



EXPLAINER BRIEF

Decoding Industrial Decarbonization

What is the industry sector's share of global greenhouse gas emissions?

Industrial greenhouse gas (GHG) emissions play a major role in climate change. But what portion actually comes from industry? Answering this question is surprisingly tricky due to varying classifications of what exactly constitutes the industrial sector. Moreover, data limitations, particularly in developing countries, make it difficult to measure these emissions precisely.

In short, here's our conclusion: Industry is a major contributor to global greenhouse gas emissions, with direct industrial emissions responsible for almost 22 per cent of the global total, and nearly 31 per cent when factoring in indirect emissions from electricity use. Industrial emissions have nearly doubled since 1990. The iron, steel, cement, and chemical sectors are the primary sources of industrial CO₂ emissions, contributing 71 per cent. This makes these sectors important targets for emission reduction efforts.

Here's how we reached that insight

Using data from EDGAR 2024 database¹, and classifications from the Intergovernmental Panel on Climate Change (IPCC)², we find that:

- Direct industrial³ GHG emissions – from combustion and industrial processes – amounted to 11,408.47 Million tons of CO₂ equivalent (Mt CO₂e).
- Total global emissions (excluding Land Use, Land Use Change, and Forestry, or LULUCF) reached 52,963 Mt, putting industry's direct share at 21.54 per cent.
- If we focus only on energy and process-related emissions (excluding agriculture and waste), industry's share rises to 25.64 per cent.

Note: These figures exclude indirect emissions from electricity generated and used for industrial processes.

Breakdown of industry emissions

In 2023, for direct industrial GHG emissions:

- Fossil fuel combustion was responsible for 56.5 per cent of emissions (6,452 Mt CO₂e).
- Process emissions (emissions resulting from industrial chemical reactions) made up the remaining 43.5 per cent (4,956.42 Mt CO₂e).

Among the different greenhouse gasses (GHGs) emitted:

- Carbon dioxide (CO₂) was the dominant gas, accounting for 84.3 per cent of the total.
- Fluorinated gasses (F-gasses) contributed 12.7 per cent.
- Nitrous oxide (N₂O) accounted for 2.7 per cent.
- Methane (CH₄) made up 0.3 per cent.

1 EDGAR (Emissions Database for Global Atmospheric Research) Community GHG Database, a collaboration between the European Commission, Joint Research Centre (JRC), the International Energy Agency (IEA), and comprising IEA-EDGAR CO₂, EDGAR CH₄, EDGAR N₂O, EDGAR F-GASES version EDGAR_2024_GHG (2024) European Commission, JRC (Datasets). https://edgar.jrc.ec.europa.eu/report_2024

2 IPCC 2006 Guidelines for National GHG Emission Inventories

3 Industrial combustion (IPCC: 1 Energy - 1A2) and processes (IPCC: 2 IPPU) include combustion for industrial manufacturing and industrial process emissions (e.g., nonmetallic minerals, non-ferrous metals, solvents and other product use, chemicals, etc.).

CO₂ emissions by industrial sector

In 2022, data from the International Energy Agency (IEA)⁴ shows that CO₂ emissions from key industrial sectors were as follows:

- **Iron and steel:** 2.62 Gt CO₂ (29 per cent of industrial emissions).
- **Cement and lime:** 2.42 Gt CO₂ (27 per cent).
- **Chemicals and petrochemicals:** 1.33 Gt CO₂ (15 per cent).
- **Other industrial sectors:** 2.61 Gt CO₂ (29 per cent).

This breakdown shows that the so-called “hard-to-abate” sectors (like steel, cement, and chemicals) contribute over 71 per cent of CO₂ emissions from industry globally.

Long-term trends and indirect emissions

Since 2000, the share of industrial emissions has grown, from 18.25 per cent to 21.54 per cent in 2023 – a 5 Gt CO₂e increase in 23 years. Industrial emissions have nearly doubled since 1990.

Estimating indirect emissions from electricity production is challenging due to limited global data. However, available analysis⁵ suggests that around 30 per cent of emissions from electricity and heat production are consumed by industry.

Including these indirect emissions, industry’s share of global GHG emissions (excluding LULUCF) **would be about 31 per cent in 2023 – making industry the largest single contributor to GHG emissions globally.**

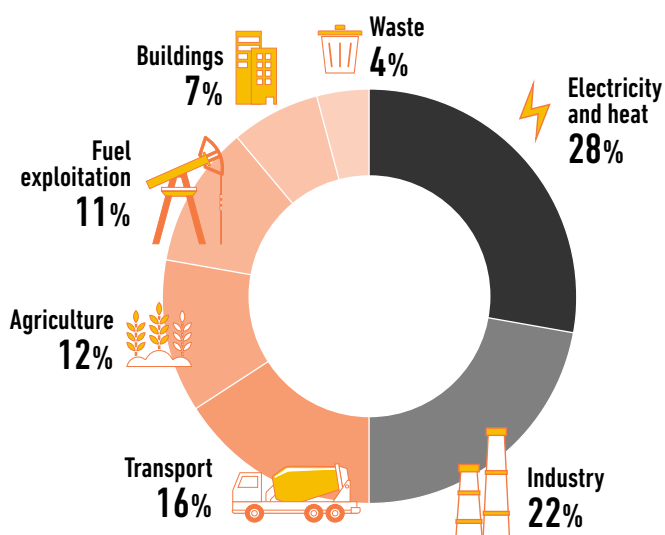
Table 1. Global and industrial GHG emissions 1990 – 2023, in Mt CO₂e (without LULUCF)

| | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2023 |
|---------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Industry | 5,974.38 | 6,215.91 | 6,404.46 | 8,097.42 | 9,746.37 | 10,483.25 | 11,026.77 | 11,408.47 |
| Global total | 32,726.23 | 33,930.45 | 36,175.15 | 41,296.88 | 45,814.94 | 48,808.77 | 49,327.54 | 52,962.90 |
| Share of industry* | 18.26% | 18.32% | 17.70% | 19.61% | 21.27% | 21.48% | 22.35% | 21.54% |

*direct GHG emissions

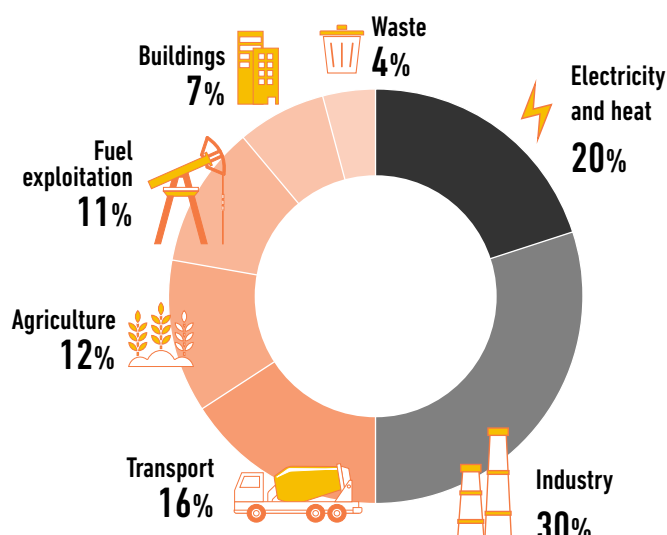
Source: EDGAR Database 2024

Figure 1. Share of sectors in global GHG emissions in 2023.



Source: EDGAR Database 2024.

Figure 2. Share of sectors in global GHG emissions in 2023, with industrial electricity use attributed to industry.



Source: EDGAR Database 2024.

⁴ <https://www.iea.org/energy-system/industry>

⁵ Bataille and M. Alfare (2023), IID Policy Brief 9: Policy packages for decarbonizing heavy industry, UNIDO, <https://www.unido.org/sites/default/files/2023-12/IID%20Policy%20Brief%209%20-%20Policy%20packages%20for%20decarbonizing%20heavy%20industry.pdf>