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COMMENTARY

Vietnam's Industrial Growth and Greenhouse Gas Emissions in the Paris Era

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Vietnam has reached a crossroads in its development process. Although it is well known for its high pace of economic growth among Southeast Asian countries, Vietnam is also famed for its significant pollution issues. This predicament set the stage for Vietnam's modern climate trajectory, and it is linked to one single international treaty: the 2015 Paris Agreement.

Until this point, from 1998 to 2015, Vietnam experienced a period of economic expansion, with GDP per capita growing by 4.91% annually (World Bank, 2024). This growth, however, has undoubtedly had environmental consequences. During this period, the nation's total greenhouse gas emissions climbed to 4.83% per year, positively correlated with GDP per capita growth. This relationship reflects the cost of early development: increasing wealth requires increasing pollution. Before the Paris agreement, according to Worldbank data, Vietnam's carbon intensity (T) was declining at 1.13% annually, indicating that the economy was becoming more carbon efficient. However, this gain was completely overwhelmed by the scale of affluence growth (A), which reached 4.92% annually (World Bank, 2024). This suggests that for every step forward in carbon efficiency, Vietnam took four steps back as a result of emissions-intensive economic development. Consequently, total emissions still rise annually at an approximate rate of 4.83%.

This situation changed dramatically after the 2015 Paris Accord and Vietnam's 2021 COP26 net-zero commitment. The post-Paris era (2015-2023) has been characterized by deliberate policy-driven intervention. While economic affluence (A) fell slightly to 4.71% per year (WorldBank, 2024), technology accelerated dramatically, driven by policies such as the 2017 Feed-in Tariff (FiT), in which the government guaranteed a fixed price for solar electricity (9.35 USD per kWh) with 20-year power purchase agreements. As Minh & Hue (2023) have noted, this push for clean energy began to reshape the national grid. The International Energy Agency (2024) tracks this surge in solar capacity—from just 105MW in 2018 to 16,000 MW by 2020, an increase of over 152-fold in only two years. Data from Vietnam's Ministry of Natural Resources (2023) also show that the grid's emissions factor fell by 28%, from 0.913 tCO_2/MWh in 2018 to 0.659 tCO_2/MWh by 2023. The IPAT/Kaya framework below illustrates this shift (Table 1).

Table 1: *IPAT/Kaya Decomposition of GHG Emissions in Vietnam (1997–2023)*

Component (Annual Growth)	Pre-Paris 1997-2014 (% p.a.)	Post-Paris 2015-2023 (% p.a.)	Change (pp)
Total GHG Emissions	+4.83	+5.11	+0.28
Population (P)	+1.24	+0.93	-0.31
GDP per capita (A)	+4.91	+4.71	-0.20
Carbon Intensity (T)	-1.13	-0.53	+0.60

Note. Author's calculation based on World Bank (2024) data using population (SP.POP.TOTL), GDP per capita (NY.GDP.PCAP.KN), and Total greenhouse gas emissions excluding LULUCF (Mt CO2e) (EN.GHG.ALL.MT.CE.AR5)

From the table, it's clear that annual emissions growth experienced a slight increase of 0.28 percentage points. This decomposition reveals a concerning trend in Vietnam's greenhouse gasses emissions: the rate of technological improvement in carbon intensity (T) has slowed dramatically in the post-Paris period, improving by only 0.53% annually compared with 1.13% previously. This 0.60-percentage-point deterioration represents a 53% reduction in the pace of carbon efficiency improvements.

Furthermore, the correlation between GDP per capita growth and emissions growth remains strongly positive, indicating that Vietnam has not yet reached the peak of the Environmental Kuznets Curve (EKC), where environmental quality begins to improve with rising

income (Grossman & Krueger, 1995; Stern, 2004). While population growth has decelerated from 1.24% to 0.93% annually, and affluence growth correspondingly decreased from 4.91% to 4.71% annually, these demographic and economic shifts were not enough to offset the weakened carbon intensity improvements. The net result was a slight acceleration in total emissions growth from 4.83% to 5.11% annually.

This finding raises serious questions about Vietnam's pathway to achieving net-zero emissions by 2050. At the current growth rate of 5.11% annually, Vietnam's carbon emissions would more than triple by 2050. The statistics, however, indicate that Vietnam has already taken first steps toward implementing renewable energy in key sectors, but more ambitious or radical policy initiatives are critical to bend the emissions curve downward and make substantial progress towards carbon neutrality.

Acknowledgment

The author used Gemini, including its Grounded Search capabilities, to conduct a comprehensive literature search on Vietnam's greenhouse gas emission trends, renewable energy policies, Paris Agreement implementation, and applications of the IPAT/Kaya identity. The AI assisted in identifying World Bank development indicators, EDGAR emissions databases, Vietnamese government reports, and recent peer-reviewed publications on ASEAN climate policy. Additionally, the AI helped structure the analytical framework for decomposition and improved the clarity of technical explanations regarding carbon intensity calculations and grid emission factors. However, all data analysis, hypothesis formulation, interpretation of results, policy assessments, and conclusions are entirely the author's responsibility. The author independently selected Vietnam as the case study, developed the research question comparing pre- and post-Paris periods, analyzed emission trajectories using the Kaya decomposition methodology, and drew conclusions regarding decoupling dynamics and policy implications. A detailed AI Usage Log for all contributors to this special issue is available as a separate PDF file.

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