GHGSAT

2024

METHANE EMISSIONS REPORT

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2024 IN REVIEW

Maintaining Momentum Amidst Uncertainty

In many ways, the macro environment in 2024 was marked by an escalating tension between the status quo and calls for change.

On the geopolitical stage, new leaders took office, prompting a reassessment of energy security policy, with global ripple effects. At the same time, against this political backdrop, the planet experienced its **warmest year on record**, with the global average annual temperature coming in at **2.32°F / 1.29°C higher than the 20th century average.**

One constant throughout these changes, however, is the recognition that reducing methane emissions is a low-hanging fruit to lessen the impacts of planetary warming. Because methane has a warming effect roughly **80 times stronger than carbon dioxide** over a 20-year period, reducing its levels in the atmosphere can have a swift impact on the climate. In the near-term, **every ton of methane reduced will be equivalent to over 100 tons of carbon dioxide** reduced over the subsequent five years.

Moreover, reducing methane emissions bolsters **energy security goals**. By minimizing losses across production and distribution systems, countries can get more value from their existing energy infrastructure without expanding output. This makes energy supplies more stable and predictable—critical in an era of geopolitical shifts and rising global energy demand.

Indeed, in 2024 it was clear that the need to reduce emissions is an economic and environmental imperative. Climbing global temperatures contributed to an increase in damage from natural disasters, wreaking havoc on communities around the world, with direct **global economic losses reaching an estimated $417 billion**.

These warmer temperatures also drove increased power demand for cooling, with electricity consumption further fueled by a combination of other factors, such as stronger industrial activity and more widespread electrification of the vehicle fleet. Indeed, according to the IEA, increased electricity uptake was the primary factor for higher overall energy demand during the year.

While **585GW of renewable energy capacity was added in 2024**, it was not enough to fully offset this higher demand, translating into stronger consumption of other energy sources, including natural gas and coal, given their role as baseload fuels.

This trend is expected to continue, further boosted by greater uptake and demand from data centers, thanks to increasingly widespread use of artificial intelligence (AI).

Acknowledging these shifting patterns, several governments around the world have been evolving their policies and/or promoting initiatives for a more pragmatic approach to the energy transition, encouraging a more responsible use of fossil fuels in the short-term while enabling long-term energy security and economic growth by developing other sources.

For example, in Europe, the **EU Methane Regulation, adopted in August 2024**, recognizes the continuing need for fossil fuels, but seeks to reduce avoidable emissions across the supply chain. This regulation applies to both natural gas and coal. With its remit including emissions transparency for fossil fuel imports into the EU, this regulation's impact will be felt beyond EU borders.

The U.S. also made changes to its **Greenhouse Gas Reporting Program** in 2024, releasing a final rule in **May 2024** to ensure greater visibility into methane emissions from the Oil & Gas sector, though one aspect of this regulation, the Waste Emissions Charge (WEC), has since been repealed.

China has also placed **stricter requirements on its mining industry**, mandating the use of sensors across the production and gas transmission infrastructure and amending requirements for the use and destruction of coal mine gas. These new standards became effective on **April 1, 2025** for new mines and coalbed methane development systems, while existing ones have a two-year grace period.

Beyond fossil fuels, landfills have been gaining global attention due to their contribution to global methane emissions. COP29 spotlighted landfill methane emissions, **with 65 countries supporting a declaration on *Reducing Methane from Organic Waste***. This commitment builds on developments in countries with some of the biggest waste methane emissions earlier in the year, which included either new regulations (e.g. Canada, the EU) or national strategies (e.g. U.S., Brazil, Chile).

Other countries, such as UAE and the U.K., established targets and pledged action, respectively, to ensure more effective landfill diversion. In the U.S., while a new federal standard for the sector had been anticipated for 2025, the timing and status are uncertain. With the EPA's Greenhouse Gas Reporting Program reportedly under review for possible termination at the time of this report's writing, some states, such as California and Colorado, are moving forward to provide operators with greater regulatory certainty.

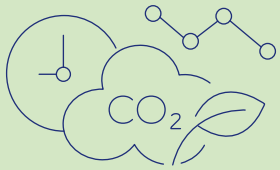
THE ROAD AHEAD

As geopolitical factors continue to drive change globally, momentum that had been building to address methane emissions over the last few years may be at least partly redirected to other government priorities. However, energy security and affordability are not at odds with preserving the health of the planet for future generations.

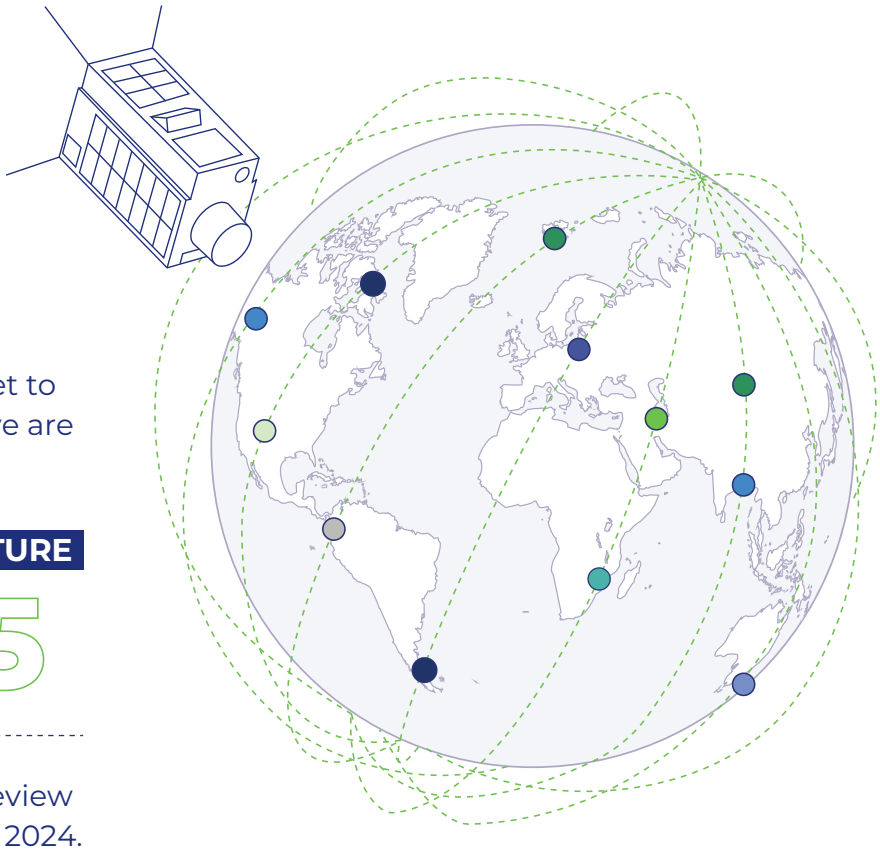
Indeed, mitigation activities create economic benefits, such as jobs creation, increased operational efficiency, and additional profit through commercialization of product that otherwise would be wasted.

The technology and capabilities to both identify and harness these emissions exists.

With GHGSat's sensors on satellites and aircraft, decision-makers can reduce emissions and boost revenues, thanks to **near-daily site revisits and rapid data delivery within hours**.



With **14 satellites launched** since 2016, GHGSat's constellation is poised for rapid, near-term growth to meet the growing demand for emissions monitoring.



Four additional satellites are set to launch in 2025, and another five are on order for future launches.

2024	2025	FUTURE
12	+4	+5

The following report offers a review of some of our highlights from 2024.

2024 KEY ACHIEVEMENTS

Total methane emissions detected in 2024

>20K

CH_4

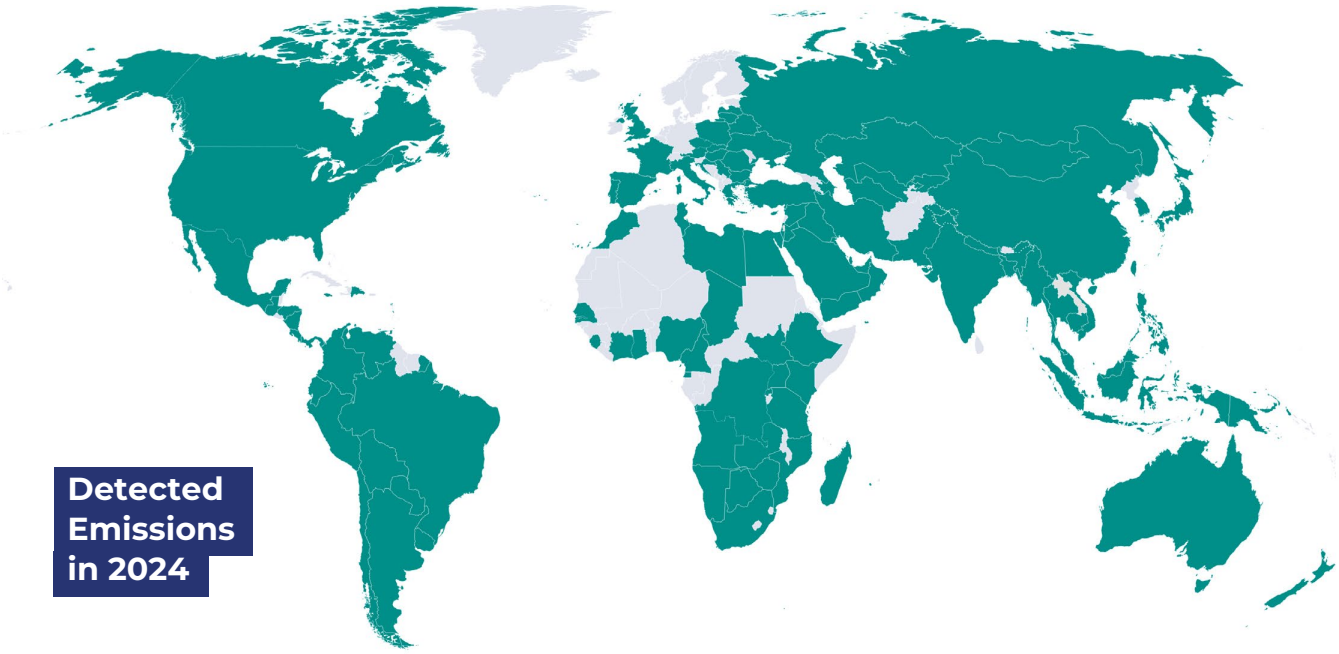
534
$MTCO_2e$

110 **Countries**

Monitored for emissions **in 2024**

+30%

Increase in geographic coverage **vs 2023**



Detected Emissions in 2024

DATA.SAT

DATA.AIR

>4.15M **Facilities**

Measured through **DATA.SAT** and **DATA.AIR** in 2024

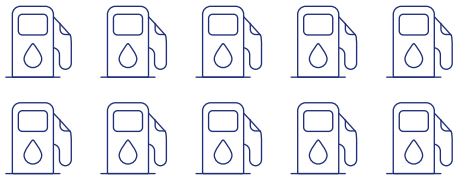
+40%

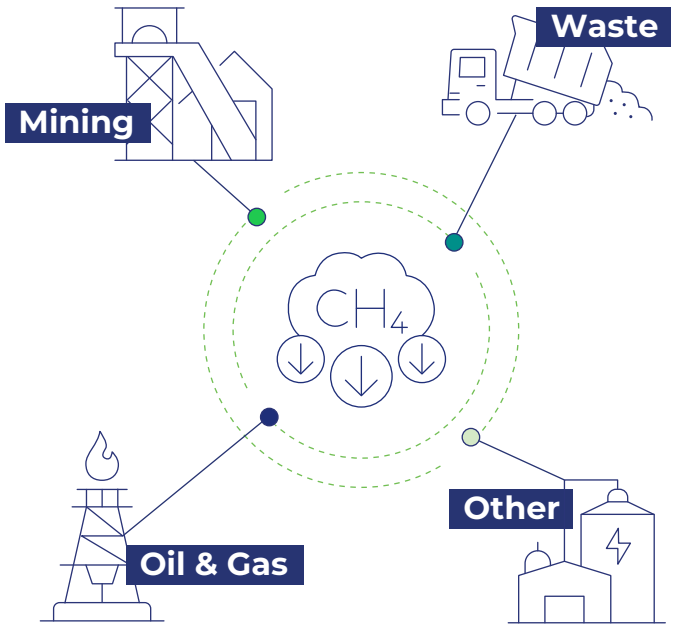
Increase in detected emissions from our satellites

We continue to create impact through constructive dialogue with industry stakeholders as a trusted partner, with audited mitigations since inception through 2024 totaling:

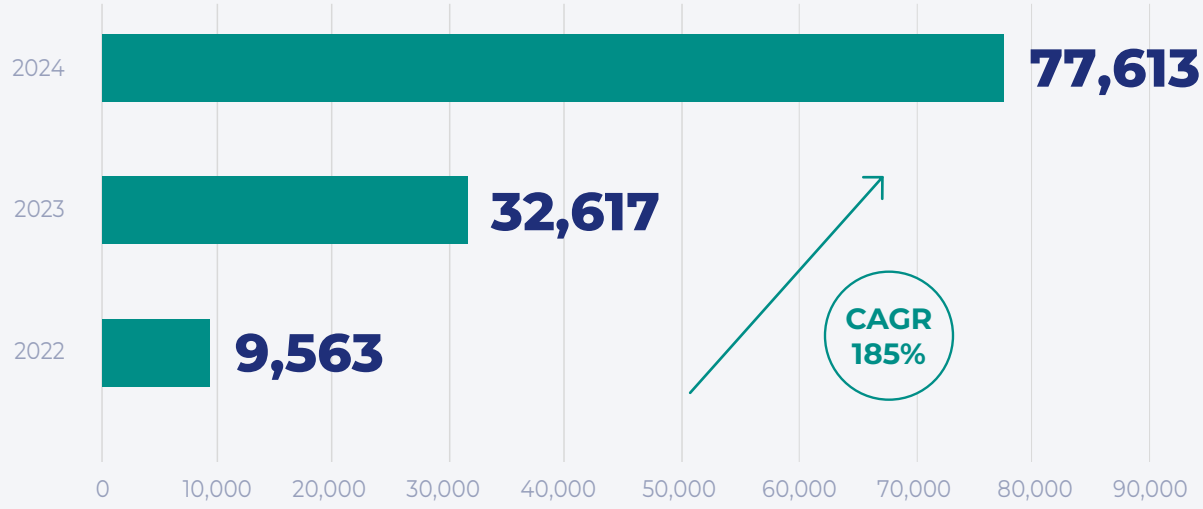
>18 $MTCO_2e$

Equal to removing 4.4 million gasoline-powered passenger cars from roads for a year.



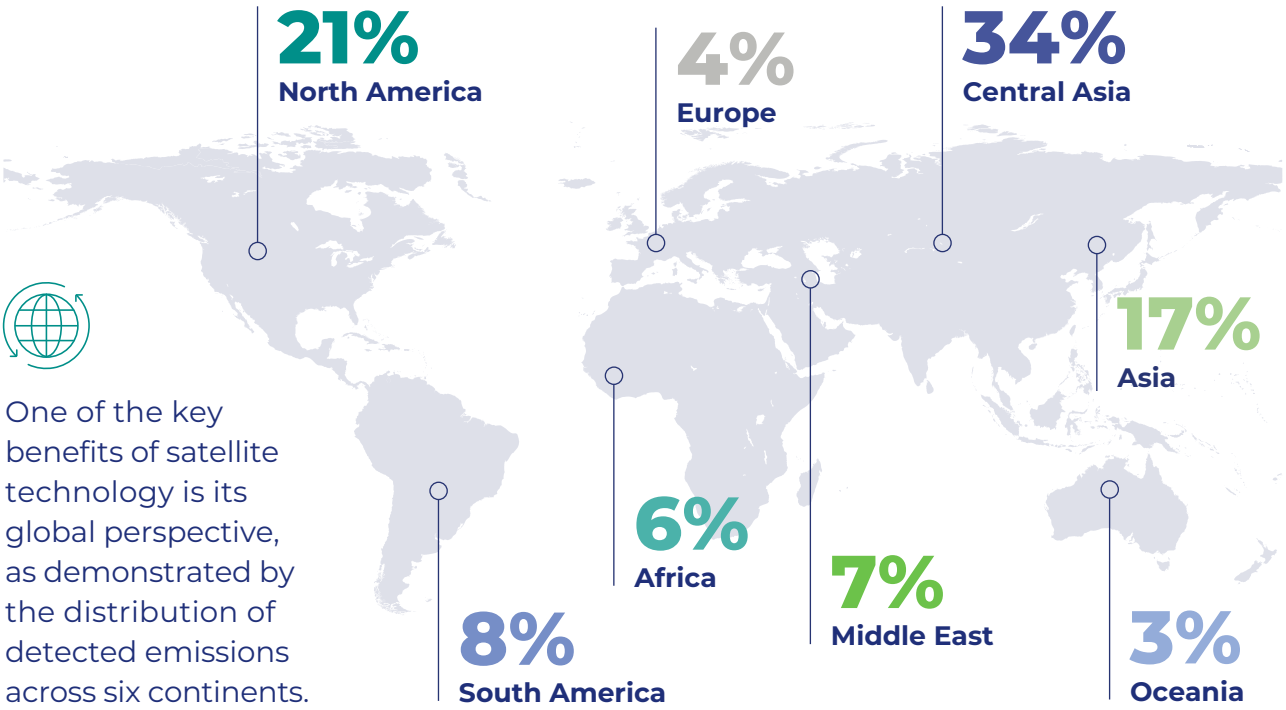


Yearly Growth in Satellite Observations (Count)



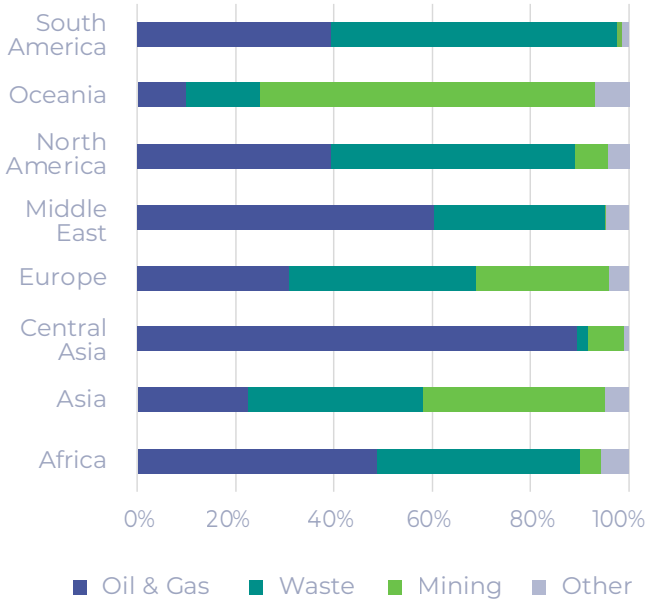
REGIONAL OVERVIEW

Regional Distribution of Detected Emissions Across All Emitting Sectors in 2024



One of the key benefits of satellite technology is its global perspective, as demonstrated by the distribution of detected emissions across six continents.

Industry Emissions Detected by Region - 2024



An analysis of detected emissions at a geographic level highlights a distinct difference in emissions profiles across regions, with these trends even more pronounced on an individual country-basis due to a range of different factors.

Though slightly skewed towards the **Waste sector (38%)**, the European region exhibited the most even distribution of detected emissions across the three major emitting sectors (Oil & Gas, Waste, and Mining). In contrast, Central Asia's detected emissions predominantly stemmed from **Oil & Gas activities (89%)**.

SECTOR OVERVIEW

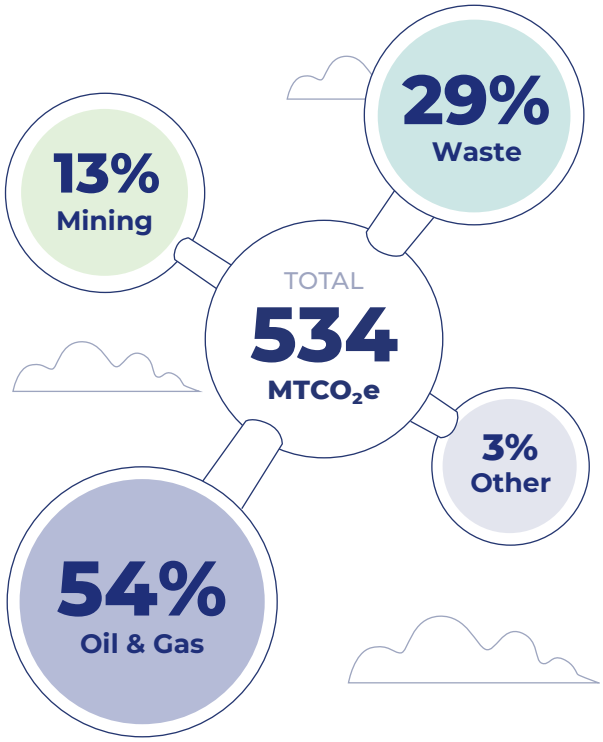
The Oil & Gas and Waste sectors each accounted for a higher proportion of overall emissions in 2024 than in 2023, representing a combined 83% of detected emissions during the year. **Oil & Gas alone accounted for 54% of this total**.

In terms of number of detections, GHGSat's satellites observed over **20,000 methane plumes** over the "super-emitter" **100 kg/hr threshold** during the year, with most of these plumes (55%) originating from Oil & Gas activities. However, this sector was also the most closely monitored by GHGSat during the year.

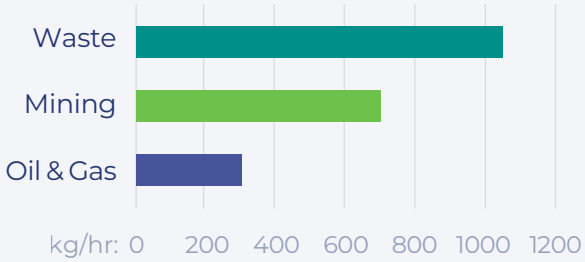
Emission persistence varies significantly across sectors; Oil & Gas emissions are the most intermittent, with these sites exhibiting a calculated average persistence rate of 15%. This means that at sites which GHGSat measured multiple times, our satellites detected repeated emissions in only 15% of sites.

The observed average persistence rates for the Mining and Waste sectors are higher, at 48% and 69%, respectively.

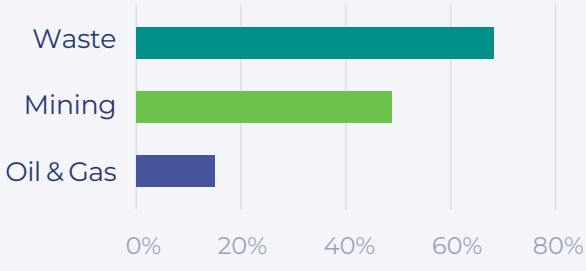
Number of Detections – Sector Distribution



Average Site Emissions Rate by Sector



Persistence Rate by Sector

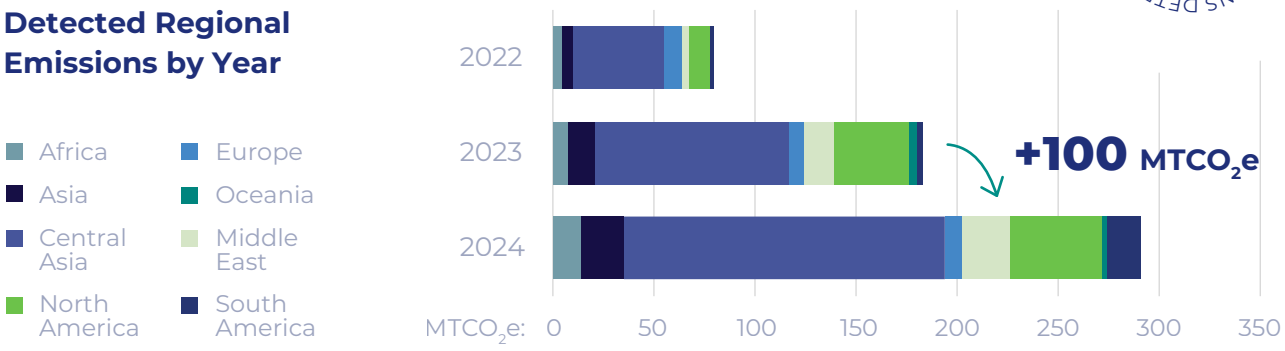


OIL & GAS

TOTAL METHANE EMISSIONS DETECTED IN 2024

290 $MTCO_2e$

Detected Regional Emissions by Year



GHGSat's detected emissions from Oil & Gas were **higher than any other sector** in terms of absolute measured emissions in 2024.

This sector also saw the greatest increase in overall methane emissions measured, with an **additional 100 $MTCO_2e$ detected**.

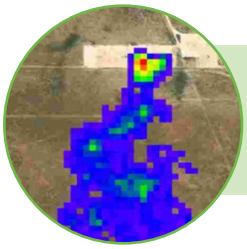
While all regions, except for Oceania, saw a rise in detected Oil & Gas emissions, Central Asia's growth of 65% during the year was noteworthy, given its relatively high level of emissions in 2023, which had reached nearly **100 $MTCO_2e$**.

As a result, this region accounted for a slightly greater proportion of the segment's total detected emissions (55%).

In addition to Central Asia, South America also saw significant increases in Oil & Gas emissions in 2024, both in absolute and percentage terms compared to the previous year.

GHGSat's precise and timely data enables industry operators, such as those in Oil & Gas, to **take swift mitigation action** with confidence, benefiting both their bottom line and the environment.

GHGSat both has **unparalleled revisit times**—in one case, measuring a single site more than 30 times in three days—and the fastest data delivery after a detection, alerting customers about detected emissions just a few hours after measuring them from space.



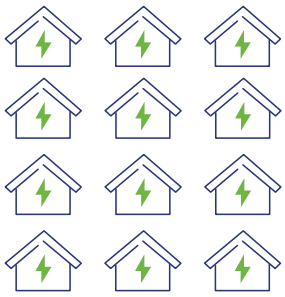
North America
Source rate: 1,039 kg/hr
December 2024

As one example, in late 2024, GHGSat alerted an operator about a detected emission *(shown above)*. Follow-up measurements confirmed mitigation. Measured at **1,039 kg/hr** (equivalent to 58 MMBtu/hr), this action resulted in annualized savings of $1.3M for the operator.

GLINT: Scientifically Validated Capablities for Offshore O&G

In September 2022, a series of explosions damaged the 1,200-km long Nord Sea subsea pipeline. This pipeline has been built to carry natural gas from Russia to Europe, and, while not operational at the time, was full of natural gas.

Leveraging GHGSat observations and measurements, as well as data and expertise from a UN-led international team, it was determined that the measured amount of methane released in one week due to this leak was up to **485,000 metric tons**. For better context, this amount is equivalent to the annual electricity usage of 2.8M homes in the U.S.

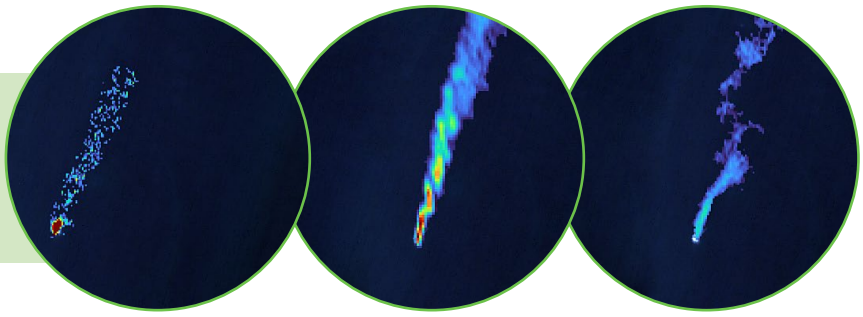


485K

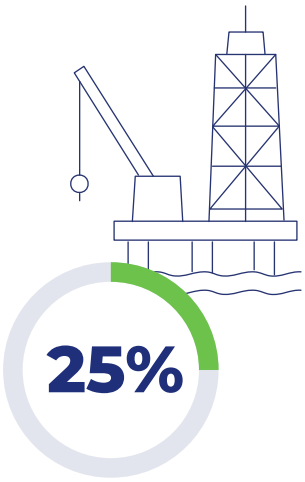
Metric Tons

Equivalent to the annual power use of 2.8M+ homes.

Nord Stream
Satellite CH_4 Measurements from GHGSat-C2, C1, and C4 — two hours apart



This event afforded an opportunity for GHGSat to test, refine, and validate GLINT mode capabilities in offshore methane detections.

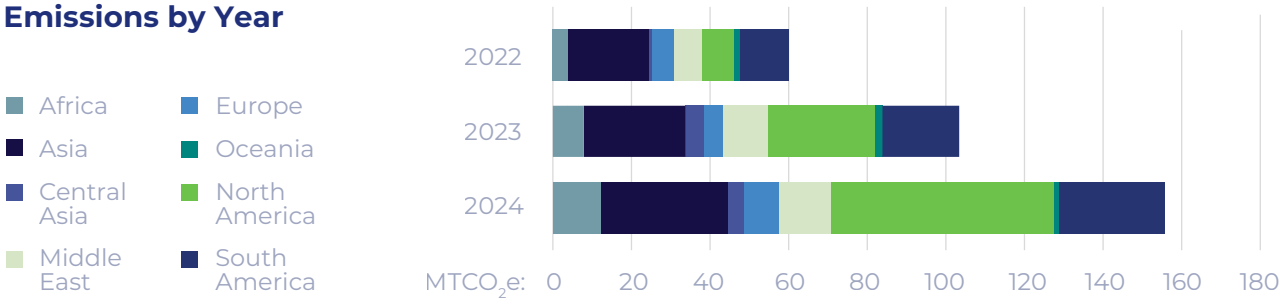


While events like the Nord Stream pipeline explosion are not a common occurrence, methane monitoring of offshore facilities is increasingly critical for operators.

More than **one-quarter of global Oil & Gas production is generated offshore**. With GLINT mode, Oil & Gas operators can confidently monitor offshore assets, and swiftly take action on any detected emissions.

WASTE

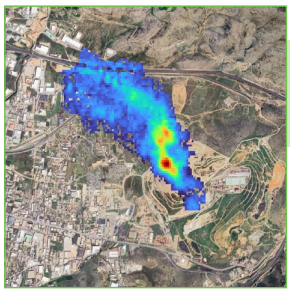
Detected Regional Emissions by Year



GHGSat's detected emissions from the Waste sector **increased by 50%** from 2023 to 2024, thanks in part to more streamlined site tasking and monitoring, with total detected emissions reaching just over **155 $MTCO_2e$** in 2024.

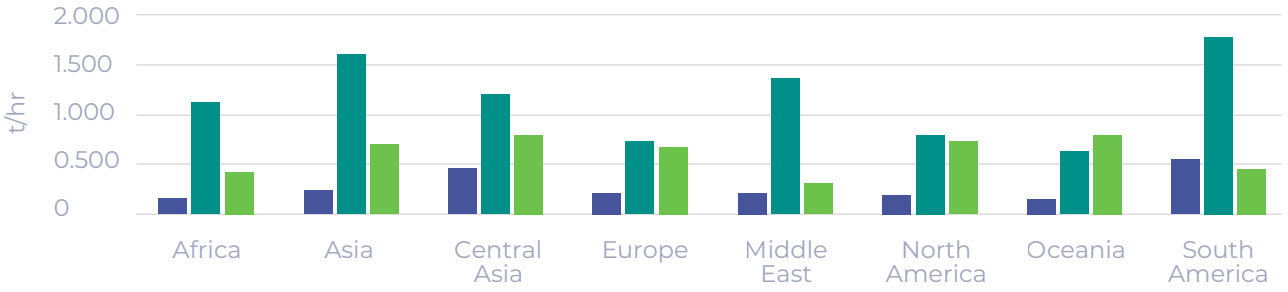
From a geographic perspective, GHGSat detected Waste emissions from nearly **90 countries** during 2024, highlighting the universality of the challenge.

At the regional level across all sectors, except for Mining in Oceania, the average per site detected source rates for the Waste sector were the highest.



Greece
March 2024

Average Source Rate by Region & Sector

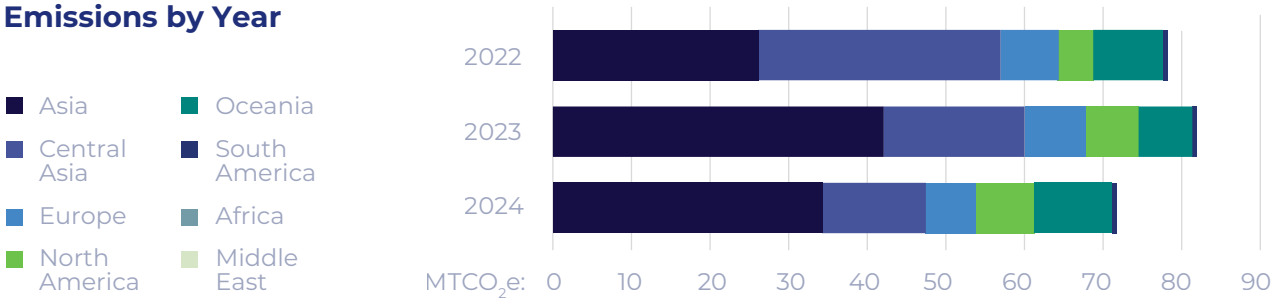


Satellites can play a key role in overcoming data scarcity in the Waste sector. Through a collaboration with the Clean Air Task Force (CATF), GHGSat monitored **13 landfills** in West, Central, and Eastern Africa over a six-month period to address this challenge.

During this initiative, multiple observations detected emissions within the **~500 kg/hr to 3,000 kg/hr**. These findings provide a basis for further investigation and to create strategies to reduce landfill emissions.

MINING

Detected Regional Emissions by Year



Three countries accounted for more than **two-thirds of the overall detected emissions** from this sector during the year, partly due to their role as global coal suppliers, but also due in part to more frequent site monitoring.

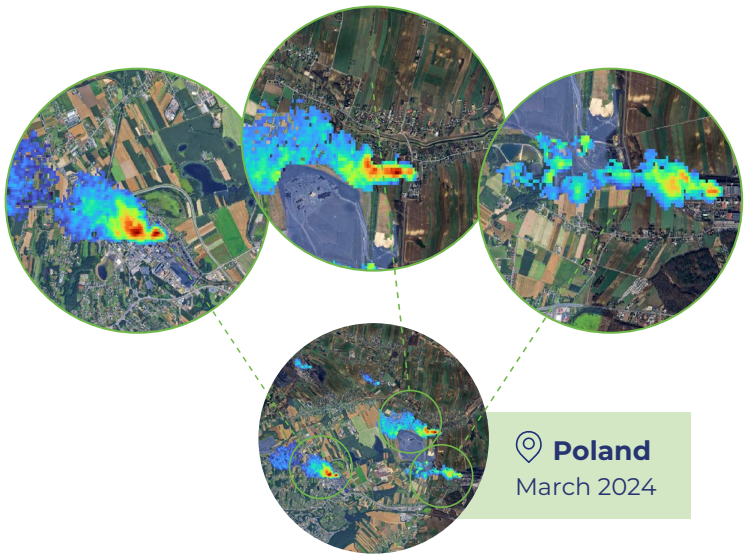
From a broader regional distribution perspective, each of the top five countries was located in a different region.

Asia continued to represent the majority of detected emissions, both in absolute number of methane plumes and methane measured.

However, **Central Asia** saw the highest average source rate for this sector, at **804 kg/hr**, during the year.

Satellites can provide useful information into the level of activity occurring at underground mines.

This data can also be used as an input for Coal Mine Methane (CMM) commercialization opportunities, creating new revenue and energy streams for operators.



OTHER

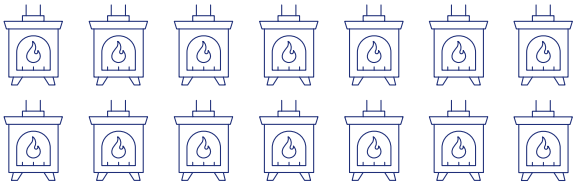
In addition to detections from Oil & Gas, Mining, and Waste, GHGSat detected emissions from a range of other sectors, including **agriculture, power generation, and chemicals**. All regions saw an increase in detected emissions from this broader category relative to 2023, rising 64% year on year, on a CO_2e basis.

We continued to detect methane emissions from hog farms and sugar mills from our satellites during 2024, while early 2025 has brought a new source of emissions: the Fentale volcano in Ethiopia. This discovery was made through GHGSat's tip-and-cue approach.

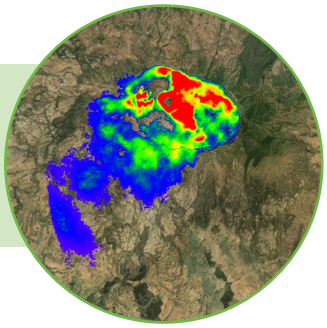
These emissions, initially identified through the Netherlands Institute for Space Research (SRON), occurred following a series of earthquakes in the region, providing GHGSat with an opportunity to zoom in for a more targeted view.

58 **Tons/Hour**

Emissions detected equivalent to burning over 20M kg of coal in one day.



Ethiopia
Source rate:
58 tons/hr
January 2025



VANGUARD: CO_2 SATELLITE MEASUREMENTS

As GHGSat continued to push the scientific boundary with its methane-sensing capabilities, it also recently became the first commercial entity to launch a satellite fully dedicated to detecting carbon dioxide at the facility level.

This innovation, Vanguard, earned a place on TIME's list of Best Inventions of 2024. Since launch, Vanguard has been undergoing rigorous scientific validation. GHGSat recently unveiled highlights from its initial observations, with detections spanning around the world.

Detected Emissions from Power Plants

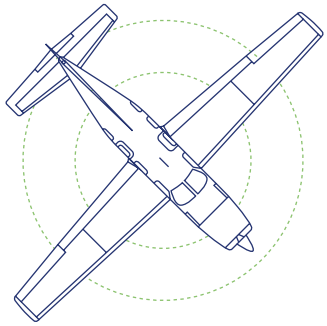
Source rate: 700 – 1,500 t/h
November – December 2024

DATA.AIR

In 2024, GHGSat experienced double-digit growth in aircraft campaigns conducted, working closely with industry partners to deliver a more granular view of their operations through targeted campaigns. This access to **precise, accurate data translated into concrete mitigations**.

>750,000
Emissions Mitigated in 2024 (tCO_2e)

↑16x
Growth in Facility Measurements



COMPANY HIGHLIGHTS

Select 2024 News

GHGSat Detects Giant Emission from Ethiopia's Fentale Volcano

S&P Global Leverages GHGSat Data for International LNG Benchmarking

GHGSat Honored for Role Protecting Critical Energy Infrastructure in Uzbekistan

GHGSat Satellites Support Disaster Response to California Wildfires

GHGSat's AV Gen1 Secures EPA Approval

Upcoming 2025 Events

SEP 9-12	**Gastech** Milan, Italy
SEP 21-28	**Climate Week NYC** New York, NY, USA
NOV 3-6	**ADIPEC** Abu Dhabi, UAE
NOV 10-21	**COP30** Belém, Brazil

2024 Awards & Accolades

Most Innovative Companies 2024 Fast Company's World's Most Innovative Companies	INVESTMENT WEEK SUSTAINABLE INVESTMENT AWARDS 2024 Best Sustainable Investment Research & Ratings Provider	FORTUNE CHANGE THE WORLD 2024 Tops Fortune's 2024 Change the World List	REUTERS EVENTS Reuters Sustainability Awards: SDG Pioneer
TIME BEST INVENTIONS 2024 TIME's Best Inventions of 2024	SPACENEWS 2024 ICON AWARDS SpaceNews Icon Award: Sustainability & Environmental Impact	500 Technology Fast 500 2024 NORTH AMERICA Deloitte. Deloitte's 2024 Technology Fast 500™ Awards	50 Technologie Fast 50 CANADA Deloitte. Deloitte's 2024 Technology Fast 50™ Program

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