



Green Transition:
Barriers and Opportunities for the

AUTOMOTIVE INDUSTRY

in Pakistan



Ali Asghar Jamali

**Chief Executive Officer
Indus Motor Company Limited**

Pakistan today stands at a critical juncture in its climate journey. As one of the most climatevulnerable countries in the world, we are grappling with devastating floods, unpredictable weather patterns, and rising temperatures—despite contributing less than 1% to global greenhouse gas emissions. The urgency to reduce our carbon footprint is undeniable. However, any path forward must reflect the country's unique energy landscape, infrastructure readiness, and economic realities.

At Indus Motor Company (IMC), we believe that sustainability must be pursued through practical and inclusive solutions that deliver measurable results today while preparing us for a greener tomorrow. The transport sector—including bikes, cars, and buses—accounts for over 21% of Pakistan's total CO₂ emissions. At the same time, nearly 64% of our electricity grid is still powered by fossil fuels, limiting the immediate impact of energy-dependent technologies.

Addressing emissions from transportation requires solutions that are available, scalable, and suited to local conditions. Instead of waiting for ideal circumstances, IMC is actively contributing

to climate action by promoting fuel-efficient and lower-emission vehicle technologies that can be adopted without requiring large-scale energy or infrastructure overhauls.

Our strategy focuses on reducing carbon intensity through innovation and operational excellence, while empowering customers with cleaner mobility choices. IMC's commitment is reflected in several ongoing initiatives that deliver real-world environmental benefits:

- **Corolla Cross – Pakistan's First Locally Manufactured Hybrid Electric Vehicle** Over just one year, the Corolla Cross has helped reduce 4 kilotons of CO₂ emissions—cutting per-unit emissions from 13kt (conventional vehicles) to 9kt across 4,861 units.
- **Solarizing the Network** - Through our Solar Support Program, the Toyota Dealership Network has cut electricity-related emissions by 38% since 2019—dropping from 2,442 to 1,522 tonnes of CO₂. By the end of 2025, 75% of our dealerships will operate on solar power, eliminating 1,856 tonnes of CO₂ annually.
- **Pakistan's Largest Rooftop Solar Plant** - IMC's 6.6 MW rooftop solar installation at our Karachi plant is a benchmark for industrial decarbonization, reducing the company's grid reliance and emissions footprint.
- **Urban Forests and Coastal Resilience** - IMC has planted over 920,000 trees nationwide, including 6,000 mangroves along Karachi's coastline, in partnership with WWF-Pakistan. We aim to reach 1 million trees by June 2026 to further enhance biodiversity and carbon sequestration.

These initiatives are guided by the Toyota Environmental Challenge 2050, which aims to achieve zero CO₂ emissions throughout the entire vehicle lifecycle—from production to end-of-life. IMC remains committed to building a cleaner, more resilient Pakistan through a balanced and results-oriented approach. We believe progress must be inclusive, aligned with national capabilities, and rooted in long-term impact. Through continued investment in clean technologies, renewable energy, and environmental stewardship, we are helping pave the way for a sustainable mobility future that works for all.



Atif Ikram Sheikh

President, FPCCI

President - ECO CCI

Vice President - CACCI

Climate Change is no longer a distant threat – it is an urgent reality that poses profound challenges to Pakistan’s economy, society, and environment. Pakistan ranks among the most climate-vulnerable countries in the world , despite contributing less than 1% to global greenhouse gas emissions . The devastating floods, shifting weather patterns, and rising temperatures we have witnessed in recent years underscore the critical need for climate-resilient development and sustainable economic strategies.

In this connection, the transition to green mobility – shifting from internal combustion engine vehicles to hybrid and electric vehicles – represents not just an environmental imperative but also a significant economic opportunity . The electrification of the transport sector would reduce reliance on imported fossil fuels thereby easing the persistent pressure on our balance of payments and conserve valuable foreign exchange reserves . With the transportation sector consuming a substantial share of imported oil, the shift to locally powered electric vehicles aligns both with climate goals and macroeconomic stability .

The Federation of Pakistan Chambers of Commerce and Industry (FPCCI) recognizes that the private sector has a vital role to play in accelerating this transition. Our industries can lead the charge towards a more resilient and low-carbon economy by investing in green technologies , adopting sustainable business practices , and supporting progressive policy frameworks .

The research study, “Green Transition: Barriers and Opportunities for the Automotive Industry in Pakistan”, developed in collaboration with the Indus Consortium , is an important step in identifying the practical and policy-level pathways to achieve this transformation. It offers valuable insights into the current state of the automotive sector and highlights the opportunities that lie in innovation, partnership, and forward-looking policy design.

We commend the efforts of our Policy Advisory Board , the participating automotive manufacturers , and our partner Indus Consortium for their dedication to this critical cause. The FPCCI being the apex of trade and industry will continue to champion initiatives that promote sustainable development and continue to a greener, more prosperous future for Pakistan.



Mian Zahid Hussain

(Sitara-e-Imtiaz, Hon. Ph.D.)
(Former Minister IT, Govt. of Sindh)
Chairman: Policy Advisory Board of FPCCI

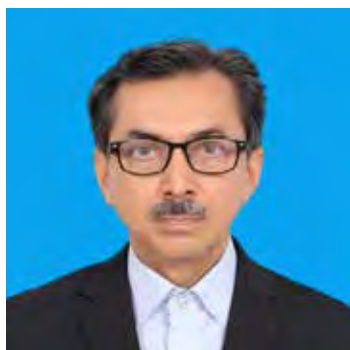
The Federation of Pakistan Chambers of Commerce and Industry (FPCCI) established the Policy Advisory Board (PAB) in 2021. The PAB continues to play a pivotal role in steering the research and policy agenda of the FPCCI, ensuring that our efforts are data-driven, inclusive, and aligned with the national development agenda flavored with international business dynamics. We remain committed to supporting industries in navigating the path to decarbonization and advocating for policies that facilitate a just and equitable green transition .

It gives me great pleasure to present this research study, “Green Transition: Barriers and Opportunities for the Automotive Industry in Pakistan” jointly developed by the Policy Advisory Board of FPCCI and Indus Consortium . This report is a timely and valuable contribution to the national discourse on sustainable industrial practices , offering a comprehensive analysis of the challenges and opportunities facing Pakistan’s automotive sector in its transition toward green mobility.

We also deeply appreciate the collaboration and transparency demonstrated by Sazgar Engineering Works and Indus Motor Company – two leading automotive manufacturers in Pakistan. Their insights and case studies have added immense value and practical relevance to this study. Their willingness to engage in the process reflects a growing commitment within Pakistan’s corporate sector toward climate-conscious innovation and net-zero transition.

We are equally grateful to the Indus Consortium for partnering with us on this initiative. Their commitment to sustainable development have been instrumental in shaping the direction and outcomes of this research.

It is our hope that this study serves as a resource and call to action for policymakers, industry leaders, and development partners alike . The transition to a low-carbon economy requires collective effort, and this report is one-step ahead towards building a unified vision . We are grateful to our research team for their diligence, professionalism, and steadfast commitment to producing insightful and impactful research on this important subject.



Liaqat Ali

Chairman
Indus Consortium

It gives me great pleasure to present this timely and comprehensive study, “Barriers and Opportunities for the Automotive Industry in Pakistan Towards Green Transition.” As the world accelerates towards sustainable development and low-carbon economies, Pakistan must seize this pivotal moment to rethink and redesign its transportation future. This study offers critical insights into the challenges, constraints, and promising pathways for the automotive sector to embark on a transformative journey towards greener practices and technologies.

The transport sector in Pakistan, responsible for a substantial portion of urban air pollution and greenhouse gas emissions, is both a contributor to and a potential solution for the climate crisis. Transitioning to a green automotive ecosystem is not a luxury—it is a necessity. However, this path is neither easy nor linear. This study has shed light on the many systemic barriers confronting the sector: from a lack of coherent policy incentives, infrastructure gaps, and weak institutional coordination, to limited consumer awareness and financial constraints that inhibit the widespread adoption of electric and hybrid vehicles.

Yet within these challenges lie tremendous opportunities. The emergence of Electric Vehicles (EVs), localisation of green automotive manufacturing, and digitalisation of mobility solutions present real possibilities for sustainable economic growth, job creation, and climate resilience. The study highlights that with the right mix of policy coherence, stakeholder collaboration, and investment in technology and infrastructure, Pakistan can build an inclusive green transport ecosystem that serves both people and the planet.

I extend my heartfelt thanks to the collaboration by the research partner of this study, Federation of Pakistan Chambers of Commerce and Industry (FPPCI) Chairman Policy Advisory Board, Mian Zahid Hussain (SI), Principle Investigator (PI), Mr. Bilawal Suhag – Head of Research, and authors, Mr. Ijlal Mansoor – Senior Researcher, Mr. Mohammad Armughan – Senior Researcher and Mr. Abdul Jawad – Research Associate for their rigorous analysis and commitment to evidence-based inquiry. Their work has deepened our understanding of the sector’s transition dynamics and provided a strong foundation for further work.

I am equally grateful to Indus Motor Company representatives, including Mr. Ali Asghar Jamali, CEO Indus Motor Company, Mr. Azam Khan, Head of Corporate Communications and CSR, IMC and their entire team, who generously contributed their data and shared feedback on the study findings, to support this effort. Their engagement affirms that industry actors are not only stakeholders but critical partners in achieving a just and sustainable transition.

Let us use the findings of this study not just as knowledge, but as a roadmap. Together, we can steer the automotive sector towards a cleaner, fairer, and more resilient future for all.



Hussain Jarwar

CEO
Indus Consortium

The automotive industry is a major sector in Pakistan, playing a vital role in providing transportation solutions to the public. Many leading automotive companies have established their presence in the country, offering a diverse range of vehicles—from two-wheelers and three-wheelers to cars and commercial vehicles. While this industry supports economic activity and mobility, it also significantly contributes to environmental pollution and greenhouse gas emissions, which in turn impact life expectancy and public health.

In light of the Paris Climate Agreement, Pakistan's Nationally Determined Contributions (NDCs), and the Electric Vehicle (EV) Policy approved by the Government of Pakistan, there is an urgent need to transition from conventional petrol and diesel vehicles to hybrid and electric alternatives. Although achieving the target of 30% of all new vehicle sales to be electric by the year 2030 presents challenges, a conducive policy and regulatory environment—along with financing support from banks, the commitment of the automotive industry to manufacture EVs, the development of charging infrastructure, and affordable vehicle options—can make this transition possible.

This report is a pioneering effort that calculates Scope 3 emissions for the leading automotive company in Pakistan. We believe this initiative will encourage other companies to follow suit in documenting emissions across their supply chains, thereby contributing to the broader goal of decarbonisation.

We are confident that all stakeholders will play a critical role in helping Pakistan meet its electric vehicle targets and build a cleaner, more sustainable future.



Overview

We would like to express our sincere gratitude to all those who contributed to the completion of this study on the automotive sector.

Special thanks to Mr. Kyle Ash and Mr. Marco Vermaasen of the Bank Information Center for their valuable time and thoughtful review of this report.

We are also grateful to Yasir Hussain of the Climate Action Center for his peer review and insightful feedback.

Our appreciation extends to Mr. Azam Khan, Head of Corporate Communications and CSR at Indus Motor Company, and the entire Indus Motor team for their engagement and support.

Your contributions have been instrumental in shaping the quality and relevance of this work.

Acknowledgment & Disclaimer

The Policy Advisory Board – Federation of Pakistan Chambers of Commerce & Industry (FPCCI) aims to provide research-based expert input for policy advocacy, and ease of doing business initiatives, and formalize the business community's inputs on policies to various government departments, ministries, and institutions.

The conclusions and interpretations expressed do not necessarily reflect the views of the Associations, Business Councils, Trade Organizations, or any affiliated body represented by FPCCI. The findings and analysis are based on data from the Pakistan Bureau of Statistics (PBS), the Emissions Database for Global Atmospheric Research (EDGAR), the BP Statistical Review of Energy, the National Electric Power Regulatory Authority (NEPRA), the World Bank, and other online sources. The author(s) are responsible for these findings, which do not necessarily represent the opinions of these agencies. All data and statistics are accurate as of Feb 28, 2025, but may be subject to change.

For further information or queries regarding this research study, please get in touch with us at pru@fpcci.org.pk

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Acronyms

GHG	Greenhouse Gas
CO ₂	Carbon Dioxide
CH ₄	Methane
N ₂ O	Nitrous Oxide
EVs	Electric Vehicles
PKR	Pakistan Rupee
IMC	Indus Motor Company
IEA	International Energy Agency
US\$	United States Dollar
CBU	Completely Built Unit
UNEPA	United Nations Environmental Protection Agency
NDCs	Nationally Determined Contributions
KW	Kilowatt
FED	Federal Excise Duty
ICE	Internal Combustion Engine
RD	Regulatory Duty
kWh	Kilowatt-hour
MCB	MCB Bank Limited
PSO	Pakistan State Oil
DC	Direct Current
M-1	Motorway-1
M-2	Motorway-2
M-3	Motorway-3
M-4	Motorway-4
M-5	Motorway-5
M-9	Motorway-9
N-52	National Highway-52
VAT	Value-Added-Tax
SUV	Sports Utility Vehicle
HEV	Hybrid Electric Vehicle
GWM	Great Wall Motor
g/Km	Gram per Kilometer
Km	Kilometer
Kg	Kilogram
Kt	Kilotonne
EPR	Extended Producer Responsibility
NEV	New Energy Vehicle
PAMA	Pakistan Automotive Manufacturers Association

Executive Summary

Climate change, primarily driven by human activities such as the burning of fossil fuels, has become one of the most pressing global challenges. This has led to rising concentrations of greenhouse gases (GHGs) like carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), resulting in global temperature increases. Three scopes are defined under the GHR protocol, mainly used by businesses: Scope I covers direct emissions from owned or controlled sources; Scope II includes indirect emissions from purchased electricity, steam, heating, and cooling; and Scope III encompasses all other indirect emissions within a company's value chain. As part of the study's scope, the transportation sector is a major contributor, accounting for 25% of global emissions and 21.6% of Pakistan's emissions.

Despite various incentives, numerous challenges for automotive manufacturers and consumers persist in the market, ranging from cost efficiency, consumer expectations, end-of-life treatment of EVs, high up-front cost, range anxiety, national grid's reliance on fossil fuels, lack of charging infrastructure, and policy inconsistencies. The unclear policies and inconsistent regulations create uncertainty for consumers and manufacturers, hindering investments in EV technology and infrastructure. Financial incentives are misaligned, and limited financing options, coupled with high upfront costs, discourage EV adoption. The lack of charging infrastructure and battery swapping options, along with revenue-based load management by electricity utilities, makes it difficult to operate charging stations. Additionally, long charging times and limited driving range contribute to consumer hesitancy. Moreover, the regional analysis reveals a stark contrast in adoption and infrastructure readiness across countries. India leads the region with over 25,000 public charging stations, low electricity rates, and strong policy support, though four-wheeler EV adoption remains modest. Nepal follows with impressive EV penetration in private vehicle imports, supported by tax incentives and hydropower-driven affordability. In contrast, Bangladesh and Pakistan lag significantly, with an underdeveloped charging infrastructure, only 114 and 35 public stations, respectively, and higher electricity tariffs that hinder mass adoption. While both countries have announced ambitious EV policies and local manufacturing plans, progress is constrained by high vehicle costs, infrastructure gaps, and limited consumer awareness. Without accelerated policy implementation and investment, particularly in charging infrastructure, these nations risk falling short of their decarbonization and mobility transformation goals.

In this study, we have discussed a case study of Indus Motor Company (IMC). In 2024, the IMC's Franchises cumulatively emitted **1,522 tonnes of CO₂** in comparison to staggering **2,442 tonnes of CO₂** in 2019. In 2024, a single IMC franchise reduced its carbon footprint by **18.45 tonnes of CO₂** through the Solar Support Program introduced for franchise dealers. Whereas, by the end of 2024, it is projected that **75% of the total electricity consumption** across franchises will be powered by solar energy, leading to an estimated reduction of **1,856 tonnes of CO₂** emissions. Moreover, thanks to the hybrid technology (Corolla Cross), actual emissions were reduced to approximately **9 kilotons**, resulting in a **carbon savings of nearly 4 kilotons** annually—marking a significant step toward low-emission mobility in Pakistan.

The New Energy Vehicle (NEV) Policy 2025-2030 is an ambitious road map to transform the whole transportation sector from fossil fuel to electrification in Pakistan. The policy sets key targets of 30% new EV sales in 2030 and 90% by 2040. The Policy plans to use fiscal incentives, infrastructure development, and local manufacturing to promote the adoption of EVs and address environmental challenges. Moreover, to mitigate Scope I, II, and III emissions, the government must strengthen the implementation of the National Electric Vehicle Policy 2025 by establishing a dedicated task force to ensure consistency and address barriers specifically posed by Pakistan's terrain. Investing in a robust EV charging infrastructure across cities and highways, with incentives for private sector participation, is essential. Lower electricity tariffs for EV charging stations should be introduced to encourage investment and reduce operational costs. Additionally, EV policies should be integrated into Pakistan's broader climate strategy for a cohesive approach to sustainability. Financial institutions should offer lower interest rates for EV financing, reduced insurance premiums, and policy incentives under Green Banking Guidelines to promote EV adoption.

Scope 3 Emissions

Overview

Scope 3 emissions refer to all indirect greenhouse gas emissions generated across a company's value chain. These are not produced from assets directly owned or controlled by the company, but rather arise from activities it influences through its operations and business relationships. Examples include emissions embedded in purchased goods and services, the fuel consumed when customers use a company's products, or even those generated from employees' commuting. In contrast to Scope 1 (direct emissions from owned sources) and Scope 2 (indirect emissions from purchased energy), Scope 3 encompasses all other upstream and downstream emissions. Because value-chain emissions typically account for the largest share of a company's carbon footprint, addressing Scope 3 has become a critical priority in corporate climate strategies.

Initially, corporate greenhouse gas accounting under the GHG Protocol's Corporate Standard (2001) focused only on Scope 1 and 2 emissions. However, businesses soon recognized that the majority of their emissions occurred beyond their immediate operations. In response, the Scope 3 Standard was introduced in 2011 after an extensive multi-year, multi-stakeholder consultation. This framework provided a structured approach to account for "value-chain" emissions and acknowledged that limiting reductions to Scope 1 and 2 alone would be insufficient to achieve global climate goals. Since then, both companies and regulators have increasingly prioritized Scope 3 reporting and mitigation as an essential component of comprehensive decarbonization efforts.

Scope 3 Categories

The Scope 3 Standard further organizes value-chain emissions into 15 distinct categories, ensuring comprehensive coverage of both upstream and downstream activities. Upstream categories capture emissions associated with a company's supply chain—such as raw material extraction, purchased inputs, and capital goods—while downstream categories reflect emissions from the use and disposal of products sold to customers. Scope 3 framework spans a wide range of activities, including:

Upstream Activities



Purchased goods & services:

Emissions from production and delivery of the products and services a company buys



Capital goods:

Emissions from manufacturing capital assets (buildings, machines, vehicles) that the company acquires



• **Fuel & energy-related activities:**

Upstream emissions from fuel production, electricity generation, and losses in energy transmission (not included in Scope 1/2).



• **Upstream transport & distribution:**

Emissions from moving purchased materials to the company's sites (via truck, ship, etc.).



• **Waste generated in operations:**

Emissions from treating and disposing of waste produced by the company



• **Business travel:**

Emissions from employee travel (flights, taxis, hotels) for work.



• **Employee commuting:**

Emissions from employees traveling to and from work (cars, buses, trains).



• **Upstream leased assets:**

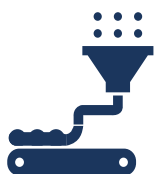
Emissions from leased assets used by the company (e.g. leased offices or equipment not owned by the company).

Downstream Activities



• **Downstream transport & distribution:**

Emissions from moving products to customers (e.g. delivery vehicles, distribution centers).



• **Processing of sold products:**

Emissions from further processing of intermediate products by customers.



• **Use of sold products:**

Emissions from the use-phase of sold products (e.g. fuel burned when a customer uses the product).



• **End-of-life treatment of sold products:**

Emissions from disposal or recycling of products after their use.



• **Downstream leased assets:**

Emissions from assets leased to others (e.g. equipment or property rented out).



• **Franchises:**

Emissions from franchise operations of the company's brand.



• **Investments:**

Emissions associated with the company's investments (e.g. equity or debt investments in other companies).

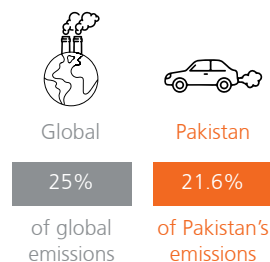
The quantification of Scope 3 emissions remains a major challenge for companies and regulators alike, despite the maturity of standards, for several reasons including data complexity and availability, methodological uncertainty, supply chain fragmentation, downstream usage assumptions, dynamic nature of value chains, high cost and resource burden, limited regulatory enforcement, etc. As part of this study, due to said limitation scope 3 emissions are only calculated for following three categories:

- a) **Use of Sold Products**
- b) **End-of-life treatment of sold products**
- c) **Franchises**

01

Transport Emissions Impact

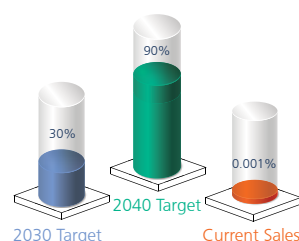
The transport sector contributes **25% of global emissions** and **21.6% of Pakistan's emissions**, making it one of the biggest challenges in the country's climate agenda.



02

Policy Targets vs Reality

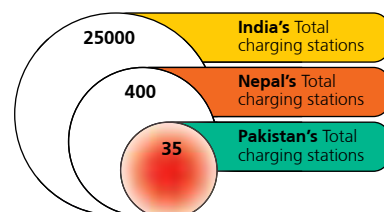
Pakistan's **New Energy Vehicle Policy (2025–30)** sets a target of **30% EV sales by 2030** and **90% by 2040**, yet current EV sales remain under **600 units annually** due to high costs, poor infrastructure, and low consumer awareness.



03

Charging Infrastructure Gap

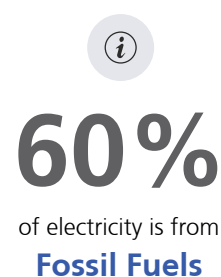
Pakistan has just **35 public charging stations (0.15 per million people)**, compared to **25,000 in India** and **400 in Nepal**. Without investment, Pakistan risks missing its e-mobility goals.



04

National Grid Misalignment

As of 2024, **60% of Pakistan's electricity generation comes from fossil fuels**. Without shifting to renewables, EV adoption would merely transfer emissions from vehicles to power plants.

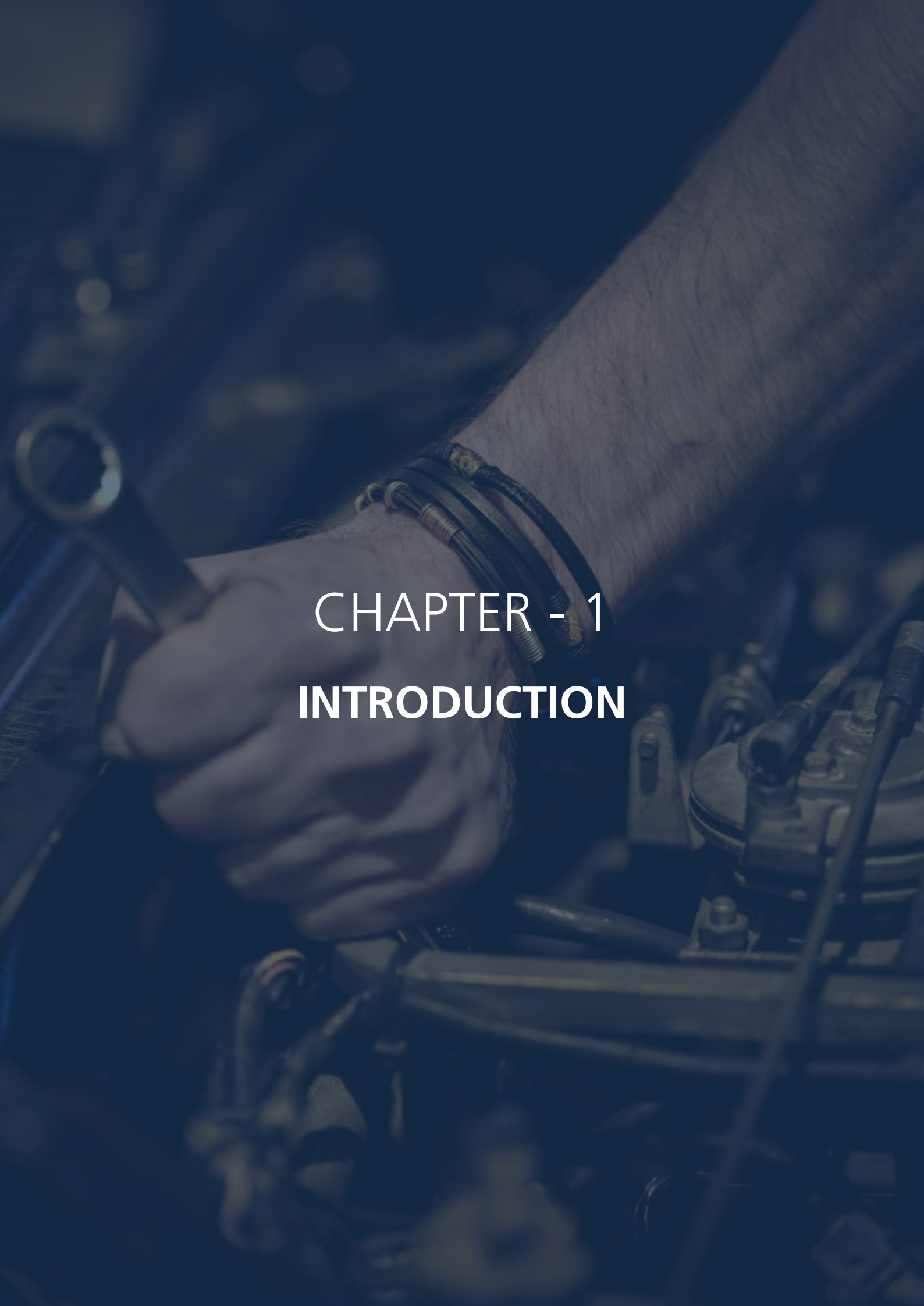


05

Indus Motor Company Progress

In 2024, Indus Motor Company's hybrid **Corolla Cross** reduced actual emissions to 9 kilotons, achieving a **carbon savings of 4 kilotons annually**, while **75% of its dealerships are set to run on solar energy**.





CHAPTER - 1

INTRODUCTION

1. Introduction

Climate change, characterised by long-term shifts in temperatures and weather patterns, has become one of the most pressing global challenges. While natural factors such as changes in the sun's activity or large volcanic eruptions can cause these shifts, human activities have been the primary driver of climate change since the 1800s. The burning of fossil fuels like coal, oil, and gas generates greenhouse gases (GHG), which act like a blanket around the Earth. The steady increase in the concentration of human-caused GHGs in the Earth's atmosphere has led to a rise in global temperatures since the Industrial Revolution.

The most abundant GHG, carbon dioxide (CO₂), accounts for about two-thirds of these emissions and is largely a product of burning fossil fuels. According to the "New Emissions Gap Report" by the UN Environment Program, there has been progress since the Paris Agreement was signed in 2015. Initially, greenhouse gas emissions in 2030 were projected to increase by 16 per cent based on policies in place at the time. Today, the projected increase is down to 3 per cent. However, to meet the Paris Agreement's targets, GHG emissions in 2030 must still fall by 28 per cent for the 2°C pathway and by 42 per cent for the 1.5°C pathway¹.

Addressing climate change while fostering economic growth necessitates a transition toward low-carbon energy technologies and a broader green economic system. A green economy should not be limited to niche sectors focused on environmental protection; it should encompass an economy with very low levels of carbon emissions, protecting biodiversity and environmental quality while delivering high levels of human welfare with low energy and material throughput. This requires fundamental changes to production, distribution, and consumption patterns, along with innovative strategies to reduce material content across all sectors.

Globally, the transport sector was responsible for 25% of total carbon dioxide emissions from fuel combustion in 2023². It is the fourth-largest contributor to global greenhouse gas emissions³. In Pakistan, the transport sector is the second most CO₂ emitting sector, by 25.1% in 2022⁴, and within the transport sector, road transport contributes around 23% of total CO₂ emissions⁵. Over the years, the vehicle ownership level has increased with a growth rate of 35% for two and three-wheelers, and 23% for cars from 2018 to 2022⁶ in Pakistan, leading to an increase in emission levels on the road due to the combustion of fuel.

The automotive industry in Pakistan stands at a critical juncture. The sector, traditionally reliant on fossil fuels, has significantly contributed to GHG, and it also presents an opportunity to expedite its green transition. However, it faces significant challenges due to consumer preferences, unavailability of EV charging infrastructure, lack of targeted policy measures, and untargeted fiscal incentives. In this context, the research study investigates the specific barriers hindering the industry's shift to sustainable practices and highlights potential opportunities for consumers, automotive manufacturers, and the Government to innovate the automotive sector. Additionally, this study quantifies the Scope 3 emissions of Indus Motors Company (IMC) as case study to highlight the efforts of the company in curbing its Scope III carbon footprints.

1 UN Environment Programme – Emission Gap Report 2023

2 IEA's CO₂ Emissions in 2023

3 <https://www.ipcc.ch/report/ar6/wg3/chapter/chapter-10>

4 EDGAR – Emissions Database for Global Atmospheric Research

5 Mir et al., 2022. Environmental Science & Policy

6 Pakistan Bureau of Statistics



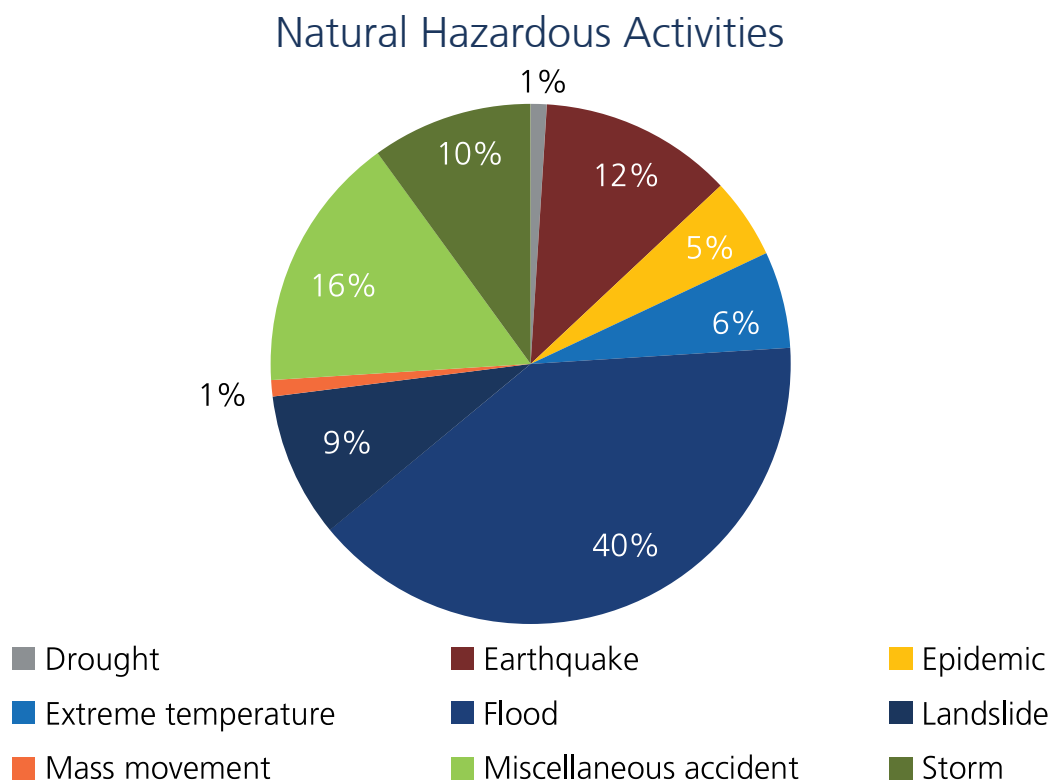
1.1. Climate Change in Pakistan

On average, Pakistan has accounted for 0.85% of global emissions⁷ for the last three decades. At the same time, Pakistan is the 5th most vulnerable country to the impacts of climate change⁸. It has resulted in increased frequency and severity of floods, unpredictable and extreme rainfall variations, accelerated melting of Himalayan glaciers, and more frequent and severe natural disasters such as storms and droughts.

Figure 1 demonstrates that floods are the most frequent natural hazard in Pakistan, accounting for 40% of occurrences from 1980 to 2020. Miscellaneous accidents follow at 16%, while earthquakes account for 12%, and storms 10%. Extreme temperatures, epidemics, mass movements, and droughts contribute to the hazard by 6%, 5%, 1%, and 1% respectively. The numbers emphasise the urgent need for comprehensive disaster management strategies and climate adaptation measures to mitigate the impacts of these recurrent events on the country's economy and society.

Over the past four decades, natural disasters have severely impacted Pakistan, including floods, extreme temperatures, and heavy rainfall. Millions of people have been affected, primarily by flash floods. Notably, the devastating flash floods of 2022 resulted in significant economic losses of more than US\$30 billion and reconstruction costs estimated to be around US\$16 billion, and over 50 million people were affected⁹. These events have highlighted Pakistan's vulnerability to climate change, despite the fact that the country contributed less than 1% to global greenhouse gas emissions. There is a need for collective effort to fight the climate change threat. The developed countries and international financial institutions should support developing countries like Pakistan in their climate change effort.

Figure 1: Natural Hazard Occurrence in Pakistan from 1980 to 2020



Source 1: World Bank

7 EDGAR – Emissions Database for Global Atmosphere Research

8 https://unhabitat.org/sites/default/files/2023/06/4._pakistan_country_report_2023_b5_final_compressed.pdf

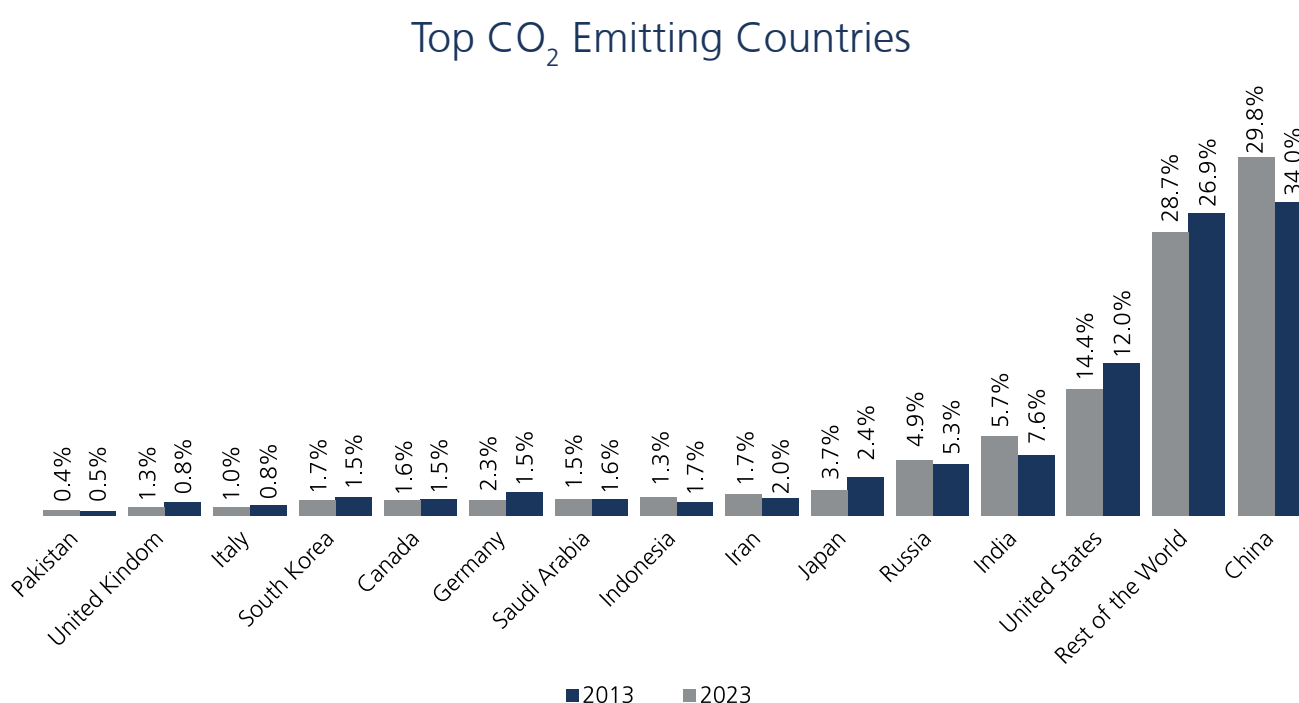
9 Pakistan: Food Damages and Economic Losses, Hakim.2022, UNDP-Pakistan

The road transportation sector, powered by fossil fuels, i.e., diesel, natural gas, and petrol, is a major contributor to global GHG emissions. According to the United Nations Environmental Protection Agency (UNEP), the transportation sector was responsible for 27% of the United States' GHG emissions in 2020¹⁰. Despite efforts to curb emissions, the European Environmental Agency reported that road transport alone accounted for 77% of GHG emissions from the transport sector in European countries in the same year¹¹. Moreover, a recent study in China forecasts that by 2040, the transport sector will account for over 80% of the country's GHG emissions¹².

The World Resources Institute reports that the energy sector is the largest contributor to global GHG emissions, making up 75.7% of the total energy sector. Within this sector, transportation accounts for 13.7% of the emissions, with road transport alone contributing 12.2%. This data highlights the critical need for sustainable practices and policies in the transport sector to mitigate its significant impact on global carbon emissions¹³.

Figure 2 illustrates the contributions of the top countries to global GHG emissions. Notably, China's emissions rose significantly, increasing its share from 29.8% to 34.0%, while the United States saw a decline. India and Russia showed notable growth, whereas Japan, Germany, and the United Kingdom experienced reductions. The "Rest of the World" category declined in share. Pakistan's emissions increased slightly but remained a minor contributor. The data reflects China's growing dominance, India's rising share, and a reduction in emissions from developed economies like the United States, Japan, and Europe¹⁴.

Figure 2: Top Countries' Contribution to Carbon Dioxide Emissions



Source 2: EDGAR – Emissions Database for Global Atmospheric Research

10 U.S. Transportation Sector GHG Emissions, 1990-2022

11 Dataset, European Environmental Agency, 2022

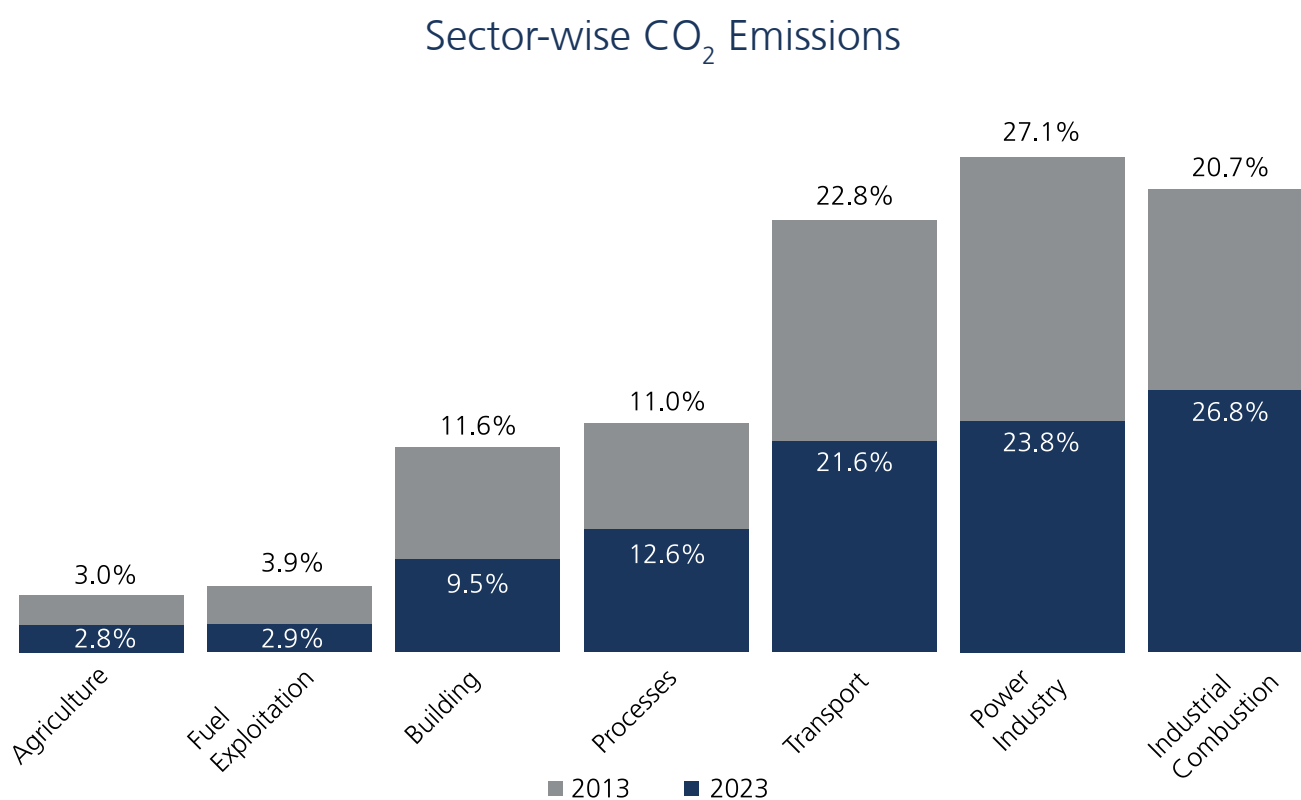
12 Carbon Brief Clear on Climate, 2022

13 Ge et al. 2024., World Resources Institute

14 EDGAR – Emissions Database for Global Atmospheric Research

As illustrated in Figure 3, the sectoral bifurcation of total emissions reflects that Industrial combustion saw the highest increase, rising from 20.7% to 26.8%, while the power industry's share declined despite a slight absolute rise. Transport emissions grew in absolute terms but declined in overall share. Processes increased in both absolute and percentage terms. Buildings experienced minimal growth, with a notable decline in share. Fuel exploitation and agriculture saw slight decreases in percentage shares. This shift indicates growing industrial emissions dominance, with the power industry's relative share decreasing despite rising emissions. While the private sector and government have taken numerous initiatives to promote renewable energy, targeted interventions are urgently needed for the transport sector's green transition.

Figure 3: Sector-Wise Carbon Emissions in Pakistan



Source 3: EDGAR – Emissions Database for Global Atmospheric Research



A photograph of a car body on an assembly line in a factory. The car is silver and is positioned on a yellow conveyor belt. The background shows a complex industrial structure with many metal beams and pipes. The text "CHAPTER - 2" and "AUTOMOTIVE INDUSTRY OF PAKISTAN" is overlaid on the image in white, bold, sans-serif font.

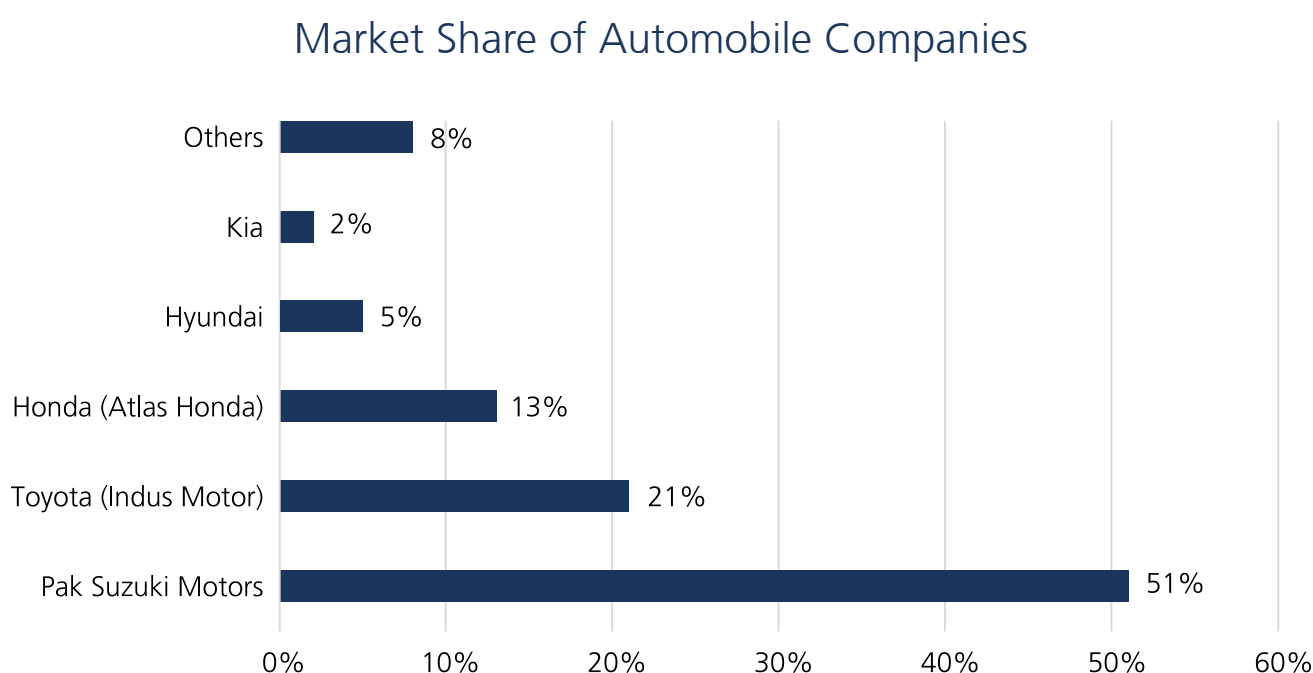
CHAPTER - 2

AUTOMOTIVE INDUSTRY OF PAKISTAN

2. Automotive Industry of Pakistan

The automotive industry in Pakistan has experienced significant growth, marked by a substantial increase in vehicle registrations and imported Completely Built Unit (CBU) vehicles. With cars leading the registrations, the sector's expansion highlights the need for sustainable policies to manage the rising environmental impact. In the year 2023, the automobile industry of Pakistan is dominated by Pak Suzuki Motors with a commanding 51% share (Figure 4), illustrating its strong presence and consumer preference in the region. Toyota, through Indus Motor, holds a significant portion as well, with 21% of the market, securing its position as a major player. Honda, via Atlas Honda, also maintains a noteworthy presence, accounting for 13% of the market. Hyundai and KIA have smaller shares, at 5% and 2% respectively, indicating their growing but more modest penetration in the market. Other automobile companies collectively account for 8%, underscoring the dominance of the leading brands in Pakistan's automotive industry in 2023¹⁵.

Figure 4: Market Share of Automobile Companies in Pakistan – (2023)



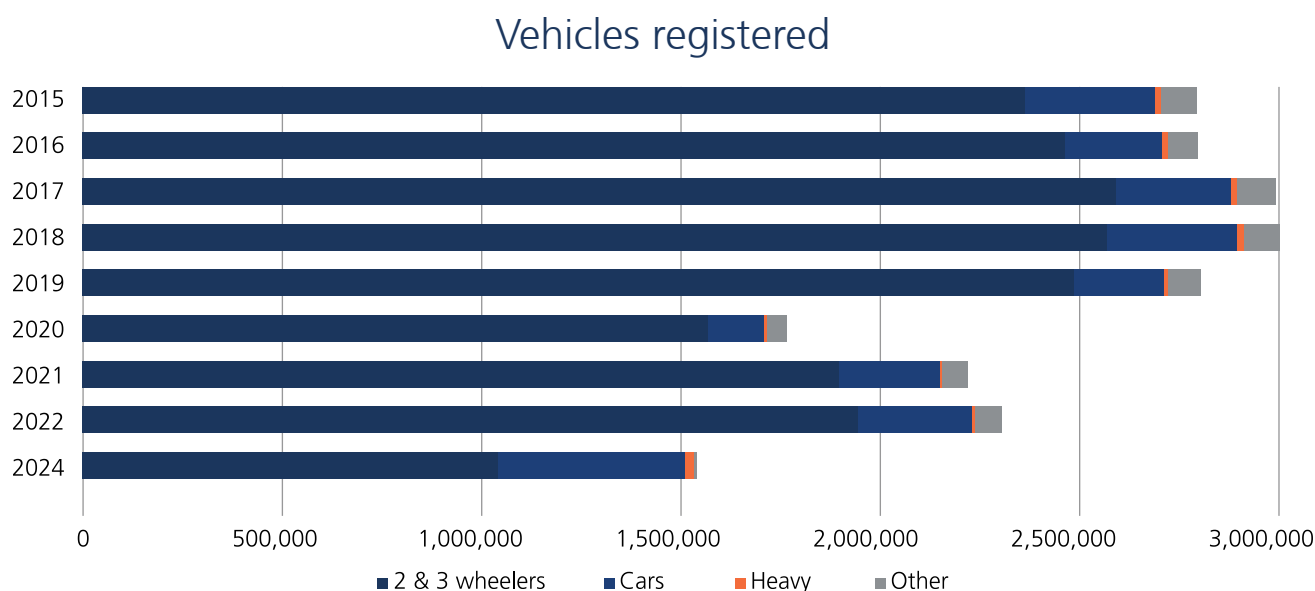
Source 4: Marklines – Automotive Industry Portal

Over the period from 2020-24, Pakistan's import of CBU vehicles amounted to US\$1.7 billion¹⁶, with passenger cars contributing 68%, trucks and vans 18%, and tractors, buses, and imported two-wheelers each contributing 4% share in the import bill of completely built units of vehicles. Figure 5 presents data on registered vehicles in Pakistan from 2015 to 2024 across various categories. Overall, there is a steady upward trend in vehicle registrations until 2022, driven largely by the surge in 2 & 3-wheelers, reflecting their affordability and importance for low-income groups. In 2024, new vehicle registrations appear significantly lower than previous years, especially for 2 & 3 wheelers, indicating either economic slowdown, regulatory shifts, or underreporting. Notably, heavy vehicle (trucks and buses) additions also declined sharply in 2024, raising questions about the health of the transport and logistics sector. Overall, the data highlights the growing motorisation trend, with two-wheelers dominating the transport landscape. The surge in car numbers highlights the urgent need for effective policies to address the resulting increase in GHG emissions as a result of fuel consumption.

¹⁵ Marklines – Automotive Industry Portal 2023 https://www.marklines.com/portal_top_en.html

¹⁶ Pakistan Bureau of Statistics, 2024

Figure 5: Number of Registered Vehicles in Pakistan



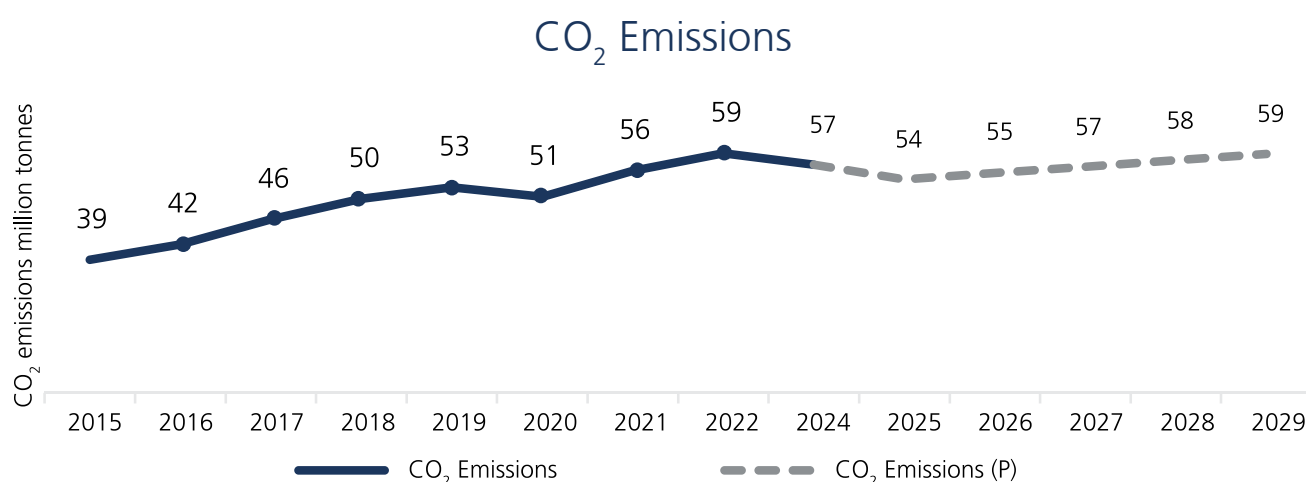
Source 5: Pakistan Bureau of Statistics. Note: Year 2023 is missing due to the unavailability of data.

2.1. Transport Sector Emissions: Results and Insights

According to the Nationally Determined Contributions (NDCs) 2021, Pakistan has promised to shift towards electric vehicles (EVs), with an ambitious target of 30% EVs of total road transport by 2030. In 2024, several EV models were launched in Pakistan, especially with the entry of BYD, a Chinese EV giant, which has completely transformed the EV landscape in the country. The lack of charging infrastructure, Pakistan seems to be far behind in this target. The significant contribution of the transport sector to carbon emissions, coupled with the rising number of registered vehicles in Pakistan, has exacerbated climate change. As illustrated in Figure 6, Pakistan's CO₂ emissions from the automotive sector have consistently increased, and are expected to rise further due to the slow adoption of hybrid and electric vehicles in the country. However, the trend shows two notable declines — one in 2020 due to COVID-19, and another in 2023 when interest rates and car prices rose sharply.

The existing infrastructure remains ill-equipped to facilitate a large-scale transition to fully electric vehicles, while the overwhelming majority of vehicles on the road continue to rely on combustion engines, serving as persistent contributors to emissions. Moreover, the environmental benefits of electric vehicles are offset, to a considerable extent, by the carbon-intensive processes associated with battery manufacturing, raising questions about the actual sustainability of this transition in Pakistan's context. Also, around 60% of the grid's electricity is produced through fossil fuels. As stated in the State of Industry Report 2023-24, roughly 81,500 (GWh) of electricity was generated through fossil fuels, which accounts for 63.76% of total electricity generation.

Figure 6: Actual and Projected Emissions of the Automotive Sector in Pakistan (Graph, emissions)

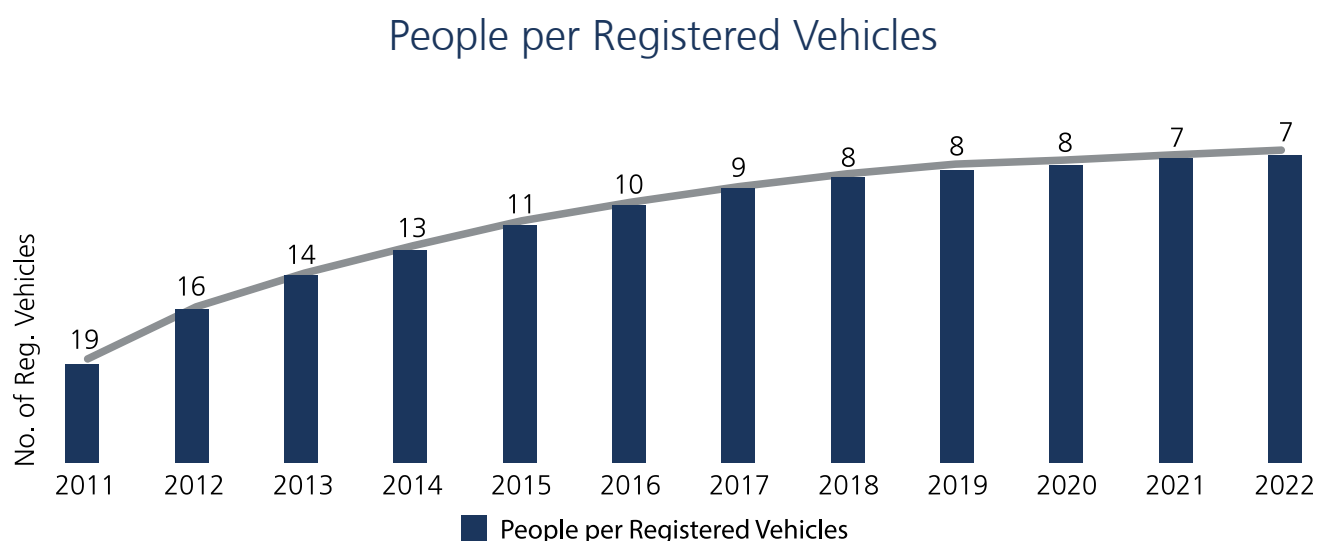


Source 6: Authors' Estimations. Note: P ~ projected emissions, year 2023, is missing due to the unavailability of data

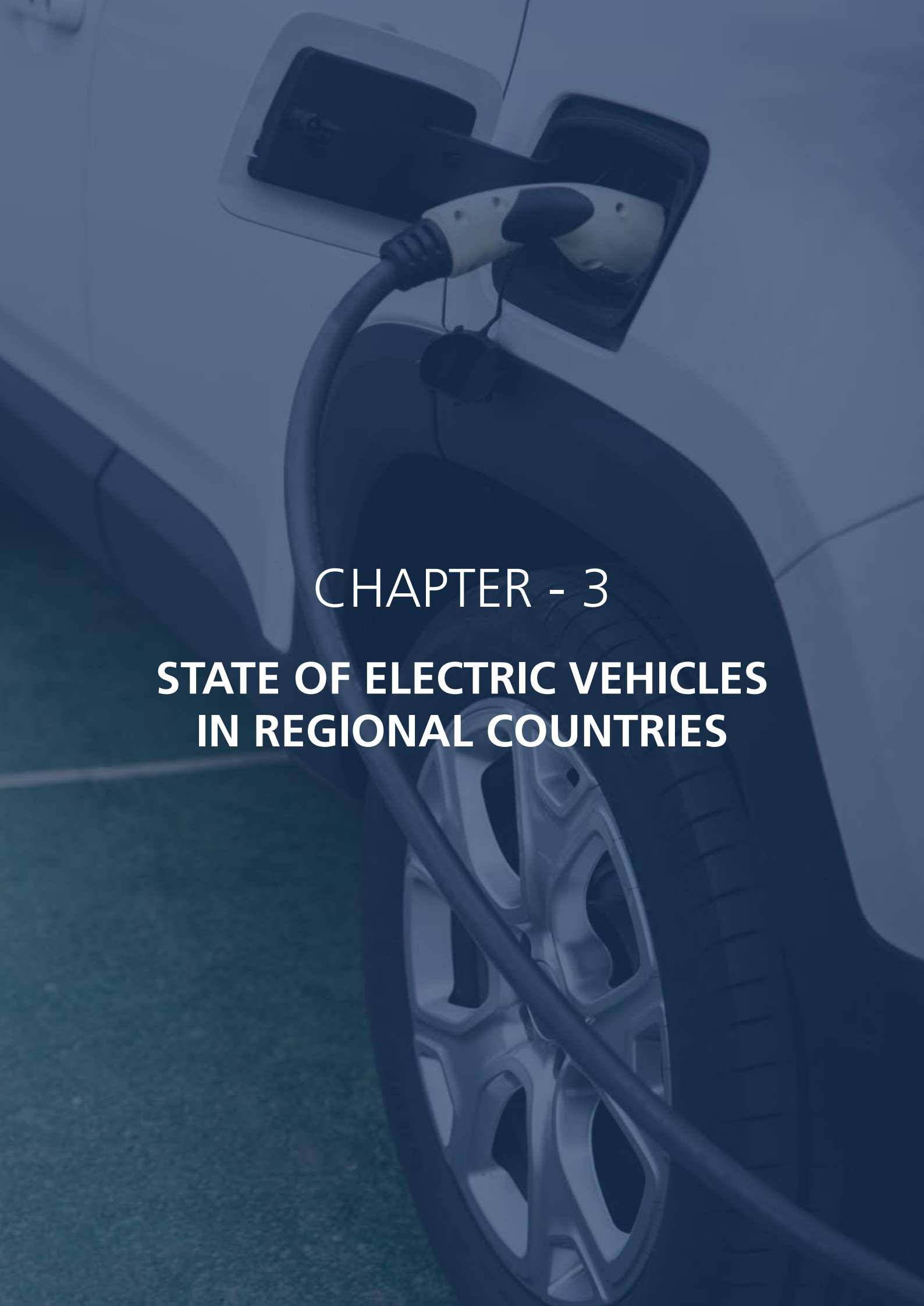
2.2 Vehicle Use Indicator: Results and Insights

Since 2011, the number of registered automobiles has significantly increased. This surge in motorisation has decreased the number of people per automobile from 19 in 2011 to 7 in 2022, as provided in Figure 7. As a result, there are more vehicles per capita, indicating enhanced potential mobility. However, this potential advantage also contributes to increased GHG emissions due to higher production activity and greater fossil fuel consumption. Thus, it is vital to increase enhanced mobility through the production of EVs and using a green supply chain.

Figure 7: People Per Registered Vehicle (Vehicles per 1,000)



Source 7: Authors' Calculations



CHAPTER - 3

STATE OF ELECTRIC VEHICLES IN REGIONAL COUNTRIES

3. State of Electric Vehicles in Regional Countries

The global transition toward electric vehicles (EVs) has gained significant momentum in recent years, driven by advancements in technology, supportive policies, and growing environmental concerns. EV adoption is rising across major markets, reshaping the future of transportation and energy demand. In this section, the EV adoptability landscape of Pakistan's regional countries is discussed.

3.1 India

3.1.1. EV Market Overview

India's EV market has experienced significant growth, with sales reaching 1.95 million units in 2024, marking a 27% increase from the previous year. This surge has brought the total number of registered EVs to over 5.39 million. Despite this progress, EVs constitute only 3.6% of total vehicle sales, falling short of the government's target of 30% by 2030 [1]. The majority of EV sales are concentrated in two- and three-wheelers, accounting for 59% and 35% respectively. Electric four-wheelers represent a mere 5% of the market, with Tata Motors leading this segment [1].

3.1.2. Policy Landscape

India's EV policy framework has evolved over the years. The Faster Adoption and Manufacturing of Hybrid & Electric Vehicles (FAME-II) program, which concluded in March 2024, provided substantial subsidies for various EV categories. Subsequently, the government introduced the PM Electric Drive Revolution in Innovative Vehicle Enhancement (PM E-DRIVE) program, allocating ₹109 billion (\$1.29 billion) to support the deployment of 2.479 million electric two-wheelers, 316,000 three-wheelers, and 14,028 e-buses [1], [2].

Additionally, the Electric Mobility Promotion Program 2024 was launched with a funding of ₹5 billion (\$60.34 million) to support 372,215 EVs, focusing on two- and three-wheelers [2].

3.1.3. Challenges

Despite policy support, several challenges hinder EV adoption in India:

- a) **Charging Infrastructure:** The country has a low density of charging stations, with one station for every 135 EVs, compared to one for every 20 in more established markets [3].
- b) **Policy Shifts:** The transition from FAME-II to PM E-DRIVE has led to reduced subsidies, particularly for electric four-wheelers, impacting consumer incentives [2].
- c) **Investment Decline:** Funding in the EV sector dropped by 37% from 2022 to 2024, reflecting investor caution amid policy changes and slower sales growth [4].

3.2. Nepal

3.2.1. EV Market Overview

Nepal has witnessed a remarkable increase in EV adoption, with over 13,000 electric passenger vehicles imported annually, a significant rise from just 250 in 2020-21. This growth is attributed to cost savings, stable electricity from hydropower, and reduced import taxes [5].

The government's ambitious targets aim for 90% of private and 60% of public vehicle sales to be electric by 2030. Currently, more than 70% of newly imported passenger vehicles are electric [5].

3.2.2. Policy Landscape

Nepal's policies favour EV adoption through:

- a) **Tax Incentives:** Lower import duties for electric vehicles compared to fossil-fuel-powered ones [6].
- b) **Infrastructure Development:** Installation of 400 charging stations, with plans to double this number soon [6].
- c) **Environmental Goals:** Leveraging hydropower to reduce oil imports by \$22 million annually and combat air pollution, which contributes to nearly 19% of all deaths in the Kathmandu valley [5], [6].

3.2.3. Challenges

While progress is notable, Nepal faces challenges in:

- a) **Electrifying Public Transport:** High costs and limited infrastructure hinder the transition of buses and trucks to electric power [5].
- b) **Public Transport System:** A disorganised system complicates the integration of electric vehicles [5].

3.3 Bangladesh

3.3.1. EV Market Overview

As of April 2024, Bangladesh had approximately 400 registered electric vehicles out of over 6 million total registered vehicles, highlighting the nascent state of EV adoption in the country.

3.3.2. Policy Landscape

The Bangladeshi government has set ambitious goals to increase EV adoption:

- a) **30% EV adoption by 2030:** Aiming to reduce carbon emissions and reliance on fossil fuels [7].
- b) **50% EV access by 2050:** Outlined in the Integrated Energy and Power Masterplan 2023 (IEPMP-23), this target focuses on expanding EV accessibility across the population [8].

To support these targets, the government has implemented policies such as the Electric Motor Vehicle Registration and Operation Policy 2023, which streamlines EV registration processes.

3.3.3. Local Manufacturing Initiatives

Bangladesh is making strides in developing a domestic EV industry:

- a) **Bangladesh Auto Industries Ltd (BAIL):** Investing BDT 1,400 crore to establish EV manufacturing facilities in Chattogram, aiming to produce two-wheelers, three-wheelers, sedans, and SUVs [9].
- b) **Walton Digi-Tech Industries Ltd:** Launched the country's first electric bus for staff transportation, indicating a move towards larger EVs.

3.3.4. Infrastructure Development

Charging infrastructure remains a critical area for development:

- a) **Limited Charging Stations:** Only 14 solar-powered EV charging stations are currently operational, which is insufficient for large-scale EV adoption.
- b) **DESCO's Initiatives:** The Dhaka Electric Supply Company (DESCO) is actively working to establish more charging stations in the capital to support the growing number of EVs [8].

3.3.5. Challenges

Several challenges hinder the rapid adoption of EVs in Bangladesh:

- a) **High Costs:** The price of EVs remains high, with new electric cars ranging from BDT 11.44 lakh to BDT 79.6 lakh, making them less accessible to the average consumer [10].
- b) **Infrastructure Gaps:** The lack of widespread and reliable charging stations limits the practicality of owning an EV.
- c) **Dependence on Imports:** Currently, most EVs and their components are imported, which can increase costs and affect the trade balance [10].

3.4. Pakistan

3.4.1. EV Market Overview

As of 2024, Pakistan's EV market is in its early stages, with annual sales under 600 units. This limited uptake is attributed to factors such as high vehicle costs, insufficient charging infrastructure, and limited consumer awareness. However, projections indicate a significant shift, with expectations of EVs comprising up to 30% of vehicle sales by 2030 and reaching 90% by 2040 [11], [12].

3.4.2. Policy Landscape

The government has introduced the draft New Energy Vehicle (NEV) Policy 2025–2030, aiming to accelerate EV adoption. Key components include:

- a) **Adoption Targets:** 30% of new vehicle sales as EVs by 2030, 90% by 2040, and a fully zero-emission fleet by 2060 [11].
- b) **Incentives:** Subsidies of Rs. 50,000 for electric two-wheelers and Rs. 200,000 for three-wheelers to reduce upfront costs [13].
- c) **Taxation:** Reduced customs duties on specific imported parts, with 1% on certain components, and a structured increase for others over three years [11].
- d) **Infrastructure Development:** Plans to establish 10,000 EV charging stations nationwide by 2030, including 40 along motorways and 300 along highways [14], [15].
- e) **Investment Facilitation:** Allocation of 20% of special technology zones to the EV sector and incentives for investors contributing Rs. 3 billion during the policy's initial five years [11].

3.4.3. Charging Infrastructure

To support the anticipated growth in EVs, the government is focusing on expanding charging infrastructure:

- a) **National Plan:** Establishment of 10,000 charging stations by 2030 [14], [16].
- b) **Public-Private Partnerships:** A \$350 million agreement with a Chinese company to install 3,000 charging stations along the Peshawar-Karachi motorway [17].
- c) **Urban Initiatives:** Mandating charging stations at every fuel pump in Islamabad to position the capital as a model city for EV readiness [12].

3.4.4. Industry Developments

The private sector is increasingly participating in Pakistan's EV landscape:

- a) **BYD's Entry:** Chinese EV manufacturer BYD, in partnership with Mega Motors, plans to launch three EV models and establish a local assembly plant by early 2026 [18].
- b) **Local Manufacturing:** Companies like Regal Automobiles and Dewan Farooque Motors have initiated

ed local assembly of electric vehicles, indicating growing industry engagement [12].

3.4.5. Challenges

Despite these initiatives, several challenges persist:

- a) **Infrastructure Gaps:** The current scarcity of charging stations hampers consumer confidence in EV adoption.
- b) **High Costs:** Elevated prices for EVs, due to import duties and limited local production, deter potential buyers.
- c) **Consumer Awareness:** Limited public knowledge about EV benefits and options affects market growth.

3.5. Snapshot of Regional Comparison

The comparative data on EV charging infrastructure across South Asian countries highlights significant disparities in both affordability and accessibility. India leads the region with over **25,000 public charging stations**, offering relatively low electricity rates between **₹4–₹8 per kWh (\$0.05–\$0.10)**. This strong infrastructure push, coupled with a favourable tariff structure, results in approximately **17.8 charging stations per million people**, supporting the country's ambitious EV adoption targets. Nepal, despite its smaller economy, has made notable progress with **400 public EV stations** and competitive electricity rates **of NPR 5–10 per kWh (~\$0.04–\$0.08)**, resulting in **13.3 stations per million people**—the second highest in the region. These figures reflect an effective policy focus on clean energy transition and accessibility in both countries.

In contrast, **Bangladesh** and **Pakistan** lag significantly behind. Bangladesh has around **114 EV stations**, equating to only **0.67 stations per million people**, and relatively high electricity rates **of BDT 14–19 per kWh (~\$0.12–\$0.16)**, which could discourage both EV use and investment in infrastructure. *Pakistan fares the worst in terms of infrastructure readiness*, with **only 35 public charging stations**—a mere **0.15 per million people**, despite a recent 44% reduction in tariff to **PKR 39.70 per kWh (~\$0.14)**. These gaps indicate that without targeted government support, policy reforms, and public-private investments, countries like Pakistan and Bangladesh may struggle to meet their e-mobility and decarbonization goals.

Table 1: Snapshot of Regional Comparison

	• Rate per kWh:	• Charging Stations:	• Per Capita Charging Stations (per million people):
India	Varies by state; typically, ₹4–₹8 (\$0.05–\$0.10)	~ 25,000	~ 17.8 (based on 1.4 billion population)
Nepal	Approximately NPR 5–10 (~\$0.04–\$0.08)	~ 400 operational, with plans to double soon	~ 13.3 (based on 30 million population)
Bangladesh	Varies; typically, BDT 14–19 (~\$0.12–\$0.16)	~ 114 EV stations	~ 0.67 (based on 170 million population)
Pakistan	PKR 39.70 (~\$0.14) after 44% reduction from PKR 71	~ 35 as of early 2025	~ 0.15 (based on 232 million population)





CHAPTER - 4

CHALLENGES TO THE GREEN TRANSITION OF THE AUTOMOTIVE SECTOR

4. Challenges to the Green Transition of the Automotive Sector

4.1. Challenges for Automotive Manufacturers

Cost Efficiency	One of the key challenges for automotive manufacturers is balancing sustainability with cost efficiency. Eco-friendly initiatives often involve higher upfront costs, and for these to succeed, consumers must also find sustainability produced vehicles financially accessible.
Consumer Expectations	Today's consumers are increasingly rational and environmentally conscious, prompting car manufacturers to align their sustainability goals with evolving customer expectations. Clear and transparent communication of these efforts is essential to building trust, enhancing brand loyalty, and reinforcing consumer confidence in sustainable mobility solutions.
Supply Chain Complexity	The complexity of automotive supply chains presents a significant sustainability challenge, spanning from raw material extraction to final assembly. Manufacturers must manage a diverse network of suppliers - each with varying environmental footprints to ensure a more transparent, responsible, and sustainable value chain across all production stages.
End-of-Life Considerations	A vehicle's environmental impact extends well beyond its years on the road. Managing end-of-life vehicles (ELVs) presents a major sustainability challenge, particularly in Pakistan where formal recycling systems are limited. Adopting sustainable practices for dismantling, recycling, and responsibly disposing of components such as interiors, metals, and plastics is essential to minimizing the lifecycle footprint of automobiles and promoting a circular economy in the automotive sector.

4.2. Consumer Specific Challenges

High Upfront Costs	Range Anxiety & Charging Infrastructure	Low Awareness	Maintenance Concerns	Low Fiscal Incentives
The average consumer in Pakistan is not in position to afford EVs due to their price in comparison to conventional vehicles with similar torque power and overall performance.	The vehicles in Pakistan are used quite frequently in intra city travel as well due to poor public transport infrastructure. Thus, the range anxiety and unavailability of charging stations in sub-urban and rural areas discourage EV buying.	The consumers are skeptical on battery performance and replacement cost and EV's adoptability in mountain areas and rainy seasons. There is need for research based advocacy to curb misconceptions regarding EVs.	The consumers are also aware of the fact, the human capital required to maintain vehicle after sale is not available which also discourages EV adoption.	In Pakistan the commercial Banks does not offer concessional car financing schemes in comparison to ICE vehicles. Moreover, the electricity tariff for charging stations is also on higher side.
				

4.3. National Grid's Misalignment with EV Policy

As of 31 December 2024, approximately 60% of Pakistan's electricity generation through the national grid remains dependent on fossil fuels, including gas, coal, and oil¹⁷. This persistent reliance on **carbon-intensive energy sources undermines the environmental rationale for large-scale electric vehicle (EV) adoption**, as shifting from ICE vehicles to EVs would merely transfer greenhouse gases (GHG) from the transportation sector to the power generation sector.

Therefore, without a concurrent transition of the national grid to renewable energy sources such as solar, wind, and hydropower, achieving 100% EV penetration would result in a reclassification of emissions rather than a net reduction in the country's overall carbon footprint. Consequently, decarbonising the electricity grid is not merely complementary but equally critical to advancing EV adoption. A holistic approach integrating grid modernisation with renewable energy integration and transport electrification is imperative to ensure meaningful progress towards Pakistan's goals.

4.4. Policy Implementation

The **National Electric Vehicle Policy (NEVP)**, introduced in 2020, sets a commendable target of achieving **30% electric vehicle (EV) penetration by 2030**. However, the progress required to meet this objective remains inadequate, with several initiatives either delayed or left unimplemented. For instance, although the Ministry of Industries and Production introduced a **concessionary financing scheme** for e-bikes and e-rickshaws backed by a subsidy to support up to **15,000 units**, the scheme was never operationalised¹⁸.

Furthermore, the lack of access to affordable financing continues to hinder EV adoption. **Only 4% of financial institutions in Pakistan currently offer EV-specific financing**, reflecting limited engagement despite the existence of a progressive lending framework. This is largely due to the perception among banks that EV technologies pose high risks and offer low returns. Additional challenges, such as the absence of a formal secondary market, limited technical expertise, and low consumer demand, have further restricted the financial ecosystem supporting EVs.

The **National Electric Vehicle Policy (2025-30)** ambitiously aims to ensure that **90% of new vehicle sales are electric by 2040**, yet fails to prioritise the foundational requirements for such a transition¹⁹. These include the development of nationwide charging infrastructure, battery swapping stations, awareness campaigns, and a robust battery-recycling framework. Moreover, there is a critical disconnect between EV policies and Pakistan's broader **renewable energy and national conservation strategies**, which undermines the long-term sustainability and circularity of the EV ecosystem. Without coordinated planning and effective implementation, these policy ambitions are unlikely to translate into measurable outcomes.

17 State of Industry Report 2024 of NEPRA

18 https://www.agora-energievwende.org/fileadmin/Projekte/2023/202328_INT_Pakistan_Study/Facilitating_Green_Loans_for_Sustainable_Energy_Transition.pdf

19 <https://www.brecorder.com/news/40343170>

4.5. Charging Infrastructure

As of the latest available data from Electromaps²⁰, PSO²¹, and Shell²², as of 2024, Pakistan has a total of 15 to 20 charging stations for electric vehicles. Islamabad hosts 6 charging stations, Lahore has 6, Karachi has 5, and 1 in Nooriabad, whereas Hafizabad and Sargodha host one each. This limited infrastructure highlights the nascent stage of EV adoption in Pakistan and underscores the need for rapid expansion to alleviate range anxiety among potential EV buyers²³.

To address the current gap in EV infrastructure, plans are underway to set up 40 additional charging stations along key motorways, including M-1, M-2, M-3, M-4, M-5, M-9, etc²⁴. This will ensure broader coverage and support long-distance EV travel. In addition, a Chinese firm is expected to install 3,000 EV charging stations across Pakistan, with each station costing around Rs 8 million²⁵. This initiative will significantly improve EV feasibility and encourage wider adoption.

However, the government's lack of progress in developing these charging stations since 2022 has raised concerns among the general public and the business community. Establishing public-private partnerships for the development of these stations could be a viable solution, potentially helping to realise these ambitious plans successfully.



4.6. Consumer Preferences

One of the key challenges in the adoption of electric vehicles (EVs) or HEVs in Pakistan is consumer preference and perception. Many consumers remain hesitant due to concerns over EV performance, range anxiety, charging infrastructure, and resale value. The traditional preference for gasoline and diesel-powered vehicles, coupled with a lack of awareness regarding the long-term cost benefits of EVs, further slows adoption. Additionally, misconceptions about battery life, high upfront costs, and the availability of spare parts contribute to scepticism.

There is a need for strong policy incentives, awareness campaigns, and proven success stories; changing consumer perception remains a significant hurdle in accelerating the transition to green mobility in Pakistan.

20 Electromaps. (2024). Charging Stations in Pakistan. Available at: Electromaps.

21 Pakistan State Oil. (2024). Electric Vehicle Charger. Available at: PSO.

22 Shell Pakistan. (2024). Shell Recharge. Available at: Shell Pakistan.

23 Alternative Energy Development Board (AEDB). Available at: <https://aedb.org/>.

24 EV stations for motorways approved: Available at Express Tribune.

25 Chinese firm to install 3,000 EV charging stations in Pakistan: available at Express Tribune.

4.7. Case Study Scenarios

4.7.1. Successful Country Case: Norway

Norway has achieved remarkable success in the adoption of electric vehicles through a comprehensive and multifaceted policy framework. As of 2020, EVs accounted for over 54% of all new car sales in Norway, making it a global leader in EV adoption. This impressive feat has been achieved through several key strategies (Table 2: *Successful Case Study of Norway*).

Table 2: Successful Case Study of Norway

S.No	Activity	Success Story
1	Financial Incentives	Norway offers substantial financial incentives for EV owners. These include exemptions from import taxes and the 25% value-added tax (VAT), as well as reduced road taxes. Additionally, EV owners benefit from lower registration fees and various local tax reductions, making EVs significantly more affordable compared to traditional internal combustion engine vehicles.
2	Charging Infrastructure	The government has invested heavily in developing a widespread and accessible network of charging stations. As of 2021, Norway has more than 27,500 public charging points, including a substantial number of fast-charging stations, ensuring that EV users can conveniently charge their vehicles across the country ²⁶ .
3	Regulatory Support	EVs enjoy several regulatory benefits in Norway. These include access to bus lanes, which helps reduce travel time during peak hours, free parking in many city centres, and exemptions from road tolls. Such benefits make EVs a more practical and attractive option for daily commuting.
4	Public Awareness	The Norwegian government has actively promoted the benefits of EVs through public awareness campaigns. These campaigns highlight the environmental and economic advantages of switching to electric mobility, fostering a positive public perception and encouraging more consumers to make the switch ²⁷ .

These measures have collectively resulted in Norway having one of the highest per capita rates of electric car ownership in the world. Norway's approach to EV adoption is often cited as a model for other nations aiming to reduce transportation emissions. The country's success underscores the effectiveness of coordinated policy actions and incentives in driving the transition to electric mobility. Norway has demonstrated a successful pathway to achieving widespread EV adoption by addressing financial, infrastructural, regulatory, and awareness challenges.

4.7.2. Successful Company Case: Volvo

The Volvo's case has been included due to its robust transition from ICE vehicles to EVs. Volvo has committed to becoming a fully electric car company by 2030 and has made significant strides towards this goal. Volvo's approach to EV adoption involves a combination of innovation, strategic partnerships, and a strong commitment to sustainability. This multifaceted strategy has positioned Volvo as a leader in the transition to electric

²⁶ Statista, (2024) 'Norway: Electric Vehicle Chargers'. Available at: Statista

²⁷ Norwegian Electric Vehicle Association. Available at: <https://elbil.no/english/>

mobility within the traditional automotive industry, demonstrating the company's forward-thinking approach and dedication to environmental responsibility²⁸ (Table 3: *Successful Case Study of Volvo*).

Table 3: Successful Case Study of Volvo

S.No	Activity	Success Story
1	Electrification Strategy	Volvo announced an ambitious target to have 50% of its global sales consist of fully electric cars by 2025, with the remaining sales coming from hybrid vehicles. This goal is part of Volvo's broader vision to become a fully electric car company by 2030. However, Volvo has revised its EV target and now expects at least 90% of its output to be made up of both electric cars and plug-in hybrids by 2030 ²⁹ .
2	Investment in Technology	Volvo is investing heavily in electric vehicle technology, developing its electric powertrain to ensure high performance and efficiency. This investment reflects Volvo's commitment to innovation and technological advancement in the EV sector.
3	Sustainable Manufacturing	The company is focusing on sustainable vehicle production, aiming to significantly reduce the lifecycle carbon footprint of each car. This includes using recycled materials and renewable energy in manufacturing processes, as well as designing cars for recyclability at the end of their life.
4	Partnership	Volvo has formed strategic partnerships with battery manufacturers and charging solution providers to enhance the EV ecosystem. These collaborations are crucial for ensuring a reliable supply of batteries and expanding the availability of charging infrastructure for Volvo's electric vehicles.

²⁸ Volvo's Sustainability Reports. Available at: <https://www.volvocars.com/sustainability>

²⁹ <https://www.bbc.co.uk/news/articles/c3ejye39434o>



CHAPTER - 5

AUTOMOTIVE EMISSIONS AND ENVIRONMENTAL AGREEMENTS

5. Automotive Emissions and Environmental Agreements

The global automotive industry is one of the largest contributors to greenhouse gas emissions. Since the early 20th century, as the industry grew, so did its environmental footprint. By the 1990s, it became increasingly clear that the industry's impact on the environment was unfavourable. This realisation spurred a series of international efforts to mitigate the environmental damage caused by automotive emissions.

With the global automotive industry making strides towards sustainability, the focus shifts to how these changes are reflected in Pakistan. The country's automotive industry, while smaller in scale compared to global giants, plays a crucial role in its economic landscape.

Table 4: Implications of Climate Change for the World and Pakistan

Activity	Implications for the World	Implications for Pakistan
The 1990s: A Decade of Transformation and GHG Emissions	The 1990s marked a pivotal era for the global automotive industry, with increasing awareness about environmental issues. Greenhouse gas emissions became a central concern, and the automotive sector, known for its significant carbon footprint, faced growing scrutiny. During this period, major automotive markets in North America, Europe, and Asia experienced unprecedented growth, leading to a surge in vehicle production and sales. However, this growth came at a significant environmental cost. Global GHG emissions from the transportation sector increased dramatically. The combustion of fossil fuels in internal combustion engines was identified as a primary source of carbon dioxide (CO₂), one of the most potent greenhouse gases. This era saw the rise of environmental advocacy groups and the publication of numerous scientific studies highlighting the link between GHG emissions and climate change³⁰.	The 1990s were a period of significant growth for Pakistan's automotive sector. With the liberalisation of economic policies, there was a surge in vehicle production and imports. New assembly plants were established, and international brands entered the Pakistani market. However, this growth came with minimal consideration for environmental impacts. During this period, Pakistan's automotive sector saw a significant increase in GHG emissions. The country's industrial policies focused primarily on economic growth, often sidelining environmental considerations. The lack of stringent emission standards and regulatory oversight meant that the industry operated with minimal accountability regarding its environmental impact. Transparency International highlighted the need for greater transparency and accountability in industrial operations, emphasising the automotive sector's role in environmental degradation³¹.
Kyoto Protocol: A Landmark Agreement	The Kyoto Protocol was a significant step towards international cooperation on climate change, setting legally binding targets for developed countries to reduce their emissions. The Kyoto Protocol's impact on the automotive industry was profound. It necessitated a reevaluation of production processes, fuel efficiency, and emissions standards. Automotive manufacturers began investing in research and development to create more fuel-efficient engines and alternative fuel vehicles. Hybrid and electric vehicles started to emerge as viable alternatives to traditional gasoline-powered cars³².	Although Pakistan was a signatory to the Kyoto Protocol, the implementation of measures was inconsistent. The procedural requirements for emissions reduction were often not followed, resulting in continued environmental degradation. The automotive industry, driven by economic incentives, did not prioritise environmental sustainability. This led to an increase in vehicle emissions, contributing to urban air pollution and associated health issues. Whereas some manufacturers began exploring cleaner technologies and fuel-efficient vehicles, although these efforts were limited and largely driven by self-initiatives rather than domestic policies.

30 Transparency International. (1999). Transparency in Industrial Operations. Retrieved from <https://www.transparency.org/research/industries>

31 Government of Pakistan. (2020). National Development Goals Report. Retrieved from <http://www.pbs.gov.pk/content/national-report-sustainable-development-goals>

32 United Nations Framework Convention on Climate Change (UNFCCC). (1997). Kyoto Protocol. Retrieved from https://unfccc.int/kyoto_protocol

Paris Agreement: Raising the Stakes

In 2015, the Paris Agreement included commitments from both developed and developing countries. The agreement aimed to limit global warming to well below 2 degrees Celsius above pre-industrial levels, with efforts to limit the increase to 1.5 degrees Celsius. The Paris Agreement emphasised the importance of transitioning to cleaner technologies and reducing Scope I, II, and III emissions. For the automotive industry, this meant not only improving vehicle fuel efficiency but also addressing emissions throughout the supply chain and lifecycle of vehicles³³.

The Paris Agreement in 2015 brought renewed focus on environmental sustainability. For Pakistan, this meant aligning its industrial policies with global standards. The automotive industry, particularly in developing countries like Pakistan, faced immense pressure to comply with the Paris Agreement's targets. This involved not only reducing direct emissions but also addressing indirect emissions throughout the supply chain.

³³ United Nations Framework Convention on Climate Change (UNFCCC). (2015). Paris Agreement. Retrieved from <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>



TOYOTA

CHAPTER - 6

BUSINESS CASE STUDY OF INDUS MOTOR COMPANY (IMC) PAKISTAN



6. Business Case Study of Indus Motor Company (IMC) Pakistan

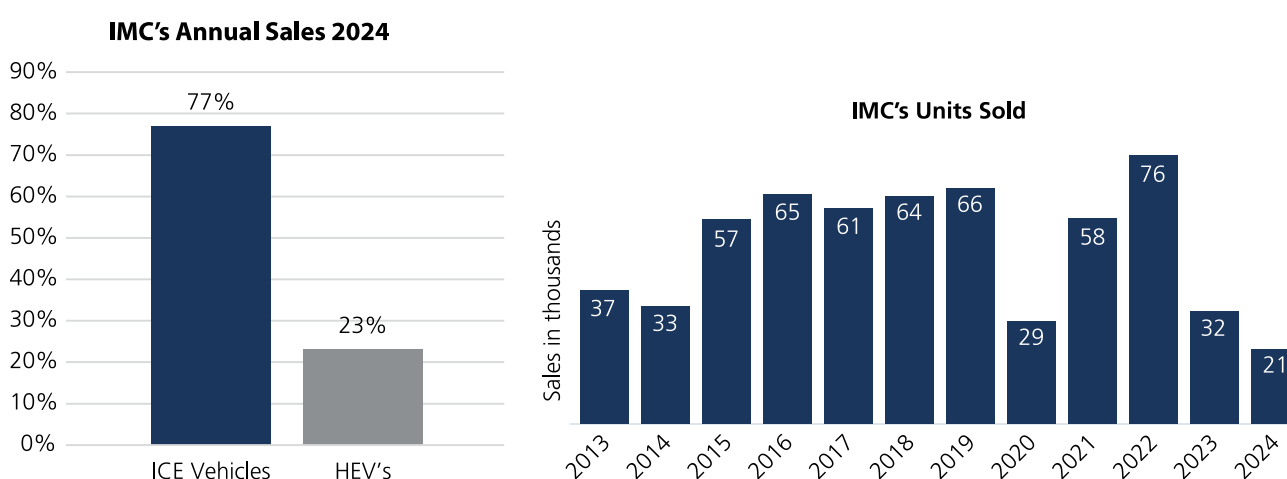
6.1 Overview

Indus Motor Company stands as one of the foremost automotive manufacturers in Pakistan. Established in 1989 as a joint venture between the House of Habib, Toyota Motor Corporation, and Toyota Tsusho Corporation, IMC has become a significant player in the automotive landscape of Pakistan. The company is headquartered in Karachi with its manufacturing plant located at Port Qasim. Over the years, IMC has played a pivotal role in the growth and development of the automotive industry in Pakistan, consistently delivering high-quality vehicles and contributing to the economy³⁴.

IMC's journey began with the production of Toyota and Daihatsu vehicles in Pakistan. The company started its operations with a modest assembly line and has since expanded its production capacity significantly. Today, IMC manufactures a diverse range of vehicles, including sedans, SUVs, and commercial vehicles, under the Toyota brand. Some of the popular models produced by IMC include the Toyota Corolla, Toyota Hilux, and Toyota Fortuner. One of the key initiatives of IMC was to introduce Pakistan's first locally manufactured HEV, "Corolla Cross", to encourage green mobility throughout the country. The sales performance from 2013 to 2023 for the IMC shows significant fluctuations in Figure 8, reflecting a dynamic market environment. Unit sales were 37,405 in 2013, dropping to 33,012 in 2014, indicating initial challenges. A substantial recovery followed, with sales rising to 64,584 units in 2016 and peaking at 66,211 in 2019, showing successful strategic initiatives. However, a dramatic drop to 28,837 units in 2020 likely resulted from economic downturns or the COVID-19 pandemic.

The subsequent recovery to 75,611 units in 2022 demonstrates resilience and an effective response to previous challenges. Yet, the sharp decline to 31,602 units in 2023 was overall inflationary pressure, high interest rates, etc. The lack of pre-2012 data limits the ability to contextualise these trends within a longer historical framework, making it difficult to determine if these fluctuations are part of a larger cyclical pattern or isolated incidents. Understanding and addressing the factors behind these variations is crucial for achieving long-term stability and growth³⁵. In 2024, the HEVs accounted for 23% of IMC's total Sales.

Figure 8: Historical Sales of IMC and HEVs-ICEs in 2024



Source 12: IMC Annual Reports

³⁴ Indus Motor Company. (2024). About Us. Retrieved from <https://www.toyota-indus.com/company/about-us/>

³⁵ Indus Motor Company. (2024). Annual Report 2023. Retrieved from <https://www.toyota-indus.com/investors/annual-reports/>

6.2 Carbon Footprints in Scope 3 Emissions

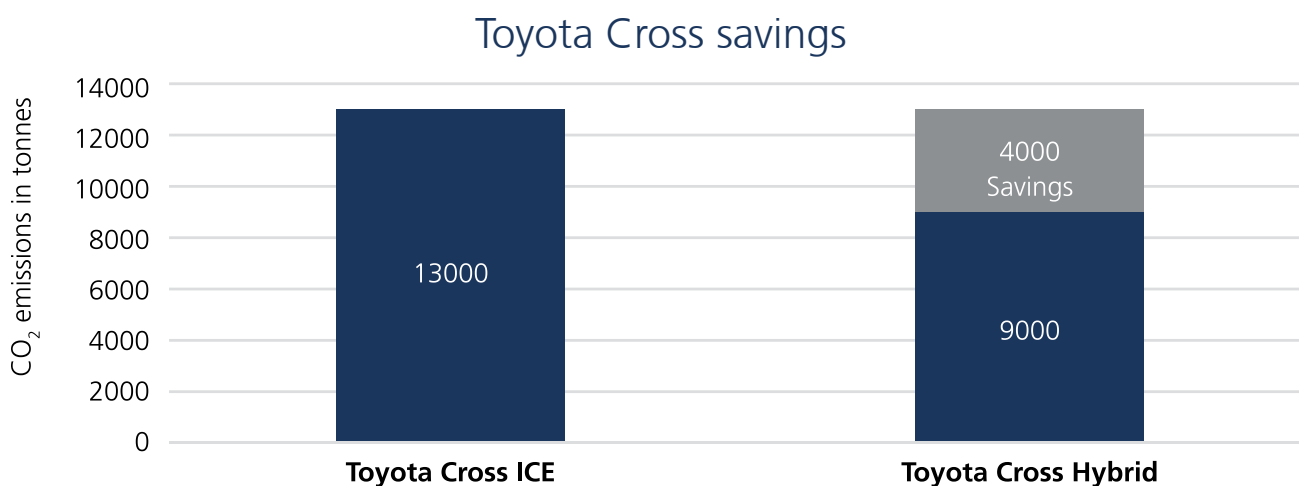
Scope 3 emissions encompass all indirect emissions that occur in the value chain of the reporting company, including both upstream and downstream activities. The Scope 3 emission is categorised into 15 different categories. However, due to data and time limitations, the quantifications of Scope 3 emissions for this case study are limited to only three activities.

As Indus Motor Company continues to lead in Pakistan's automotive industry, its commitment to reducing carbon footprints is evident as it **introduced Corolla Cross, its first Locally Manufactured Hybrid Electric vehicle introduced in 2024**, which reflects IMC's late response in addressing climate change but is still a first mover in Pakistan's market. This case study further explores how IMC navigates the challenges and opportunities within this evolving landscape, highlighting its pivotal role in driving sustainable automotive practices in the region.

6.2.1. Scope III Emissions Savings from Toyota Cross

In 2024, Indus Motor Company (IMC) launched its first locally manufactured **Hybrid Electric Vehicle (HEV)**—the Toyota Corolla Cross. As reported in IMC's Annual Report, around **4,861 units** of the Toyota Cross were sold between 2023 and 2024. Had these vehicles been conventional **Internal Combustion Engine (ICE)** models, they would have generated an estimated **13 kilotons of CO₂ emissions** over one year. However, thanks to the hybrid technology, actual emissions were reduced to approximately **9 kilotons**, resulting in a **carbon savings of nearly 4 kilotons** annually—marking a significant step toward low-emission mobility in Pakistan.

Figure 9: Emissions Savings by IMC from Toyota Cross Model



6.2.2. Carbon Footprints by Use of Sold Units

The carbon footprints based on the number of units sold by Indus Motors Company over the last three years were calculated using the following assumptions:

Considering equal sales of vehicles in each month by IMC.

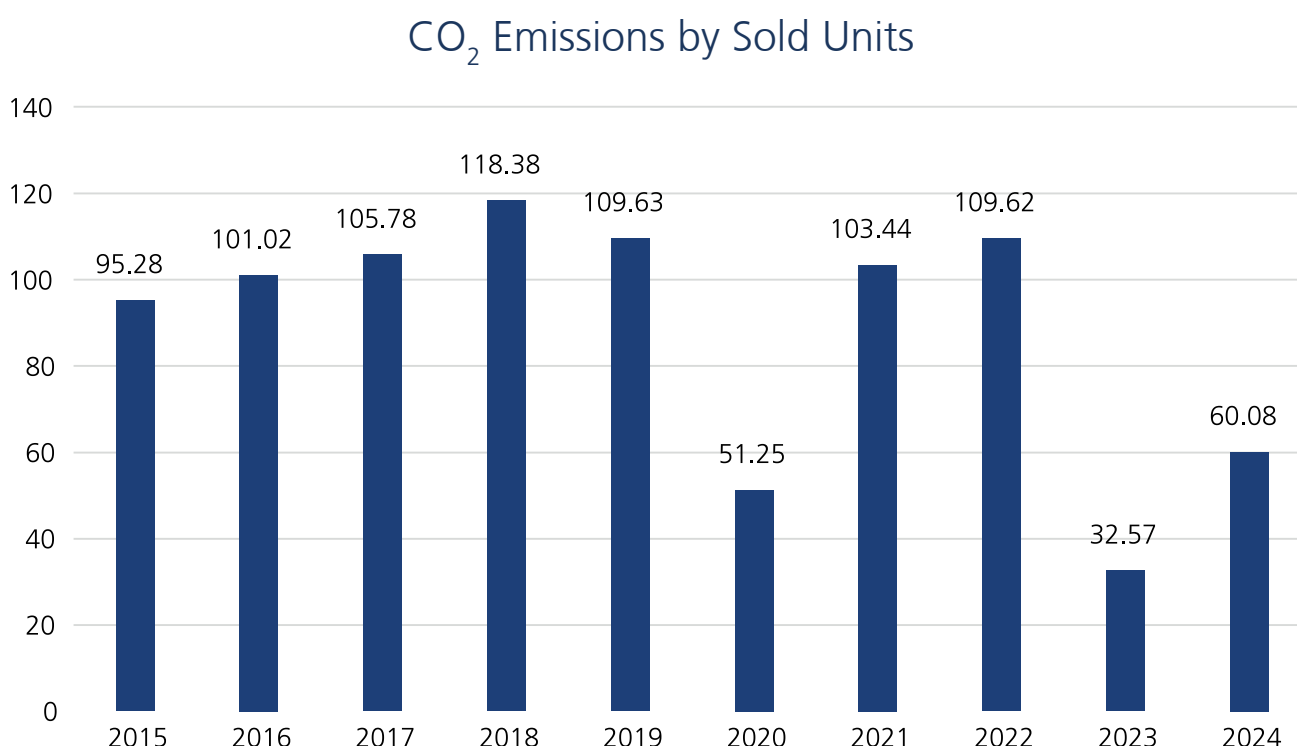
Passenger vehicles emit 4.6 metric tons of CO₂ emissions per year. (United States Environmental Protection Agency)

Assumption: 22 miles per gallon and drive around 11,500 miles per year. Every gallon of gasoline burned creates about 8,887g of CO₂.

As illustrated in Figure 10, the carbon emissions resulting from the use of units sold by Indus Motors from 2015 to 2024 reflect a fluctuating trend in Scope 3 emissions. **Emissions gradually increased from 95,283 tons**

in 2015 to a peak of 118,383 tons in 2018, indicating a period of production expansion. However, emissions dropped significantly in 2020 to 51,254 tons, likely due to pandemic-related production halts. Post-pandemic recovery was evident in 2021 and 2022, with emissions rebounding above 100,000 tons. In 2024, emissions partially recovered to 60,075 tons, but remained well below pre-2020 levels. These numbers underline the substantial impact of vehicle use on carbon emissions within Scope 3, emphasising the critical need for Indus Motors to implement effective strategies to reduce emissions throughout the lifecycle of their vehicles, from production to end-of-life.

Figure 10: Carbon Footprints by Use of Sold Units



Source 13: Author's Estimations ~ above emissions are not cumulative

6.2.3. Carbon Footprints by End-of-Life Treatment of Sold Products

The carbon footprints based on the vehicles scrapped by Indus Motors, produced in the last three years, are calculated using the assumptions detailed in Table 7: Emissions based on Material Recycled and Table 8: Assumptions of Vehicles Weight's Based on Material in the Appendix. Vehicle scrapping includes four steps: transportation emissions, dismantling emissions, recycling emissions, and disposal emissions. This estimate accounts only for the carbon contribution from the recycling process. According to international standards, vehicles typically have a lifespan of 10 to 15 years before being scrapped. Based on this assumption and other global parameters, we have quantified the potential future emissions resulting from vehicle sales in 2022, 2023, and 2024.

These projections help in understanding the environmental impact and emphasise the need for strategic measures to address end-of-life vehicle emissions, ensuring a comprehensive approach to mitigate the automotive sector's carbon footprint. As provided in table 4, the IMC's sales in 2021, 2022, and 2023 were 57,731, 75,611, and 31,602, respectively. **In future, these vehicles will potentially go into scrap at the end of their life, which will potentially result in 226,952 tonnes of CO₂ emissions.** These emissions from end-of-life treatments highlight the substantial environmental impact of vehicle disposal and recycling processes, highlighting the importance for Indus Motors to adopt and promote sustainable end-of-life practices to mitigate its Scope 3 emissions footprint.

Table 5: Carbon Footprints of Vehicle Recycling Processing

Category	2021	2022	2023
Sales	57,731	75,611	31,602
Emissions (tonnes)	79,434	104,036	43,482

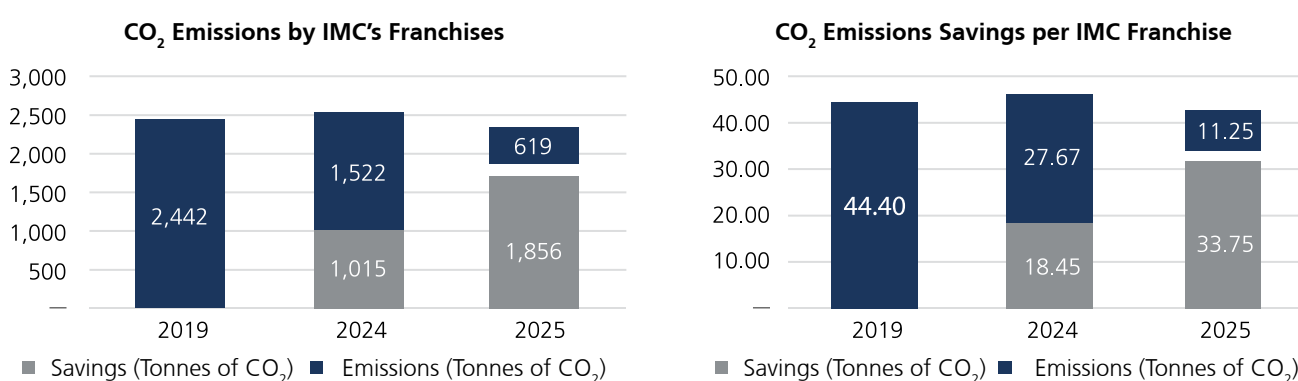
Note: Emissions are expected at the end of the product's life

Source 14: Author's Estimations

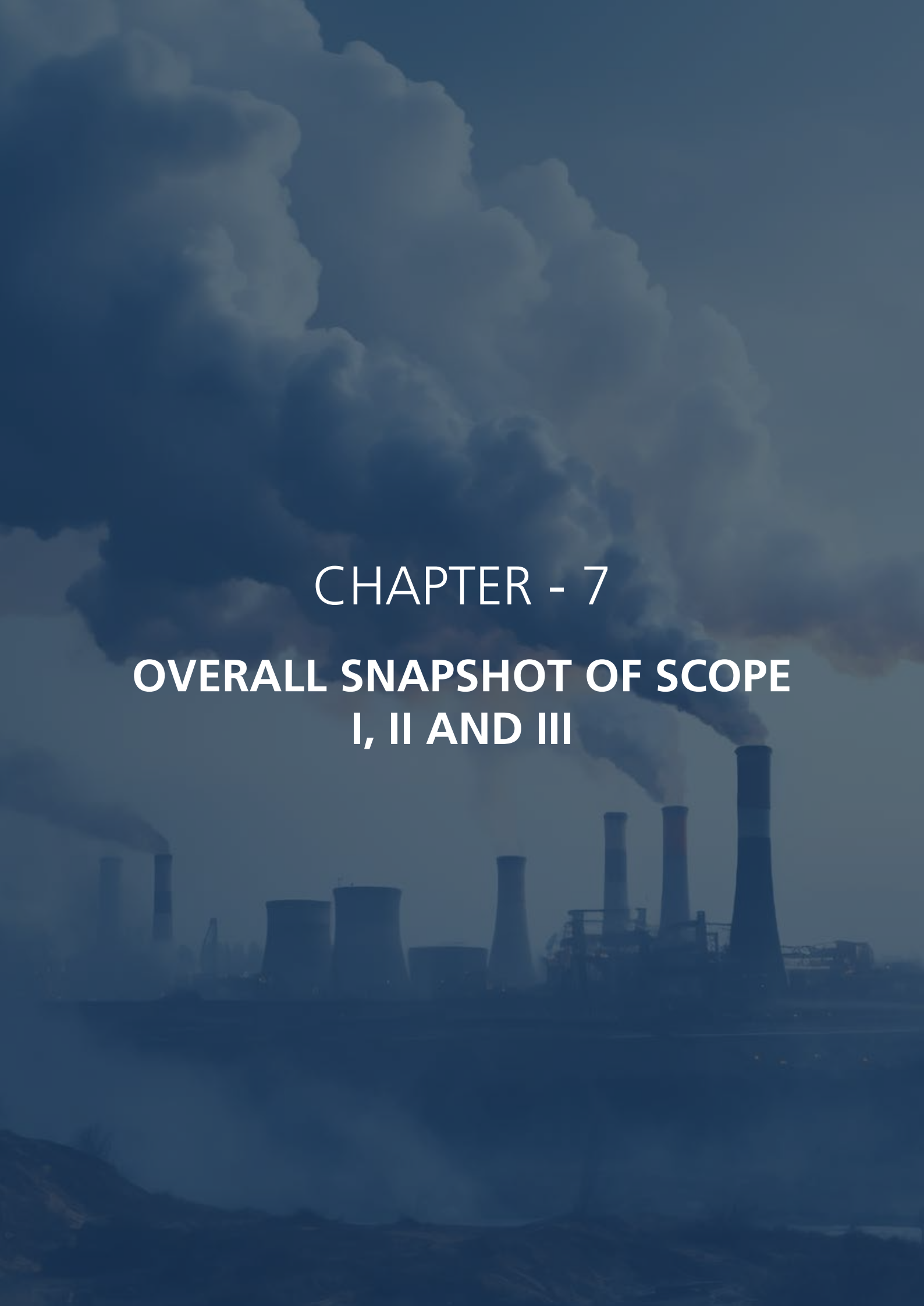
6.2.4. Carbon Footprints by Franchises

In the downstream, the IMC vehicles are sold through 57 different authorised dealers across Pakistan. In 2024 (Jan-Dec), the network has consumed around 5,700 MWh of electricity (40% of total consumption driven from Solar Installations) in comparison to 4,400 MWh of electricity consumption in 2019. In 2024, the IMC's network cumulatively emitted **1,522 tonnes of CO₂** (i.e. 38% reduction) in comparison to staggering **2,442 tonnes of CO₂** in 2019. In 2024, a single IMC's authorised dealer reduced its carbon footprint by **18.45 tonnes of CO₂** through the Solar Support Program introduced for franchise dealers. Whereas, by the end of 2024, it is projected that **75% of the total electricity consumption** across franchises will be powered by solar energy, leading to an estimated reduction of **1,856 tonnes of CO₂ emissions** (Figure 13).

Figure 11: Carbon Emissions by Authorised Franchises



Source 15: Author(s) Calculations based on data provided by IMC

The background image shows an industrial facility, likely a power plant, with several tall smokestacks and cooling towers. Thick white smoke is being emitted from the stacks, rising into a sky filled with large, billowing clouds. The foreground is dark and hazy, suggesting a body of water or a distant shoreline. The overall tone is industrial and somewhat somber due to the smoke and the dark foreground.

CHAPTER - 7

OVERALL SNAPSHOT OF SCOPE I, II AND III

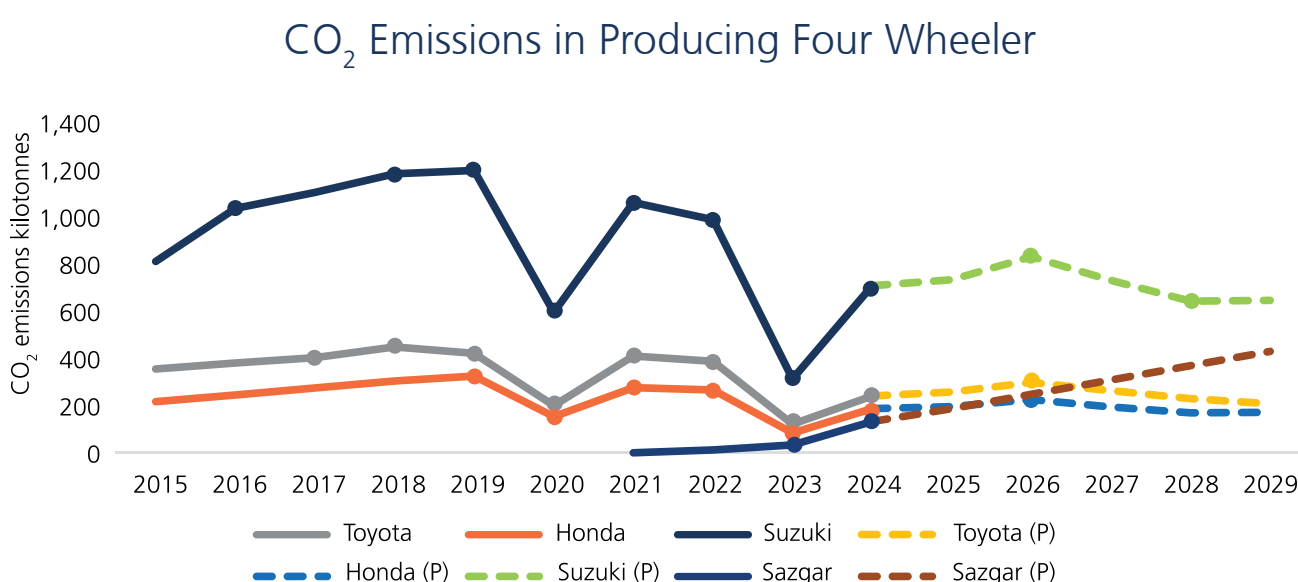
7. Overall Snapshot of Scope I, II and III

7.1 Companies' Direct CO₂ Emissions

Figure 12 presents the direct CO₂ emissions from vehicle production across key companies. The overall trend indicates consistent emissions over the years, with sharp declines observed in 2020 and 2023. The 2020 drop can be attributed to COVID-19-induced production halts, while the 2023 decline reflects reduced vehicle production due to soaring car prices and higher interest rates, which significantly slowed sales.

Despite these temporary dips, the projected emissions highlight the automotive sector's substantial contribution to CO₂ emissions. Among the companies, Suzuki stands out as the largest emitter, followed by Toyota and Honda. The methodology used to quantify emissions is provided in the Appendix.

Figure 12: Company-wise CO₂ emissions (Scope I – Pakistan Market)



Source 16: Authors' Estimations. Note: P ~ projected emissions

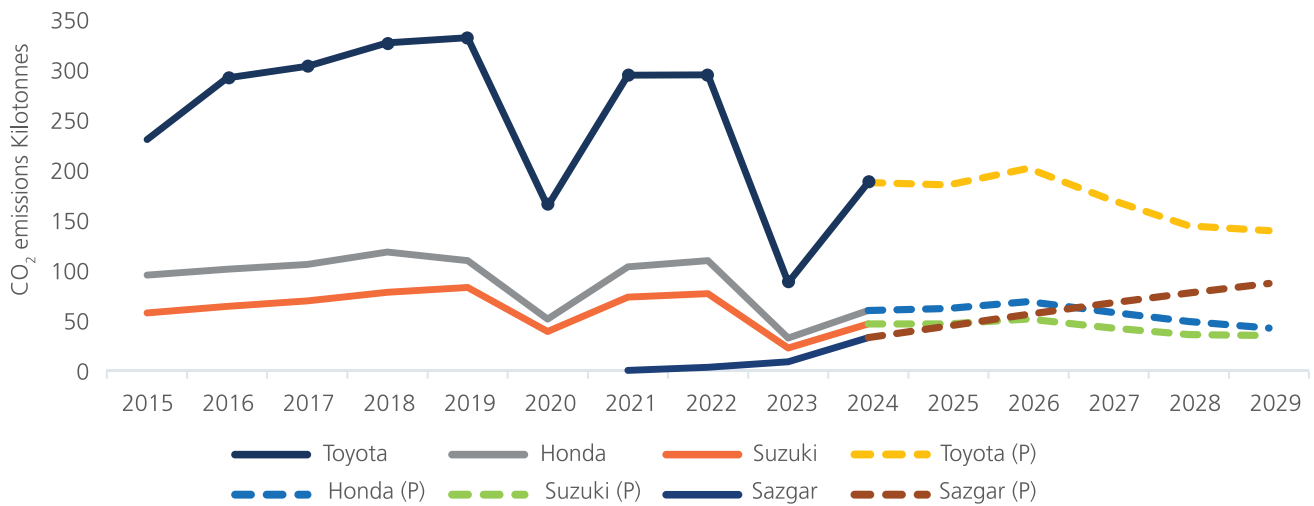
7.2 Indirect CO₂ Emissions by Companies' Products

Figure 13 illustrates the indirect CO₂ emissions from the aftermarket segment across key vehicle manufacturers. The data reveals a consistent emissions pattern, with Suzuki leading due to its dominant market share and large vehicle fleet on the roads. Toyota and Honda follow, reflecting their significant presence in the market as well. Sazgar currently ranks lowest in aftermarket emissions, given its relatively smaller vehicle footprint.

The methodology used to quantify emissions is provided in the Appendix.

Figure 13: Company-wise CO₂ emissions in Pakistan (Scope II & III) – Accumulation of emissions

Aftermarket CO₂ Emissions of Four Wheeler



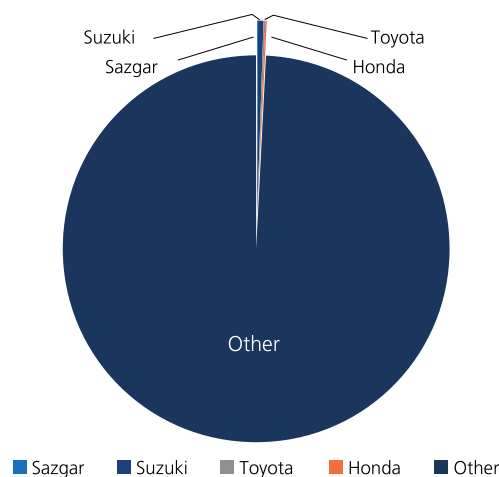
Source 17: Authors' Estimations. Note: P ~ projected emissions

7.3 Companies' Total Contribution

Figure 14 provides a comparative overview of CO₂ emissions contributions from Toyota, Honda, Suzuki, Sazgar, and other sources, such as the transport sector, industries, buildings, agriculture, and power. **The data highlights that Suzuki is the largest emitter among the listed companies, contributing 0.45% of the total emissions. Toyota follows with 0.15%, while Honda contributes 0.12%, and Sazgar contributes 0.08%.** However, the dominant category is 'other,' which accounts for a staggering 99.20% of total emissions, indicating that emissions from industries, buildings, agriculture, and the power sector far exceed those from the automotive companies. This analysis underlines the importance of adopting comprehensive, cross-sectoral strategies to achieve meaningful reductions in overall emissions. The methodology used to quantify emissions is provided in the Appendix.

Figure 14: CO₂ Footprint of Pakistan's Automotive Sector

Companies Contribution



Source 18: Authors Calculations

CHAPTER - 8

RECOMMENDATIONS



8. Recommendations

8.1. Recommendations for Government

- i. **Strengthening Implementation and Consistency of EV Policies:** Enhance the implementation and ensure the consistency of the National Electric Vehicle Policy (2025-30). Establish a dedicated task force to oversee and evaluate the progress, addressing any barriers promptly. Despite the introduction of the policy, the lack of consistent application has hindered progress. A dedicated task force can ensure that policy objectives are met and updated periodically. In addition, the NEV does not explicitly provide a mechanism for the recycling of ICE vehicles.
- ii. **Develop Robust Charging Infrastructure:** Invest in the development of a comprehensive charging infrastructure across megacities, national highways, and motorways. Provide incentives for private sector investment in this area. The absence of adequate charging infrastructure is a major barrier to EV adoption. By ensuring a widespread and reliable charging network, the attractiveness of EVs for consumers and investors will increase.
- iii. **Adjusted Electricity Tariff Rates:** Introduce lower electricity tariff rates specifically for EV charging stations to encourage investment and reduce operational costs for EV owners. High electricity tariffs discourage investment in EV infrastructure. Reduced tariffs for EV charging can stimulate investment and make EVs more economically viable for consumers.
- iv. **Integrate EV Policies into Climate Change Strategy:** Incorporate specific EV-related goals and measures into Pakistan's broader climate change policy. Aligning EV policies with the national climate strategy will ensure a cohesive approach to reducing carbon emissions and promoting sustainability across sectors.
- v. **Integrate EV Policy with HEV:** As the EV infrastructure is underdeveloped, the policy should recognise **Hybrid Electric Vehicles (HEVs)** as a transitional solution toward full EV adoption. Therefore, it is recommended to align and integrate the **HEVs** with the **National Electric Vehicle Policy (2025–30)** to support a smoother and more practical transition.
- vi. **Launch Extended Producer Responsibility (EPR) model:** The government must implement the EPR model for all EV manufacturers and assemblers in Pakistan, making them accountable for their products' environmental impact. This includes sustainable design and end-of-life management, such as recalling and recycling used products responsibly.
- vii. **Mandate Local EV Manufacturing Targets:** Mandate that all automotive manufacturers, including both PAMA and Non-PAMA companies, produce at least 10% of their total annual sales as HEVs and EVs. Setting a minimum production target for EVs along with reduced duties and tax rebates will push manufacturers to invest in EV technology and production, accelerating the shift towards electric mobility.

8.2. Recommendations for Automobile Manufacturers

- i. **Monitor and Report Carbon Footprints:** Make it mandatory for automotive manufacturers to mea-

sure and report their carbon footprints across scope 1, 2, and 3 emissions to the Ministry of Climate Change and Environmental Coordination. Regular reporting of carbon emissions will increase accountability and encourage manufacturers to adopt more sustainable practices, contributing to national climate goals. In addition, the automotive companies in Pakistan may follow the Volvo case and set decarbonization goals.

ii. Transitioning to HEVs: In the near term, automotive manufacturers should shift towards **Hybrid Electric Vehicles (HEVs)** to facilitate the green transition of the automotive sector and bridge the gap toward full electrification.

8.3. Recommendations for Financial Institutions

1. **State Bank of Pakistan (SBP):** The SBP should encourage and offer concessionary financial schemes through commercial banks for HEV/EV financing under the Green Banking Guidelines. Ensure that commercial banks recognise HEV/EVs in their car financing schemes with favourable terms. Currently, HEV/EV financing is treated the same as non-EV financing, which does not incentivise consumers. Lower policy rates and favourable financing terms for HEV/EVs will make them more attractive to buyers.
2. **Commercial Banks:** The commercial banks should participate in climate change activities and must commit a certain percentage of vehicle financing for HEV/EV financing. Implement lower interest rates for HEV/EV loans compared to those for ICE vehicles to promote better adoption of electric vehicles. This financial measure will make HEV/EVs more accessible and attractive to potential buyers, encouraging a shift towards cleaner automotive technologies.
3. **Insurance Companies:** The reduced insurance premiums for Hybrid Electric Vehicles (HEVs)/Electric Vehicles (EVs) compared to conventional vehicles are intended to encourage their adoption. Lower insurance costs can provide peace of mind for HEVs/EV owners and reflect the lower operational and maintenance costs associated with electric vehicles, making them a more attractive option for consumers.
4. **Development Agencies:** Development agencies should partner with local firms to improve the overall landscape of electric vehicle adoption through research, policy advocacy, and media campaigns, along with the development of policy frameworks.

9. Conclusion

The automotive sector in Pakistan plays a significant role in contributing to CO₂ emissions across Scope I, II, and III. With Suzuki leading in emissions, followed by Toyota, Honda, and Sazgar, it is evident that production processes, energy usage, and downstream activities all contribute to the sector's environmental footprint. As climate change accelerates, the urgency for sustainable transformation in the automotive industry becomes unavoidable. This requires a collaborative effort from key industry players such as Toyota, Honda, Suzuki, and Sazgar, along with strong regulatory enforcement of the National Electric Vehicle Policy. Learning from global best practices — such as Norway's successful EV transition and Volvo's sustainable production initiatives — can provide Pakistan's automotive sector with a practical roadmap. Furthermore, companies must actively adopt cleaner production machinery, invest in fuel-efficient vehicle technology, and establish robust recycling mechanisms to minimise lifecycle emissions. A holistic and coordinated approach across all scopes of emissions will be critical for driving the automotive sector toward a low-carbon future.

10. Limitations and way forward

Due to data limitations, this study focuses on carbon emissions from selected activities of scope I, II, and III, including company production, processing of sold items, product use, end-of-life disposal, and franchises. With access to more extensive and reliable data, the study can be extrapolated to further activities within these scopes.

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Appendix

1. Assumptions for quantification of emissions at the End-of-Life Treatment of vehicles

Table 6: Emissions based on Material Recycled

S. No	Description	Emission per kg
1	Steel	1.8 kg CO ₂ /kg
2	Plastic	2.5 kg CO ₂ /kg
3	Aluminium	0.5 kg CO ₂ /kg
4	Rubber	1.1 kg CO ₂ /kg
5	Glass	0.4 kg CO ₂ /kg
6	Landfill Disposal	0.2 kg CO ₂ /kg

Table 7: Assumptions of Vehicle Weight Based on Material

Assumptions – Four Wheelers	Assumptions – Three Wheelers
Average weight of vehicle 1,000 to 1,500 kg	Average weight of vehicle: 300 kg to 500 kg
On average, 70% vehicle's material is recyclable	On average, 70%-80% of a vehicle's material is recyclable
90% Iron and Steel used in vehicles is recyclable	90% of Iron and Steel used in vehicles is recyclable
8-10% of the aluminium used in vehicles is recyclable	5-10% of the aluminium used in vehicles is recyclable
10-15% of the plastic used in vehicles is recyclable	10-15% of the plastic used in vehicles is recyclable
10-20% of the Rubber used in vehicles is recyclable	5-8% of rubber is recyclable of the total car's weight
10-20% of the Glass used in vehicles is recyclable	2-3% of glass is recyclable of the total car's weight
Expected life 10 to 15 years	Expected life 7 to 10 years

Methodology

This study employs a holistic methodology to estimate vehicle-related CO₂ emissions by accounting for a wide range of contributing factors. The study's main focus includes quantification of Scope III emissions, in this connection the study have quantified scope three emissions of IMC from three activities i.e. carbon emissions of sold vehicles, carbon emissions due to end-of-life treatment, and carbon emissions of franchises in line with Greenhouse Gas Protocol (GGP) as the framework for reporting GHG emissions. Moreover, the analysis encompasses emissions from three primary sources: (1) vehicle manufacturing, (2) fuel refining and electricity generation, (3) tailpipe emissions resulting from vehicle operation, and

For emissions linked to vehicle manufacturing and energy production (including electricity for electric vehicles and refining processes for conventional fuels), the study draws upon data from the Polestar and Rivian collaborative study. Tailpipe emissions are estimated using paid data sourced from Statista, which includes emission standards associated with different fuel types. Additionally, franchising electricity emission data was sourced from the respective companies.

To capture vehicle market dynamics, production and sales data were collected from annual reports of key automotive manufacturers operating in Pakistan—namely Indus Motors, Honda, Suzuki, and Sazgar. In cases of missing or incomplete data, supplementary information was sourced from the Pakistan Association of Automotive Parts & Accessories Manufacturers (PAAPAM).

The study assumes an average annual vehicle usage of 15,000 kilometres, culminating in a total operational lifespan of approximately 240,000 kilometres—equivalent to an average vehicle lifespan of 16 years.

To support the analysis and ensure data reliability, an extensive review of literature was conducted. This included data from national and international organizations such as the Pakistan Bureau of Statistics, Emissions Database for Global Atmospheric Research (EDGAR), International Energy Agency (IEA), World Bank, United Nations Development Programme (UNDP), European Environmental Agency (EEA), World Resources Institute (WRI), U.S. Transportation Sector GHG Emissions database, Norwegian Electric Vehicle Association, Volvo Sustainability Reports, Alternative Energy Development Board (AEDB), Electromaps, National Electric Power Regulatory Authority (NEPRA), Pakistan State Oil (PSO), Shell Pakistan, and the State Bank of Pakistan (SBP), and several other banks. Additionally, there were a few other national and international institutes with government and non-government affiliations.



The Indus Consortium, founded by Help Foundation, Doaba Foundation and LHDP in 2008, comprises 64 affiliates working with grassroot communities, academic institutions and government bodies.

It addresses climate change, disaster risk and development issues of communities living along the river Indus basin through enhancing their resilience and facilitating them to raise their voices at policymaking platforms.

By bridging the knowledge gap, promoting green & fair financing , RE acceleration, Fossil fuel phaseout & Industrial decarbonization, the Consortium aims to achieve a Just Energy Transition which is both Paris and SDG's aligned.