

In-Depth Analysis: N₂O Emissions from Industrial Combustion

1. Full-Series Trend (1970–2024): A Sensitive Indicator of Industrial Intensity

Nitrous Oxide (N₂O) from industrial combustion is a very minor emission source, growing from just **~1 Mt CO₂eq** in 1970 to **~6 Mt CO₂eq** in 2024. Its national climate impact is negligible.

However, its primary value is as a highly sensitive indicator. The data shows a textbook case of accelerating growth that perfectly mirrors the major phases of India’s industrial development, confirming the trends seen in larger emission sources.

2. Breakpoint Detection: A Perfect Story of Acceleration

The analysis identifies breakpoints at **1990, 2005, and 2020**, which align perfectly with the start of key industrial phases. The slopes tell a clear story of compounding acceleration: **[0.01 → 0.04 → 0.12 → 0.29]**.

- **1970–1989:** For two decades, growth was effectively zero.
- **1990–2004:** The growth rate triples, marking the start of post-liberalization industrial activity.
- **2005–2019:** The rate triples again, aligning perfectly with the main industrial and manufacturing boom of the 2000s.
- **2020–2024:** The post-COVID break is **highly significant (p-value approx 0.00000009)**. The growth rate has more than doubled again, reflecting the intense nature of the post-pandemic industrial rebound.

3. Conclusions: A “Canary in the Coal Mine”

- **A Perfect Microcosm:** This tiny emission source is a perfect “canary in the coal mine.” Its growth has accelerated in lockstep with each major phase of India’s industrialization, providing an independent confirmation of the trends seen in more significant CO₂ emissions.
- **Confirmation of Post-COVID Intensity:** The dramatic jump in the growth rate post-2020 confirms that the recent industrial recovery has been exceptionally strong and energy-intensive.
- **Not a Direct Climate Threat:** While the pattern is insightful, the absolute scale of these emissions is too small to be a direct climate policy concern.