

## Hidden Drivers of Greenhouse Gas Emissions: Exploring Business Travel and Employee Commuting's Role in Climate Change

Muhammad Zainuddin Noor<sup>1\*</sup>, Hartuti Purnaweni<sup>2</sup>, Jafron Wasiq Hidayat<sup>3</sup>

<sup>1</sup>Master of Environmental Science, School of Postgraduate Studies, Universitas Diponegoro

<sup>2</sup>Department of Public Administration, Faculty of Social and Political Sciences, Universitas Diponegoro

<sup>3</sup>Department of Biology, Faculty of Science and Mathematics, Universitas Diponegoro

**Corresponding Author:** Muhammad Zainuddin Noor,  
[mzainuddinnoor@gmail.com](mailto:mzainuddinnoor@gmail.com)

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### ABSTRACT

This research examines the impact of business travel and employee commuting on greenhouse gas (GHG) emissions of a growing telecommunications company in Indonesia. Utilizing quantitative descriptive analysis, the research relies on the company's secondary data to quantify emissions, adhering to Tier 1 standards set by the Intergovernmental Panel on Climate Change (IPCC). The findings reveal that these activities contribute to the company's GHG emissions, amounting to 143,291 tCO<sub>2</sub>e, highlighting the role of business travel and employee commuting as drivers of emissions.

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## INTRODUCTION

Climate change is one of the environmental impacts caused by the formation of greenhouse gases (Citra, Purwanto & Soenoko, 2020). Climate change also changes climate patterns and intensity (Sugiarto, Pujiono, Hidayat & Adhi, 2023). According to the Intergovernmental Panel on Climate Change (IPCC), GHG emissions are the primary cause of global warming and climate change (Lahn, 2021). GHG emissions release certain atmospheric gases that can absorb and emit infrared radiation, causing global warming (Hergoualc'h, Mueller, Bernoux, Kasimir, Weerden & Ogle, 2021).

GHG emissions need to be reduced to avoid worse impacts of global climate change (Creutzig, Erb, Haberl, Hof, Hunsberger & Roe, 2021). Telecommunications companies are vital in creating more innovative and efficient solutions to global challenges like climate change and sustainability (Carpenter & Lazonick, 2023). Therefore, telecommunications companies are starting to take steps to reduce their GHG emissions (Jonas, Bun, Nahorski, Marlan, Gusti & Danylo, 2019). Telecommunication companies are expected to play a more positive role in global efforts to maintain a healthy environment for future generations (Hertwich, 2021).

Efforts to reduce GHG emissions are crucial in protecting the environment and human health from the negative impacts of GHG emissions and maintaining the planet's sustainability (Olhoff, Kuramochi, Rogelj, Hohne, Faber & Capstick, 2020). This research aims to provide an insight into the contribution of PT XYZ, a growing telecommunications company in Indonesia, particularly in terms of business travel and employee commuting activities, to GHG emissions, as well as the initiatives to reduce these emissions.

## THEORETICAL REVIEW

### *Climate Change and GHG Emissions*

According to Indonesia (2009) Law No. 32 of 2009 concerning Environmental Protection and Management, climate change is a change in climate that occurs directly or indirectly due to human activities, causing changes in the composition of the atmosphere globally and in addition also in the form of changes in natural climate variability observed over a comparable period. The classification of climate change as a global catastrophic risk remains a significant point of debate (Baum, 2024). The impacts of climate change are underscored by a rise in both the frequency and intensity of extreme weather events, along with escalating sea levels, which significantly affect ecosystems and pose risks to human health (Filonchyk, Peterson, Zhang, Hurynovich & He, 2024).

Climate change brings forth a range of alarming factors, including GHG emissions, such as rising temperatures, increased levels of carbon dioxide (CO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O), and methane (CH<sub>4</sub>), as well as ozone depletion and deforestation (Shah, Manzoor, Jinhui, Li, Hameed, Rehaman, Li, Zhang, Niu & Chang, 2024). The concentration of carbon dioxide in the atmosphere has risen by 40% compared to the pre-industrial period (Stocker, 2013). Increasing GHG emissions is one of the most critical issues endangering ecosystems and the global economy (Yan, Liu & Li, 2023). GHG emissions contribute to climate change,

disrupting ecosystems, potentially causing species extinction, declining biodiversity, and disturbances in ecological balance (Jordan, Kuipers, Huang, Hu, Verones & Cherubini, 2023).

In summary, climate change impacts are highlighted by the increased frequency and severity of extreme weather events, rising sea levels, and threats to ecosystems and human health, causing various impacts on life on Earth (Adiatma et al., 2013). Indeed, climate change is a very serious problem for the community all over the world (Rusmadi et al., 2018). Key factors of climate change include GHG emissions such as carbon dioxide, nitrous oxide, methane, ozone depletion, and deforestation.

### ***Business Travel and Employee Commuting***

GHG emissions originate from various sources and are categorized into Scope 1, Scope 2, and Scope 3. Based on the GHG Protocol (2015), scope 1 emissions are direct emissions from sources owned or controlled by the company, such as combustion in boilers, furnaces, and vehicles. Scope 2 emissions are indirect emissions resulting from the consumption of purchased electricity, steam, heating, and cooling. Scope 3 includes other indirect emissions throughout the company's value chain, both upstream and downstream, which are not directly owned or controlled by the company. This category encompasses business travel and employee commuting, which fall under Scope 3 upstream and part of transportation activities.

The company should focus on tracking and reporting activities relevant to their business objectives and for which they have accurate data (GHG Protocol, 2015). The transportation sector plays a significant role in GHG emissions, contributing about 20 percent of global carbon dioxide (CO<sub>2</sub>) emissions, with road transport being the primary source (Albuquerque, Maraqa, Chowdury, Mauga & Alzard, 2020). Business travel and employee commuting are vital activities that substantially generate GHG emissions (Müller, 2023; Sutton-Parker, 2021). Travel, especially by air, is increasing and is projected to continue growing. Therefore, GHG emissions are also rising (Goeverden, Arem & Nes, 2016).

Reduced overall travel and increased cycling rates may decrease total GHG emissions. However, if public transport use declines and car usage increases, emissions could rise as more individuals return to the workplace (DeWeese, Ravensbergen & El-Geneidy, 2022). Based on data from the Environmental Protection Agency (EPA), it is stated that in 2022, the most significant contributor of emissions in the United States will be the transportation sector, which produces around 28% of total GHG emissions (Environmental Protection Agency, 2022). This demonstrates that business travel and employee commuting are critical areas that require focus due to their significant contribution to GHG emissions and climate change.

### **METHODOLOGY**

This research was conducted at PT XYZ, a growing telecommunications company in Indonesia, focusing on GHG emissions from business travel and

employee commuting during 2023. The emissions were calculated using the Tier 1 methodology outlined in the Intergovernmental Panel on Climate Change (2006) guidelines for national greenhouse gas inventories which provide a framework for reporting emissions. All GHG emission calculation results will be expressed in tons of CO<sub>2</sub> equivalent (tCO<sub>2</sub>e). A dot is used as the thousand separators, while a comma is used for decimal separators in all calculations.

$$\text{Emissions (tCO}_2\text{e)} = \text{Activity Data (unit)} \times \text{Emissions Factor (unit)}$$

The data utilized in this research consists of secondary data sourced from the company's reports and records from January to December 2023. The data is maintained for the following activities:

Table 1. Research Data Source

Activity Data	Remarks	Unit
Business Travel	Number of business travel	km
	Number of hotel stays	Night
Employee Commuting	Number of employees commuting from home to office and from office to home	km

Emission factors are required for each activity data set to measure GHG emissions. This research's emission factor data refers to the Department of Environment, Food, and Rural Affairs, United Kingdom Government GHG Conversion Factors for Company Reporting, full factor set 2023 (version 1.1). The emission factor data are as follows:

Table 2: Emission Factors

Activity	Value	Unit
<b>Business Travel</b>		
Medium Car - Petrol Based	0,178	kgCO <sub>2</sub> e/km
National Rail - Train	0,035	kgCO <sub>2</sub> e/passenger km
Domestic flight	0,273	kgCO <sub>2</sub> e/passenger km
International flight	0,215	kgCO <sub>2</sub> e/passenger km
Hotel stay	62,7	kgCO <sub>2</sub> e/night
<b>Employee Commuting</b>		
Medium Car - Petrol Based	0,178	kgCO <sub>2</sub> e/km
Metro, Suburban trains	0,028	kgCO <sub>2</sub> e/passenger km
Bus	0,118	kgCO <sub>2</sub> e/km
Motorbike	0,083	kgCO <sub>2</sub> e/km
Regular Taxi	0,149	kgCO <sub>2</sub> e/km

## RESULTS

### *Business Travel Activity Data*

Based on company data, the total distance covered by business travel is 303.007 km, which includes trips by medium car, train, domestic and international flights. Additionally, the total number of hotel nights is 126. The data is summarized from the period January-December 2023. The data details are as follows:

Table 3. Business Travel

Source	Total	Unit
Medium Car - Petrol Based	255.126	km
National Rail - Train	22.197	
Domestic flight	18.660	
International flight	7.024	
Hotel stay	126	Night

### *Business Travel GHG Emissions Calculation*

This section will quantify the total distance of business travel and the length of stay at the hotel. The data obtained is the total distance of business trips traveled in km and the length of hotel stay (night) with the emission factor unit kgCO<sub>2</sub>e, which will be converted to tCO<sub>2</sub>e as follows:

Table 4. Business Travel GHG Emissions

Source	Total (KM) (a)	Emission Factors (kCO <sub>2</sub> e/KM) (b)	Result (c) = a x b	Conversion (tCO <sub>2</sub> e/KM) (d) = c /1000
Medium Car	255.126	0,178	45.458	45,458
National Rail	22.197	0,035	787	0,787
Domestic Flight	18.660	0,273	5.086	5,086
International Flight	7.024	0,215	1.513	1,513
<b>Total</b>				<b>52,845</b>

Table 5. Hotel Stay GHG Emissions

Source	Total (Night) (a)	Emission Factors (kCO <sub>2</sub> e/Night) (b)	Result (c) = a x b	Conversion (tCO <sub>2</sub> e/Night) (d) = c /1000
Hotel stay	126	62,7	7.900	7,900
<b>Total</b>				<b>7,900</b>

**Employee Commuting Activity**

Based on company data, the total number of employees commuting from home to the office and from the office to home is 979.656 km, using several modes of transportation. The data is summarized from January to December 2023.

Table 6. Employee Commuting Data

Source	Total	Unit
Medium Car - Petrol Based	62.674	
Metro, Suburban trains (KRL)	161.885	
Metro, Suburban trains (MRT)	131.353	km
Motorbike	371.800	
Bus	170.060	
Regular taxi	81.884	

**Employee Commuting GHG Calculation**

This section will quantify the total distance of employees commuting from home to office and from office to home. The data obtained is the total distance of employees commuting in km with the emission factor unit kgCO<sub>2</sub>e, which will be converted to tCO<sub>2</sub>e as follows:

Table 7. Employee Commuting GHG Emissions

Source	Total (KM) (a)	Emission Factors (kCO <sub>2</sub> e/KM) (b)	Result (c) = a x b	Conversion (tCO <sub>2</sub> e/KM) (d) = c /1000
Medium Car - Petrol Based	62.674	0,178	11.167	11,167
Metro, Suburban trains (KRL)	161.885	0,028	4.501	4,501
Metro, Suburban trains (MRT)	131.353	0,028	3.652	3,652
Motorbike	371.800	0,083	30.928	30,928
Bus	170.060	0,118	20.129	20,129
Regular Taxi	81.884	0,149	12.169	12,169
	<b>Total</b>			<b>82,546</b>

**GHG Emissions Summary from Business Travel and Employee Commuting**

This section will summarize the total GHG emissions from business travel and employee commuting. The total GHG emissions are as follows:

Table 8. GHG Emissions Summary

Source	GHG Emissions
<b>Business Travel</b>	
Medium Car - Petrol Based	45,458
National Rail - Train	0,787
Domestic flight	5,086
International flight	1,513
Hotel stay	7,900
<b>Sub Total</b>	<b>60,745</b>
<b>Employee Commuting</b>	
Medium Car - Petrol Based	11,167
Metro, Suburban trains (KRL)	4,501
Metro, Suburban trains (MRT)	3,652
Motorbike	30,928
Bus	20,129
Regular Taxi	12,169
<b>Sub Total</b>	<b>82,546</b>
<b>Total</b>	<b>143,291</b>

## DISCUSSION

In 2023, PT. XYZ company's business travel and hotel stays collectively generated 60,745 tCO<sub>2</sub>e in GHG emissions. Car travel was the most significant contributor to these emissions, responsible for 45,458 tCO<sub>2</sub>e. In addition, employee commuting resulted in 82,546 tCO<sub>2</sub>e in GHG emissions, with motorbike use being the predominant source, producing 30,928 tCO<sub>2</sub>e. The combined GHG emissions from business travel and employee commuting activities totaled 143,291 tCO<sub>2</sub>e. Employee commuting was the single most significant contributor, accounting for 82,546 tCO<sub>2</sub>e. These findings underscore the vital role that business travel and employee commuting play in elevating the company's GHG emissions and, consequently, their contribution to climate change.

Given the pressing need to address climate change, the company must implement strategies to reduce GHG emissions. Several measures can be recommended. One such measure is promoting video conferencing as an alternative to business travel, particularly for short meetings. By reducing the frequency of physical travel, the company can reduce their carbon footprint. Furthermore, developing operational policies that incentivize public transportation, biking, or carpooling can be crucial in lowering commuting emissions (Science Based Target Initiative, 2018). For example, implementing reward systems for employees who opt for these sustainable transport options could be a motivational tool to reduce emissions from daily commutes.

In addition to travel-related strategies, the adoption of hybrid or remote working models can have a significant impact on reducing GHG emissions. Remote work minimizes the need for daily commuting, which, as research has shown, can substantially reduce transport related GHG emissions (Tao, Yang,

Jaffe, Amini, Bergen, Hecht & You, 2023). A study by Sutton-Parker (2021) supports this, indicating that remote working has the potential to drastically reduce commuting emissions by reducing the frequency of trips to the office. By offering flexible work arrangements, the company can take meaningful steps toward curbing its environmental impact while offering employees greater flexibility in their work routines.

Another critical step in addressing the company's emissions is using carbon offsets. Carbon offsets provide a way for the company to neutralize its emissions by supporting efforts to reduce or remove carbon emissions elsewhere, outside of the company's direct operations. This could involve investing in renewable energy projects, reforestation initiatives, or carbon capture technologies, all of which work to absorb or eliminate carbon dioxide from the atmosphere (Warburg, Frommeyer, Koch, Gerdt & Schewe, 2021). This carbon offset should be a supplementary strategy, not the primary approach for reducing carbon footprint or emissions (Eijkern, 2024).

The recommendations align with the International Finance Corporation (IFC) Performance Standards' mitigation hierarchy for addressing environmental and social risks, established in 2012. This hierarchy prioritizes a structured approach to managing impacts. First, it emphasizes avoidance, focusing on preventing direct environmental impacts altogether. When avoidance is impossible, minimization becomes the next priority, which involves taking measures to reduce the severity of the impacts that cannot be entirely avoided. Lastly, offsetting is a final step to compensate for residual impacts after applying avoidance and minimization efforts.

This hierarchical approach is essential in guiding the company to implement GHG emission reduction measures, especially when faced with constraints such as limited financial resources or operational capacity. Using this prioritization framework, the company can strategically address the most critical recommendations, ensuring they maximize the environmental benefits while managing costs effectively. The company can gradually reduce its GHG emissions through a systematic approach that includes avoidance, minimization, and offsetting, contributing to global efforts to combat climate change while maintaining operational efficiency and sustainability.

Addressing the significant sources of GHG emissions, such as business travel and employee commuting, is crucial for any company aiming to reduce its environmental impact. By adopting a combination of travel reduction strategies, incentivizing sustainable transport, implementing remote working options, and using carbon offsets, the company can significantly reduce its GHG emissions and align itself with international standards for environmental responsibility. Through a straightforward, structured approach, the company can make meaningful progress in its sustainability efforts, benefiting both the environment and its long-term business goals.

## **CONCLUSIONS AND RECOMMENDATIONS**

In 2023, the combined emissions from business travel and employee commuting at PT XYZ, a growing telecommunications company in Indonesia, amounted to 143,291 tCO<sub>2</sub>e. Employee commuting emerged as the primary

source, contributing 82,546 tCO<sub>2</sub>e, while business travel generated 60,745 tCO<sub>2</sub>e. These findings indicate that business travel and commuting play a significant role in the company's GHG emissions, thus contributing to climate change. Given the growing global urgency to address climate-related issues, the company must take immediate and targeted action to reduce its emissions.

Tackling emissions from business travel and employee commuting is necessary to reduce the company's carbon footprint and align with broader sustainability goals and regulatory requirements. The scale of emissions from employee commuting underscores the need for robust intervention, as it represents the largest share of the company's transport-related emissions. Moreover, reductions in emissions can help the company achieve operational cost savings, improve social responsibility, and contribute to the global fight against climate change. Therefore, implementing strategies to reduce these emissions is a key priority for the company moving forward.

Recommendations have been proposed to address the significant contribution of business travel and employee commuting to GHG emissions. These strategies follow the mitigation hierarchy of avoidance, minimization, and offsetting as outlined in the International Finance Corporation (IFC) Performance Standards. Each recommendation is designed to prioritize the most effective measures while considering the company's resource constraints. The proposed recommendations are structured to ensure that the company can substantially reduce GHG emissions cost-effectively while maintaining operational efficiency and supporting employee well-being.

#### *Avoidance*

- (1) Replace business travel by adopting virtual meeting technology: This strategy encourages the company to limit physical business travel whenever possible and instead use virtual meeting platforms such as video conferencing.
- (2) Implement a hybrid working arrangement program: Introducing a hybrid working model, where employees split their time between working remotely and from the office, can drastically reduce the number of employee commutes, thus cutting down on commuting-related emissions.

#### *Minimization*

- (3) Develop policies to minimize travel and choose low-emission or prioritize public transportation: The company can reduce travel by developing clear policies that promote using low-emission vehicles, carpooling, biking, or public transport for necessary trips.

#### *Offset*

- (4) Conduct carbon offsets or compensation: Carbon offsets should neutralize any unavoidable emissions from business travel and commuting. Through carbon offset programs, the company can invest in renewable energy projects, forest conservation efforts, or carbon capture technologies that help remove carbon dioxide from the atmosphere.

## FURTHER STUDY

Exploring several areas that could build on this study's findings is recommended for future research. One avenue is investigating the factors contributing to the high GHG emissions from motorbike commuting and car-based business travel. Researchers could analyze alternative, low-emission transportation options and assess their feasibility for employees. Additionally, future research could evaluate the effectiveness of corporate policies that reduce GHG emissions from travel, such as remote working, carpooling incentives, or green travel programs.

It would also be beneficial to gather primary data directly from the company to understand better employee commuting patterns, travel behaviors, and associated emissions. This primary data could complement secondary data, providing deeper insights into emissions sources and helping tailor more effective mitigation strategies.

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