

CHAPTER

3

SUSTAINABLE TECHNOLOGIES FOR EMISSION REDUCTION

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3.1 INTRODUCTION

In contemporary times, there is a global shift towards sustainability, with air emissions playing a crucial role in facilitating sustainable development. The emission of greenhouse gases (GHG), including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), fluorocarbons (HFCs), perfluorocarbons (PFCs), Sulphur hexafluoride (SF₆), and natrium trifluoride (NF₃), has been identified as a significant factor in the process of climate change (Fan et al., 2018). The escalating apprehension regarding GHG emissions stemming from corporate travel has emerged as a pressing issue considering the persistent global predicament of climate change.

As per the findings of the International Energy Agency (IEA), the transportation industry is accountable for approximately 26% of the worldwide energy-related CO₂ emissions in 2018; thereby emerging as a noteworthy contributor to the phenomenon of climate change. Within this context, the mitigation of carbon emissions stemming from corporate travel has emerged as a significant concern that necessitates attention and action from businesses.

Staff travelling behaviours for various purposes such as meetings, site visits, consultations, and other related activities constitute a substantial

proportion of carbon emissions for numerous organisations, especially those with a nationwide or worldwide presence. Despite the increasing acknowledgement of the significance of reducing GHG emissions and the presence of global and domestic regulations intended to foster sustainability and minimise transportation emissions; numerous institutions encounter difficulties in efficiently overseeing and curbing GHG emissions resulting from employee travel. The insufficient availability of tools and resources that facilitate the computation of emissions and the identification of prospects for mitigating them via sustainable travel practices is a contributing factor to this phenomenon.

3.2 CONTEXTUAL ANALYSIS OF AIR EMISSIONS

The issue of GHG emissions has received considerable attention and has been extensively studied by the scientific community, eliciting widespread concern over time. Despite representing a small proportion of all atmospheric gases, GHG is an essential component of the earth's energy balance (Mann, 2023). The phenomenon commonly referred to as the greenhouse effect can be traced back to the 19th century, during which esteemed scientists such as Joseph Fourier and John Tyndall initially introduced the idea. The pioneering research conducted by the authors shed light on the ability of specific gases, namely CO₂ and water vapour, to assimilate and discharge infrared radiation, leading to the retention of thermal energy in the atmosphere and consequently, exacerbating the phenomenon of climate change.

3.2.1 Source of Air Emissions

The comprehension of emission origins hold paramount importance in assessing mitigation measures. Principally, greenhouse gas emissions emanate predominantly from two major sectors: Electricity and transport, constituting 29% and 27% of total emissions, respectively. Data from Fan et al. (2018) highlights a noteworthy shift in the United States, where the

transportation sector has surpassed the electric power sector as the primary source of CO₂ emissions.

Similarly, in the European Union's 28 member states, the transport sector emerges as the second most significant contributor, accounting for 25.8% of total emissions, as reported by the European Environment Agency (EEA) (2017). Analysis of greenhouse gas constituents reveals that CH₄ emissions primarily originate from natural gas and petroleum systems, while agriculture and soil management contribute significantly to N₂O emissions, constituting as much as 75%.

Furthermore, empirical evidence, particularly from major contributors, aligns with global statistical data. Human activities, according to Fan et al. (2018), account for over 60% of CH₄ emissions and 40% of N₂O emissions. Figure 3.1 illustrates the dominance of CO₂ as the primary contributor to total greenhouse gas emissions, consistent with emission patterns where electricity and transportation remain key sources. CO₂ alone is responsible for 76% of worldwide greenhouse gas emissions.

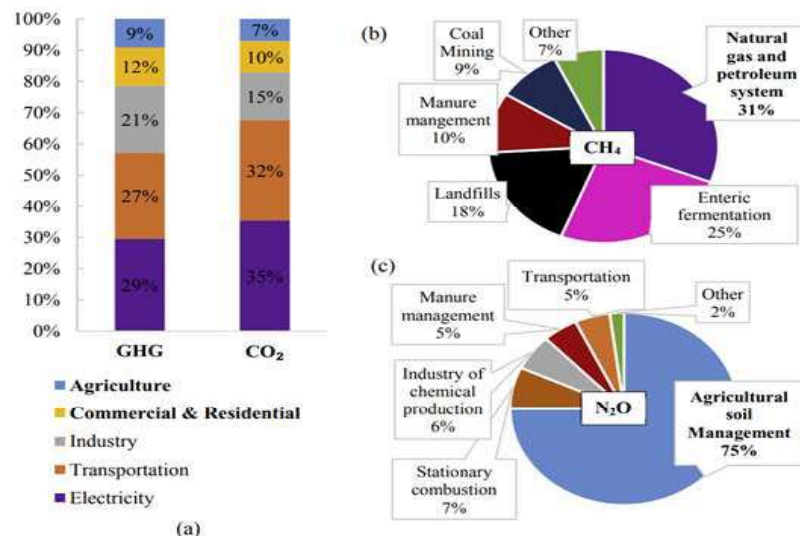


Figure 3.1 The greenhouse gas emissions by source sector in United States, (a) Bar chart shows the contribution of major sectors in greenhouse gas and CO₂, (b) and (c) Shows the main anthropogenic sources of methane and nitrous oxide (Source: Fan et al., 2018)