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# Global Methane Super-Emitters — Satellite Study Exposes 4,400 Plumes from Oil and Gas Sites

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SUBJECTS COVERED

**ENVIRONMENT**

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# Global Methane Super-Emitters — Satellite Study Exposes 4,400 Plumes from Oil and Gas Sites

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## WHY IN NEWS

A satellite-based study by UCLA's Stop Methane Project, using Carbon Mapper data, identified over 4,400 methane plumes across nearly 2,500 oil and gas facilities worldwide, with Turkmenistan hosting 15 of the 25 highest-emitting sites.

## KEY FINDINGS OF THE STUDY

The **UCLA Stop Methane Project**, using satellite data from **Carbon Mapper**, conducted the most comprehensive global survey of methane super-emitters from the oil and gas sector.

Finding	Data
Total methane plumes identified	4,400+
Oil and gas facilities surveyed	~2,500
Highest-emitting country	Turkmenistan (~15 of top 25 sites)
Other hotspots	Iran, Venezuela, Texas (USA), Sindh (Pakistan)
Super-emitter emission range	3.7 to 10.5 metric tonnes per hour

### SCALE OF IMPACT

A single leak of **5 tonnes/hour** has a warming impact comparable to:

- A major coal-fired power plant, or
- ~1 million vehicles on the road

## WHY METHANE MATTERS

Methane (CH<sub>4</sub>) is the **second most significant greenhouse gas** after carbon dioxide, but is far more potent per molecule.

Property	Value
<b>Global Warming Potential (100 years)</b>	28x more than CO <sub>2</sub>
<b>Global Warming Potential (20 years)</b>	86x more than CO <sub>2</sub>
<b>Atmospheric lifespan</b>	~12 years (vs CO <sub>2</sub> 's centuries)
<b>Share of global warming since Industrial Revolution</b>	~30%

### WHY THE 20-YEAR VS 100-YEAR DISTINCTION MATTERS

Methane breaks down much faster than CO<sub>2</sub>, so its warming effect is concentrated in the **near term**.

Reducing methane emissions is the **fastest lever** to slow global warming in the next two decades — making it a high-priority climate action.

## SOURCES OF GLOBAL METHANE EMISSIONS

Source	Share
<b>Agriculture</b> (rice paddies, livestock enteric fermentation)	~40%
<b>Fossil fuels</b> (oil, gas, coal mining)	~35%
<b>Waste</b> (landfills, wastewater)	~20%
<b>Biomass burning</b>	~5%

The current study focused on fossil fuel sources, which are considered the most **technically avoidable** through leak detection and repair.

## ROOT CAUSES OF SUPER-EMISSIONS

**Equipment leaks** — faulty valves, connectors, compressors

**Flaring inefficiencies** — incomplete combustion during gas flaring releases unburned methane

**Venting** — deliberate release of methane during maintenance or pressure relief

**Poor infrastructure maintenance** — aging pipelines and facilities in countries like Turkmenistan and Venezuela

**Lack of regulation** — many countries have no mandatory leak detection and repair (LDAR) programmes

## GLOBAL METHANE PLEDGE

The **Global Methane Pledge** was launched at **COP26 in Glasgow (November 2021)**, led by the **United States and the European Union**.

### KEY DETAILS

**Target:** Reduce global methane emissions by **30% below 2020 levels by 2030**

**Signatories:** 159 countries (as of 2025)

**Notable non-signatories:** China, Russia, India

**India's position:** India did not sign the pledge at COP26 citing concerns about its large agricultural sector and livestock economy. However, India has taken domestic steps on methane capture from coal mines and landfills.

## INDIA CONTEXT

### METHANE HOTSPOTS IN INDIA

**Ghazipur landfill (Delhi):** recorded extreme methane events exceeding **400 tonnes per hour** — among the highest non-fossil-fuel methane point sources globally

**Coal mine methane:** India's coal mines release significant methane; Coal India Ltd has pilot projects for **Coal Mine Methane (CMM) capture**

**Rice paddies:** India is the world's second-largest rice producer; paddy fields emit methane from anaerobic decomposition

**Livestock:** India has the world's largest cattle population (~192.9 million as per 20th Livestock Census, 2019); enteric fermentation is a major methane source

### INDIA'S DOMESTIC ACTIONS

**National Action Plan on Climate Change (NAPCC)** — includes methane mitigation under multiple missions

**Swachh Bharat Mission** — addresses landfill methane through waste segregation and bimethanation

**System of Rice Intensification (SRI)** — alternate wetting and drying reduces methane from paddies by up to 50%

**Gobardhan Scheme** — biogas from cattle dung, converting methane into energy

## SATELLITE MONITORING TECHNOLOGY

### CARBON MAPPER

A public-private partnership using satellite-based remote sensing to detect and quantify methane point sources

Uses **imaging spectrometers** on satellites to identify methane plumes from space

Data is made **publicly available** to enable accountability

### OTHER SATELLITE PROGRAMMES

**TROPOMI** (ESA) — Tropospheric Monitoring Instrument on Sentinel-5P

**MethaneSAT** (Environmental Defense Fund) — launched 2024, dedicated methane-monitoring satellite

**GHGSat** (Canada) — commercial high-resolution methane monitoring

**UPSC RELEVANCE**

Methane GWP (28x/86x CO<sub>2</sub>), Global Methane Pledge (COP26, Glasgow 2021, 30% by 2030), Carbon Mapper, methane atmospheric lifespan (~12 years), methane sources (agriculture 40%, fossil fuels 35%).

**MAINS GS3:**

Role of methane in climate change; satellite-based environmental monitoring; India's methane mitigation — SRI, Gobardhan, CMM capture; India's non-participation in Global Methane Pledge.

**MAINS GS2:**

International environmental governance; COP process and voluntary pledges vs binding commitments.

## ★ FACTS CORNER — KNOWLEDGEPEDIA

### METHANE — CORE DATA:

- GWP-100: 28x CO<sub>2</sub>; GWP-20: 86x CO<sub>2</sub>
- Atmospheric lifespan: ~12 years
- Share of global warming: ~30% since Industrial Revolution
- Second most significant GHG after CO<sub>2</sub>

### STUDY FINDINGS:

- UCLA Stop Methane Project + Carbon Mapper
- 4,400+ plumes across ~2,500 oil and gas facilities
- Turkmenistan: 15 of top 25 sites; others: Iran, Venezuela, Texas, Sindh
- Super-emitter range: 3.7-10.5 tonnes/hour

### GLOBAL METHANE PLEDGE:

- COP26, Glasgow, November 2021
- Led by: USA and EU
- Target: 30% reduction below 2020 levels by 2030
- 150+ signatories; India, China, Russia did not sign

### INDIA'S METHANE CONTEXT:

- Ghazipur landfill: >400 tonnes/hour recorded
- World's largest cattle population: ~300 million
- 2nd largest rice producer; SRI reduces paddy methane by ~50%
- Gobardhan Scheme: biogas from cattle dung
- CMM capture pilots by Coal India Ltd

### SATELLITE MONITORING:

- Carbon Mapper: public-private, imaging spectrometers
- MethaneSAT: launched 2024 by EDF
- TROPOMI: ESA Sentinel-5P instrument
- GHGSat: Canadian commercial system

### OTHER RELEVANT FACTS:

- NAPCC: 8 national missions; methane addressed under multiple missions
- Swachh Bharat: waste segregation + biomethanation for landfill methane
- Alternate Wetting and Drying (AWD): rice paddy technique to cut CH<sub>4</sub>

Sources: [GKToday](#), [Carbon Mapper](#), [UNFCCC](#)

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