric motors; early replacement of devices with lower-release versions; replace compressor seals or rods; cap unused wells.	
	Coal mine methane management: pre-mining degasification and recovery and oxidation of ventilation air methane; flooding abandoned coal mines.	▪ Projects reported through voluntary carbon markets (Berkley Carbon Trading Project and CDM) ▪ Some projects reported through GMI's International Coal Mine Methane Projects Database. ▪ Analysis of the sector top emitters' sustainability reports and disclosure

Sector	CCAC categories	Main data sources and coverage
Waste Sector	**Solid waste management:** (residential) source separation with recycling/reuse; no landfill of organic waste; treatment with energy recovery or collection and flaring of landfill gas; (industrial) recycling or treatment with energy recovery; no landfill of organic waste.	▪ Development finance projects covered by OECD CRS and IATI ▪ Additional analysis of some MDBs' own reporting (WB, EBRD, EIB, ...) ▪ Bloomberg New Energy Finance (BNEF) for some waste-to-energy and wastewater-to-energy projects. ▪ IJGlobal and World Bank PPI to cover some solid waste and wastewater infrastructure projects. ▪ Projects reported through voluntary carbon markets (Berkley Carbon Trading Project and CDM)
	Wastewater treatment: (residential) upgrade to secondary/ tertiary anaerobic treatment with biogas recovery and utilization; wastewater treatment plants instead of latrines and disposal; (industrial) upgrade to two-stage treatment, i.e., anaerobic treatment with biogas recovery followed by aerobic treatment.	
Agricultural Sector	**Improve animal health and husbandry:** reduce enteric fermentation in cattle, sheep and other ruminants through: feed changes and supplements; selective breeding to improve productivity and animal health/fertility	▪ Development finance projects covered by OECD CRS and Iati ▪ Additional analysis of some MDBs' own reporting (WB, EBRD, EIB, ...) ▪ Analysis of the sector top emitters' sustainability reports and disclosure
	Livestock manure management: treatment in biogas digesters; decreased manure storage time; improve manure storage covering; improve housing systems and bedding; manure acidification	▪ AgSTAR and state-level grant program reporting (e.g. CFDA) for biodigesters in the U.S. ▪ Bloomberg New Energy Finance (BNEF) for some manure-to-energy projects. ▪ Projects reported through voluntary carbon markets (Berkley Carbon Trading Project and CDM)
	Rice paddies: improved water management or alternate flooding/drainage wetland rice; direct wet seeding; phosphogypsum and sulphate addition to inhibit methanogenesis; composting rice straw; use of alternative hybrids species	▪ Development finance projects covered by OECD CRS and IATI ▪ Additional analysis of some MDBs' own reporting (WB, EBRD, EIB, ...)
	Agricultural crop residues: prevent burning of agricultural crop residues	▪ Development finance projects covered by OECD CRS and IATI ▪ Bloomberg New Energy Finance (BNEF) for crop residue-to-energy projects.
Additional beneficial measures		
Fossil Fuel Sector (Oil, Gas, and Coal)	**Renewables for power generation:** use incentives to foster expanded use of wind, solar, and hydro power for electricity generation.	▪ CPI's own Global Landscape of Climate Finance 2021
	Improved energy efficiency and energy demand management: (residential) use incentives to improve the energy efficiency of household appliances, buildings, lighting, heating and cooling, encourage rooftop solar installations; (industrial) introduce ambitious energy efficiency standards for industry; improve consumer awareness of cleaner energy options.	▪ CPI's own Global Landscape of Climate Finance 2021

Sector	CCAC categories	Main data sources and coverage
Waste sector	Reduced consumer waste and improved waste separation and recycling, improved sustainable consumption.	▪ Development finance projects covered by OECD CRS and Iati ▪ Additional analysis of some MDBs' own reporting (WB, EBRD, EIB, ...)
Agricultural Sector	**Reduced food waste and loss:** strengthen and expand food cold chains; consumer education campaigns; facilitate donation of unsold or excess food.	
	Adoption of healthier diets: decrease intake where consumption of ruminant products is above recommended guidelines	

The above table only highlights the main data sources used in each segment of the methane universe. The full list of data sources investigated is:

- The Organization of Economic Co-operation and Development's Development Assistance Committee (OECD-DAC)
- The Organization of Economic Co-operation and Development's Common Reporting Standard (OECD-CRS)
- Bloomberg New Energy Finance (BNEF)
- Climate Bonds Initiative (CBI)
- Convergence Blended Finance, Climate Funds Update (CFU)
- International Energy Agency (IEA)
- IJ Global
- Biannual surveys of development finance institutions conducted by CPI
- The International Aid Transparency Initiative (IATI)
- World Bank PPI
- GMI International Coal Mine Methane database
- AgSTAR & CdFA reporting
- Berkley Carbon Trading Project
- UNFCCC' Clean Development Mechanism (CDM)
- Impact and sustainability reports by major fossil fuel and agriculture industry corporates.

Not all these sources provide standardized financial data. When needed, we used best available estimates to calculate projects' costs and CPI's Global Landscape methodology (CPI, 2021) to fill some of the gaps.

9. ANNEX III: ADDITIONAL INFORMATION ON INVESTMENT AND EMISSION PROFILES

Emission reduction potential in Figure 4 for methane were extracted from IPCC AR6 WG3 SPM7 data by calculating total average gigatonnes of CO_2e emission reduction based on GWP100 by 2030 for the following solutions:

- Reduce CH_4 emission from coal mining
- Reduce CH_4 emission from oil and gas
- Reduce CH_4 and N2O emission in agriculture
- Reduce CH_4 emission from solid waste
- Reduce CH_4 emission from wastewater

Although reducing food loss and food waste and shifting to sustainable healthy diets may also have methane abatement potentials, they also have carbon dioxide abatement potentials. Given finance to these solutions were not tracked as targeted solutions, emission reduction potentials were not included in the graph.

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