# Greening Pakistan's Special Economic Zones:

## Technical Roadmap and Policy Lessons from China

June 2025

Lead Authors: Ayesha Naeem, Arfa Ijaz, Ubaid ur Rehman Zia
Special Chapters: Dr. Yixian Sun, Dr. Peng Wang, and Waqas Nazir Awan

A publication of the Sustainable Development Policy Institute (SDPI), Islamabad.



Sustainable Development Policy Institute is an independent, non-profit research institute on sustainable development.

April 2025



Cover & Report Layout: Bilal Safdar (dotadverts.com)

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# Acknowledgments

This report has been developed under the Clean Energy Transition Programme Pakistan, led by the Sustainable Development Policy Institute (SDPI), Islamabad.

The authors, Ayesha Naeem, Engr. Arfa Ijaz, and Engr. Ubaid ur Rehman Zia, examine the strategic role of Special Economic Zones (SEZs) in driving Pakistan's renewable energy transition. The report also includes a Special Chapter on "China's Belt & Road Initiative and Opportunities to Promote GSEZs under CPEC 2.0" by Dr Yixian Sun, Senior Lecturer (Associate Professor) in International Development at the University of Bath.

Reflecting SDPI's enduring commitment to sustainable development, the report places particular emphasis on the transformative potential of SEZs as enablers of clean energy adoption. It offers a combination of evidence-based research, policy analysis, and actionable recommendations aimed at supporting the integration of renewable energy within Pakistan's industrial zones. It draws on extensive stakeholder consultations and policy assessments conducted through SDPI's Network for Clean Energy Transition (NCET) and incorporates analysis of foundational legislative and strategic frameworks, including the Special Economic Zones Act (2012), the Special Economic Zones (Amendment) Act (2016), and the Long-Term Plan for CPEC (2017–2030). These instruments are central to the country's industrial policy and offer critical entry points for greening SEZ infrastructure, boosting energy efficiency, and mainstreaming renewable energy across the national energy mix.

The authors gratefully acknowledge the collaboration and support of the following key institutions, stakeholders, and technical partners whose contributions were instrumental in shaping the findings and recommendations presented herein:

**Key Institutions and Technical Partners**

- Pakistan-China Institute (PCI)
- Ministry of Energy (Power Division), Government of Pakistan
- National Electric Power Regulatory Authority (NEPRA)
- Private Power and Infrastructure Board (PPIB)
- National Transmission and Dispatch Company (NTDC)
- Central Power Purchasing Agency (CPPA-G)
- National Energy Efficiency and Conservation Authority (NEECA), Ministry of Energy (Power Division)
- Board of Investment (BoI)
- Khyber Pakhtunkhwa Economic Zones Development and Management Company (KPEZDMC)

- Special Technology Zones Authority
- Pakistan Economic Forum
- Pakistan Solar Association
- Khyber Pakhtunkhwa Transmission & Grid Company (KPT&GC)

**Subject Experts**

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- Dr Yixian Sun, Associate Professor, University of Bath
- Dr Hassan Daud Butt, Senior Advisor, China Energy Engineering Group Co. Ltd.
- Shahjahan Mirza, Managing Director, Private Power and Infrastructure Board
- Wang Huihui, Chairman, Chinese Chamber of Commerce and Industry
- Yang Guangyuan, Economic Minister, Embassy of People's Republic of China in Pakistan
- Wang Shengjie, Director of the Political Section, Embassy of People's Republic of China in Pakistan
- Dr Zhang Jianyu, Executive Director, BRI Green Development Institute
- Dr Liaqat Ali Shah, Executive Director, Centre of Excellence for China Pakistan Economic Corridor
- N. A. Zuberi, Senior Advisor, China Three Gorges South Asia Investment Limited
- Najia Ubaid, Additional Director, Securities and Exchange Commission of Pakistan
- Shakeel Ahmad Ramay, Chief Executive Officer, Asian Institute of Eco-civilization Research and Development
- Dr Christoph Nedopil Wang, Director, Griffith Asia Institute
- Dr Hina Aslam, Senior Research Fellow, The Australian National University
- Dr Khalid Waleed, Research Fellow, Sustainable Development Policy Institute
- Muhammad Faisal Sharif, Director (Environment), PPIB, Ministry of Energy, Govt of Pakistan and Doctoral Researcher (Climate Sustainability and Energy Transition), University of Bath, UK.
- Dr Fareeha Armughan, Research Fellow & Lead-Centre of Evidence Action Research, Sustainable Development Policy Institute
- Badar Alam, Chief Executive Officer, Policy Research Institute for Equitable Development
- Tanveer Afzal Mirza, Director Operation & Coordination / Company Secretary, United Energy Pakistan ( Ex-BP ), Wind Power Division
- Dr Irfan Ahmed, Energy Consultant

- Basit Ghauri, Manager Research & Networks, Renewables First
- Commodore Dr Imran Ul Haque, Director, Bahria University
- Misbah Khan, Research Associate, Sustainable Development Policy Institute
- Dr Gulshan Irshad, Associate Professor, Arid Agriculture University
- Prof. Dr Muhammad Abid, Director, COMSATS University Islamabad, Wah Campus
- Prof. Dr Saeed Badshah, Dean, Faculty of Engineering and Technology, International Islamic University Islamabad
- Sajjeed Aslam, Partner - ESG & Technology, SpectrEco
- Zeeshan Ahmed, former COO, SkyElectric Pvt. Ltd

The authors express their gratitude to Mr. Sarim Zia, Research Assistant, Energy Unit, SDPI for his insights, the SDPI management team for their unwavering support, especially Executive Director Dr Abid Qaiyum Suleri, and Deputy Executive Director (Research) Dr Sajid Amin Javed. Special recognition is extended to the Advocacy team (Moazzam Sharif Bhatti, Ali Jabir, Syed Asim Sherazi, Sohail Abbas, Yahya Gulraiz and Abid Rashid), MIS team (Adnan Hassan and Hamza Baig), and Administration Unit (Nisar Ahmed and Imran Khan) for their invaluable contributions throughout the development and dissemination of this report.

The report has been edited by Sarah Siddiq for technical accuracy, structural coherence and academic quality.

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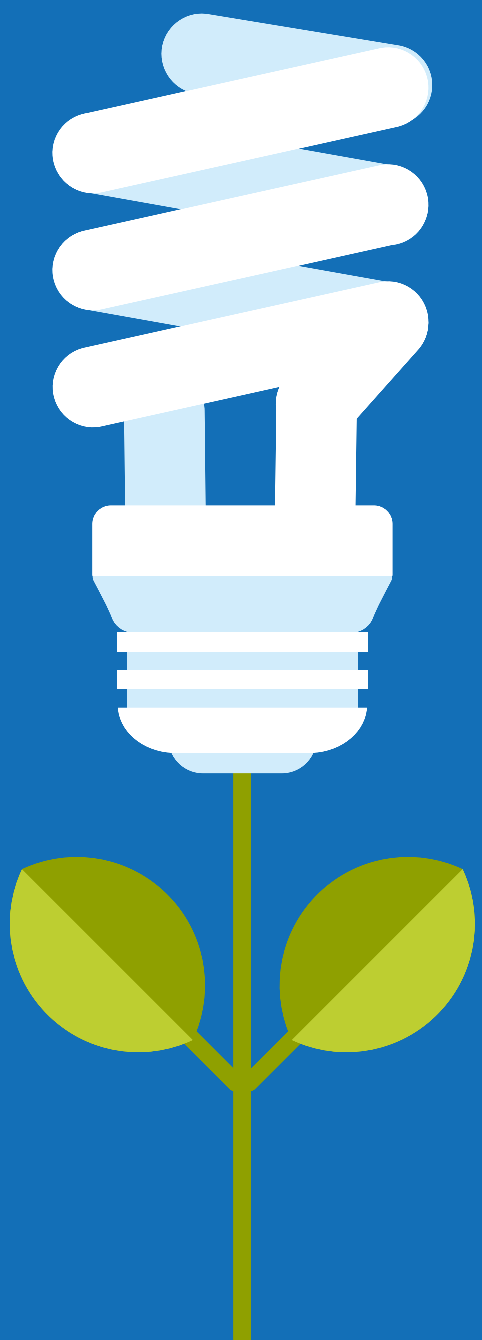
# Abbreviations & Acronyms

| | |
|---|---|
| **ADB** | Asian Development Bank |
| **AEDB** | Alternative Energy Development Board (Pakistan) |
| **AEI** | American Enterprise Institute |
| **AEPZ** | Aqaba Export Processing Zone (Jordan) |
| **AQI** | Air Quality Index |
| **ASEAN** | Association of Southeast Asian Nations |
| **AWP** | Applied Working Paper (Harvard Kennedy School series) |
| **B-SEZA** | Balochistan Economic Zones Authority |
| **BESS** | Battery-Energy Storage System |
| **BoA** | Board of Approval (for SEZs, Pakistan) |
| **BoI / BOI** | Board of Investment (Pakistan) |
| **BRI / B&R** | Belt and Road Initiative (China) |
| **BRIGC** | BRI International Green Development Coalition |
| **BRT** | Bus Rapid Transit |
| **CBAM** | Carbon Border Adjustment Mechanism (EU) |
| **CCoE** | Cabinet Committee on Energy (Pakistan) |
| **CEDIP** | Circular Economy Demonstration Industrial Parks |
| **CDM** | Clean Development Mechanism (Kyoto Protocol) |
| **C&D** | Construction & Demolition |
| **CPEC** | China-Pakistan Economic Corridor |
| **CPPA-G** | Central Power Purchasing Agency – Guaranteed (Pakistan) |
| **CTIP** | Circular Transformation of Industrial Parks (China) |
| **DISCO** | Distribution Company (electric power) |
| **EIA** | Environmental Impact Assessment |
| **EIP** | Eco-Industrial Park (China) |
| **EPZ** | Export Processing Zone |
| **EV** | Electric Vehicle |
| **FDI** | Foreign Direct Investment |
| **FYP** | Five-Year Plan (China) |
| **GASEZ** | Global Alliance of Special Economic Zones |
| **GBA** | Guangdong-Hong Kong-Macau Greater Bay Area |
| **GDP** | Gross Domestic Product |
| **GEIPP** | Global Eco-Industrial Parks Programme (UNIDO) |

| | |
|---|---|
| **GHG** | Greenhouse Gas |
| **GIS** | Geographic Information System |
| **GoP** | Government of Pakistan |
| **GPIPC** | Green Partnership of Industrial Parks China |
| **GSEZ / GSEZs** | Green Special Economic Zone(s) |
| **GW** | Gigawatts |
| **HVAC** | Heating, Ventilation and Air-Conditioning |
| **ICBC** | Industrial and Commercial Bank of China |
| **IEA** | International Energy Agency |
| **IED** | Independent Evaluation Department (ADB) |
| **IGC** | International Growth Centre |
| **IMF** | International Monetary Fund |
| **IPP** | Independent Power Producer |
| **IRENA** | International Renewable Energy Agency |
| **ISO** | International Organization for Standardization (ISO 14001, etc.) |
| **KCCI** | Karachi Chamber of Commerce & Industry |
| **KPEZDMC** | Khyber Pakhtunkhwa Economic Zones Development & Management Company |
| **KWSB** | Karachi Water and Sewerage Board |
| **LCIP** | Low-Carbon Industrial Park (China) |
| **LNG** | Liquefied Natural Gas |
| **MITT** | Ministry of Industry and Information Technology (China) |
| **MoF** | Ministry of Finance (Pakistan/China – context dependent) |
| **MoIP** | Ministry of Industries & Production (Pakistan) |
| **MoCC&EC** | Ministry of Climate Change and Environmental Coordination (Pakistan) |
| **MoPD&SI** | Ministry of Planning Development & Special Initiatives (Pakistan) |
| **MoITT** | Ministry of Information Technology and Telecommunication (Pakistan) |
| **MW** | Megawatt |
| **NDCs** | Nationally Determined Contributions |
| **NDRC** | National Development & Reform Commission (China) |
| **NCET** | Network for Clean Energy Transition (SDPI) |
| **NEECA** | National Energy Efficiency & Conservation Authority (Pakistan) |
| **NEPRA** | National Electric Power Regulatory Authority (Pakistan) |
| **NOCs** | No-Objection Certificates |
| **NTDC** | National Transmission & Dispatch Company (Pakistan) |
| **OSS** | One-Stop Service |
| **PACRA** | Pakistan Credit Rating Agency |

| | |
|---|---|
| **PBM** | Power-Battery Manufacturing |
| **PBS** | Pakistan Bureau of Statistics |
| **PEZA** | Philippine Economic Zone Authority |
| **PHEV** | Plug-in Hybrid Electric Vehicle |
| **PPIB** | Private Power & Infrastructure Board (Pakistan) |
| **PPP** | Public-Private Partnership |
| **PQEPC** | Port Qasim Electric Power Company |
| **PSDP** | Public Sector Development Programme (Pakistan) |
| **PSM** | Pakistan Steel Mills |
| **PV** | Photovoltaic |
| **R&D** | Research & Development |
| **RE** | Renewable Energy |
| **REIPPP** | Renewable Energy Independent Power Producer Programme |
| **RR** | Rating Report (PACRA series) |
| **SCP** | Supply-Chain Partnership |
| **SDGs** | Sustainable Development Goals |
| **SDPI** | Sustainable Development Policy Institute |
| **SECP** | Securities & Exchange Commission of Pakistan |
| **SEIA** | Solar Energy Industries Association (US) |
| **SEMC / SEZMC** | Sindh Economic Zones Management Company |
| **SEZ / SEZs** | Special Economic Zone(s) |
| **SIFC** | Special Investment Facilitation Council (Pakistan) |
| **SLM** | Service Long March |
| **SME** | Small & Medium-sized Enterprise |
| **SOE** | State-Owned Enterprise |
| **STZA** | Special Technology Zones Authority (Pakistan) |
| **T&D** | Transmission & Distribution |
| **UNCTAD** | United Nations Conference on Trade & Development |
| **UNDP** | United Nations Development Programme |
| **UNIDO** | United Nations Industrial Development Organization |
| **USD / US$** | United States Dollar |
| **VRE** | Variable Renewable Energy |
| **WEF** | World Economic Forum |
| **WIR** | World Investment Report (UNCTAD) |
| **WTI** | West Texas Intermediate |

# Executive Summary



# Executive Summary

The world faces increasing pressure to transition toward low-carbon economies while still achieving high levels of industrial and economic development. In 2024, global investments in low-carbon energy reached a record $2.1 trillion, reflecting a growing commitment to sustainability. Green Special Economic Zones (GSEZs) can resolve that tension, but only when planners balance environmental and economic requirements. As countries like China have demonstrated, GSEZs have the potential to drive industrialization, attract Foreign Direct Investment (FDI), and create jobs, without compromising the environment.

China's experience with Special Economic Zones (SEZs) provides valuable insights into the potential of GSEZs. The country's journey with SEZs began in 1980 with the establishment of zones like Shenzhen. China has since grown the programme to more than 2,500 sites, 552 of them at state level. These zones contributed to the country's economic transformation, making China the world's second-largest economy. As of 2024, China's SEZs account for approximately 22% of the country's GDP, 45% of its FDI, and 60% of its total exports. This transition, while initially focused on industrial growth, has increasingly integrated green practices, creating a model for sustainable industrialization.

For developing nations like Pakistan, this presents a unique opportunity to leapfrog over traditional industrialization models that prioritize economic gains at the expense of the environment. Pakistan, with its rapidly growing population of over 240 million, faces pressing environmental challenges, including air pollution and water scarcity. With industrialization on the rise, the establishment of GSEZs could offer Pakistan a path toward sustainable growth. This report aims to analyze China's success with SEZs, particularly in its integration of green technologies, and explore how such practices can be tailored to Pakistan's needs, ensuring that economic development goes hand in hand with environmental protection.

### Analyzing China's GSEZs: Insights from the Study

This report presents a comprehensive, data-driven analysis of China's experience with SEZs, with a particular emphasis on the evolution and integration of GSEZs. It explores how China has embedded sustainability into its broader industrial growth strategy and identifies key lessons relevant to countries like Pakistan. Tracing the development of SEZs from their inception in the 1980s, the report highlights how these zones became central to China's transformation from an agrarian economy into a global industrial powerhouse. Today, SEZs employ over 30 million people and contribute significantly to national economic output. Over time, the integration of green technologies has enabled many of these zones to become models of sustainable industrial development. By 2020, China had reduced its carbon intensity by 48 % from 2005 levels: a milestone largely attributed to clean technologies deployed within SEZs.

A central pillar of China's success has been the strength of its policy framework. The "1+N" strategy, for instance, has provided a structured roadmap for achieving the country's 2030 and 2060 climate targets. In parallel, the government has actively promoted green innovation, channeling over $100 billion into renewable energy sectors by 2024, including solar power and electric vehicles (EVs). Drawing on China's experience, the report identifies several critical challenges in the development of GSEZs, particularly regulatory overlap and weak local enforcement capacity. Despite strong central coordination through the NDRC and integration into Five-Year Plans, implementation has often been hindered by fragmented mandates across multiple agencies, leading to inconsistent policy enforcement and delays in meeting environmental targets. Local governments, especially in smaller cities, frequently lack the expertise and financial resources to enforce green standards. Nonetheless, provinces like Guangdong illustrate how strong provincial leadership, targeted investments, and public-private partnerships can drive green transformation. For developing countries like Pakistan, GSEZs present an opportunity to accelerate industrialisation through a green lens. By prioritizing low-carbon industries and sustainable infrastructure, Pakistan could enhance FDI, improve energy efficiency, and stimulate job creation.

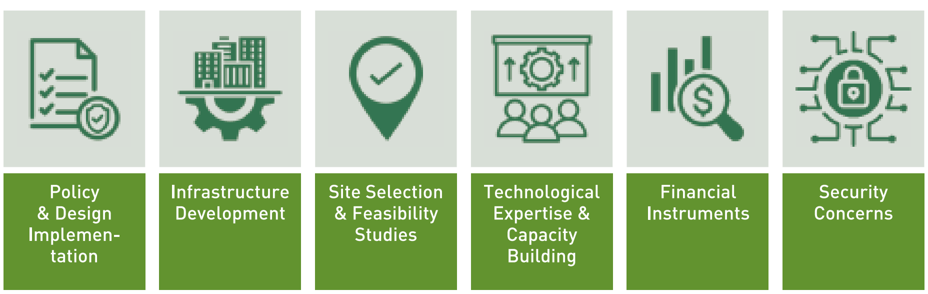



**Figure 1:** Enabling Components for GSEZs Development in Pakistan

## Key Findings and Implications

Pakistan has the potential to transition its SEZs into a hub for relocation of renewable energy manufacturing industries but faces competition from Association of Southeast Asian Nations (ASEAN) nations and countries which China is relocating to. Shifting Belt and Road Initiative (BRI) priorities and changes in China's economy have led to a sharp drop in Chinese investment, making it essential for Pakistan to sharpen its competitiveness. Improving competitiveness involves strategic efforts in policy design, infrastructure development, and facilitating green finance markets. Successfully positioning SEZs as preferred investment locations is crucial for capturing this opportunity.


**Figure 2:** Opportunities for Advancing GSEZs Development

Pakistan's SEZs continue to face systemic challenges stemming from inconsistent policies, weak institutional coordination, overlapping mandates, and a fragmented tax regime. These governance shortcomings, coupled with chronic deficiencies in infrastructure, utilities, and service delivery, have significantly hampered the rollout of SEZs across the country. To address these constraints, Pakistan must prioritize the appointment of qualified leadership, establish transparent accountability mechanisms, and design targeted policy packages that incentivize green industrialisation.

Strengthening stakeholder engagement, enhancing regulatory autonomy, and aligning fiscal incentives with sustainability goals are also critical. The implementation of the "One Stop Service Act" and the promotion of robust public-private collaboration are essential steps toward unlocking the investment potential of SEZs. In parallel, the establishment of a dedicated SEZ authority and the development of transparent criteria for selecting qualified developers would streamline operations and improve investor confidence. SEZ site selection should prioritize strategic and economic advantages, with comprehensive site analysis and feasibility studies. Financing GSEZs will require (1) rigorous feasibility studies, (2) benchmarking against ASEAN competitors, (3) technology-transfer partnerships, (4) renewable-energy skills training, and (5) a phased green-transition plan for CPEC projects.

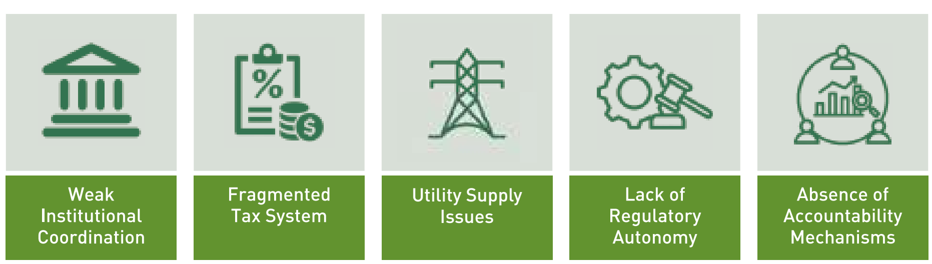
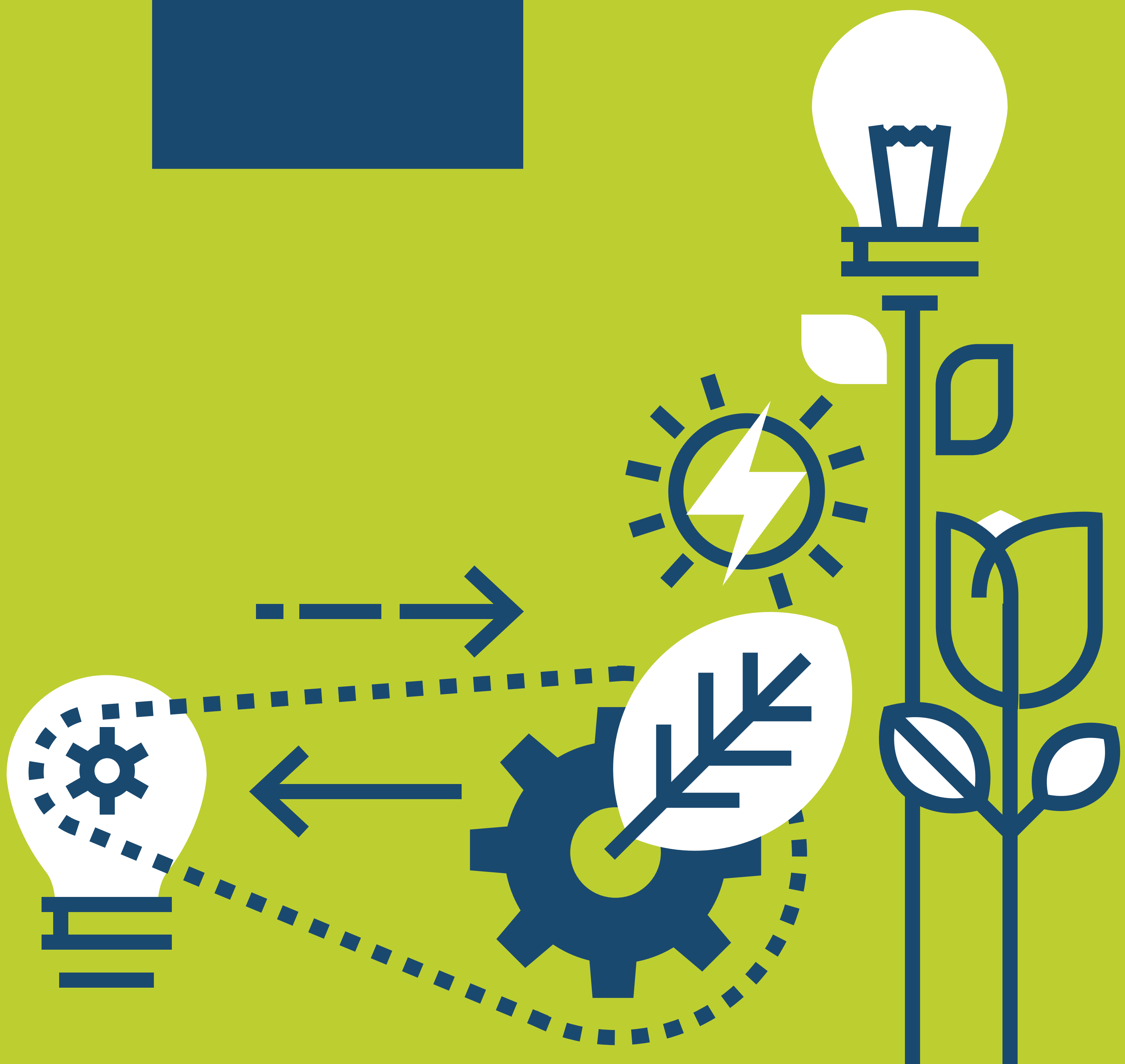



**Figure 3:** Challenges in Developing GSEZs in Pakistan

China's experience demonstrates that economic growth and environmental sustainability can be pursued in tandem. By adopting strategic policy frameworks, investing in green technologies, and fostering effective PPPs, Pakistan can similarly position its SEZs as catalysts for sustainable industrialisation. While Pakistan faces distinct developmental challenges, this report identifies actionable pathways to address these constraints through improved governance, regulatory reform, and targeted infrastructure development. The GSEZ model offers a viable route for Pakistan to align industrial expansion with environmental stewardship, attract FDI, generate employment, and build climate resilience. Ensuring that SEZ development is inclusive and gender-responsive, particularly by addressing the needs of women workers, smallholder farmers, and vulnerable communities, will be vital to achieving equitable and sustainable outcomes. The successful implementation of GSEZs in Pakistan is not merely aspirational: it is imperative. Advancing a GSEZ agenda is essential to securing the country's long-term economic prosperity and ensuring a sustainable future for generations to come.

# 01

## Introduction



# Chapter 1 - Introduction

Building on the high-level findings previewed in the Executive Summary, this chapter positions Pakistan's Special Economic Zones (SEZs) within the broader debate on sustainable industrialization and sets out the report's objectives, methodology and analytical lens.

## 1.1 Background

Globally, SEZs have been successful in promoting regional development and economic prosperity, with many countries experiencing significant positive spillover effects outside the zones. Pakistan, through regional initiatives such as the China-Pakistan Economic Corridor (CPEC), is expanding its SEZ network, hoping to replicate the successes seen in other economies and accelerate economic growth. The nine priority SEZs planned under CPEC are designed to accelerate industrial development, enhance export potential, and facilitate technological advancement. These zones represent a strategic opportunity for Pakistan to align industrial growth with its renewable energy ambitions. As CPEC enters its second phase, with a stronger emphasis on sustainability and green growth, SEZs offer a critical platform for integrating clean energy technologies. By embedding renewable solutions such as solar and wind power into their infrastructure, these zones can reduce dependence on conventional energy sources and contribute meaningfully to Pakistan's energy security and environmental sustainability.

To fully realize the potential of GSEZs, Pakistan can draw important lessons from China's experience. Catalyzed by international climate commitments such as the Kyoto Protocol (2005), China spent the subsequent two decades developing an extensive network of GSEZs, anchoring its role as a global industrial leader while advancing its environmental agenda. These zones integrate renewable energy, energy-efficient technologies, and sustainable practices, offering a replicable model for developing countries. For Pakistan, localizing renewable energy manufacturing and embedding green practices within SEZs presents a unique opportunity to leverage CPEC for achieving national energy transition goals. Such a strategy could reduce dependence on imported fuels, foster technological innovation, and support climate resilience.

## 1.2 Scope and Objectives

This report analyses Pakistan's SEZ experience and gauges the potential for greening those zones under CPEC, with a focus on regulation, economic feasibility and sustainability opportunities. It explores the integration of renewable energy and the localization of green technologies, drawing lessons from international models, including China's GSEZs. Specifically, it had the following objectives:

1. Analyze the specific challenges and opportunities in developing GSEZs within the framework of CPEC, given Pakistan's historical administrative hurdles and institutional limitations
2. Evaluate the critical factors that have contributed to the success of China's GSEZ initiatives, such as policy frameworks, government support, incentives, and innovation in green technologies and their applicability to Pakistan's context.
3. Provide actionable recommendations for localizing renewable energy manufacturing in SEZs, contributing to Pakistan's green energy transition and climate goals.

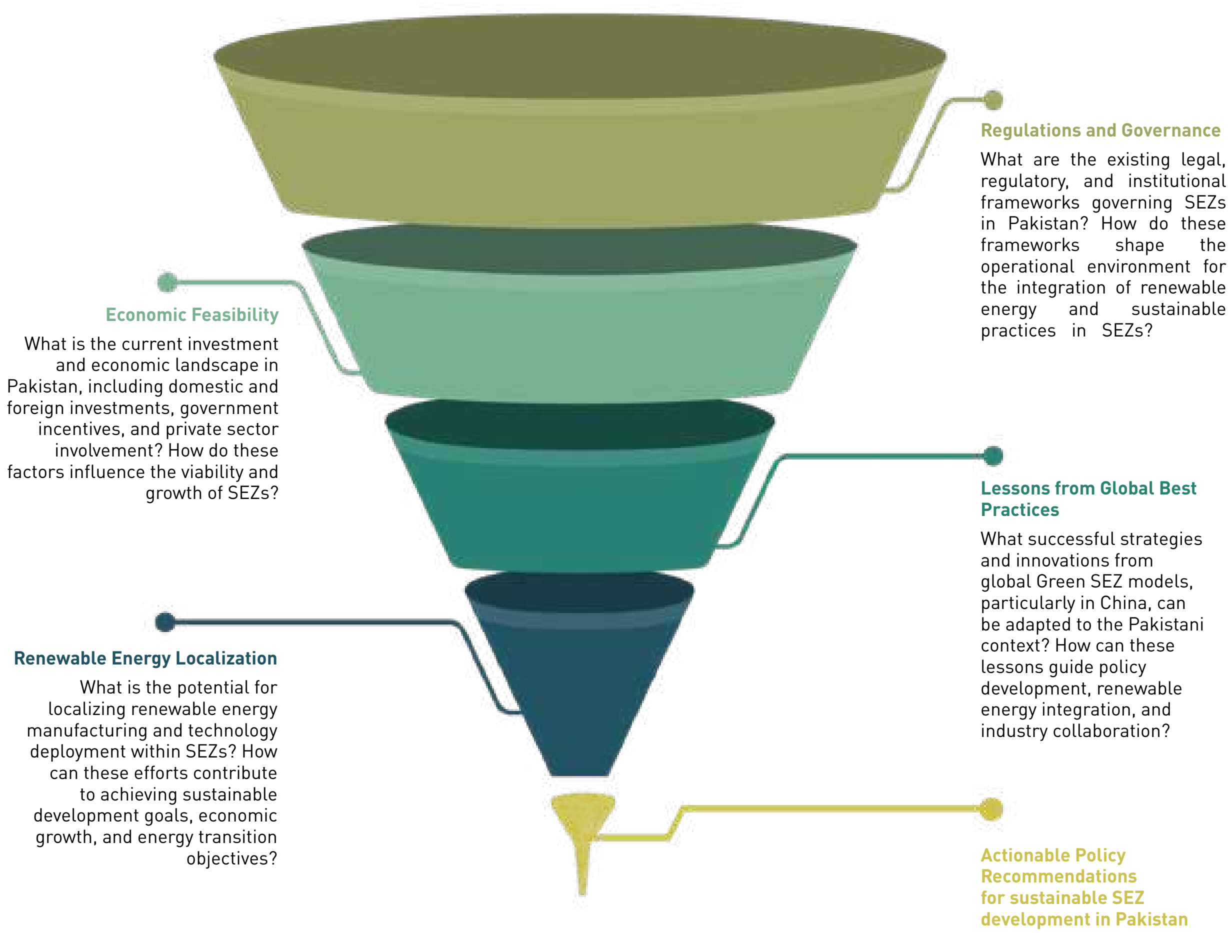



**Figure 1.1**: Report's Conceptual and Assessment Framework

## 1.3 Methodology

The methodology is designed to be both sequential and component-based. The study uses a mixed-methods design, desktop analysis plus expert interviews, to deliver an evidence-based assessment of Pakistan's prospects for developing GSEZs. The methodology follows a four-pillar framework: Regulations and Governance, Economic Feasibility, Global Best Practices, and Renewable-Energy Localization. Equity and inclusion, particularly gender-responsive planning, labor considerations, and impacts on local communities, were also integrated as a cross-cutting dimension across all four pillars.

A critical component of this research is the evaluation of existing legal, regulatory, and institutional frameworks governing SEZs in Pakistan. The review covers the "SEZ Act 2012" and its amendments, implementing rules, sole-enterprise regulations, the draft "One-Stop Service Bill", incentive packages and governance structures to see how they affect renewable energy integration. It also maps Pakistan's investment landscape, drawing on the Economic Survey, State Bank data, World Bank market analyses and existing incentive schemes, to gauge the competitiveness of GSEZs under CPEC.

Drawing from international experiences, particularly China's GSEZ models, the authors review academic studies, international reports, and policy documents from global SEZs to identify key strategies that have contributed to their success. These include policy frameworks, government support mechanisms, incentives, and technological innovations that can inform Pakistan's approach. Furthermore, they analyze the potential for localizing renewable energy manufacturing within Pakistan's SEZs by reviewing Pakistan's renewable energy resource potential and the current state of renewable energy technologies. Data sources included Pakistan's Alternative Energy Development Board (AEDB) reports, National Electric Power Regulatory Authority (NEPRA), National Energy Efficiency and Conservation Authority (NEECA), and Private Power and Infrastructure Board (PPIB), World Economic Forum publications, market reports and industry studies including supply chain dynamics, cost structures, and market demand. In addition, the team held consultations with renewable energy experts, SEZ developers, CPEC officials, China-Pakistan research centres, academics and private-sector stakeholders to identify localization challenges and opportunities.

02

# SEZs in Pakistan: Framework and Development

# Chapter 2 - SEZs in Pakistan: Framework and Development

With the conceptual ground now laid, this chapter turns inward to trace Pakistan's own SEZ journey to examine the policies, performance and institutional architecture that currently shape industrial growth.

## 2.1 Rationale for SEZs

Industrial growth is widely seen as a prerequisite for sustained GDP expansion and overall national development. However, Pakistan's economy has faced persistent challenges over the years, from a dwindling industrial base to structural inefficiencies that have compromised sustainable growth. PBS data show GDP rose just 2.4 % in FY 2023-24, below the 3.5 % target, largely because industrial output sagged (Ansari, 2024). Industrial GDP shrank 1.1 % in FY 2024, better than the previous year's 3.7 % slide, but output remained weak amid tight monetary policy, higher input costs and fiscal consolidation (Ministry of Finance, Government of Pakistan, 2024).

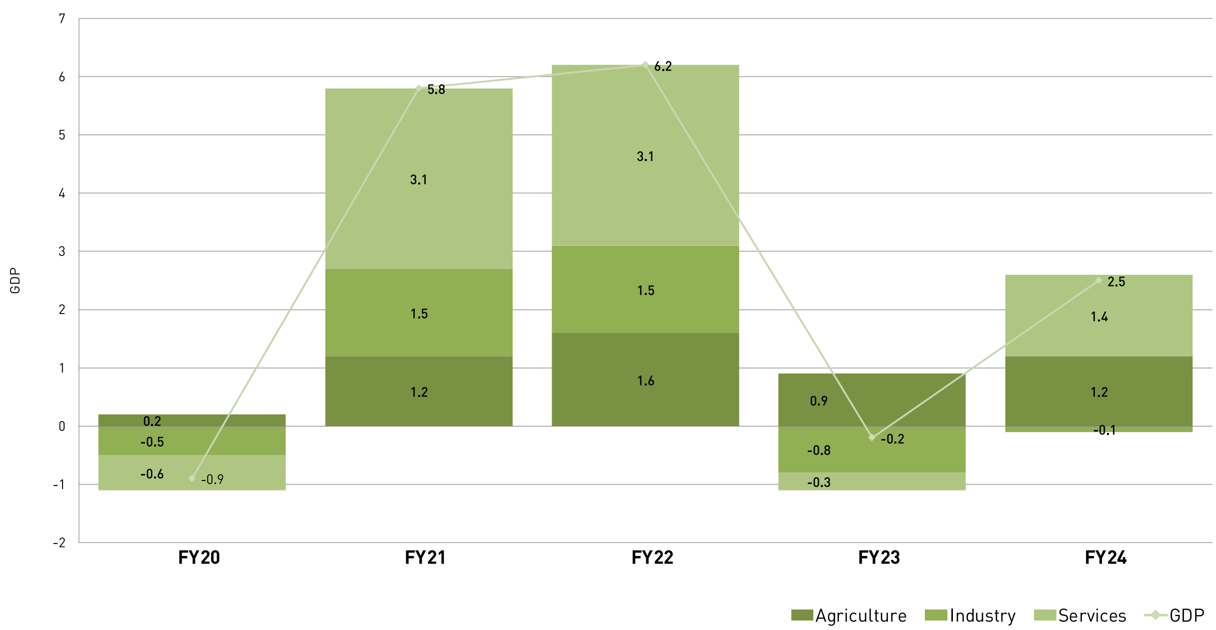



**Figure 2.1:** Sectoral Contribution to GDP Growth - Supply Side
Source: Pakistan Bureau of Statistics

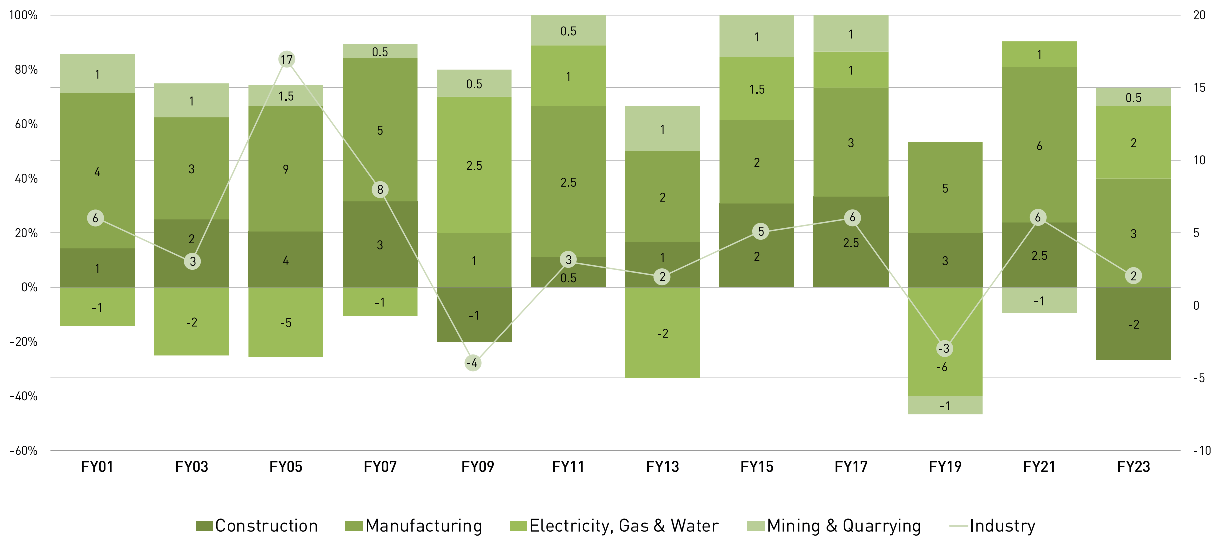



**Figure 2.2:** Sectoral Contribution to Growth in Industry
Source: Pakistan Bureau of Statistics

By June 2024, the investment-to-GDP ratio had fallen to 13.1 %, its lowest since 1974, and private investment to 8.7 %, reinforcing a long-running downward trend (Rana, 2024a). Structural inefficiencies, scant foreign capital and fading industrial growth have dogged Pakistan for decades. Investment has trended downward for decades and now trails levels in peer emerging economies. Comparisons with India and Bangladesh underscore Pakistan's weaker revenue-to-GDP, savings and investment ratios. In 2023, Bangladesh's tax-to-GDP ratio was under 10 % but investment-to-GDP was 31 % compared to Pakistan's 13.6 %. India's tax-to-GDP ratio was 11.2 % but the investment-to-GDP ratio was 34 % (Nazar, 2024).

Aware of these shortcomings, the Government of Pakistan (GoP) launched several reform packages focused on industrialisation and investment. One such reform was the drafting of the Tenth Five-Year Plan (2010-2015), which aimed to transform Pakistan from an agriculture-based economy into an industrialized nation in the medium and long term (Dawn, 2009). Although the Plan never materialized, the government did roll out SEZs as a strategic alternative.

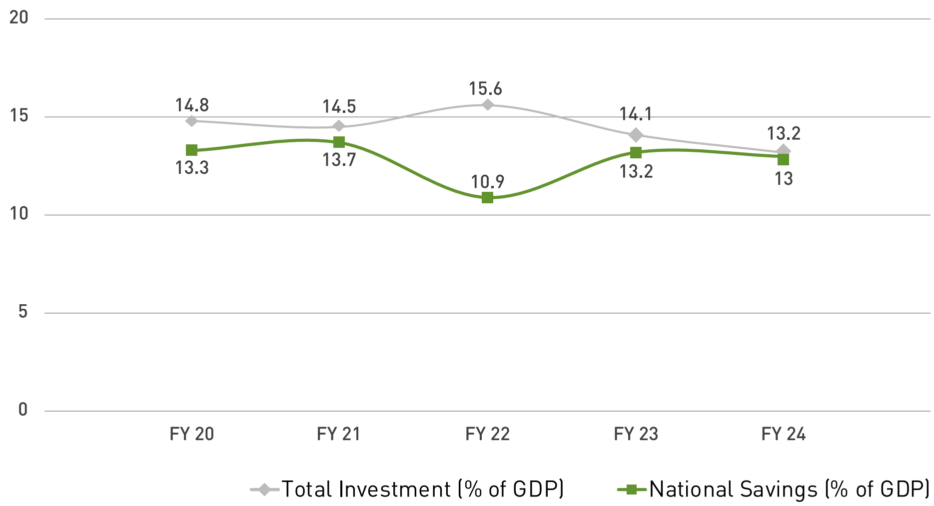



**Figure 2.3:** Pakistan's Saving Investment Gap (FY 2020-24)
Source: Pakistan Bureau of Statistics


**Figure 2.4:** Comparative Economic Indicators: Pakistan, Bangladesh, India (2023)
Source: Compiled by Authors

Introduced in 2012 in Pakistan, SEZs are designated geographical areas where economic regulations differ from those in the rest of the country. Designed as a targeted intervention to address enduring economic issues, these zones aim to stimulate industrial development by attracting FDI, promoting exports, and enhancing growth. To achieve this, SEZs offer a range of incentives to businesses within their boundaries, including tax breaks, relaxed regulatory frameworks, and improved infrastructure to create an ideal business environment for economic activity.

Worldwide, economic zones have progressed from early free ports to today's SEZs geared toward industrial innovation. China exemplifies the transformative potential of this model. Starting in 1980 with four zones in Guangdong and Fujian provinces, China expanded to include Economic and Technical Development Zones (ETDZs) and High-tech Industrial Development Zones (HIDZs). Over the 15 years since HIDZs were formed, they generated half of China's high-tech gross industrial output and one-third of its high-tech exports, while ETDZs contributed another one-third to both high-tech industrial output and exports. According to the World Bank, as of 2007, SEZs in China accounted for 22% of China's GDP, 46% of total national FDI, and 60% of exports (Zeng, 2012).

China's model inspired a global proliferation of SEZs, particularly in developing countries. According to UNCTAD, the number of SEZs increased dramatically from 176 in 1986 to over 5,400 by 2019, making them a popular tool for economic reform and industrial experimentation. Research demonstrates that SEZs have a strong positive impact on FDI, attracting new greenfield investments while not significantly crowding out domestic investment. For instance, in the Philippines, the share of FDI flows directed to SEZs increased significantly from 30% in 1997 to over 81% in 2000. This trend is evident in many countries, with SEZs attracting a substantial portion of total FDI: over 80% in China, nearly 90% in Malaysia, and between 60 and 80% in Vietnam (UNCTAD, 2019).

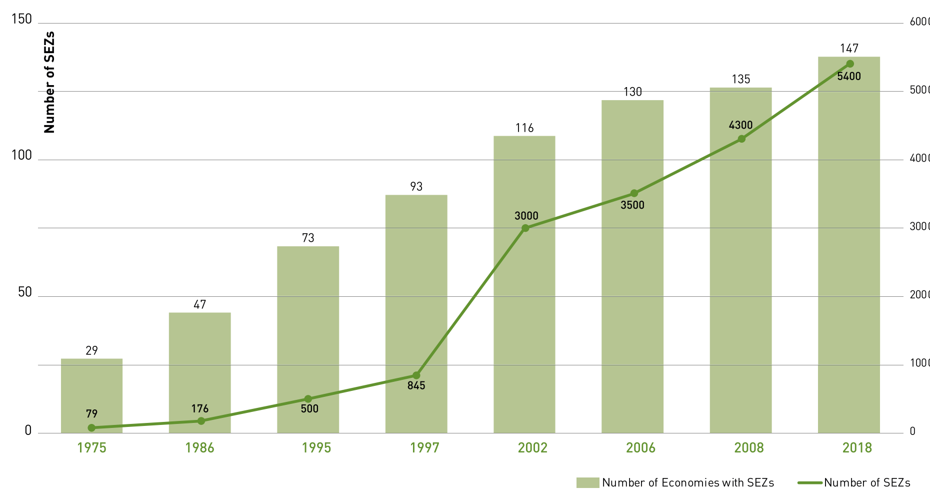



**Figure 2.5:** Historical Trend of SEZs (Countries & Number of SEZs)
Source: UNCTAD, 2019

One of the primary objectives of SEZ development is job creation. According to UNCTAD (2019), globally, an estimated 90-100 million people are directly employed in SEZs and free-zone programs, with the potential for a substantial indirect employment impact within individual countries. In the United States, Foreign Trade Zones (FTZs) have experienced an average job creation rate of over 7% per year since 2013, exceeding the broader economy's rate of less than 2%. In Tunisia, employment in SEZs has grown steadily, reaching 8.7% of the workforce in 2019. Ethiopia has successfully created nearly 50,000 jobs through its SEZs, with a high proportion of these jobs going to women. Similar positive employment impacts are observed in Kenya, Colombia, and the Dominican Republic, where SEZs have generated significant numbers of both direct and indirect jobs.

## 2.2 Pakistan's SEZs Journey

The concept of creating delimited industrial estates in Pakistan dates back to the First Five-Year Plan (1955–60), which sought to promote industrialization through designated areas with infrastructure like roads, utilities, and rail links (Ahmad, 2024). By the 1970s, provincial governments had started establishing Industrial Estates (IEs) aimed at developing clusters of small and cottage industries. However, many IEs struggled due to inadequate infrastructure, poor planning, location disadvantages, and speculative real estate activities, which discouraged industrialization.

To boost export-led growth, Pakistan introduced Export Processing Zones (EPZs) in 1980. These zones offered incentives like duty-free imports, tax exemptions, and relaxed foreign exchange regulations. Despite the establishment of seven EPZs, including Karachi EPZ, performance remained underwhelming compared to regional counterparts like Bangladesh, where EPZs contributed significantly to exports and employment.

In Pakistan, the economic contribution of EPZs has been less than in neighboring countries and has done little to enhance export performance (SBP, 2021). In 2012-13 Bangladesh's EPZs far out-performed Pakistan's, posting $4.9 billion in exports, $329 million in new investment and about 34 000 jobs. In contrast, Pakistan's EPZs in 2011-12 recorded only $485 million in exports, $516 million in investment, and a mere 3,500 jobs (World Bank, 2020). Moreover, only between 2009 and 2019, Bangladesh's EPZs exported $60.1 billion, six times the total exports of Pakistan's EPZs over four decades since their inception in 1980 till 2021 (SBP, 2021).

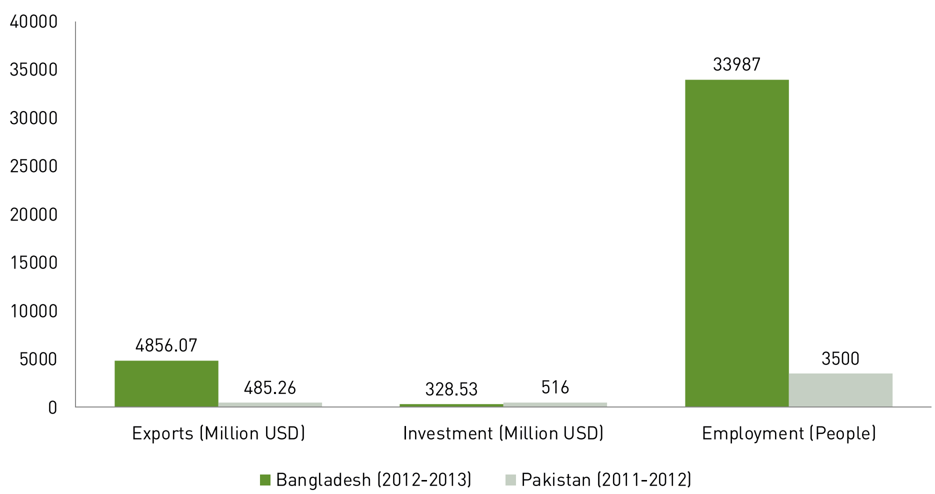



**Figure 2.6:** EPZ Performance: Bangladesh vs Pakistan (2011-2013)
Source: Developed by authors using data sourced from World Bank

According to a study by Frick et al. (2018), covering the period 2007–2012, Pakistan was the only country where economic zones experienced absolute negative growth. In contrast, zones in Jordan, Korea, Lesotho, Malaysia, and South Africa remained relatively stable, and the remaining countries demonstrated a strong increase in economic activity within their zones. Figure 2.7 reinforces the point, comparing zone growth across 22 developing economies.

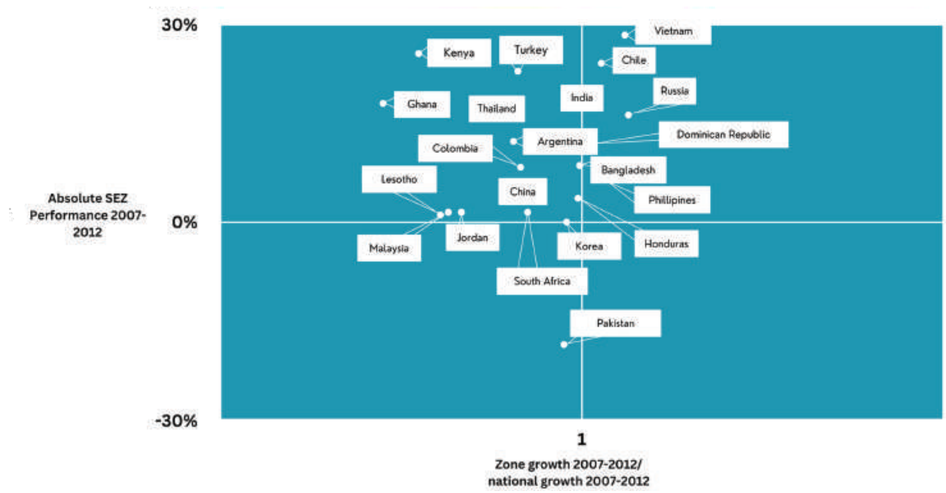



**Figure 2.7:** Average SEZ Growth Per Country: Absolute And Relative To National Growth, 2007-12
Source: Frick et al. (2018)

## 2.3 Regulatory Oversight and Timelines

Aware of the limits of industrial estates and EPZs, Pakistan embraced the SEZ model in 2012. This initiative was formalized with the passage of the "Special Economic Zone Act 2012", which provides a comprehensive legal and governing framework, enabling both federal and provincial governments to establish SEZs either independently or in collaboration with private entities through various models, including PPPs. The Act also permits recognition of privately developed economic zones as SEZs, ensuring they are governed under its regulatory framework.

To facilitate industrialization, trade, and investment, the Act categorizes economic zones into eight main types based on the nature of economic activities they support, ranging from export-focused manufacturing to regional development initiatives (refer to Annex A). The Act aims to attract domestic and international investors by offering fiscal and allied incentives to developers and zone enterprises, with its primary objectives including promoting industrial infrastructure development, export growth, import substitution, technology transfer, and employment generation.

The original Act placed SEZs outside the customs territory, so domestic buyers had to pay import duties and taxes on goods made inside the zones. This policy limited the attractiveness of SEZs for local and foreign investors, particularly those aiming to cater to the domestic market. Recognizing these limitations, the Act was amended in 2015 to bring SEZs within the customs territory of Pakistan, thereby removing the tax burden on domestic buyers and improving the zones' appeal. Regulation has kept evolving, with new policies introduced to match changing industrial and investor needs. Key policies introduced include the "Sole Enterprise SEZ Regulations", the "Zone Enterprise Admission and Sale, Lease, and Sub-Lease Regulations", and the "SEZ Management Information System (MIS) Module" (refer to Annex B for key initiatives undertaken by BoI). To further streamline the SEZ framework, BOI recently approved a new Land Lease Policy and an accompanying action plan aimed at resolving longstanding challenges related to industrial land allocation and development (Ahmed 2025). These policies aim to facilitate various investment aspects, including single-entity investment, land allocation, and transactions within SEZs, while enhancing operational efficiency, data transparency, and oversight. A comprehensive survey of 35 zones was also completed, identifying key bottlenecks such as infrastructure gaps, utility availability, and plot possession issues.

## 2.4 Number and Types of SEZs in Pakistan

There are currently 35 notified SEZs in Pakistan, an increase from 21 notified SEZs in 2021. Of these, 13 previously existed as Industrial Estates and Industrial Parks (SBP, 2021). A detailed breakdown of the 21 SEZs notified until 2021, including their location, area, and business activity, is provided in Annex C. Together, these SEZs covered more than 15,000 acres with investments of Rs.634 billion, 44 % of which is FDI ($1.73 billion) (Pakistan Economic Survey, 2021).

Since 2022, Pakistan has notified 14 additional SEZs, bringing the total to 35. Provincially, Punjab hosts 18 SEZs, Sindh has 9, Balochistan 3, Khyber Pakhtunkhwa 4, and Islamabad 1. The six SEZs approved in 2022 are expected to attract over $540 million in infrastructure investment (Khan, 2022). Eight SEZs approved in 2023 are projected to generate Rs 507.13 billion in investment and create 74,000 direct employment opportunities (Business Recorder, 2023).

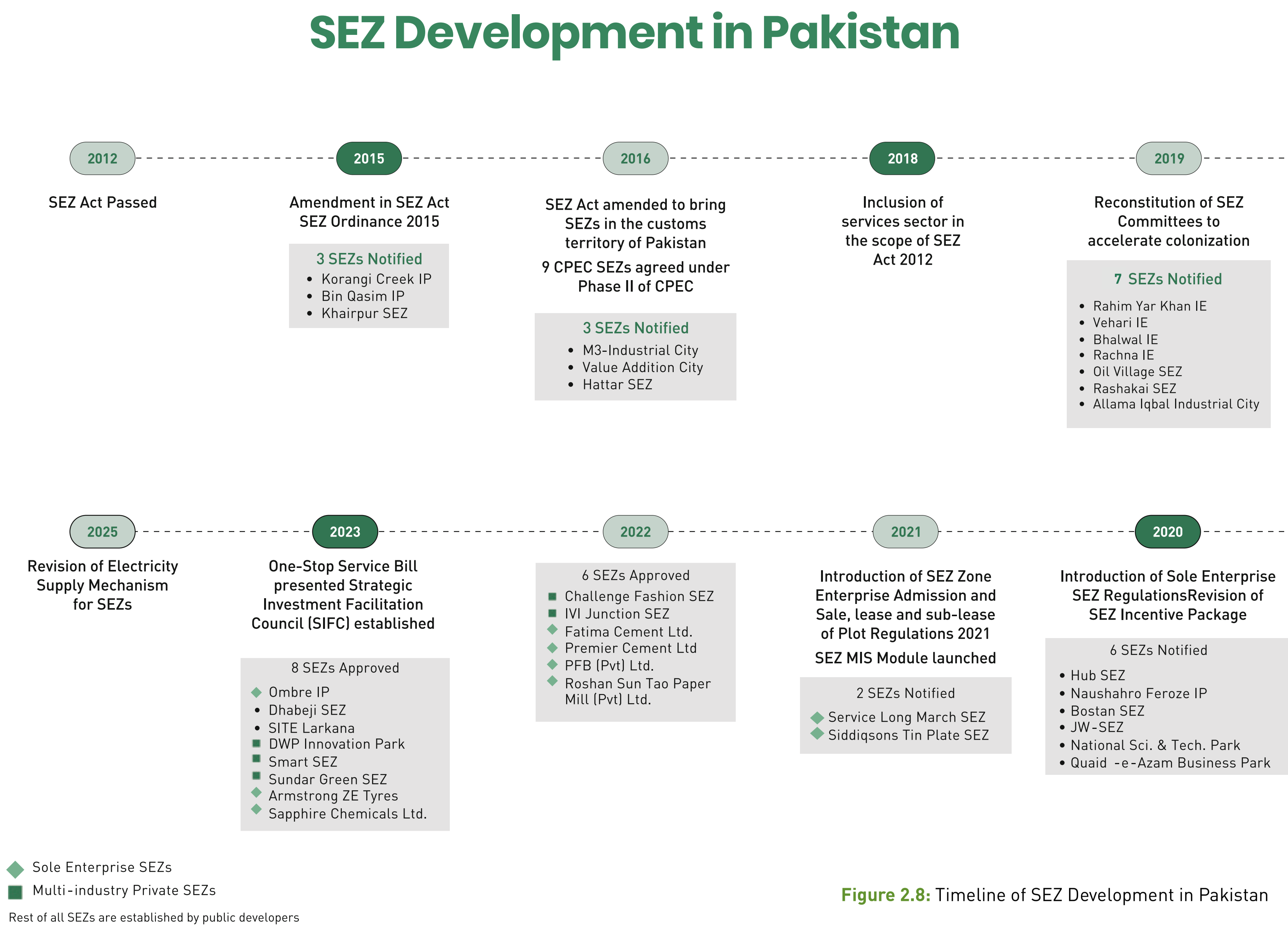



**Figure 2.8:** Timeline of SEZ Development in Pakistan

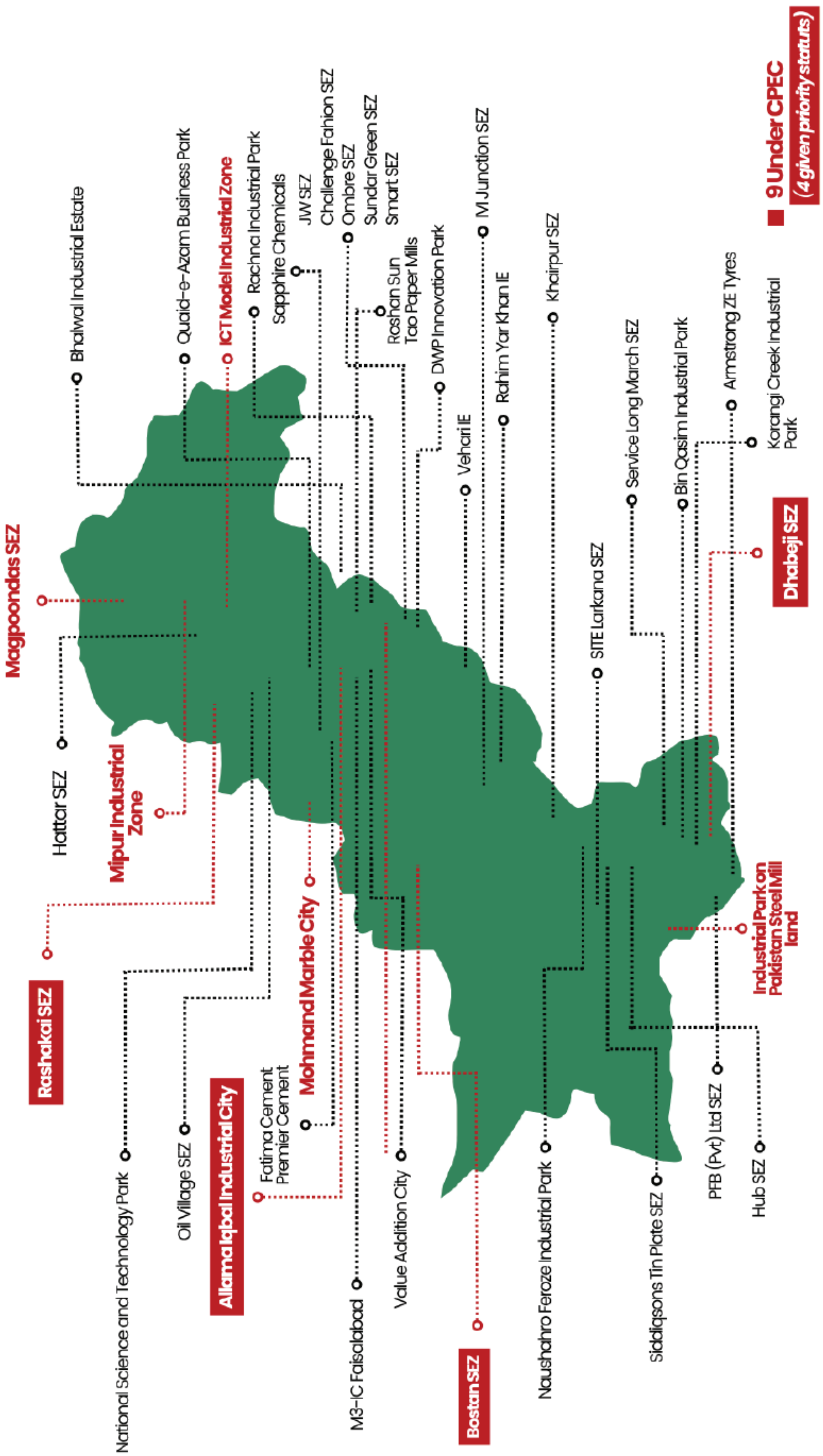



**Figure 2.9:** Map of CPEC and Notified SEZs in Pakistan

## 2.5 SEZs Under CPEC

The first SEZs under the SEZ Act were notified around 2015-16, coinciding with a significant amendment in the law (SBP, 2021). By the end of 2016, seven SEZs had been notified across Pakistan. However, the momentum in regulatory activities and notifications increased notably after 2019.

The launch of CPEC marked a turning point in Pakistan's industrial policy. SEZs became a central pillar of the initiative, with nine SEZs, seven Provincial and two Federal, initially proposed under the framework. Of the nine SEZs approved under CPEC, four namely, Rashakai SEZ (Khyber Pakhtunkhwa), Allama Iqbal Industrial City (Punjab), Dhabeji SEZ (Sindh), and Bostan SEZ (Balochistan), were prioritized for development. In order to fast-track development of these SEZs, the Federal Government allocated Rs. 4 billion in the Federal Public Sector Development Programme (PSDP) for FY 2021 to ensure the provision of utilities to their designated zero points (Pakistan Economic Survey, 2021).

SEZs, under CPEC have emerged as a key driver of industrialization and economic growth in Pakistan. Notable developments include the Faisalabad SEZs, where investments worth Rs. 31.492 billion have been approved across multiple projects in the region. The package also covers ventures in CPEC's Allama Iqbal Industrial City (The Nation, 2024). The priority SEZs under CPEC, Rashakai M-1 (Nowshera), Dhabeji (Thatta), Allama Iqbal Industrial City (Faisalabad), and Bostan (Balochistan), are expected to generate approximately 475,000 direct and 1,000,000 indirect jobs across the country (The Nation, 2021). CPEC has already generated 236 000 jobs, 155 000 of them for Pakistani workers (Profit, 2024).

Dhabeji SEZ, which had received principal approval, is also set to be formally established under the PPP model by Sindh Economic Zones Management Company (SEZMC) and PowerChina International. The project is expected to attract $3 billion in investment and create over 100,000 jobs (Siddiqui, 2025). The Federal Government has also decided to establish the SEZ planned under CPEC on Pakistan Steel Mills (PSM) land, integrating it with Karachi Industrial Park (KIP) to form a single federal SEZ named Karachi Industrial Park (Federal SEZ). Covering 6,409 acres, the project will be developed in two phases by June 2027, with BoA approval of the lease framework expected by 2025 (Profit, 2025).

| **BOX 2A: Notable Industrial Projects in SEZs with Chinese Partnerships** | |
|---|---|
| **MG JW Automobile Pakistan Pvt. Ltd** | **Service Long March Tyres (Pvt.) Ltd** |
| MG JW Automobile Pakistan Pvt. Ltd. entered into JW-SEZ, Raiwind, as a Zone Enterprise, with an estimated investment of Rs. 1.3 billion, including Rs 663 million in FDI and Rs 637 million in local investment (The Nation, 2021a). This joint venture between JW SEZ (Pvt) Ltd. and SMIL, a subsidiary of SAIC Motor Corporation Ltd., marks a significant milestone as the first private sector SEZ under CPEC. Facilitated by the BoI, this initiative enables SAIC, China's largest and the world's seventh-largest auto manufacturer, to introduce electric vehicles in Pakistan. | Designated as a Sole Enterprise Special Economic Zone (SESEZ), Service Long March Tyres (Pvt.) Limited is a $300 million joint venture ensuring full technology transfer from China's Chaoyang Long March Tyre Company. With a targeted annual production of 2.4 million tyres under the SLM brand, the company has achieved 90% capacity utilization in 9MFY24, driving a 122% revenue increase and exports rising to 35% (PACRA, 2024). In 2024, SLM committed a further investment of Rs 30 billion to double its capacity and to increase exports to $100 million in 2025 (Business Recorder, 2024). |

These developments, particularly involvement of Chinese investors, have contributed to a significant increase in FDI. According to data released by SBP, Pakistan witnessed a 48% surge in FDI during Q1FY 2025, with China contributing $404 million, or 52% of the total. In September 2024 alone, FDI from China amounted to $244.8 million (Dawn, 2024).

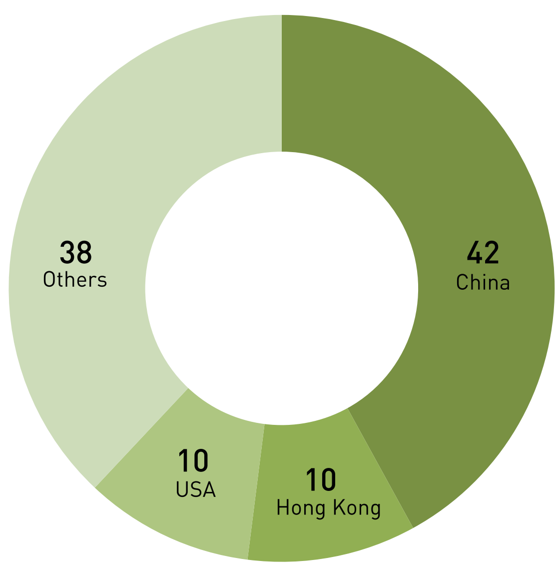



**Figure 2.10**: Country-Wise Net FDI in Pakistan ($ Million) (July-Nov FY 2025)
Source: BoI

## 2.6 Institutional Oversight

The "SEZ Act, 2012" created a multi-tier governance system that shares responsibilities between federal and provincial bodies. This structure has been designed to facilitate the establishment, regulation, and promotion of SEZs, ensuring effective coordination among various stakeholders. To oversee this process, dedicated authorities have been established in each of Pakistan's four provinces. The federal Board of Investment (BoI) leads industrial-cooperation efforts under CPEC. A dedicated CPEC-SEZ Cell addresses matters related to SEZs, while the BoI Chairman serves as the convener of the Pakistan-side Joint Working Group on industrial cooperation (Dawn, 2017).

The BoI, in consultation with the respective provincial governments, holds the authority to approve SEZ establishment applications. Provincial SEZ authorities such as Khyber Pakhtunkhwa Economic Zones Development and Management Company (KPEZDMC) and Balochistan Economic Zones Authority (B-SEZA) have been set up to establish and promote industrial activity in KPK and Balochistan respectively. Similarly, the Punjab Board of Investment and Trade (PBIT) serves as the Secretariat of the Special Economic Zones Authority (SEZA) while SEZMC has been established to institutionally facilitate and promote the industrial base in Sindh with Dhabeji SEZ as its flagship project (Munir, 2024).

The SEZ Act mandates a minimum area of 50 acres for zone establishment, with no upper limit, allowing for diverse development strategies. This regulatory framework has been further streamlined through subsequent rules. SEZ enterprises must adhere to strict timelines. Construction must begin within six months of approval, followed by the initiation of commercial operations within 24 months. The developer is bound to take all necessary approvals to start construction activities. Land ownership is transferred only after six months of consistent operations, ensuring accountability. Non-compliance with these timelines may result in the withdrawal of SEZ status (BoI, 2013).

The regulatory framework for SEZs comprises several organizational layers and actors, each with clearly defined roles and responsibilities. This structure designated the BoI as the lead agency and secretariat for the Board of Approval (BoA) and the Approval Committee, which are responsible for overseeing the establishment and operation of SEZs. Provincial SEZ authorities, established under the law, are tasked with forwarding developers' applications to the Federal BoI for necessary approvals. The Act establishes a two-tier approval process for SEZ applications. The BoA holds the final power to accept or reject zone applications; however, the provincial SEZAs are first required to receive, review, and approve the applications before they are submitted to the BoA. If the BoA approves a zone application, the provincial SEZA is responsible for selecting a developer and negotiating a development agreement for the designated SEZ territory (refer to Annex D for logistical details of notified SEZs, and Annex E for details about notified SEZs bodies and their roles and responsibilities in Pakistan).

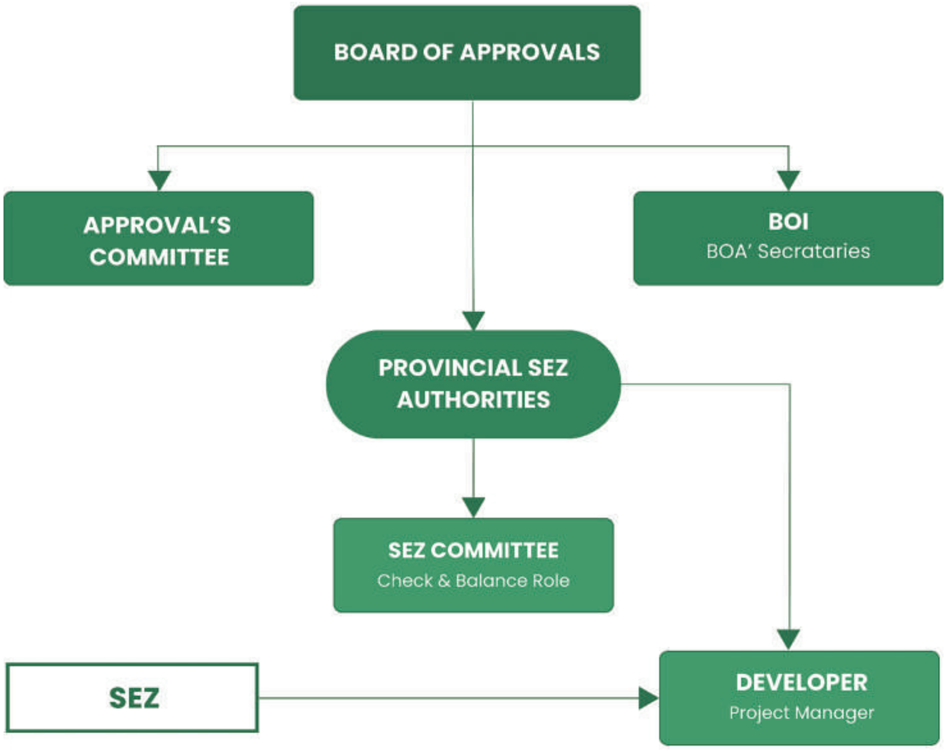



**Figure 2.11:** Governance Structure of SEZs

## 2.7 One Stop Service (OSS) System

What sets SEZs apart is their business-friendly set-up, designed to cut the red tape that plagues many developing-country projects. One significant intervention in this regard is the "One-Stop Service" (OSS), also referred to as a one-window operation. The OSS streamlines processes for zone enterprises by reducing delays and uncertainties in obtaining registrations, permits, licenses, and approvals, while also facilitating access to essential public services from various government agencies.

In Pakistan, the governance structure stipulated by the SEZ Act 2012 includes two layers of OSS, but these have not been fully implemented in any SEZs. Developers are responsible for providing utilities to SEZ plots, while provincial authorities are tasked with ensuring availability of public utilities. Institutional overlap, however, often delays those hookups (SBP, 2021). Moreover, the current online portals launched by Investment Promotion Agencies (IPAs) in Punjab, Sindh, and Khyber Pakhtunkhwa provide basic information but do not facilitate fast-tracking of permits or clearances. The portals only direct users to other government department websites, hindering the desired simplification of processes (SBP, 2021). Additionally, SEZAs lack the power to hold federal or provincial bodies accountable for ensuring timely provision of services further slowing down the overall process.

Splitting off-site infrastructure duties, such as gas, electricity, and road access, between federal and provincial tiers further complicates service delivery and slows developers. Developers depend on the SEZA to liaise with higher tiers, yet no service deadlines or delivery unit exist, which worsens delays (SBP, 2021). This fragmentation and lack of coordination underscores a critical need for effective OSS to ensure smooth operation and success of SEZs in Pakistan.

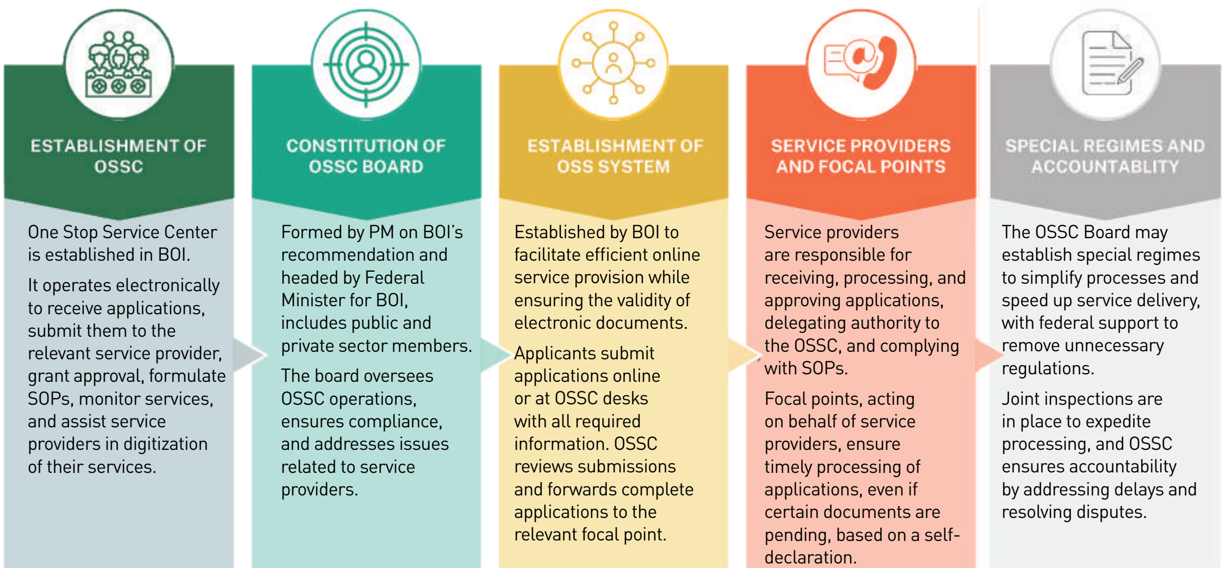



**Figure 2.12:** One-Stop Service Bill Framework
Source: Developed by authors using data from One Stop Service Bill, 2023.

To address these challenges, the government introduced the "One-Stop Service" initiative in 2023, aiming to streamline industrial infrastructure development within SEZs under CPEC. The proposed "One-Stop Service Bill, 2023" seeks to eliminate the need for approximately 28 separate no-objection certificates (NOCs), licenses, and permits required to establish industrial units in SEZs (The Express Tribune, 2023). This centralized, time-efficient platform is designed to simplify the investment process, offering a unified solution for obtaining all necessary clearances and public services. The bill, approved by the Federal Cabinet and pending presentation in Parliament, aims to address the delays and inefficiencies that hinder establishment and operation of businesses within SEZs. By creating a streamlined process for obtaining clearances, the initiative is expected to improve the investment climate in Pakistan, promoting both domestic and foreign investment. The One-Stop Service is aligned with the industrialization goals of CPEC and is anticipated to help diversify Pakistan's exports by accelerating industrial development. This legislation is seen as a key step toward enhancing the competitiveness and success of SEZs in the country.

**BOX 2B: Delays in the Passage of the One-Stop Service Bill, 2023**

The "One-Stop Service (OSS) Bill, 2023", which was approved for presentation to the Parliament in 2023, has yet to be passed. The Senate Standing Committee on Parliamentary Affairs raised several concerns regarding the Bill, particularly around utilization of existing institutional frameworks rather than the creation of a new organization for facilitating industrial activity. There were questions about the current system's inability to provide necessary facilitation services to investors, which raised doubts about the proposed OSS's effectiveness in improving ease-of-doing business.

The Bill's provision of extensive powers to the One-Stop Service also faced reservations, with Committee members questioning the service's ability to deliver impactful results given the challenging industrial environment in Pakistan.

Despite acknowledging the Bill's objective to streamline industrial operations, the Committee recommended that the governing board of the OSS should have broader representation, including provinces and essential service providers.

Concerns were also raised about the Bill's provisions that allowed the one-stop service center to bypass existing legal frameworks, which could potentially infringe on provincial jurisdictions. The Committee directed that these issues be addressed and has recommended that the final bill include necessary procedural details and limitations to ensure smoother implementation and avoid conflicts with existing governance structures (Azad, 2023).

## 2.8 Incentives for SEZ Developers and Enterprises

As discussed earlier, the SEZ Act provides a comprehensive framework of fiscal and allied incentives to attract investment and facilitate establishment of SEZs. These incentives, outlined in Sections 35 and 36 of the Act, apply to both zone developers and enterprises.

**BOX 2C: Incentives for SEZ Developers and Enterprises**

**For SEZ Developers**

- One-time exemption from all customs duties and taxes on plant and machinery imported into Pakistan (for SEZ development)
- Exemption from all taxes on income earned from SEZ operation for a period of five years, starting from the date of signing of the development agreement. This period has been extended to ten years through recent amendments to enhance attractiveness of SEZ projects.

**For SEZ Investors**

- One-time exemption from all customs duties and taxes on plant and machinery imported into Pakistan (into the SEZ)
- Exemption from all taxes on income for a period of ten years to units starting production by 30 June 2020, and five years to units starting after 30 June 2020.

According to the SEZ Act, only new businesses and industries established after an area is designated as a SEZ can apply for SEZ enterprise status. This means that if an existing industrial park gains SEZ designation, only new investors within that park qualify for SEZ enterprise status, while its current investors remain ineligible (World Bank, 2020).

### 2.8.1. Expanded Scope of Incentives

Over the past few years, the scope of fiscal incentives under Sections 36 and 37 of the SEZ Act has been significantly broadened. The inclusion of service sectors such as IT, storage, communication, and infrastructure development under the "Fifth Schedule to the Customs Act, 1969" enables developers and enterprises to access exemptions for a wider range of capital goods that are used in manufacturing and service sectors. The "Finance Act, 2020" introduced amendments to the Customs Act to facilitate the import of machinery and equipment required for these sectors, supporting a diverse industrial base within SEZs. Furthermore, Fiscal incentives have been extended to co-developers under PPP arrangements, ensuring broader participation in SEZ development. Similarly, the income tax holiday for zone developers has been extended from five to ten years, and the cut-off date for zone enterprises under Section 37 of the SEZ Act, 2012 has been removed through Section 126E of the Income Tax Ordinance 2001, granting them a ten-year income tax holiday as well (Ministry of Finance, 2021). While Pakistan's SEZ fiscal incentives are competitive in the region, neighboring countries provide longer exemptions in certain areas, such as capital expenditures (capex) *(refer to Annex F for details)*. Efforts are ongoing to align Pakistan's SEZ policies with regional best practices, ensuring the framework remains attractive to investors.

A critical aspect of SEZ development is the provision of utilities and infrastructure to ensure operational readiness for enterprises. Chronic resource gaps have long held back SEZs, including the CPEC sites. However, joint efforts have led to the allocation of Rs. 19.9 billion from the PSDP for power and gas infrastructure in SEZs. This included Rs. 5.6 billion in FY2019, Rs. 4 billion in FY2021, and Rs. 3.4 billion specifically allocated for CPEC SEZs to improve their operational readiness (Ministry of Finance, 2021).

**BOX 2D: Revision of Electricity Supply Mechanism for SEZs**

In this context, the government has prioritised resolving persistent challenges related to electricity supply in SEZs. Although the SEZ Act, 2012 mandates federal and provincial authorities to ensure the provision of essential utilities, including electricity, SEZs have continued to experience unreliable power supply, infrastructure development delays, and non-compliance with generation capacity requirements outlined in Section 23E of the NEPRA Act. Legal ambiguities have further complicated matters, hindering timely power connections from Distribution Companies (DISCOs) and delaying industrial operations. To address these issues, the Ministry of Energy (Power Division), in consultation with Chinese stakeholders, has developed a revised electricity supply mechanism for SEZs, which has been approved by the Cabinet Committee on Energy (CCoE). Under this framework, SEZs will sign a Power Purchase Agency Agreement (PPAA) with DISCOs to secure power supply equivalent to their projected peak demand over a five-year term (extendable). In parallel, SEZs will be required to obtain a supplier of last resort license and a distribution license from NEPRA under Sections 23E and 20, respectively, enabling them to supply electricity and manage the development, operation, and maintenance of distribution infrastructure within their premises. SEZs will also be obligated to procure additional power in line with NEPRA-approved regulations and applicable technical codes. The Power Division and NEPRA are expected to operationalize this mechanism within the next two to three months (Ahmadani, 2025). This new approach is expected to ensure uninterrupted power supply, improve operational efficiency, and resolve long-standing regulatory ambiguities. By empowering SEZs to manage their own distribution infrastructure and secure supplier licenses, the mechanism aligns with NEPRA's regulatory framework and directly addresses power-related development delays, such as those encountered in the Rashakai SEZ (Ghumman, 2024a). While initially designed for CPEC SEZs, the scope of this mechanism has been extended, through CCoE approval, to all SEZs nationwide, ensuring uniform benefits for industrial consumers across Pakistan (Profit, 2025).

### 2.8.2. Caveat: IMF's Limits on SEZ Incentives

In 2024, as part of the conditions for securing a $7 billion bailout package from the International Monetary Fund (IMF), Pakistan made formal commitments to enhance transparency and accountability in the operations of the Special Investment Facilitation Council (SIFC) and the Sovereign Wealth Fund. These commitments included limiting the discretionary powers of both entities and aligning their governance with international standards. Pakistan also pledged to phase out all SEZ incentives by 2035 (Rana, 2024d). Established in 2023, the SIFC and the Sovereign Wealth Fund were intended to remove structural barriers to investment and facilitate the divestment of state-owned assets to foreign investors, with the broader goal of reducing Pakistan's reliance on IMF financial assistance. However, these IMF-mandated reforms may carry far-reaching implications for Pakistan's economic trajectory, particularly for the second phase of CPEC, which relies heavily on the development and operationalization of SEZs.

Pakistan has also accepted the IMF's condition to halt the establishment of new SEZs and EPZs while ensuring that tax incentives for existing zones are not extended after expiry. This decision directly impacts the government's plans for industrial development, such as the EPZ proposed on the Pakistan Steel Mills land (Rana, 2024b). Furthermore, IMF's restriction on provincial governments from developing new zones poses challenges for underdeveloped regions like Khyber Pakhtunkhwa, where industrial zones are crucial for economic growth. Provincial officials, among them Khyber Pakhtunkhwa's, oppose the conditions, arguing they erode provincial autonomy and competitiveness (Rana, 2024c).

The commitments outlined in the Memorandum for Economic and Financial Policies (MEFP) emphasize limiting SIFC's powers to provide tax or investment incentives. The government has assured the IMF of ensuring competitive neutrality and transparency in SIFC operations and aligning them with standard Public Investment Management frameworks (Ahmed, 2025). Despite these assurances, concerns remain regarding the broader implications of IMF conditions on Pakistan's economic sovereignty and its ability to foster industrial growth, particularly through SEZs under CPEC. Nevertheless, high-level discussions, such as those between the SIFC and Chinese business delegations, reflect ongoing efforts to mitigate these challenges and sustain investment momentum in priority sectors.

# 03

# Greening Industrial Zones: China's Approach and Its Relevance

# Chapter 3 - Greening Industrial Zones: China's Approach and Its Relevance

Against the domestic backdrop, this chapter pivots to China's experience, distilling the policy instruments that transformed conventional SEZs into green engines offering a comparative benchmark for Pakistan.

## 3.1 Overview of China's GSEZs

The traditional SEZ model has driven economic growth globally but has also led to significant environmental degradation, with the industrial sector responsible for approximately 24% of global GHG emissions. As SEZs create concentrated centers of industrial production, they contribute to the rise in $CO_2$ levels, which have increased by 50% since pre-industrial times, exacerbating global warming (Lindsey, 2024). In today's push for sustainable growth, industrial clusters—which generate 15–20 % of global $CO_2$—have become key targets for emission cuts (Skidmore and Girling, 2024).

SEZs can curb emissions by promoting green technologies and enabling vertical spillovers across supply chains. The findings of a study by Chen, Long and Lin (2022) analyzing panel data from 264 prefecture-level cities in China show that effective regulatory measures in SEZs can reduce $CO_2$ emissions. Specifically, every 10 $m^2$ increase in SEZ area resulted in a 0.882 g per $m^2$ reduction in $CO_2$ emissions, showing the role SEZs can play in green economic development when guided by sound policies. The study's findings affirm how China's SEZ policies foster green economic development by reducing emissions.

This potential provides a strong foundation for the concept of Green Special Economic Zones (GSEZs). GSEZs are purpose-built zones that combine green technologies and infrastructure to minimise environmental impact while supporting economic growth and social responsibility. Growing global demand for sustainability has heightened the relevance of GSEZs. The global push for sustainability has made green SEZs increasingly relevant. Evidence of this shift is seen in the growing number of SEZs aligning their development plans with sustainability targets such as net-zero goals and nationally determined contributions (NDCs). A recent survey of 50 SEZs participating in the Global Alliance of Special Economic Zones (GASEZ) initiative found that over 70 per cent offer clean energy or waste management services, and nearly half provide sustainability-linked incentives, such as tax reductions and support for green technologies or ESG adoption (UNCTAD, 2024). Countries including China, Indonesia, and South Africa have successfully transitioned to GSEZs and Eco Industrial Parks (UNIDO, 2023; NCPC-SA, 2021), capitalizing on the growing renewable energy market, which was valued at $1.1 trillion in 2023 and is projected to reach 2.5 trillion by 2033 (Llp, 2024).

GSEZs also play a key role in reducing carbon footprints. Heavy industries like cement, steel, and chemical production are major contributors to global greenhouse gas emissions (U.S. Environmental Protection Agency, 2024). In contrast, GSEZs prioritize low-carbon technologies such as electric vehicles (EVs), solar panels, and wind turbines. The Guangdong Green Eco-Industrial Park (EIP) in China, for instance, has reduced emissions by incorporating solar energy and waste-to-energy technologies (*see the next chapter for details*). Similarly, South Africa's Atlantis Greentech SEZ, the only Greentech SEZ in Africa, focuses on green industrialization and manufacturing of renewable energy technologies such as wind turbines, solar panels, insulation, biofuels, electric vehicles, and recycling materials. This Greentech manufacturing hub was established under the country's Renewable Energy Independent Power Producer Programme (REIPPP).

GSEZs not only cut emissions, they also boost job creation and economic activity. According to the International Labour Organization (ILO), the green economy could generate 24 million new jobs globally by 2030, offering opportunities in sectors like renewable energy, green construction, and environmental consulting.

## 3.2 Learnings from China's Success with GSEZs

China offers valuable best practices on the successful integration of green principles within the framework of SEZs. The country has made significant progress in transforming its industrial sectors toward greater environmental sustainability, particularly through the development of EIPs and GSEZs. China's mix of policy initiatives and green technology has aligned industrial growth with environmental goals offering insights, especially for emerging economies like Pakistan.

### 3.2.1. Historical Context: Role of SEZs in China's Economic Development

The history of SEZs in China dates back to the late 1970s when the government-initiated reforms under the leadership of Deng Xiaoping. The first SEZs were established in Shenzhen, Xiamen, Zhuhai, and Shantou, as part of Beijing's 'Reform and Open-Door' policy aimed at opening up the Chinese economy to foreign investment and modernizing its industrial base. These zones were designed to attract foreign capital and technology, promote industrial production, and infrastructure development.

By the mid-1990s, the success of the initial SEZs prompted China to expand this model to other regions, including Hainan which became the fifth SEZ. The most successful of the special zones was Shenzhen. It evolved from a collection of villages over 126 square miles to a commercial centre. Between 1979 and 2017, Shenzhen's GDP grew 2,152-fold, and per capita GDP rose 56 times—an average annual rate of 11.2 %. The GDP of Shenzhen was only 0.2% of Hong Kong's prior to 1980.

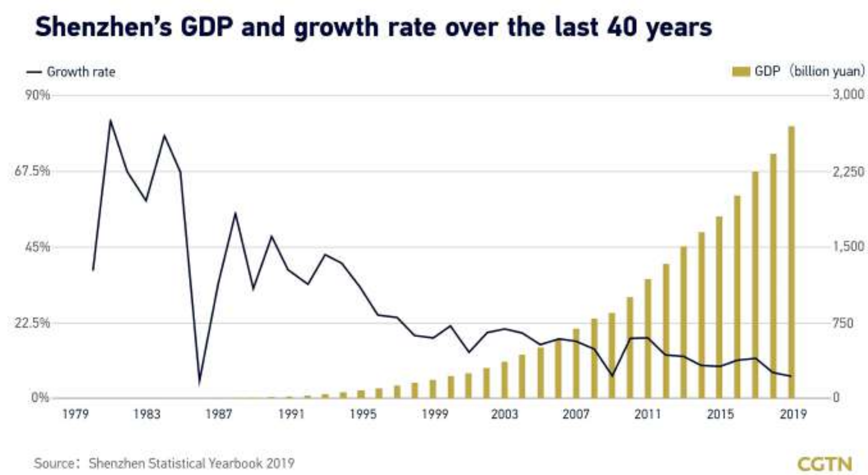



**Figure 3.1:** Shenzhen's GDP and Growth Rate (1979–2019)
Source: CGTN, 2020

With a GDP of 2.42 trillion yuan ($372 billion) in 2018, the city surpassed Hong Kong for the first time (UN-Habitat, 2019). Chinese central authorities instructed provincial officials to take inspiration from Shenzhen due to its success. These zones were key to China's industrial boom and its rise as the "world's factory" (The Economist, 2021).

However, during this period, environmental concerns began to reshape global development models. Between 1990 and 2019, global emissions of all major greenhouse gases increased significantly, with net emissions of $CO_2$ rising by 64% (U.S. Environmental Protection Agency, 2024). As a result, implementation of global agreements like the Kyoto Protocol (2005) legally bound industrialized countries to reduce greenhouse gas emissions by an average of 5% below 1990 levels.

Environmental fallout from rapid growth pushed China to pivot toward more sustainable industrial practices. As a result, the Chinese government embraced a "green industrial policy" approach (Zeng et al., 2020). China launched several green initiatives aimed at transforming its industrial zones. Through a combination of government programs, business incentives, and technological innovation, China has succeeded in balancing industrial growth with environmental protection.

## 3.3 Best Practices: China's Programs and Incentive Strategies

China's experience with GSEZs provides several best practices that have been implemented through a combination of government programs and business incentives, designed to drive both economic growth and environmental stewardship. The concept of sustainable industrial zones in China began with the integration of Circular Economy (CE) principles into national policies. In 2001, CE was introduced as a core element of the national development agenda, emphasizing the 3Rs - Reduce, Reuse, and Recycle. This was followed in 2003 by the launch of the Eco-Industrial Park (EIP) demonstration program, which sought to transform existing SEZs or develop new ones based on clean production, industrial symbiosis, and centralized pollution abatement.

The first pilot EIP - Guigang Sugar-making EIP - was initiated by MEE in 2001 (Zhang et al., 2009). Managed by the Ministry of Environmental Protection, the program targeted resource-intensive sectors like iron and steel, chemicals, and building materials. National EIP Certification was introduced to enforce environmental standards, requiring compliance with regulations and an environmental management system. Certified EIPs are randomly reassessed every three years, and non-compliant parks risk losing their certification. The accreditation process is designed to prevent industrial parks from using the program for image-building without genuine commitment (Huang et al., 2018).

Building on the success of the EIP program, the Circular Economy Demonstration Industrial Parks (CEDIP) initiative was launched in 2005 under the leadership of the National Development and Reform Commission (NDRC) and other key ministries (Geng et al., 2008). While similar to the EIP program in its focus on resource efficiency, CEDIP expanded its scope to include the entire economic chain, addressing production, distribution, and consumption processes. Introduction of the 'Circular Economy Promotion Law' in 2009 formalized the development of CE in China, establishing financial incentives, tax breaks, and support for research and clean technology investments. The law also phased out harmful practices and promoted innovation in resource-efficient technologies (Green Growth Knowledge Platform, 2017).

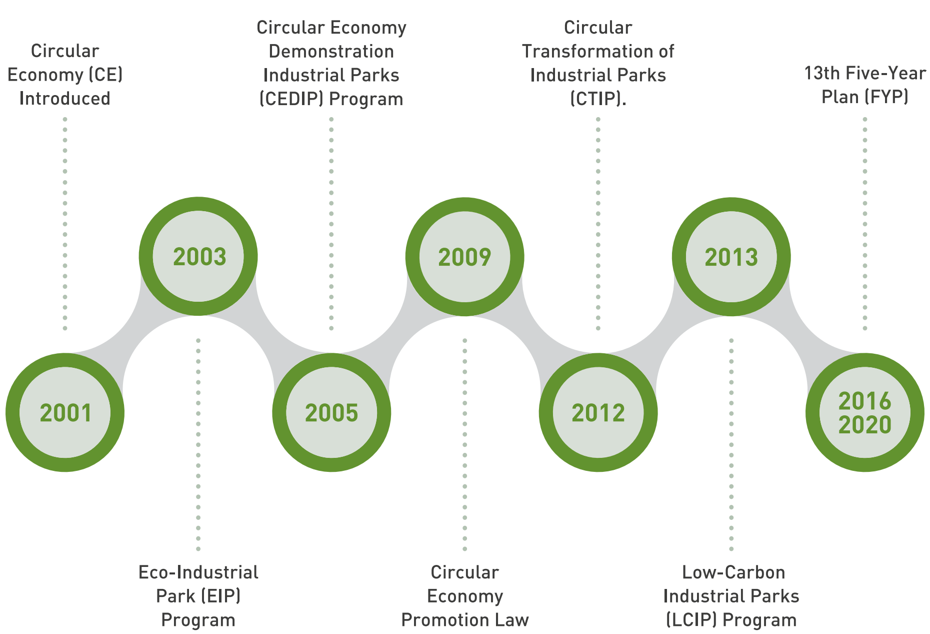



**Figure 3.2:** Timeline of China's Green Industrial Development Programs

In 2012, the NDRC and Ministry of Finance (MoF) launched the Circular Transformation of Industrial Parks (CTIP) program, aligned with the 12th Five-Year Plan (FYP). This initiative emphasized energy conservation and carbon reduction, reflecting China's commitment to cutting national carbon intensity by 40-45% from 2005 levels by 2020. The 12th FYP was instrumental in the growth of the solar energy and EV sectors within the parks. The program introduced special funds for low-carbon restructuring and support to seven emerging green sectors. These included clean energy sectors: nuclear, solar, wind, EVs, and energy-efficient tech. Support for new strategic industries included access to dedicated state industrial funds, tax support policies, increased credit support from financial institutions, and technological innovation by strengthening R&D (Central Government Portal, 2010).

**Table 3.1:** Pillar Industries in China's 12th FYP

| S.No | Old Pillar Industries | New Strategic & Emerging Industries |
|---|---|---|
| 1 | National Defense | Energy saving and environmental protection |
| 2 | Telecom | Next generation information technology |
| 3 | Electricity | Biotechnology |
| 4 | Oil | High-end manufacturing (e.g. aeronautics, high speed rail) |
| 5 | Coal | New energy (nuclear, solar, wind, biomass) |
| 6 | Airlines | New materials (special and high-performance composites) |
| 7 | Marine Shipping | Clean energy vehicles (PHEVs and electric cars) |

Source: Lewis, 2011.a

The 18th National Congress of the Communist Party in 2012 marked a significant milestone by elevating the concept of "ecological civilization" as a national goal. This laid the groundwork for the Low-Carbon Industrial Park (LCIP) program, launched in 2013 as part of the broader Low-Carbon Zone initiative. The LCIP program incorporated many principles from earlier initiatives, such as clean technology and renewable energy adoption, while placing greater emphasis on greenhouse gas accounting and infrastructure development. This approach highlighted the importance of monitoring and reporting environmental performance, ensuring accountability and transparency (Kim, 2017).

China's 13th Five-Year Plan (2016-2020) reinforced its commitment to a low-carbon economy by strengthening market mechanisms, encouraging private investment in green technologies, and promoting SEZs as models of sustainable industrialization. This period also saw the introduction of innovative green finance tools to support long-term transition to clean energy (Kim, 2017). Key policy initiatives included the "Made in China 2025" strategy, which prioritized building a green manufacturing system through the development of green factories, products, industrial parks, and supply chains (Seneca ESG, 2023). Additionally, the Green Industry Development Plan (2016-2020) released by the Ministry of Industry and Information Technology (MIIT) introduced indicators and related targets to guide green industry transformation (Yuan et al., 2019). The "Made in China 2025" initiative set targets for expanding domestic EV brands and led to the Energy Equipment Implementation Plan to strengthen the manufacturing of power-generation equipment for solar, wind and other renewable energy sources (Joe, 2023). As a result of the 12th and 13th FYP policy support, by 2024, China had become the world's largest EV market, taking over more than 50% of global market share (Kim, 2024), while by 2022, China had become the largest producer of solar panels, accounting for 83.8% of the global exports of solar cells (Joe, 2023).

## 3.4 Policy Governance and China's GSEZs

Given the high initial investment costs incurred at both the overall EIPs and enterprise levels for adopting green technologies and green production practices, there was significant initial resistance from zone managers and enterprises towards embracing changes needed for a green transformation. Yet over time, the zones that balanced environmental and economic goals proved to be China's most competitive and resilient. The EIP approach not only brought environmental benefits but also enhanced competitiveness of the zones (Zeng et al., 2020).

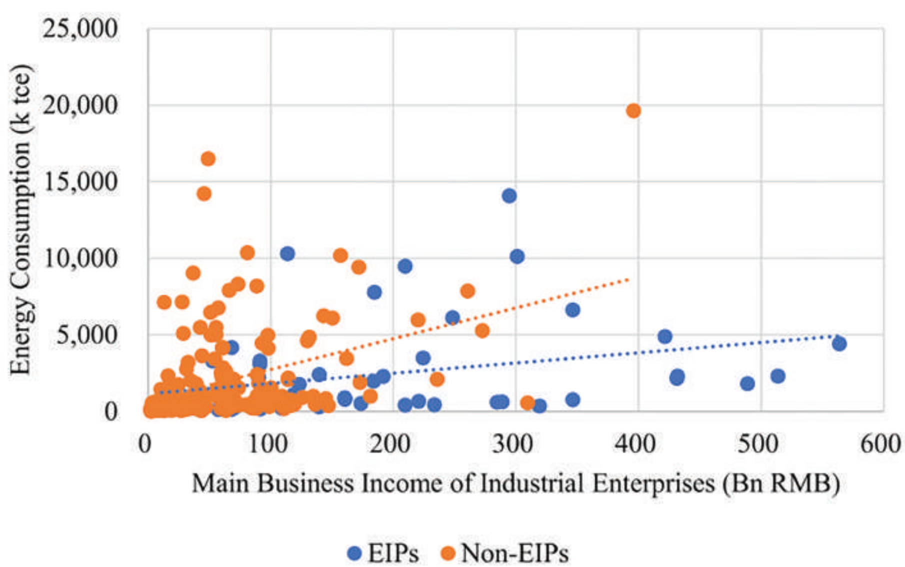



**Figure 3.3**: Correlation between Energy Consumption and Main Business Income of EIPs vs non-EIPs (2017)
Source: Zeng et al., 2020

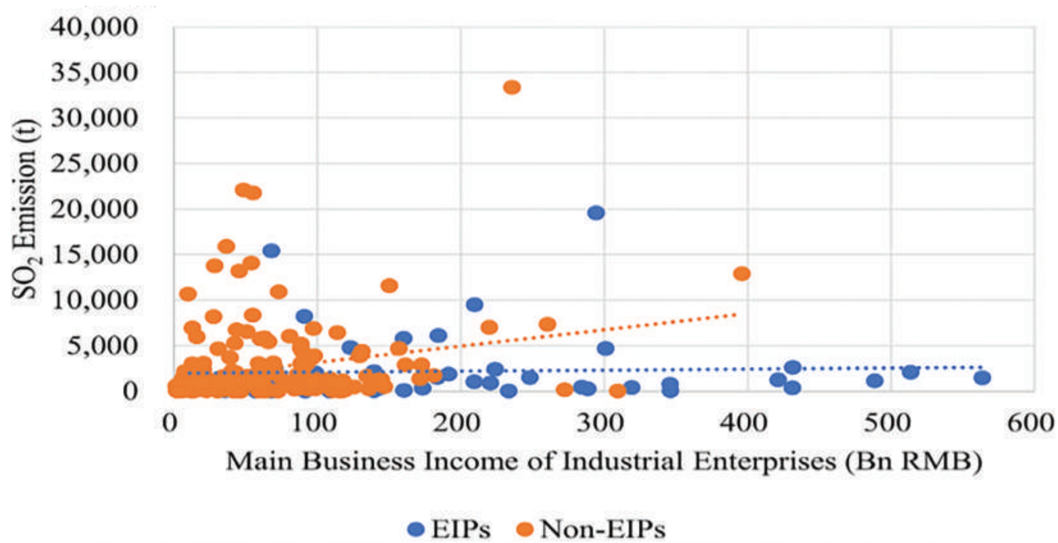



**Figure 3.4:** Correlation between SO2 Emission and Main Business Income of EIPs vs non-EIPs (2017)
Source: Zeng et al., 2020

The success of China's GSEZs initiatives lies primarily in their integration into the national development agenda. These initiatives are centrally driven, coordinated, or managed by the NDRC, China's most influential policy body. The programs are mainstreamed into the Five-Year Plans (FYPs), which serve as the country's mid-term national strategy. The inclusion of green industrialization initiatives in such high-level policy frameworks provides clear direction to SEZ authorities and local governments, ensuring alignment with national priorities. Furthermore, the Chinese government promotes these initiatives not just through subsidies and tax incentives but through access to financing, participation in certification schemes and access to technical expertise to support improvements in energy and emissions performance. Certification schemes also help firms evaluate their environmental performance through a structured process review.'

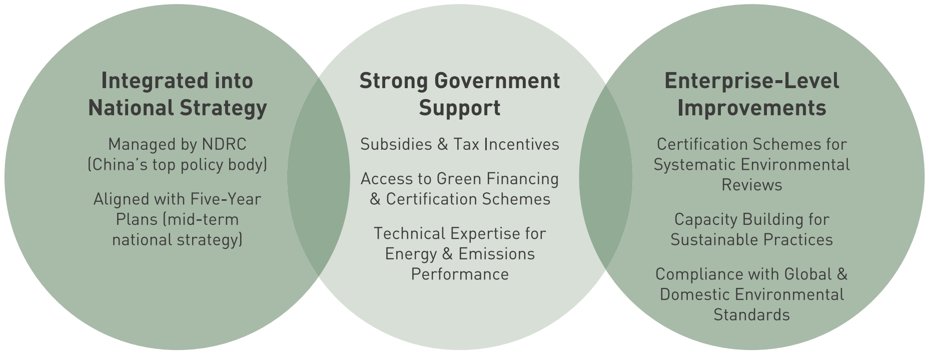



**Figure 3.5:** Reasons for the Success of China's GSEZs
Source: Authors' own.

The government's consistent green messaging has played a vital role. Official channels and media helped create strong motivation for participation even in the absence of direct financial incentives. Since the late 1990s, energy-efficient and low-carbon development of industrial zones has been a recurring theme in FYPs. This consistency helped build investor and government confidence, enabling rapid adoption of GSEZ programs (Kim, 2017). The accreditation system further supports voluntary participation by recognizing SEZs as National Demonstration Zones upon meeting the evaluation criteria. This official recognition enhances the SEZs' reputation, making them more attractive to investors by signaling reduced environmental risks, economic benefits from resource efficiency, and transparent management practices (Huang et al., 2018).

The Chinese government has also worked diligently to create a conducive policy environment for green transformation. Initially, environmental policies focused on pollution control and regulatory measures. Over time, these efforts expanded to include enabling mechanisms like market-based instruments. Starting with the 11$^{th}$ FYP, the government emphasized initiatives such as carbon trading through the Clean Development Mechanism (CDM) and green finance to mobilize private sector involvement and leverage financial resources. Construction of China's National Carbon Market has progressed significantly. In 2024, the State Council promulgated and implemented the "Interim Regulations for the Management of Carbon Emission Trading." In January 2024, the "National

Voluntary Greenhouse Gas Emission Reduction Trading Market" was also officially launched. China's "National Carbon Emission Trading System" covers the largest amount of greenhouse gas emissions globally — more than 40% percent of China's total $CO_2$ emissions (Progress Report of China's National Carbon Market, 2024).

In addition, the requirement for regular monitoring and evaluation of all GSEZ initiatives has ensured measurable success. While evaluation primarily involves self-assessment against predefined work plans, the Central Government provides detailed guidelines and policy notes to support participants. The EIP and CTIP programs have established measurable criteria covering essential aspects such as land use, water and material recycling, energy efficiency, and emissions reduction (Kim, 2017).

## 3.5 Challenges in Implementing GSEZs

Despite the significant progress, China has faced several challenges in fully implementing GSEZs. These challenges stem primarily from regulatory complexities and local government capacity. One of the key challenges in China's implementation of GSEZs has been overlapping mandates, procedures, and eligibility criteria of various governmental agencies. Several national and local bodies are responsible for regulating SEZs, including environmental agencies, industry regulators, and local government offices. This has led to confusion and inefficiencies in policy enforcement, with businesses sometimes navigating conflicting regulations. This regulatory overlap has hindered the implementation of green policies in certain regions, delaying the enforcement of environmental standards and emissions reduction targets (Kim, 2017). For instance, some green zones are actually certified by multiple ministries (Zeng et al., 2020).

| Regulatory Complexity | Local Government Constraints | Governance & Incentive Gaps |
|---|---|---|
| • Overlapping Mandates (multiple agencies regulating SEZs)<br>• Conflicting Regulations (Businesses face policy inconsistencies)<br>• Delays in Green Policy Enforcement | • Limited Technical Expertise<br>• Insufficient Financial Resources<br>• Inconsistent Policy Coordination (national policies not effectively localized) | • Lack of Local Incentives<br>• Selective Implementation (complexity leads to partial policy adoption)<br>• Fragmented Local Governance |

**Figure 3.6:** Implementation Challenges for China's GSEZs
Source: Authors' own.

While national policies have been developed to promote sustainability in SEZs, their coordination at the local level has been inconsistent. Local governments play a crucial role in the implementation of green policies within SEZs, but many of them lack the technical expertise and financial resources needed to enforce stringent environmental standards. This issue has been particularly pronounced in smaller cities and rural areas, where local authorities often struggle to balance economic growth with environmental preservation due to weak capacity. Local governments in China also face significant data collection and monitoring challenges in implementing green development practices, primarily due to the absence of incentives for adopting effective environmental governance measures that are suited to local conditions (Zeng et al., 2020). The traditional, fragmented model of local governance further undermines the efficiency of environmental governance. Therefore, effective localization of green development practices requires focused research to understand essential implementation processes and strategies.

Special Chapter

# 04

# Eco-Industrial Development: The Guangdong Case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# Chapter 4 - Eco-Industrial Development: The Guangdong Case

To translate China's national-level insights into a tangible blueprint, the Guangdong eco-industrial park is profiled in this chapter, illustrating how a single province operationalized green-SEZ principles in practice.

## 4.1 Introduction

Climate change and resource depletion demand a new development model, particularly for developing countries striving to balance economic growth with environmental protection. This chapter examines Guangdong Province, China's economic powerhouse, as a leading example of sustainable industrial development through its commitment to carbon reduction, renewable energy, and the establishment of GSEZs. As one of the first regions in China to adopt market-oriented reforms, Guangdong's transition into a hub for green technology and sustainable practices offers valuable lessons for other nations, notably Pakistan. Facing its own energy and environmental challenges, Pakistan can draw critical insights from Guangdong's success in advancing renewable energy, fostering innovation, and leveraging PPPs to drive sustainable growth. Yet, the path has not been without challenges. Ongoing fossil fuel reliance, urban sprawl, and industrial pressures continue to test Guangdong's adaptability and planning. This exploration seeks to analyze both the success factors that have propelled Guangdong's journey towards sustainability and the challenges that have emerged along the way. The findings highlight key strategies that can be implemented, drawing from Guangdong's experiences, to foster sustainable practices while ensuring economic growth and energy security, thereby furnishing a framework that can guide policy formulation and implementation in emerging economies.

### 4.1.1. Guangdong Region

Guangdong, home to over 126 million people and among China's top-performing economies, is a southern province known for its industrial strength and economic dynamism. As one of the foremost economic engines of China, Guangdong has established itself as a global manufacturing hub, facilitating a substantial contribution to the national Gross Domestic Product (GDP). This rapid industrial growth has come at an environmental cost, necessitating a strategic pivot towards eco-industrial development that emphasizes sustainability and resource efficiency.

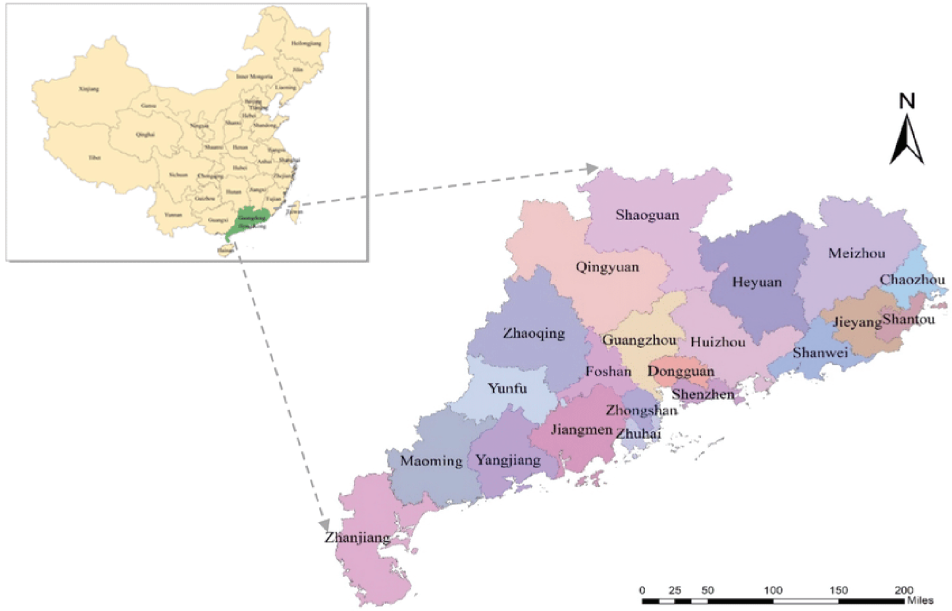



**Figure 4.1:** Geographical Map of Guangdong Region, China

In recent years, Guangdong has actively engaged with the framework of GSEZs, a component of China's broader green development strategy. The Chinese province is reshaping its industrial base by prioritizing environmentally responsible policies and has made considerable investments in sustainable practices as part of its commitment to eco-industrial development. Noteworthy initiatives include advancement of renewable energy sources such as solar and wind power. It also promotes industrial recycling and resource recovery to support a circular economy. Guangdong's efforts to balance growth with ecological responsibility make it a valuable case study. Comparative studies show how Guangdong's experience can inform sustainable transitions in other emerging economies. Scholars emphasize the necessity for tailored approaches that reflect the distinct socioeconomic and environmental contexts of each region. The successful strategies employed by Guangdong provide a potentially viable roadmap for countries striving to harmonize economic growth with environmental sustainability.

### 4.1.2. Historical Perspective

Guangdong's shift to a market economy has become a major focus of academic research. Research has extensively examined the critical role that governmental policies have played in facilitating Guangdong's rapid economic growth and industrialization. Key reforms, such as launching SEZs and attracting foreign investment, have positioned Guangdong as a global economic hub.

Recent research highlights Guangdong's strong commitment to embedding sustainability in economic policy, illustrating how supportive policies can effectively catalyze green development. The discourse surrounding the transition to renewable energy constitutes a central theme in sustainability literature. Innovative technologies are recognized as essential drivers of renewable energy adoption in Guangdong, where the province has distinguished itself as a leader in the solar and wind energy sectors. Government incentives and tech innovation have driven this leadership, thereby underscoring the critical importance of R&D in promoting the adoption of green technologies. These efforts align with broader goals of lowering emissions and improving energy efficiency. Collaboration between public and private sectors has been identified as a crucial determinant of successful sustainability initiatives. PPPs in Guangdong have enabled investments in green infrastructure and facilitated sustainable urban development. Guangdong has leveraged public-private collaboration to pioneer solutions to environmental challenges, reinforcing the notion that active stakeholder engagement is paramount for achieving sustainability objectives.

## 4.2 Guangdong's 1+1+N Policy Framework

The "1+1+N policy" framework represents a systematic approach towards the dual objectives of carbon peaking and carbon neutrality in Guangdong Province. This framework comprises two primary stages:

1. Attainment of carbon peak by 2030
2. Eventual realization of carbon neutrality in 2060.

In February 2022, the Provincial Party Committee and the Provincial Government released the "Implementation Opinions on Fully, Accurately, and Comprehensively Implementing the New Development Concept to Promote Carbon Peaking and Carbon Neutrality." This pivotal document represents the first "1" within the province's "1+1+N" policy framework for carbon peaking and carbon neutrality, outlining a systematic plan and comprehensive deployment strategy that encompasses both carbon peaking and carbon neutrality phases. The "Guangdong Province Carbon Peaking Implementation Plan" constitutes the second "1," delineating specific objectives, tasks, and actions to be undertaken during the peak phase. The "N" aspect encompasses essential sectors including energy, industry, urban and rural development, transportation, and agriculture, as well as carbon peaking plans developed by various municipalities. Additionally, it includes necessary safeguard programs and complementary policy measures, thereby establishing a cohesive framework to effectively support the attainment of the "dual carbon" goals.

| Table 4.1: 1+1+N Policy Framework | | |
|---|---|---|
| 1 | Implementation Opinions on the New Development Concept to Promote Carbon Peaking and Carbon Neutral Work | Systematic planning and overall deployment, covering two stages of carbon peaking and carbon neutrality |
| | | Issued and implemented by the Provincial Party Committee and the provincial government |
| 1 | Guangdong Carbon Peaking Implementation Program | Focus on specific goals, tasks, and initiatives to reach carbon peaking by 2030 |
| | | Issued and implemented by the provincial government |
| N | Develop City-Level Carbon Peak Implementation Plans | Municipal people's governments at or above the prefecture level to take the lead |
| | Develop Sector-Level Carbon Peak Implementation Plans | Includes 5 key sectors: energy, industry, construction, transportation, agriculture & rural areas |
| | Develop Key Protection Programs & Support Policy Measures | Key safeguard programs |
| | | Support policy measures |
| Source: Authors' own. | | |

#### 4.2.1. Guangdong's Implementation Plan

The Guangdong Implementation Plan is a comprehensive strategy aimed at facilitating the province's transition to a greener economy and society through a structured and multifaceted approach. The primary goal of the plan is to promote economic and social development via green transformation, thus balancing economic growth with environmental stewardship and aligning with global sustainability goals. Central to the plan are several key sectors identified as critical for achieving substantial energy savings and carbon reductions, including the industry sector, which emphasizes industrial restructuring to enhance efficiency and transition towards cleaner production methods

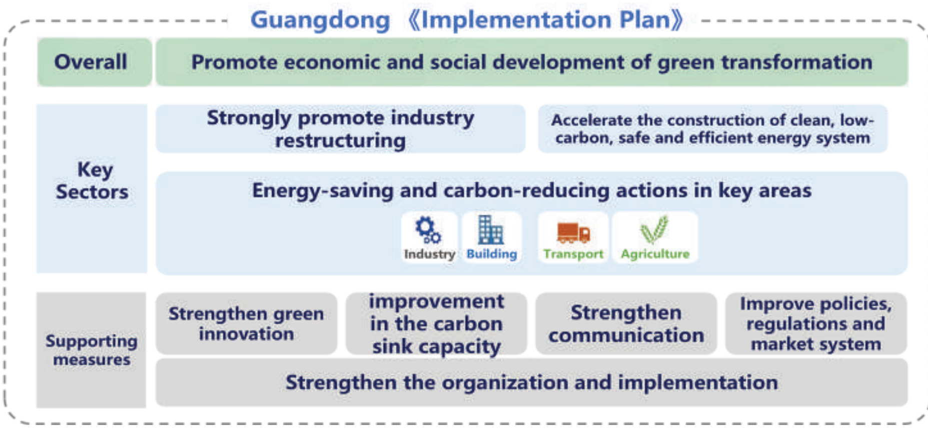



**Figure 4.2:** Guangdong Implementation Plan

Furthermore, energy efficiency in the building sector is prioritized to minimize carbon emissions associated with construction and operation, while strategies for the transport sector focus on developing efficient and low-emission transport systems that mitigate greenhouse gas emissions. Sustainable practices in agriculture are also emphasized, aiming to enhance productivity while reducing environmental impacts. To ensure successful execution, several supporting measures are outlined, including strengthening green innovation through R&D of sustainable technologies, improving carbon sink capacity with natural and technological solutions, and enhancing communication efforts to engage stakeholders and promote public awareness. The plan also calls for improving policies, regulations, and market systems to create a favorable environment for green transformation and stresses the importance of strengthening organization and implementation to coordinate efforts across various levels of government and sectors. Overall, the Guangdong Implementation Plan establishes a cohesive framework designed to achieve a low-carbon, efficient, and sustainable energy system, thereby laying a solid foundation for a greener future in the province while aligning with China's broader sustainability objectives.

### 4.2.2 Key Nodes of Carbon Peaking and Neutrality Targets

The outlined framework for Guangdong's transition to a sustainable and low-carbon future establishes a strategic vision with specific objectives across various sectors, culminating in overarching goals for 2030 and 2060. By 2030, the province aims for a comprehensive green transformation, while envisioning a new power system dominated by clean energy sources by 2050.

| Table 4.2: Key Time Nodes in Guangdong's Implementation Plan | | |
|---|---|---|
| Overall Development | 2030 | Comprehensive green transformation |
| | 2050 | A new power system dominated by clean energy sources |
| | 2060 | Green low-carbon economic system; clean, safe and efficient energy system |
| Energy Efficiency | 2030 | Reducing energy consumption per unit of GDP continues to be a key national focus |
| | 2050 | Energy efficiency to reach advanced level internationally |
| Energy Structure | 2025 | Non-fossil energy installed capacity reaches appox. 48% |
| | 2030 | Non-fossil energy use is approx. 35% and non-fossil energy install capacity reaches approx. 54% |
| | 2060 | Non-fossil energy use exceeds 80% |
| De-carbonization | 2030 | Reducing carbon emissions per unit of GDP continues to be a key national focus |
| | 2050 | Wide application of low-carbon and zero carbon technology |
| Carbon Sinks | 2030 | Forest coverage of about 59% with a storage volume of 660 million cubic meters of $CO_2$ |
| | 2050 | Continued improvement in the carbon sink capacity of ecosystems |
| Overall Aim | 2030 | Achieving the carbon-peak schedule with a steady decrease in carbon emissions afterward |
| | 2060 | Achieve carbon neutrality goal |
| Source: Authors' own. | | |

The framework underscores the goal of reducing energy consumption per unit of GDP to position the country at the top by 2030 and advancing energy efficiency to reach internationally recognised standards by 2050. In terms of energy structure, targets include reaching 48% non-fossil energy installed capacity by 2025, with non-fossil energy use projected to constitute 35% of total consumption by 2030 and exceeding 80% by 2060. Decarbonization objectives focus on reducing carbon emissions per unit of GDP to remain among the lowest in the country by 2030, accompanied by the widespread application of low-carbon and zero-carbon technologies. The plan also prioritizes enhancing carbon sinks, targeting 59% forest coverage with a storage capacity of approximately 660 million cubic meters of $CO_2$ by 2030. Overall, the framework aims to achieve carbon peaks as scheduled by 2030, followed by a steady decrease in carbon emissions, ultimately reaching carbon neutrality by 2060.

## 4.3 Holistic Eco-Industrial Development

The eco-industrial development for Guangdong's transition to a low-carbon and sustainable economy consists of ten major reform initiatives, two types of major demonstrations in cities, towns, and villages; and in industrial parks, communities, public institutions, and enterprises, and six key projects aimed at achieving comprehensive carbon reduction and sustainability goals. The reform initiatives include the *Guangdong Province Carbon Peak Implementation Program* and a corresponding *City-Level Carbon Peak Implementation Program*, both aimed at steering the region toward its carbon peaking targets. These initiatives are supported by a comprehensive set of policies and safeguard mechanisms to strengthen oversight of carbon reduction efforts (Table 4.3). Central to the strategy is the development of a green, low-carbon, circular economic system that promotes sustainable production and consumption patterns. Measures to curb the unchecked development of high-emission projects are critical for preventing further environmental degradation.

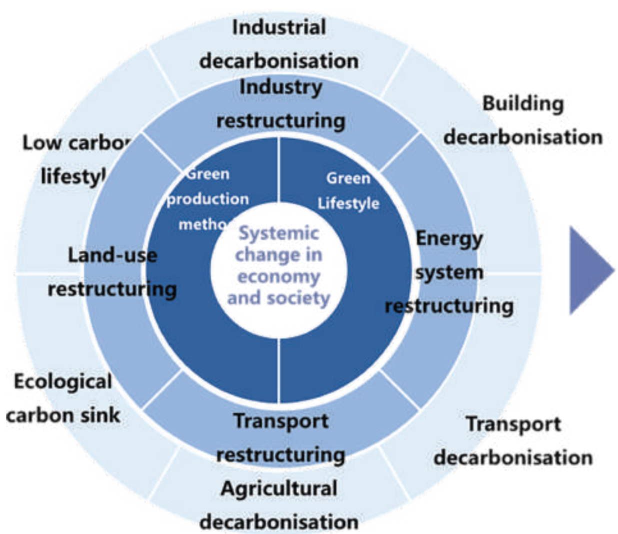
**Table 4.3: Guangdong's Eco-Industrial Development Plan**

| Major Reform Initiatives | Major Demonstrations | Major Projects |
|---|---|---|
| 1. Guangdong Province Carbon Peak Implementation Program<br>2. City-Level Carbon Peak Implementation Program<br><br>*Supporting Policy & Safeguard Measures:*<br>• Development of a green, low-carbon, circular economic system<br>• Prevention of uncontrolled development of high-emission, high-energy-consuming projects<br>• Integrated solutions for pollution control and carbon reduction<br>• Enhancement of carbon sink capacity<br>• Establishment of a total carbon control system and carbon target assessment mechanism<br>• Creation of a Green Low-Carbon Development Fund<br>• Implementation of a Carbon Neutrality Action Framework | 1. Pilot demonstration in cities, towns and villages<br>2. Pilot demonstration in industrial parks, communities, public institutions and enterprises | • Green Low-Carbon Industry Cultivation<br>• Green Low-Carbon Energy Transformation<br>• Energy Conservation and Carbon Emission Reduction Implementation<br>• Resources Recycling<br>• Key Low-Carbon Technology Innovations<br>• Carbon Sink Capacity Enhancement Plans |

The framework also offers pollution and carbon reduction solutions through innovative practices, proposes to enhance carbon sink capacity via various solutions, and a total carbon control system along with a carbon target assessment mechanism for monitoring and accountability. Furthermore, the creation of a Green Low Carbon Development Fund will finance projects aimed at achieving low-carbon objectives, complemented by a comprehensive carbon neutrality action framework. Together, this comprehensive framework represents a robust and innovative approach to ensuring a sustainable, low-carbon future for Guangdong Province while fostering efficiency and community engagement.

## 4.4 Alignment with GSEZ Policies/Frameworks

The presented framework outlines a comprehensive approach to achieving carbon peaking through systematic transformations across the province's economy and society. It includes integrated sectoral strategies like industrial decarbonization, energy system restructuring, sustainable agriculture, transport sector transformation, and optimized land-use management, collectively promoting a greener lifestyle and sustainable production practices.




| 15 actions for carbon peaking | |
|---|---|
| 1 | Industry green quality improvement |
| 2 | Green energy transition |
| 3 | Energy saving and energy efficiency |
| 4 | Carbon peak in key industry sectors |
| 5 | Urban and rural construction |
| 6 | Carbon peak in transport |
| 7 | Agricultural and rural emissions reduction and carbon sequestration actions |
| 8 | Circular economy to help reduce carbon |
| 9 | Technology empowered carbon peak |
| 10 | Trading market construction for green elements |
| 11 | Green economic and trade cooperation initiative |
| 12 | Improve in ecological carbon sink capacity |
| 13 | Green low-carbon action for all citizens |
| 14 | Step-by-step orderly peak action in each region |
| 15 | Multi-level pilot demonstration |

**Figure 4.3**: Guangdong's Carbon Peaking Framework

To support this transition, the framework outlines 15 specific actions that serve as key mechanisms for achieving carbon peaking targets (Figure 4.3). These include enhancing green industrial quality to embed sustainable practices, advancing a green energy transition towards renewable sources, and implementing energy-saving measures to optimize resource efficiency. The framework also sets defined carbon reduction targets for key industries and the transport sector, alongside initiatives aimed at lowering emissions and enhancing carbon sequestration in agricultural and rural areas. Given the importance of a circular economy, it promotes resource reuse, waste reduction, and technological innovation to support carbon peaking efforts. The creation of a trading market for green elements will enable carbon trading and the development of financial instruments that support sustainability. The framework calls for broad-based citizen engagement through a structured, region-specific action plan, complemented by multilevel pilot demonstrations to showcase best practices and innovative solutions.

## 4.5 Key Enablers and Barriers to Green Transformation in Guangdong

A critical enabler in Guangdong has been strong policy support from the provincial government, which established clear emissions reduction targets and effectively leveraged national frameworks to drive local initiatives. This governance structure has been complemented by Guangdong's economic diversity, characterised by a dynamic mix of advanced manufacturing, technology, and service sectors. Economic diversification has not only promoted innovation in green technologies but also encouraged adoption of sustainable practices across industries.

Significant investments in renewable energy, particularly solar and wind, have reduced Guangdong's reliance on fossil fuels and strengthened its energy security. The province has actively promoted innovation, supporting R&D in green technologies and a culture of energy-efficient practices. PPPs have played a vital role by mobilizing private sector investment in key green infrastructure projects, thus supporting economic growth alongside environmental objectives. Furthermore, comprehensive energy efficiency programs across multiple sectors have helped lower energy consumption and greenhouse gas emissions while boosting overall productivity. Modernisation of the energy infrastructure, including development of smart grids, has improved energy distribution efficiency and facilitated a smoother transition to clean energy sources.

Despite these successes, Guangdong faces the following persistent barriers in its transition towards sustainability:

- Intense carbon abatement pressures, compounded by ongoing industrial expansion and urbanization, create tensions between economic growth imperatives and environmental sustainability goals, complicating efforts to meet emissions targets.

- Resource constraints, including limited indigenous energy supplies, have left the province heavily dependent on imported energy, exposing it to global supply disruptions and price volatility.
- Fossil fuel dependency remains significant, hindering the province's shift to a low-carbon economy despite diversification efforts.
- Structural conflicts between economic operations and emissions reduction targets further complicate progress, with concerns about the potential impact on competitiveness sometimes fostering resistance to sustainability initiatives.
- Rising energy demand from industrial, service, and residential sectors continues to strain the province's energy systems, challenging efforts to ensure sustainable supply and efficient management.
- Rapid industrialisation has exacerbated environmental degradation and resource depletion, underscoring the need for more balanced development strategies that prioritize ecological integrity.
- Although awareness of sustainability issues is growing, there remains a pressing need to deepen public engagement and foster greater community participation in green initiatives.

Overall, Guangdong's experience illustrates how key enablers can accelerate green transformation, while addressing structural barriers.

## 4.6 Lessons for Pakistan

Drawing insights from Guangdong's experience in the establishment and development of GSEZs, several lessons can be drawn for Pakistan to facilitate its transition towards sustainable development and effective carbon abatement.

Pakistan should prioritize developing a comprehensive energy policy that sets a clear framework for achieving a low-carbon economy and integrates climate goals into its overall economic and social development plans. The policy should diversify energy resources by investing heavily in renewables such as solar, wind, and hydropower, following Guangdong's example in offshore wind and solar energy development. Pakistan should also promote decentralised energy generation by supporting rooftop solar panels and community-based renewable projects, helping to empower local communities and improve energy access.

Moreover, it is imperative that Pakistan implements comprehensive energy efficiency programs across industrial, commercial, and residential sectors. Establishing stringent energy efficiency standards and providing financial incentives for the adoption of energy-saving technologies can foster a culture of sustainability. Upgrading existing energy infrastructure, such as modernizing power grids and implementing smart grid technologies, will further optimize energy distribution and consumption while enhancing resilience.

From a GSEZ perspective, promoting sustainable urban development is essential. Pakistan should integrate sustainability into urban planning by developing energy-efficient buildings, expanding public transportation, and designing spaces that support green technologies. Strengthening regulatory frameworks and establishing clear governance structures will help grow renewable energy markets and build investor confidence. Introducing carbon pricing tools, such as emissions taxes and tradable permits, can create incentives for private sector participation in carbon reduction. International collaboration will also be important for sharing best practices and benchmarking progress against global standards. Investing in R&D will help localize innovative sustainable technologies, and lastly, involving local communities in renewable energy projects will create jobs and build shared responsibility.

By leveraging the lessons learned from Guangdong's GSEZs and adapting them to its unique context, Pakistan can effectively advance its energy transition, combat climate change, and pave the way for long-term economic stability and environmental resilience. Embracing a holistic strategy that integrates sustainable development with economic growth will ultimately position Pakistan as a leader in responsible resource management, serving as a valuable model for other nations facing similar sustainability challenges. Guangdong Province stands as a prominent example of eco-industrial development, showcasing how integrated approaches to renewable energy can drive sustainability while maintaining economic growth. As Pakistan endeavors to enhance its industrial sector, the lessons from Guangdong may provide a valuable roadmap for fostering ecofriendly practices and policies that protect the environment while promoting development.

Special Chapter

# 05

# China's Belt & Road Initiative and Opportunities to Promote GSEZs under CPEC 2.0

Author: Dr. Yixian Sun

# Chapter 5 - China's Belt & Road Initiative and Opportunities to Promote GSEZs under CPEC 2.0[1]

From national policy frameworks on GSEZs to reviewing the Guangdong case at the provincial level, this chapter shifts focus to China's external green development strategy under the Belt and Road Initiative (BRI). It extends the analysis to China's overseas engagement, linking the GSEZ model with CPEC 2.0 in Pakistan.

## 5.1 China's External Green Development Strategy

China's rapid economic development over the last four decades has been significantly benefited from SEZs. Across China, SEZs have allowed the central and local governments to allocate resources, provide support, and attract foreign investment in a more targeted way, and have therefore accelerated economies of scale for the country's industrial development. While SEZs have played a crucial role in China's domestic development, China's growing overseas investments offer an opportunity for Chinese financiers and businesses to promote sustainable development in other developing countries through the SEZ model. As China emerges as a global leader in clean technology and green development, there is significant potential for Chinese investors to drive the creation of Green SEZs and support the global sustainability transition. GSEZs can thus become a key pillar of the Chinese government's strategy to advance a green Belt and Road Initiative (BRI), while also providing critical support for sustainable development across the Global South. This chapter examines the potential role of GSEZs within the China-Pakistan Economic Corridor (CPEC), identifies remaining challenges, and offers policy recommendations to leverage GSEZs for advancing Pakistan's sustainability transition.

## 5.2 Advantages of SEZs and China's Green BRI

Since the launch of its reform and opening-up policy in 1978, China has accumulated extensive experience in developing SEZs, enabling central and local governments to attract high-quality investment, facilitate technology transfer, and promote innovation. Such experiences can also be helpful for other developing countries, which may face similar challenges in their processes of development. Facing multiple economic challenges, today's Pakistan urgently

1. Special chapter contributed by Dr Yixian Sun, Senior Lecturer (Associate Professor) in International Development at the University of Bath.

needs to mobilize investments for long-term development and build strategic industry. In the context of CPEC, various Chinese stakeholders have shown a strong interest in using SEZs to accelerate industrial development in Pakistan based on China's past experiences. This has been demonstrated by a number of SEZs constructed over the last decade under CPEC.

China's shift toward green development, including its Green BRI for overseas engagement, has opened new opportunities for establishing GSEZs. Domestically, China has actively experimented with GSEZ models by investing in green industries, improving energy efficiency, and reducing waste within SEZs (see earlier chapters). In parallel, state and non-state actors have established networks to promote peer learning and share best practices in advancing GSEZs. For instance, in 2016, China established the "Green Partnership of Industrial Parks China" (GPIPC) consisting of 36 SEZs in China to develop guidelines and share knowledge and best practices regarding sustainability transition. In 2022, GPIPC became a founding member of the Global Alliance of Special Economic Zones (GASEZ), an initiative sponsored by the United Nations Conference on Trade and Development (UNCTAD). GPIPC's involvement in the creation of GASEZ reflects China's growing interest in promoting GSEZs globally and sharing its experiences in sustainable zone development. As such, GSEZs have become a key instrument for China to advance its strategy of greening its overseas engagement, including initiatives under the BRI.

In April 2017, the term "Green BRI" appeared for the first time in the document "Guidance on Promoting Green Belt and Road" co-published by four ministries (Ministry of Ecology and Environment, 2017). This guidance presents a general plan for promoting eco-sustainability and green development in the BRI, with the requirement to "incorporate eco-environment protection into all aspects and whole process of the BRI building." This high-level document not only affirms China's intention to play a more active role in global environmental governance but also highlights its ambition to promote Chinese concepts of sustainability governance, including "ecological civilization" and "a community with a shared future for mankind.

Soon after the publication of this guidance, President Xi Jinping stated that the BRI "should pursue the new vision of green development" and "strengthen cooperation in ecological and environmental protection and build a sound ecosystem so as to realize the goals set by the 2030 Agenda for Sustainable Development." This statement by China's top leader sent a strong message regarding the green BRI, which aims to not only support global environmental governance and also globally promote China's visions and solutions for green development. In this context, GSEZs can serve as an important tool within China's Green BRI policy, enabling Chinese actors to share their experiences and introduce Chinese approaches to green development globally. By supporting the successful development of GSEZs in other developing countries, including Pakistan, China can further strengthen its emerging leadership role in global sustainability governance.

As BRI (including CPEC), has entered its second decade, China has placed greater emphasis on high-quality, "small yet beautiful" investments, clean technology, and green industries in its overseas engagement. This shift coincides with the rise of green industries, particularly solar energy, battery technologies, and EVs, as new pillars of China's economic growth. In this context, GSEZs are a promising area of cooperation between China and Pakistan in CPEC 2.0, which can bring new opportunities for sustainability transition in Pakistan. By attracting investments in green industries and adopting clean technologies to promote sustainable production, GSEZs can become new drivers of Pakistan's economy and support the country's achievement of the Sustainable Development Goals (SDGs) and its targets on clean energy transition.

## 5.3 Challenges Ahead

Despite the significant potential of GSEZs within CPEC 2.0, several challenges must be addressed for stakeholders to effectively develop these zones and advance sustainable development in Pakistan. This section identifies the key challenges and explores possible strategies to overcome them.

1. Although China has many experiences on SEZs and more recently GSEZs, such experiences may not be easily translated into Pakistan's context. Accordingly, in order for GSEZs to deliver tangible benefits for the local economy and communities in Pakistan, actors who design and establish new GSEZs must carefully adapt Chinese experiences and knowledge to local contexts by actively engaging with key stakeholders on the ground. This requires not only continuous consultations with relevant stakeholders, but also a process of adaptative learning through trial and error. It also requires mutual learning between the two countries instead of copying and pasting China's experiences to Pakistan.

2. Considering the context in Pakistan, it is important to have deliberations and establish clear criteria for "green" in GSEZs. In other words, those designing GSEZs need to consider what aspects of green development each GSEZs should aim to focus on in order to maximize the benefits of SEZs for local development. When considering sectors and technologies to be prioritized under GSEZs, policymakers and businesses need to pay attention to synergies among economic, environmental and social goals and how green development can benefit local communities and support just transition.

3. With respect to stakeholder engagement, the development of GSEZs must involve all types of stakeholders including non-state actors and marginalized communities that are likely to be impacted by GSEZs. Only through an inclusive approach to stakeholder engagement can GSEZs in Pakistan gain broader societal support and contribute meaningfully to local development. In doing so, transparent and robust processes need to be established for cross-sector communication and coordination.

# 06

# Indigenization of Renewable Energy Manufacturing in Pakistan

# Chapter 6 - Indigenization of Renewable Energy Manufacturing in Pakistan

Having seen China's model up close, this chapter returns to Pakistan to explore where and how similar low-carbon manufacturing clusters could be localized within the country's SEZ network.

## 6.1 Overview

Pakistan's energy sector is entering a phase of significant structural transition, requiring comprehensive policy and infrastructure reforms to ensure long term sustainability and efficiency. The country faces complex challenges, including mounting circular debt and financial strain caused by excess capacity, inefficiencies, and reliance on fuel imports. Despite low generation costs, electricity is sold at high prices (around Rs 45 per unit) due to taxes and surcharges (Rana, 2024). According to the 2024-25 Economic Survey, Pakistan's total installed electricity capacity stood at approximately 46,605 MW as of March 2025. Once constrained by chronic energy shortages, the country now possesses a surplus of 7,000 megawatts, largely attributed to support from Beijing through the multibillion-dollar CPEC. Nevertheless, constrained fiscal resources continue to impede the expansion and modernization of the transmission and distribution network, limiting sustainable energy access and hampering broader socio-economic development.

The energy mix in Pakistan is still predominantly reliant on fossil fuels, 55.7% of its installed electricity capacity is from thermal power. Moreover, hydel, nuclear, and renewable sources collectively accounted for 44.3% of the installed capacity, as per the 2024-25 Economic Survey. This dependency on imported fuels makes the energy sector vulnerable to price volatility in global markets and creates an economic burden on the country. In addition to these challenges, Pakistan has faced transmission and distribution losses of around 18%, significantly higher than the international benchmark of 10% (Waleed, 2020). These inefficiencies, combined with a growing population and rapid urbanization, further strain the energy sector, resulting in inadequate access to electricity, particularly in rural areas.

Pakistan also faces significant challenges related to climate change and industrial pollution. However, the country's development of Green SEZs could play a pivotal role in aligning its industrial policies with its national climate and energy goals, set within the framework of its Paris Agreement commitments, national policies, and the broader agenda of achieving SDGs. The country faces significant challenges in reducing its carbon emissions and transitioning to cleaner energy sources. However, it has set ambitious targets to align with international climate action efforts and secure a sustainable future for its people. According to IRENA's "World Energy Transitions Outlook, 2023" report, the current climate commitments and plans fall far short of meeting the 1.5°C pathway, with an estimated emissions gap of 16 Gt in 2050. Additionally, the energy-related emissions gap could reach 34 Gt by 2050 (IRENA, 2023).

The development of GSEZs presents Pakistan with a strategic opportunity to align its industrial transformation with its climate and energy goals (*refer to Annex H for details*), while meeting its commitments under the Paris Agreement, particularly, the targets set out in the country's Nationally Determined Contributions (NDCs). These zones could establish Pakistan as a leader in the green economy in South Asia, through sustainable economic growth, green innovation, and investments in low-carbon technologies, considering that the green technology market size will grow from $23.63 billion in 2024 to $30.03 billion in 2025 at a compound annual growth rate (CAGR) of 27.1% (Business Research Company, 2025). With the right planning, investment, and policy support, GSEZs could play a pivotal role in ensuring a sustainable and resilient future for the country. In order to meet growing energy and ecological demands and phase out fossil fuels, a strategic shift towards sustainable, low-carbon solutions is required.

## 6.2 Low-Carbon Development in Pakistan

Low-carbon development involves shifting from fossil fuel-based energy systems to renewable energy sources, enhancing energy efficiency, and promoting sustainable transportation solutions such as EVs. Here lies the opportunity for Pakistan to diversify its energy mix, reduce reliance on imported fuels, and curb greenhouse gas (GHG) emissions. The need for low-carbon development in Pakistan is vital due to several reasons. First, the increasing cost of imported fossil fuels has placed a strain on Pakistan's foreign exchange reserves. As of 2022, Pakistan spent approximately $21.43 billion annually on fuel imports, which is about 66% of its total foreign exchange reserves (Haq, 2022). In more recent times, Pakistan's petroleum imports grew by 1.68% in the first four months (July-October) of fiscal year 2024-25, reaching $5.113 billion, up from $5.029 billion during the same period last year, according to data released by the Pakistan Bureau of Statistics (PBS). This dependence on imported fuels for energy generation is economically unsustainable and exposes the country to global energy price fluctuations.

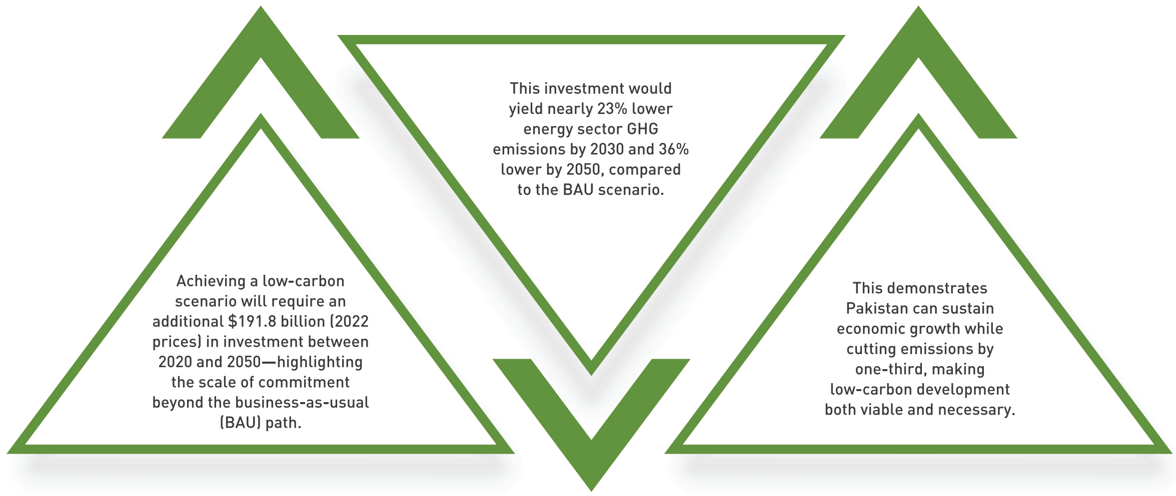



**Figure 6.1:** Costs and Gains of a Low-Carbon Scenario
Source: ADB, 2024a

### 6.2.1 Clean Energy Imperative

Pakistan's renewable energy potential is vast, but it remains largely untapped. The country's geographical advantages, with an irradiation level of 6-7 kWh/m²/day, particularly in Punjab and Sindh provinces, which are recognized as focal points for both small (kW) and large (MW) scale PV development (Malik, et al., 2016), could help address growing energy demand. In Pakistan's context, renewable energy is often seen as the "lowest hanging fruit" due to its cost-effectiveness and abundant natural resources. Unlike fossil fuel-based power plants, renewable systems such as solar farms and wind turbines can be deployed more rapidly and at scale.

EVs have also become a key pillar of low-carbon development. Pakistan's transport sector, a major consumer of petroleum products, recorded a 7.99% increase in consumption, rising from 9.76 million metric tonnes (MMT) in July-March FY 2024 to 10.54 MMT (80% of total demand) in the same period of FY 2025, according to Pakistan Economic Survey 2024-25. Consequently, it is a significant contributor to both air pollution and GHG emissions. Air quality, in major metropolitan areas such as Karachi and Lahore, is deteriorating rapidly, with some areas of Lahore recording Air Quality Index (AQI) levels surpassing 1,000, considered extremely hazardous to public health (Gabol, 2024). The adoption of EVs offers a practical and urgent solution to these challenges. As a technology central to decarbonizing road transport, a sector responsible for nearly one-sixth of global emissions, EVs can play a transformative role. Recognizing this potential, the Government of Pakistan has drafted the New Energy Vehicle (NEV) Policy, which targets transitioning 30% of vehicles in the country to electric power by 2030 (Ali, 2024).

On the other hand, the Carbon Border Adjustment Mechanism (CBAM) is a tool being developed by the European Union (EU) to impose a carbon price on imports from countries that do not have equivalent carbon pricing systems.

This mechanism is expected to be fully implemented by 2026 and will affect industries that export to the EU, such as steel, cement, and textiles, sectors in which Pakistan is a major player. For Pakistan, CBAM represents a significant challenge, as it could increase the cost of exports to the EU, especially if the country fails to adopt cleaner production methods. However, if it also presents a solid opportunity to escalate the clean energy transition through adoption of energy-efficient technologies, which would not only help reduce emissions but also protect Pakistan's competitiveness in global markets. By 2050, a significant transformation in both the power and end-use sectors is essential to support the high proportion of renewable energy needed for the clean energy transition.


**Figure 6.2:** Implementation Timeline for EU's Carbon Border Adjustment Mechanism
Source: Buzeti, 2024

## 6.3 Pakistan's Solar Energy Market Outlook

The global market for low-carbon technologies is expanding rapidly, propelled by international commitments to reduce GHG emissions and transition towards sustainable energy systems. This shift presents a strategic opportunity for Pakistan to position itself within the growing renewable energy sector, both to meet domestic energy needs and to explore export potential.

The solar energy market, in particular, has experienced remarkable growth in Pakistan over the past decade, a trend that is projected to persist. Since 2024, Pakistan has imported over 24 GW of solar PV equipment, primarily sourced from China. This influx positions Pakistan as a significant downstream consumer in the global solar supply chain. The domestic solar market has been expanding rapidly, with increasing adoption by households, commercial entities, and industrial users. Notably, uptake has been particularly strong in rural and peri-urban areas where access to the national grid remains limited.

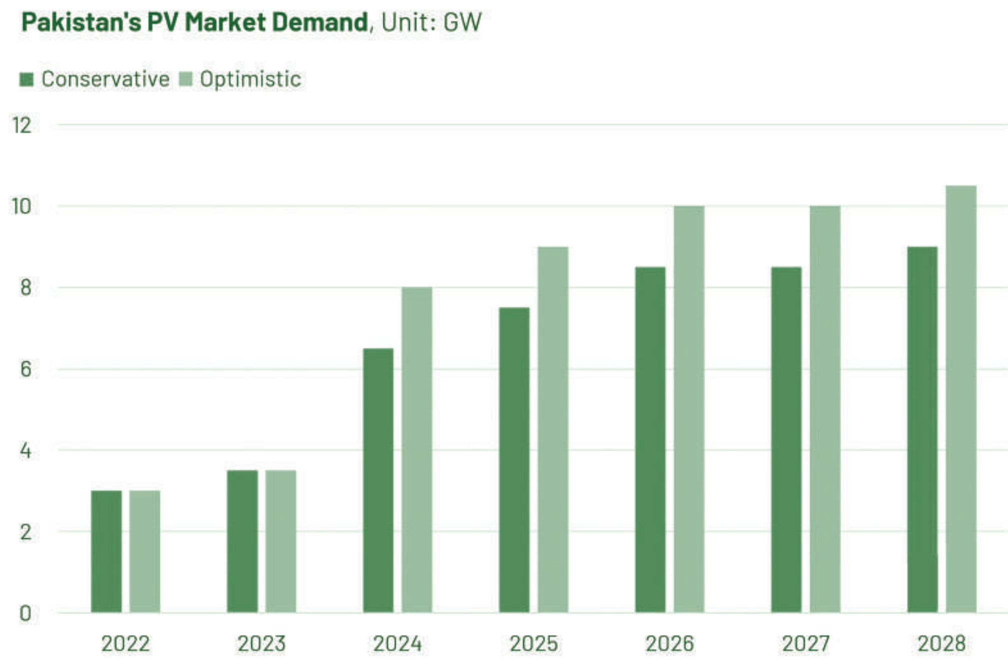



**Figure 6.3:** Pakistan's PV Market Demand
Source: Infolink, 2024

Pakistan has substantial renewable energy potential, yet slow electrification, particularly in rural areas, where 62.5% of the population lives and 14.05% of villages remain without electricity (Qureshi et al., 2024), continues to pose a significant barrier. Solar energy offers a decentralized solution ideal for expanding access in off-grid regions. Adoption is gaining traction among sectors such as healthcare, education, hospitality, and industry, including textiles in Faisalabad and Lahore, and sports manufacturing in Sialkot. In agriculture, especially in Punjab and Sindh, demand is growing for solar-powered irrigation. As this momentum builds, domestic solar manufacturing is expected to play an increasingly important role in meeting rising demand.

Despite this progress, the market remains skewed toward higher-income households utilizing net metering, while over 54% of electricity consumers, those using less than 200 units per month, are largely left out. This underserved group lacks access to affordable financing, off-grid solutions, and subsidized hybrid systems. Realizing the full potential of solar energy requires a deliberate shift toward inclusive, locally adapted technologies, such as solar tube wells in Balochistan and community microgrids in energy-poor districts. Without such efforts, energy access will remain uneven, and the broader goals of energy justice and equitable development will remain unmet.

### 6.3.1 Solar Adoption Rates and Price Trends

The price of solar technology keeps decreasing as it advances. Each time production doubled between 2010 and 2023, the cost of solar energy decreased by 33.4%. On the other hand, global politics and markets govern the price of fossil fuels. After purchasing an impressive 13 GW of Chinese solar panels in the first half of 2024, Pakistan kept the momentum going and now stands as the third-largest importer of these panels. This placed Pakistan as the sixth-largest solar panel installer in 2024, however locally, the impact is significantly greater. Pakistan's imported solar capacity has already surpassed 30% of its total installed power capacity, which stood at 46 GW in 2023 (Azhar & Warren, 2024).

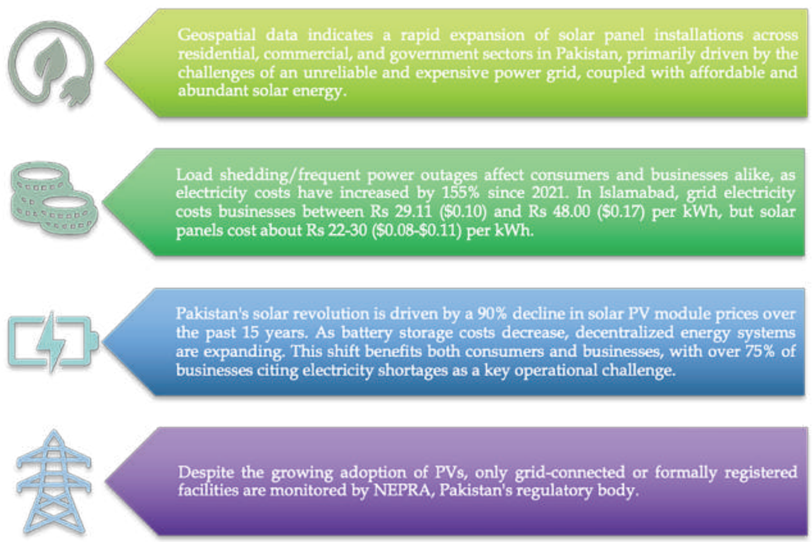



**Figure 6.4:** Trends in Renewable Energy Integration and Price Dynamics
Source: Infolink, 2024; Shield, 2024.

### 6.3.2. Policy Drivers and Infrastructure Needs for Renewable Energy

Pakistan's accelerated adoption of renewable energy, especially solar, has been largely facilitated by a series of targeted policy interventions and evolving infrastructure needs. Among the key drivers, government-led measures such as tax exemptions on solar products, introduction of net metering, and broader policy support for renewable energy development have played a pivotal role in boosting solar uptake across residential, commercial, and industrial sectors. These incentives lowered upfront costs, enhanced the financial viability of solar projects, and broadened access to clean energy solutions for a diverse range of consumers. Particularly, the government's decision to maintain tax exemptions on imports of solar cells and modules has further encouraged businesses and households to invest in solar PV technologies. Pakistan's solar market is expected to continue relying on imported modules in the near term, as local manufacturing capabilities remain limited and incentives for domestic production are still under discussion. This dynamic has led to an unbalanced model of energy sector growth, deployment has surged, yet without corresponding industrial development or strategic localization. The financial outflows due to imports also place pressure on Pakistan's balance of payments and underscore the lack of internal capacity to sustain the growth of this sector independently. From July 2024, Pakistan extended its 2023 tax exemptions on solar cells and module imports to lower the upfront costs of PV projects and attract greater business participation. As demand continues to grow, imports of solar modules are projected to rise significantly in the coming years (Lin, 2024).

However, sustaining this momentum will require substantial modernization of Pakistan's national electrical system. Improving grid reliability, expanding off-grid access, and integrating variable renewable energy (VRE) sources demand proactive infrastructure upgrades. This includes the deployment of advanced AI-powered monitoring and forecasting tools, investments in digital metering systems, and rapid-response battery storage solutions to ensure efficient supply-demand balancing. Distribution companies must also play a more active role in managing grid flexibility and expanding clean energy access, particularly in rural and peri-urban areas.

As discussed earlier, global regulatory trends are also shaping the urgency for cleaner energy adoption. Instruments such as the EU's CBAM and net-zero commitments by multinational corporations are placing pressure on Pakistan's export-oriented industries to transition towards renewable energy sources. Businesses reliant on international markets risk losing competitiveness unless they can demonstrate reduced carbon footprints through renewable energy sourcing whether via the national grid or captive generation units (Sprung & Khan, 2024).

While current growth has been largely fueled by policy incentives and rising demand, the next critical step for Pakistan's energy transition lies in developing localized supply chains. Strategically leveraging SEZs offers a unique opportunity to build domestic manufacturing capacity for solar components, battery storage, and EVs. This shift would not only enhance energy security and economic resilience but also position Pakistan competitively in the evolving global green economy.

## 6.4 Relevant Sectors for GSEZs Integration

GSEZs offer a strategic opportunity to accelerate growth in key sectors tied to renewable energy and electric vehicles (EVs). GSEZs can serve as critical enablers for localizing solar PV assembly and component manufacturing, battery storage production, EV assembly and component manufacturing, grid integration, and the development of advanced energy storage solutions.

Given that solar deployments have experienced an average annual growth rate of 26% globally over the past decade, and continue to accelerate (SEIA, 2024), Pakistan is well-positioned to capitalize on this momentum. By establishing specialized manufacturing and technology hubs within GSEZs, Pakistan can significantly reduce its reliance on imported modules, lower costs through economies of scale, create employment opportunities, and enhance the technological competitiveness of its renewable energy and clean mobility sectors. Furthermore, integrating renewable energy supply chains within GSEZs, including smart grid technologies and rapid-response storage systems, can support grid stabilization, enable higher shares of variable renewables, and attract FDI. Policy incentives such as tax breaks and customs exemptions are key to attracting investment here. In addition, a skilled workforce is critical, as the transition to clean energy is expected to generate 10.3 million net new jobs globally by 2030 (World Economic Forum, 2022). Key areas to focus on include grid integration and energy storage, with global energy storage installations projected to reach a cumulative 411 GW (or 1,194 GW/hour) by the end of 2030 (BloombergNEF, 2022). Domestic production of EV components, including batteries, also remains essential. The global EV battery market size was valued at $132.6 billion in 2023 and is expected to reach $508.8 billion by 2033, at a CAGR of 14.4%, during the forecast period 2023-2033 (MarketsandMarkets, 2024). GSEZs can enable Pakistan to localize production, reduce import dependence, create employment, and strengthen its position in the global clean energy and EV sectors.

To fully realize the potential of GSEZs in advancing Pakistan's low-carbon transition, it is essential to discuss these critical enablers in detail:

1. Localization of solar energy supply chains, particularly the balance of system (BoS) components
2. Skill development and workforce training
3. Grid integration and energy storage solutions
4. Domestic manufacturing of EV components and charging infrastructure development

### 6.4.1 Localization of Solar Energy Supply Chains

Pakistan's reliance on imported solar panels has been a significant factor contributing to the country's trade deficit. Localizing solar supply chains is a key strategy to reduce this dependence and develop a sustainable local solar industry. Given the findings from the earlier chapters on China, collaboration under BRI's CPEC Phase 2.0 could play a catalytic role. In particular, Chinese investment can bring in the technology, expertise, and scale needed to build a competitive solar manufacturing sector.

The Rashakai SEZ, located in Khyber Pakhtunkhwa, has become a hub for solar manufacturing and other renewable energy projects, with a Rs 470.78 million solar panel project underway in the area (The Nation, 2024a). In 2024, the government finalized a ten-year "Solar Panel and Allied Equipment Manufacturing Policy" which provides a comprehensive roadmap for local solar panel production. The policy offers tax exemptions on machinery imports, rebates on energy costs for manufacturing facilities, and incentives for R&D in solar technology. The government also intends to introduce a tariff on finished goods imports, starting at 5% in the first year, rising to 10% in the second year, and increasing to 15% for the subsequent years, up to the tenth year. In addition, investors will be required to provide a bank guarantee equal to the amount of the tariff and tax exemptions (Ghumman, 2024). These incentives aim to increase local manufacturing capacity to meet growing domestic demand, while also positioning Pakistan as an exporter of solar products in the region.

**Manufacturing Capacity and Sales Ratios**

Export-to-local sales ratios must progress from 50:50 in Year 1 to 60:40 in Year 2, 70:30 in Year 3, 80:20 in Year 4, and 90:10 from Year 5 onward for ten years, with manufacturing capacity expanding from 1 GW to 10 GW starting in Year 6.

**Localization Requirements**

Localization will start at 0% in Year 1, rise to 30% in Year 2, 40% in Year 3, and 50% in Year 4, remaining at 50% for the rest of the ten-year period.

**Investment Commitments**

$10 million (Year 1), $20 million (Year 2), $30 million (Year 3), $40 million (Year 4), $50 million (Year 5), and $60 million annually from Year 6 to Year 10.

**Figure 6.5:** Exemptions on Duties and Taxes Roadmap for Investors
Source: Solar Panel and Allied Equipment Manufacturing Policy, 2024

Despite the preparation and circulation of the draft policy for solar PV manufacturing localization, it has yet to receive approval from the Economic Coordination Committee (ECC), reportedly due to concerns over the fiscal implications of proposed duty protections. The delay has created uncertainty; affecting investor confidence and increasing the perceived risk for capital investment. Without a clear and consistent 10-year industrial policy outlining incentives and duties, long-term foreign direct investment, particularly from potential Chinese partners considering supply chain relocation, remains uncertain.

In Pakistan, a rapidly growing number of informal and small-scale setups are actively engaged in the assembly of solar panels, primarily relying on imported components such as integrated circuit (IC) chips, inverters, and other critical parts. This emerging sector plays a vital role in expanding solar energy access across the country. However, it remains heavily dependent on foreign supply chains, which poses challenges to long-term sustainability, energy security, and cost-efficiency.

To truly localize Pakistan's solar industry, it is essential to move beyond simple panel assembly and focus on developing domestic capacity for manufacturing key components. This includes not only solar cells and chips but also control systems and other balance of system (BoS) components such as racking systems, inverters, electrical wiring, and mounting structures. While the full-scale production of PV modules may remain a long-term ambition due to high entry barriers and China's prevailing influence in controlling nearly 70% of global solar PV manufacturing, the immediate opportunity lies in localizing the rest of the supply chain.

Due to China's cost advantages and economies of scale, importing solar panels remains more economical for now. Consequently, the cost structure of solar projects in Pakistan has shifted significantly toward BoS components, which now account for 60% to 70% of total project costs. These are precisely the areas where local industries can realistically compete and create economic value. Furthermore, Pakistan's solar market is expanding rapidly, adding approximately 300 MW of capacity each month, signaling a robust and growing domestic demand that can support localized BoS manufacturing and services.

Focusing on this segment of the supply chain offers several strategic advantages: it can reduce

**BOX 6A: Case for Localizing Solar PV Manufacturing in Pakistan**

The solar energy revolution, while bringing benefits, has also revealed a critical weakness in its foundation: an overreliance on imported solar panels. In 2024, Pakistan imported 15.8 GW of solar panels, spending a staggering $2.1 billion. This figure marked a nearly fourfold increase from $714 million in 2023, a cost that has weighed heavily on the country's economy (Amjad, et al., 2024). The growing trade deficit, which rose by 4.24% in the first quarter of FY2024–25 to $5.4 billion (Kundi, 2024), highlights the financial strain of continued solar imports. Pakistan's foreign exchange reserves fell below $5 billion in early 2024, exposing vulnerabilities in its energy transition strategy. Every imported panel carries risks of supply chain disruptions, price volatility, and geopolitical uncertainty, raising serious doubts about the sustainability of an import-dependent approach.

Shifting from an import-dependent model to domestic manufacturing could save Pakistan billions annually, ease the trade deficit, and protect foreign reserves. Solar energy in Pakistan has the potential to yield significant economic benefits. By reducing reliance on expensive fossil fuel imports, the country could save up to $5 billion in energy costs over the next two decades, as estimated by a World Bank report. Additionally, the renewable energy sector can create numerous jobs in manufacturing, installation, and maintenance, stimulating local economies. Localizing solar technology, through domestic production of panels, inverters, and components, can further strengthen this impact by reducing import dependence and strengthening a sustainable local supply chain. By attracting foreign investment, solar energy can also boost economic growth. Increased innovation and affordability of solar technology are making it more accessible to residential and commercial sectors (PVKnowHow, 2024). For households and businesses, panel prices could fall by 20–30%, making renewable energy more affordable and accelerating adoption (Saur News Bureau, 2024). In December 2024, Pakistan signed a $200 million solar power deal to develop 200 MW of solar plants, demonstrating its commitment to renewable energy (CPECInfo, 2024). Beyond economics, localization would offer energy independence, shielding Pakistan from the uncertainties of global supply chains, create jobs, promote industrial growth, and develop expertise in renewable energy technologies. Furthermore, the general sales tax (GST) on imported solar panels in Pakistan, initially proposed at 18% in the 2025–26 federal budget, has been reduced to 10% for the current year following strong opposition from a parliamentary finance committee and clean energy stakeholders. The higher tax had raised concerns about hindering the rapid adoption of solar power. Solar energy now supplies 25% of the nation's electricity, placing Pakistan among fewer than 20 countries generating at least a quarter of their power from solar sources. Officials explained that 46% of components used in solar installations are imported and already taxed, while the remaining 54% are locally sourced. The revised 10% GST aims to ease the financial burden on consumers while still encouraging the gradual localization of the solar supply chain and supporting domestic manufacturing.

| Challenges in Localization | Opportunities Offered by SEZs |
|---|---|
| The shift toward localization faces serious challenges. By the end of 2024, warehouses held 3 GW of unsold solar panels, exposing the risks of an import-driven model. A $2.1 billion import bill drained resources that could have built domestic capacity. Continuing on the current path is unsustainable; a new approach is urgently needed. | SEZs, like Dhabeji SEZ in Sindh, offer a favorable environment for solar manufacturing, with tax exemptions, duty-free raw material imports, and streamlined regulations. SEZ-based facilities could add over $1 billion annually in export earnings. To support localization, Pakistan has invited LONGi Green Energy Technology Co. Ltd. to establish a state-of-the-art manufacturing plant in Pakistan.<br><br>Proximity to major ports like Port Qasim further strengthens SEZs' role in positioning Pakistan as a regional solar manufacturing hub for South Asia, Central Asia, and the Middle East. |

overall project costs through localized logistics and labor efficiencies, lower reliance on imports, enhance innovation, create jobs, and enhance national energy security. In this context, a targeted approach that prioritizes the localization of BoS components, while gradually building capacity for more advanced manufacturing, represents the most feasible and economically rewarding path forward. Investing in the broader solar energy supply chain, even while continuing to import PV modules in the short term, could provide billions in industrial opportunity and set the foundation for a resilient, self-sustaining solar sector in Pakistan.

#### 6.4.2 Skill Development and Workforce Training

One of the main factors limiting the development of local solar PV manufacturing in Pakistan is the insufficient availability of technically skilled professionals in key areas of solar technology. According to the Economic Survey 2023–2024, the government and private sector have initiated vocational training programs and established technical institutes aimed at equipping workers with the necessary skills for the renewable energy sector. However, a significant gap remains between the competencies of engineers and the specialized expertise required for PV production. Current curricula in mechanical and electrical engineering largely overlook essential subjects such as photovoltaic materials science, semiconductor fabrication, and energy storage systems. This mismatch not only limits the industry's ability to innovate but also increases reliance on expatriate labor and semi-skilled operators. To address this, there is an urgent need for curriculum reform, investment in advanced laboratory infrastructure, and structured collaborations with international technology providers, particularly Chinese firms. These efforts are vital to developing a skilled domestic workforce capable of supporting a sustainable and independent solar manufacturing industry in Pakistan.

### 6.4.3 Grid Integration and Energy Storage Solutions

As mentioned previously, Pakistan's solar energy capacity has surged to 24 GW, yet only 4.9 GW of net-metered solar capacity has been installed (Recorder Report, 2025), revealing a significant disconnect between generation potential and actual utilization. This stems from outdated grid infrastructure, lack of large-scale storage, and limited integration of distributed solar. To fully harness this solar boom, Pakistan must modernize its grid by expanding transmission networks, deploying smart grid technologies, and integrating battery energy storage systems to manage variability. Additionally, policy reforms such as dynamic tariffs, streamlined interconnection processes, and support for hybrid solar-storage projects are essential. Incorporating demand response, flexible generation, and microgrids, especially in off-grid areas, will further enhance grid stability and ensure that solar energy becomes a reliable, mainstream contributor to the country's energy mix.

Pakistan's solar energy capacity is steadily expanding, highlighting the need for large-scale battery energy storage systems (BESS), to manage intermittency and stabilize the grid. Currently, majority of batteries in Pakistan are imported, making storage projects costly and vulnerable to global supply shocks. To address Pakistan's growing energy needs and reduce dependence on imported batteries, Wave Tech has announced a groundbreaking $200 million FDI to establish the country's first-ever lithium battery manufacturing plant at the Malir Industrial Park (MIP), the flagship project of Pakistan Economic Zone Development and Management Company (PEZDMC), in Karachi. Construction of this state-of-the-art facility is scheduled to begin in December 2025, with production expected to commence by mid-2026. This pioneering initiative represents a major step toward modernizing Pakistan's energy infrastructure by phasing out conventional oxide batteries and adopting lithium-based alternatives.

In a similar move, a leading Chinese lithium battery company has signed an agreement with the Punjab Industries and Commerce Department to set up a manufacturing plant, underscoring Punjab's growing appeal as a hub for foreign investment and advanced manufacturing. These strategic developments are poised to strengthen the nation's energy storage capacity, boost domestic production capabilities, and enhance energy security, positioning Pakistan as an emerging player in the global clean energy value chain.

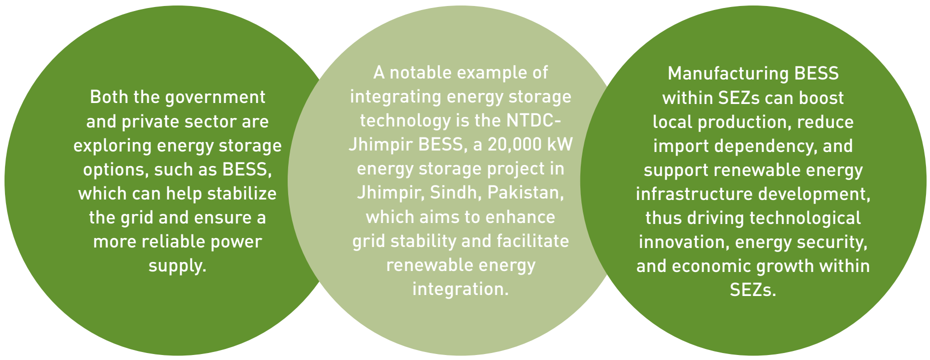



**Figure 6.6:** Potential of SEZ-based BESS Manufacturing to Enhance Grid Stability, Renewable Energy Integration & Local Production
Source: Business Recorder, 2024a

### 6.4.4 Domestic Manufacturing of EV Components

The global EV market is projected to reach a staggering $46 trillion between 2021 and 2050, according to BloombergNEF's "Long Term Electric Vehicle Outlook" (Bloomberg, 2021). In 2023, the EV sector was valued at $500.48 billion and is forecasted to expand from $671.47 billion in 2024 to $1,891.08 billion by 2032, reflecting an impressive compound annual growth rate (CAGR) of 13.8%. Notably, the Asia-Pacific region dominated the global market in 2023, accounting for 51.24% of the total share, highlighting its critical demand and strategic significance for the sector's sustained growth (Fortune Business Insights, 2024).

This market evolution presents a strategic opportunity for Pakistan to address domestic mobility needs while establishing itself as a regional EV manufacturing hub. Historically dependent on imports for critical automotive components, including those essential for EVs, Pakistan now has the chance to localize the production of key technologies through green development within its SEZs. This includes the domestic manufacturing of high-value assets such as battery systems, electric drivetrains, and charging infrastructure, positioning Pakistan as a key player in the electric mobility value chain.

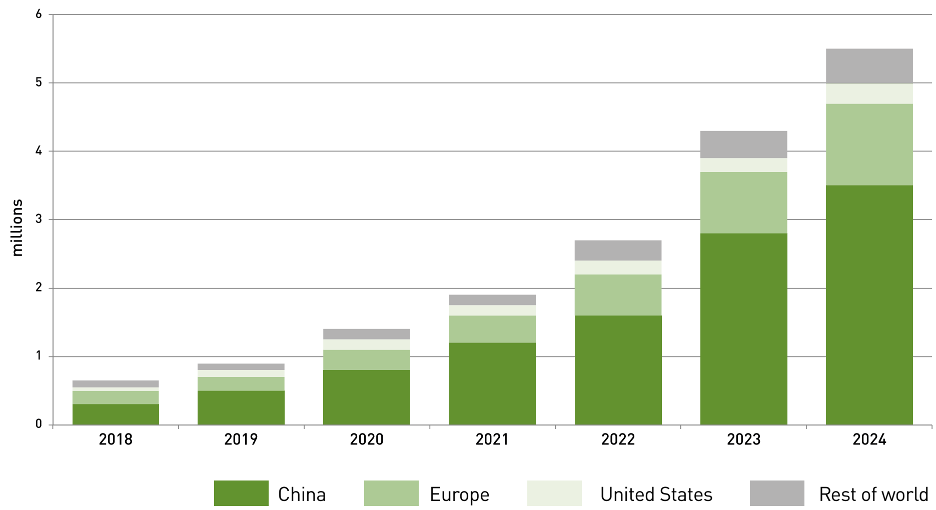



**Figure 6.7:** Global stock of public charging points by region, 2018-2024 as per the Global EV Outlook Report (IEA, 2025)

#### *6.4.4.1 Government Measures to Support the EV Market*

In 2024, the government introduced several measures to support the EV market:

- Tax exemptions on the import of EVs and EV components.
- Subsidies for local EV manufacturers to encourage domestic production.
- Reduced registration fees for EVs to incentivize consumer adoption.
- Hybrid Electric Vehicles (HEVs) incentives:
    - HEVs with engine capacities up to 1800cc receive a 50% exemption on duties and taxes.
    - HEVs with engine capacities between 1800cc and 2500cc receive a 25% exemption on duties and taxes.

Such incentives (see figure for details) aim to reduce the upfront cost of EVs, making them accessible to a broader segment of the population. Localizing the production of EV components in Pakistan is expected to further lower manufacturing costs, improve affordability, and enhance the long-term sustainability of the country's transportation sector.

The expansion of EV charging infrastructure is another critical area for development, as the number of global charging stations is expected to grow from $1.8 million in 2023 to over $5 million by 2030. Currently, the lack of a widespread charging networks is one of the key barriers to EV adoption. However, the government's focus on developing charging infrastructure aligns with Pakistan's broader goals of transitioning to cleaner energy sources and reducing reliance on imported fossil fuels.

Alongside improvements in the domestic EV ecosystem, strengthening the manufacturing base through SEZs offers a strategic opportunity to build a globally competitive EV industry. The country's expanding infrastructure, favorable policies, and rising domestic demand for EVs position SEZs as strategic platforms for investors. Establishing operations within SEZs offers cost advantages, access to skilled labor, and benefits from Preferential Trade Agreements (PTAs), enabling investors to tap into Pakistan's growing EV market and regional export opportunities.

The government approved **40 EV charging stations** along motorways at **Rs 39.75 per unit**.

Continuous efforts are needed to build an integrated EV ecosystem; SEZs offer opportunities to expand **EV charging infrastructure**.

Lahore and Islamabad were designated model cities under the National EV Policy, 2019 to **launch Green Rickshaw and Green Taxi schemes**.

EV-related greenfield projects, including charging infrastructure, can be developed within SEZs.

This approach will **drive EV manufacturing growth** and develop a local vendor industry, supporting comprehensive EV adoption.

**Figure 6.8:** Accelerating EV Adoption in Pakistan: Government Initiatives and Infrastructure Development
Source: Bhutta, 2024

Furthermore, the Minister for Industries and Production, revealed the government's ambitious plan to transform Pakistan's transportation landscape by setting up 10,000 EV charging stations by 2030. Around 31 companies have expressed interest in investing in EVs in Pakistan, with two companies already granted manufacturing licenses (Nazar, 2024b). This demonstrates the growing momentum in the EV sector and highlights the potential of SEZs to drive both EV production and the expansion of essential charging infrastructure, contributing to sustainability and attracting investment in clean energy technologies.

## 6.5 Solar PV Circularity – Scaling Recycling and Resource Recovery

An often overlooked but technically urgent area is the lifecycle management of PV systems. First-generation panels deployed over a decade ago are now reaching end-of-life, and many users are upgrading from older 12–15% efficiency modules to newer panels exceeding 26% laboratory efficiency. Pakistan currently has no formal policy, institutional capacity, or commercial infrastructure for solar panel or battery recycling. The absence of end-of-life regulations, reverse logistics, and material recovery facilities poses environmental risks and regulatory exposure. An efficient circular economy framework must be integrated into the localization roadmap, including obligations for take-back schemes, recovery rate targets, and recycling plant incentives.

## 6.6 Opportunities and Challenges in the Energy Sector

While significant progress is underway, Pakistan's energy transition also presents the following distinct opportunities and persistent challenges that must be addressed:

### 6.6.1 Opportunities

- By shifting towards localization of solar supply chain within SEZs, Pakistan can save foreign exchange, lower trade deficits, and reduce the impact of global price fluctuations on the solar energy market. SEZs offer an ideal environment with tax incentives and dedicated infrastructure to support this shift.
- Indigenizing the production of EVs within SEZs could reduce Pakistan's dependence on imported fossil fuels, which cost the country around $13 billion annually (World Bank, 2022). Local production of EVs, including electric buses and passenger vehicles, could also contribute to energy diversification, improve sustainability, and help meet Pakistan's climate commitments. SEZs provide an opportunity to develop a green supply chain for EV manufacturing and create a localized market.
- Global PV markets have experienced a price crash, causing excess capacity in China and prompting some firms to dismantle outdated production lines. Several Chinese companies are exploring relocation to cost-effective markets. Instances of solar equipment, including entire assembly lines, were reported to remain idle at Chinese ports such as Ningbo and Shanghai. This creates a time-sensitive window for Pakistan to position itself as an alternative hub for solar component manufacturing. However, to seize this opportunity, Pakistan must offer a policy architecture with guaranteed duty protections, export pathways through preferential trade agreements, within its SEZs.
- Joint ventures (JVs), licensing agreements, and co-production models are the most realistic mechanisms for strengthening solar technology transfer under the CPEC 2.0 framework. However, this requires coordinated governance involving the Special Investment Facilitation Council (SIFC),

Engineering Development Board (EDB), Board of Investment (BOI), and private sector representatives. The establishment of vertically integrated solar clusters must be accompanied by fiscal incentives such as tax holidays, duty-free capital equipment imports, and equity-sharing arrangements to ensure local value capture.

- The growth of local industries within SEZs dedicated to solar PV manufacturing and EV production can majorly increase job creation. The solar PV industry could create 1,300 manufacturing jobs for each gigawatt of production capacity (IEA, 2022). This could play a crucial in addressing Pakistan's unemployment rate, which stood at 8.5% in 2023 (Ahmed, 2023).
- FDI in Pakistan's energy sector reached $585.6 million during July-September 2024-25 (Q1FY25) (Radio Pakistan, 2024). By leveraging SEZs, Pakistan can position itself as a competitive player in the global renewable energy supply chain.
- Local production of solar PVs and EVs can contribute to Pakistan's climate commitments. By accelerating the clean energy transition, Pakistan could work towards achieving its NDCs under the Paris Agreement.

### 6.6.2 Challenges

- Setting up local solar manufacturing plants requires substantial upfront investment. Industry estimates suggest startup costs can range from $250,000 to over $2 million, depending on the scale and technology employed (BPT, 2024). There is also a technology gap in advanced manufacturing processes for solar panels, which may limit the competitiveness of local products unless domestic manufacturers can access the required expertise and technologies.
- Local production of EVs faces similar significant barriers, including the need for large-scale investment in manufacturing infrastructure. Localizing EV manufacturing would require over $100 million (Raza, 2021) investment to establish production plants and set up the associated supply chains, including battery production and assembly lines. The existing infrastructure for EVs, such as charging stations and maintenance facilities, is underdeveloped, limiting the scope of local production without simultaneous investment in charging infrastructure.
- A major structural barrier to domestic solar manufacturing is the prevailing taxation regime, which disproportionately penalizes components critical for local assembly and production. Batteries, a cornerstone of off-grid and hybrid systems, are taxed at a prohibitive rate of 51%, while inverters carry a 29% tax burden. In contrast, imported solar panels currently avail duty exemptions under Pakistan's Fifth Schedule, effectively privileging foreign-produced modules over local manufacturing. The disparity continues at the sales tax level, imported panels benefit from 0% sales tax, whereas

domestically produced panels and components face up to 18% taxation. These distortions discourage investment in local assembly lines and render domestically assembled systems uncompetitive relative to imports.

- Currently, there is a shortage of trained professionals in the fields of solar energy technology and EV assembly. The lack of specialized training programs and technical education infrastructure could delay the full realization of these green job opportunities unless urgent efforts are made to address the skills gap.
- Inconsistent policies, such as fluctuating energy tariffs, delays in renewable energy incentives, and the prolonged approval process for the solar PV manufacturing localization policy, have created uncertainty for investors. Concerns over fiscal impacts have contributed to delays, while the absence of a clear, stable 10-year industrial policy with defined incentives and duties for sectors like solar PV and EV manufacturing continues to deter long-term foreign investment. This policy limbo raises the perceived investment risk, making potential commitments, especially from Chinese firms exploring supply chain relocation, remain speculative rather than actionable.
- Pakistan currently lacks internationally recognized technical standards for solar PV and energy storage components. This gap restricts the exportability of any locally manufactured goods and raises concerns about safety and reliability in domestic deployment. Without conformity to IEC or TUV standards, Pakistani modules and inverters cannot enter regulated markets in Europe or the Middle East. Establishing a centralized certification and standardization authority is imperative to align domestic specifications with global norms, an economic necessity for export diversification and industrial competitiveness.
- Pakistan's outdated grid infrastructure is not fully equipped to manage the large-scale integration of intermittent solar energy. In addition, the country has fewer than 100 EV charging stations, far below the level needed to support widespread EV adoption. Upgrading the national grid and expanding the EV charging network are critical to enabling renewable energy integration and achieving national targets.

Addressing the above opportunities and challenges will require a cohesive set of strategic actions as discussed in the final chapter.

# Ensuring Inclusive and Gender-Responsive SEZ Development

While SEZs are often evaluated through the lens of investment attraction, industrial output, and export growth, their success must also be measured by how equitably they distribute social and economic benefits, particularly among local communities and women. In Pakistan's context, where women's labor force participation stands at just 24.5% (ILOSTAT, 2021), the SEZ agenda under CPEC 2.0 presents a critical opportunity to reshape local economies through industrial growth and job creation. However, for this transformation to be equitable and sustainable, gender-responsive planning and community inclusion must be integrated into SEZ design, regulation, and implementation as core pillars. Without deliberate safeguards and structural reforms, SEZs risk reinforcing gender-based exclusion and spatial inequality rather than correcting them.

## 1. Impacts on Local Communities and Livelihoods

Land acquisition remains a critical entry point for equitable SEZ development. Evidence from the Allama Iqbal SEZ in Faisalabad shows that while monetary compensation improved short-term household conditions, leading to purchases of vehicles and housing, much of the spending was non-productive. Without vocational training, financial literacy or reintegration mechanisms, many former farmers transitioned into informal labor with limited long-term income security (Frias et al., 2016).

Ethiopia's Eastern Industrial Zone and Nigeria's Lekki Free Zone faced similar issues: delayed compensation and unmet resettlement promises created structural risks and enduring tensions with affected communities (Gardner, 2018) (Tagliarino et al., 2018). Despite their potential to promote regional development, SEZs have often reinforced or exacerbated pre-existing social and spatial inequalities, both within and beyond the zone perimeter. Patterns of exclusion typically emerge along axes of gender, ethnicity, education, and class, with marginalized groups facing barriers to land compensation, employment, and mobility. In Polepally SEZ, India, Dalit households were disproportionately affected by land loss and received inadequate compensation, while upper-caste families retained land and benefited from speculative gains (Agarwal & Levien, 2019). Where legal or institutional safeguards are weak, such as in the Mekong region and the Musina-Makhado SEZ in South Africa, the processes of land expropriation have also entailed violations of tenure rights, insufficient consultation, and neglect of customary claims, particularly affecting women smallholder farmers. These practices often result in lasting livelihood disruptions, debt traps, and increased vulnerability to climate and market shocks (ICJ, 2022) (Thompson & Shirinda, 2021). In Nigeria's Lekki Free Zone, factory jobs largely went to in-migrants, while locals were confined to low-wage informal roles or resorted to rent extraction and extortion practice (Goodburn et al., 2024).

SEZ-led urbanization has frequently created enclave economies, where aside from utilizing local labor, no forward or backward linkages exist with the local communities and there is little upgrading of labor. The Clark SEZ in the Philippines exemplifies this failure to integrate surrounding communities: despite proximity, local employment remained limited, skills upgrading was absent, and forward and backward linkages were weak, resulting in missed spillover effects and an enclave economy that bypassed local development needs, reinforcing unenven regional development and land misuse (C. Tadem, 2022). In Faisalabad, despite increased labor demand, a study by Javaid et al. (2023) found that the impact of SEZs on improving the lives of rural communities may be limited. A contrasting example is the Łódź SEZ in Poland, which partnered with universities and investors to create a Vocational School of Automation and Robotics, aligning skills development with industrial needs. The zone also supported SMEs through a start-up accelerator and provided transition support for coal sector workers via training, career guidance, and funding (Flood et al., 2025).

In contrast to many SEZs in the Global South, China's early SEZs, such as Shenzhen, featured a more structured approach, where villagers were often provided not only with financial compensation but also with reserved land for collective development, which attracted commercial investment and became key income sources for newly urbanized villages (Wang et al., 2009). Institutional mechanisms such as joint-stock companies enabled villagers to become shareholders in collectively-owned assets, funding welfare programs and infrastructure. Resettled households were commonly offered apartments, sometimes with an extra unit to rent out, alongside access to services and training centers (Kan, 2020). While challenges of exclusion existed, such as restricted movement across SEZ boundaries in early years, these were later dismantled (Goodburn, 2024). Due to extensive land redistribution from the 1940-50s, China has not faced the problem of landless labourers losing livelihoods and being unable to access any form of compensation (Tong et al., 2021).

## 2. Gendered Labor Outcomes and Structural Exclusion

SEZs around the world have employed disproportionately high numbers of women, typically 60–80% of the workforce, and up to 90% in some zones, but this feminization of labor is rarely the outcome of inclusive industrial policy (World Bank, 2011). Instead, it often reflects cost-minimization strategies that exploit gendered stereotypes of docility, dexterity, and low bargaining power (Tejani, 2011). These strategies tend to confine women to low-wage, low-skill roles and reproduce gender hierarchies by excluding them from leadership, innovation, and entrepreneurial opportunities.

As seen in EPZs in Noida and Madagascar, even formal employment often mirrors informal sector conditions: wages far below the minimum wage, excessive overtime, and limited grievance mechanisms. Discriminatory practices such as pregnancy testing, penalties for marriage or childbirth, and gender-based violence are frequently reported (Tejani, 2011).

In China's early SEZs, millions of young migrant women from rural provinces, were recruited to garment, toy, and electronics factories for their perceived compliance, constant availability, lower wage expectations, and supposed nimbleness suited to repetitive, labor-intensive tasks. Many lived in dormitories adjacent to factories, enabling long hours and constant availability, though also increasing vulnerability to surveillance and exploitation (Ngai, 2005) (Smith & Pun, 2006). Moreover, SEZ development can reinforce patriarchal control if local women are excluded from compensation and employment. In Lekki, Nigeria, the collapse of farming and fishing due to the creation of a free zone led to the decline of women-led vending, and fewer women than men have been able to find alternative work, eroding their economic autonomy and contributing to household tensions and gender-based violence (Goodburn et al., 2024).

In Pakistan, these patterns are compounded by legal ambiguity. Even though the SEZ Act 2012 states that domestic labour laws must be complied with, it does not clarify the nature and scope of the laws which apply to different SEZ models, and EPZs are explicitly exempt from compliance with various domestic labor laws, including protections like minimum wage, social security, and occupational safety (Shahid et al., 2020). This legal vacuum disproportionately impacts women, who already face structural barriers to labor force participation reflected in their estimated share of 24.5% of the national workforce and less than 10% in CPEC and higher risks of wage theft, maternity discrimination, and unsafe workplaces (ILOSTAT, 2021) (Rashid, 2019).

As SEZs in Pakistan shift toward high-tech, capital-intensive industries under CPEC 2.0, the risk of defeminization becomes increasingly acute. Without institutionalized gender-inclusive upskilling and hiring mechanisms, women may be displaced from low-skill roles as rising skill demands, and gendered stereotypes, push higher-skilled positions toward men (World Bank, 2011). A statistically significant negative relationship between capital intensity and female employment in manufacturing was found across countries in East Asia and Latin America (Tejani, 2011) A study on SEZs in Gujarat, India found that female employment in SEZs increased in absolute terms between 2010 and 2020, but their proportional share declined due to casualization, contract invisibility, and occupational stereotyping (Thapa & Chudasama, 2023). Pakistan faces similar risks as renewable energy, electronics, and EV manufacturing are localized, with women at risk of exclusion from technical, supervisory, and innovation-linked roles unless proactive gender strategies are institutionalized.

Evidence from Ghana challenges the notion that SEZs only offer exploitative or low-skill jobs for women. A study of 328 firms (2018–2021) by Ackah et al. (2024) found that women-led SEZ firms had significantly higher rates of product and process innovation than their non-SEZ counterparts, attributed to better resourcing, compliance standards, mentoring, and inclusive firm-level policies, demonstrating SEZs' potential as platforms for gender-responsive industrial transformation, if intentionally designed.

**Box: Women in Renewable Energy SEZs**

As Pakistan moves to localize renewable energy manufacturing within SEZs, particularly solar PV and EV production, there is a risk of replicating existing exclusions unless proactive measures are taken. Globally, women comprise 32% of the renewable's workforce compared to 22% in oil and gas, and around 40% in solar PV (IRENA, 2022), yet this headline figure masks deep gender segmentation. Across the solar industry, 58% of women are concentrated in administrative roles, only 32% participate in STEM-related functions, and just 17% hold senior management positions (IRENA, 2022). In Brazil, a country where women made up 41% of the solar workforce in 2023, similar patterns of exclusion persist; while only 7% work in engineering or project management, and just 2% in assembly and installation. One-third of PV integrators reported having no female employees at all (IRENA & ILO, 2024). Technical roles, often overlooked in gender planning, remain structurally inaccessible to most women especially across South Asia's energy sector.

Green industrialization through SEZs offers a critical opportunity to reverse this pattern. Gender-responsive upskilling programs, equal hiring mandates, and workplace safety protocols must be incorporated in SEZ policy design, especially as new green manufacturing clusters emerge under CPEC.

Several international models offer tested approaches for integrating gender safeguards into SEZ governance. For instance, Bangladesh's Export Processing Zones Authority (BEPZA) launched a Labor Counselor Program in 2005 to strengthen labor compliance within EPZs, which contributed to a 32% wage increase and a reduction in workplace grievances. In Cambodia, the ILO's Better Factories initiative leveraged public audit disclosures and buyer-facing accountability to improve working conditions, especially for women. Similarly, Lesotho's textile factories, with greater share of female labor, benefitted from ethical sourcing codes enforced and monitored by international buyers. While these buyer-led initiatives expanded protections, they remain limited in scope and sustainability without state-backed labor law enforcement and broader developmental strategies (Tejani, 2011). In parallel, the HERproject, in countries like Bangladesh, China, and Egypt, demonstrated how peer-led education on reproductive health and self-care within factories can improve women's wellbeing, productivity, and communication with management (World Bank, 2011). These models demonstrate that gendered exclusion is not inevitable. Rather, it is a design failure, one that Pakistan can avoid by embedding grievance redress, third-party monitoring, and transparency in SEZ legal frameworks.

# Policy Implications and Recommendations

To ensure SEZs contribute to inclusive and sustainable development rather than deepening local inequalities, Pakistan must incorporate Zone Social Responsibility (ZSR) principles into the legal, institutional, and planning frameworks that govern SEZs. The ZSR toolbox, developed to guide policymakers, developers, and zone authorities, addresses key social and environmental challenges across four critical pillars: local community impacts, labor and employment conditions, in-migration, and environmental sustainability (Knoerich et al., 2024). These must be mainstreamed into SEZ design and implementation under CPEC 2.0.

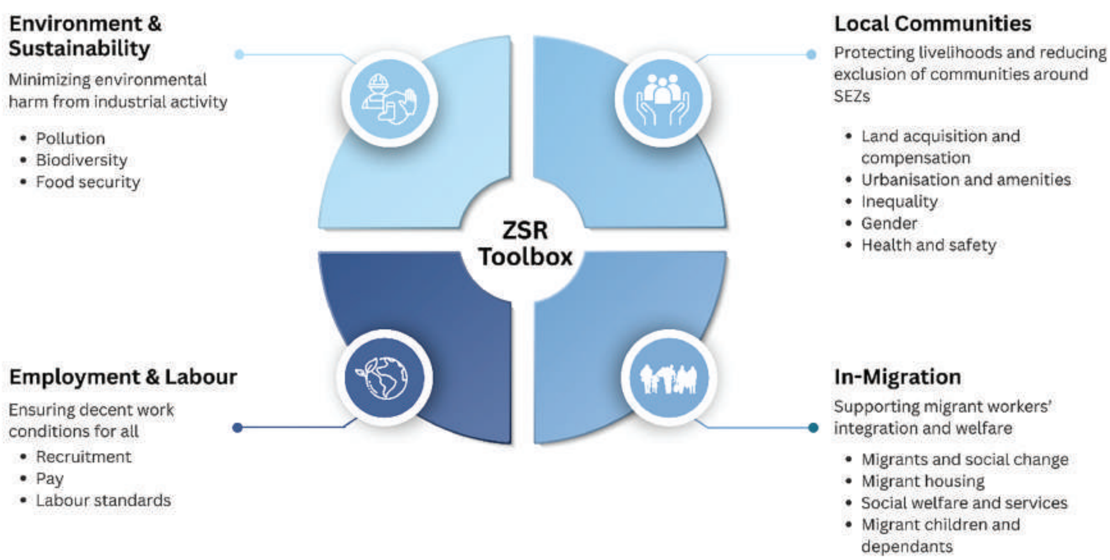



**Figure 1:** Zone Social Responsibility Toolbox
Source: (Knoerich et al., 2024)

- Reform the SEZ Act 2012 to clearly define the applicability of national labor laws across all SEZs. Mandate gender equity plans and Zone Social Responsibility (ZSR) obligations in zone approvals, linking them to measurable outcomes and monitoring mechanisms.
- Integrate requirements such as local hiring quotas, transparent compensation, and community access to shared infrastructure into SEZ licensing, contract templates, and performance assessments. SEZ developers should be held accountable not only for investment and exports but also for social outcomes in surrounding communities.
- Land acquisition must recognize customary land titles and ensure compensation is prompt, transparent, and directed to affected individuals and households, not intermediaries. Compensation schemes should extend beyond landowners to include those who lose livelihoods, and offer options such as financial literacy training, access to unused expropriated land, and options for in-kind compensation such as housing or employment.
- Require developers to partner with local vocational training institutes to offer targeted programs, prioritizing women and displaced or low-income communities. Training should go beyond basic assembly work to prepare workers for supervisory, managerial, and entrepreneurial roles, ensuring both upward mobility and economic resilience.

- Firms operating within SEZs must provide safe, accessible, and equal job opportunities for both local and migrant women, with zero tolerance for harassment, discrimination, or wage disparity. Gender audits, equal promotion policies, childcare facilities, and safe transport should be mandatory to prevent defeminization and support women's long-term economic agency.
- SEZ design must include essential public infrastructure, schools, clinics, roads, and ensure nearby communities benefit from associated urban development. Vulnerable groups should not be displaced without reintegration support, and zone authorities must establish formal mechanisms for community input into planning and grievance redress.
- Current evaluations overemphasize investment and export performance. Adopting comprehensive assessment frameworks, such as the OECD Regional Attractiveness methodology, would allow governments to track over 60 indicators, including gender inclusion, labor conditions, and environmental sustainability (Flood et al., 2025). This shift would provide a stronger evidence base for policymaking and improve zone responsiveness to local development needs.

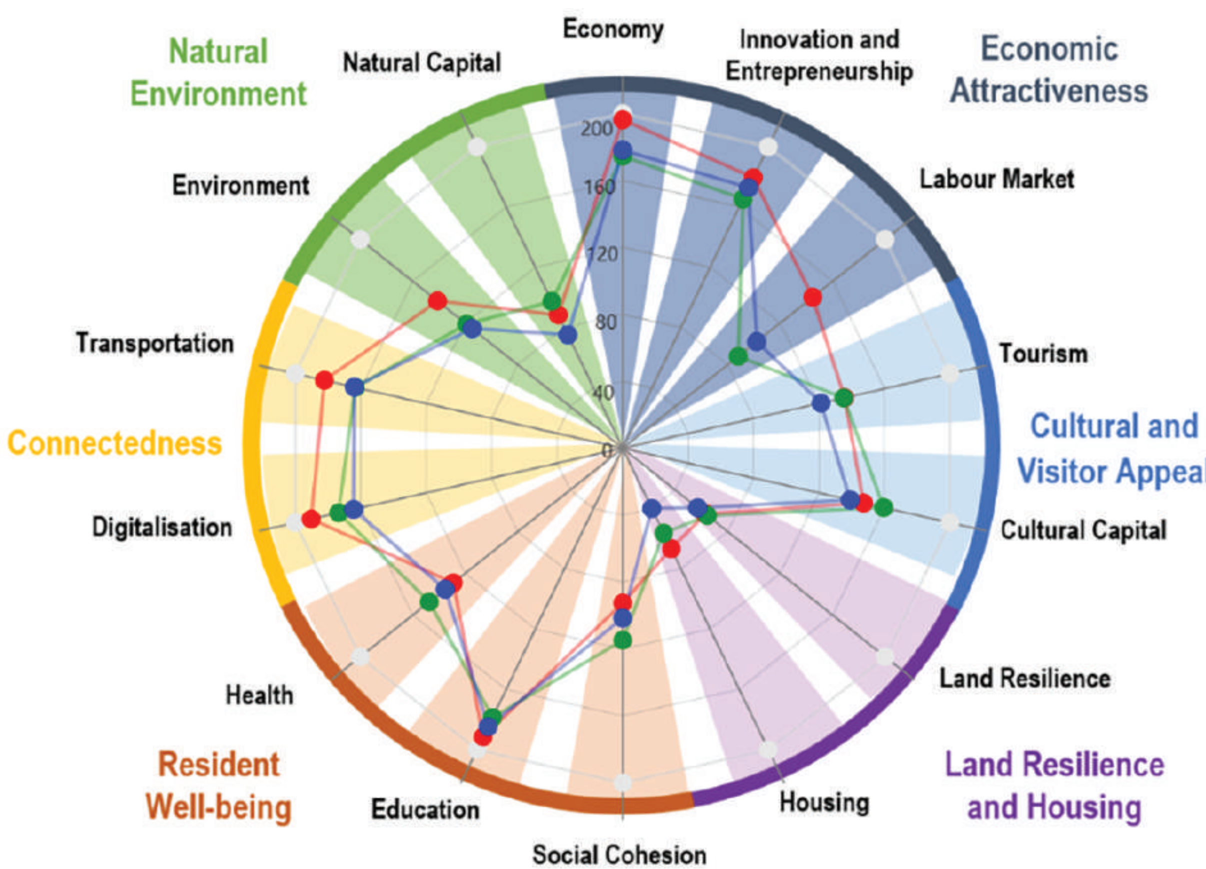



**Figure 2:** OECD Regional Attractiveness Compass

# 07

## Development Roadmap for Green Special Economic Zones in Pakistan

# Chapter 7 - Development Roadmap for Green Special Economic Zones in Pakistan

The preceding analysis naturally surfaces a set of structural hurdles; this chapter groups those bottlenecks and pairs each with pragmatic policy actions, timelines and responsible actors.

## 7.1 Structural Challenges in Attracting Renewable Energy and EV Investments

Pakistan faces a unique opportunity for its SEZs to become a hub for the relocation of renewable energy manufacturing industries and contribute to its emission reduction targets of 50% by 2030. As global supply chains continue to evolve, especially in light of the shift from traditional manufacturing hubs like China to other regions, Pakistan has the potential to position itself as a competitive destination for renewable energy industries, including the local manufacturing of solar panels and EVs. However, foreign investment inflows into Pakistan have remained volatile in recent years, reflecting broader concerns about economic stability, regulatory uncertainty, and structural inefficiencies (refer to Figure 7.1).

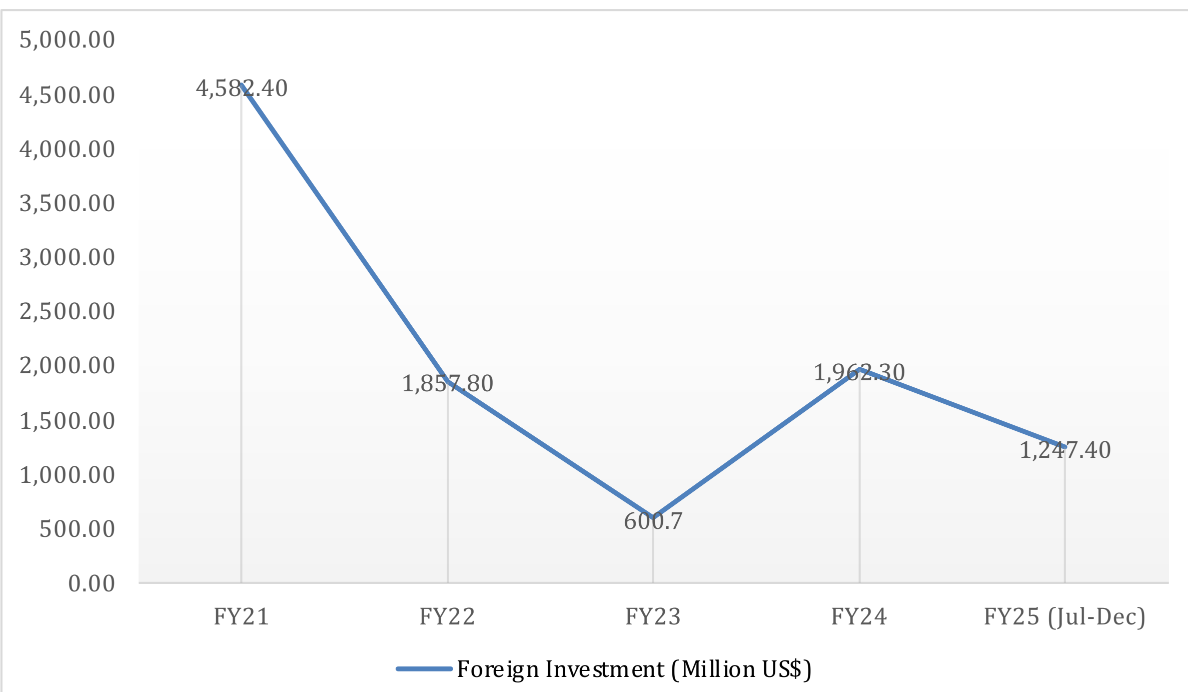



**Figure 7.1:** Foreign Investment in Pakistan (FY 2021-25)
Source: SBP

Chinese investments, which are still the largest in Pakistan, have experienced a noticeable drop along with the decrease in total foreign investments in the previous years. Between 2005 and 2024, China invested nearly $68 billion in Pakistan, with energy projects comprising 74% of this investment (Isaad & Sayed, 2025). However, investment flows have decreased significantly. While total FDI increased by 16.88% year-on-year (YoY) in FY 2024, Chinese investment fell by 17.95% YoY, declining from $692.52 million in FY 2023 (SIFC, 2024).

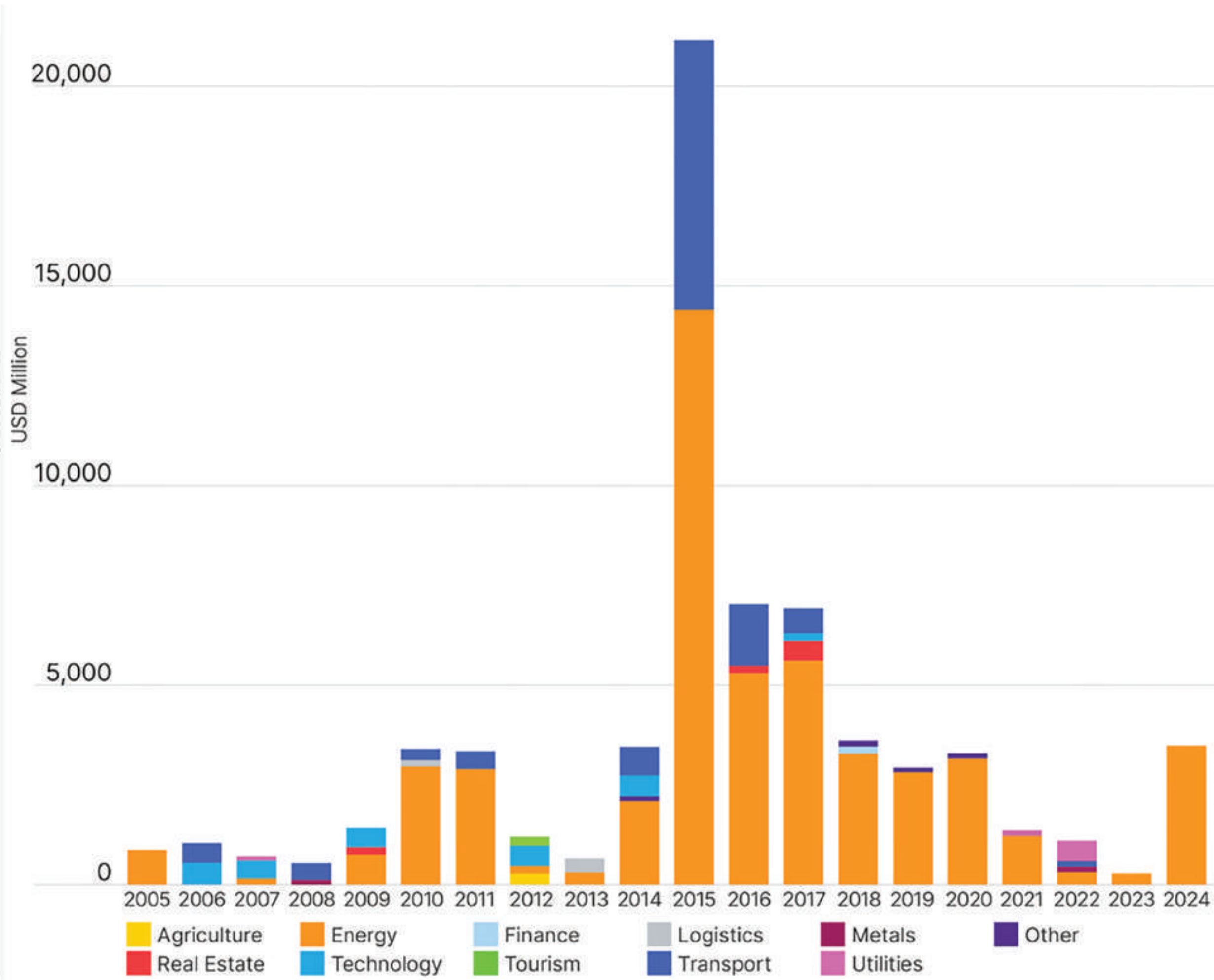



**Figure 7.2:** Chinese Investment in Pakistan (2005-2024)
Source: Isaad & Sayed, 2025

Since COVID-19, only $4.86 billion of Chinese capital has been invested in Pakistan's energy sector, with $3.7 billion allocated solely to a nuclear project in Chashma (Isaad & Sayed, 2025). At its peak in 2015, Chinese investment reached $21.14 billion, aligning with the early years of CPEC. However, post-2019, investment declined sharply, reaching a low of $280 million in 2023. Though investment rebounded to $3.48 billion in 2024, it remains significantly below its previous highs, reflecting a more cautious and selective approach by Chinese investors (AEI, 2024).

## 7.2 Lessons from Regional Competitors

While Pakistan's SEZ development has struggled to achieve critical mass, several Southeast Asian economies have successfully attracted large-scale Chinese investments. Understanding the competitive advantages leveraged by countries like Indonesia, Vietnam, and Thailand offers important lessons for Pakistan's policymakers.

In 2023 alone, Indonesia and Vietnam attracted $33 billion and $16 billion in greenfield manufacturing FDI, respectively, making them the fastest-growing hubs for industrial relocation. Meanwhile, China's total investment in manufacturing across ASEAN countries reached $24 billion in 2023 (*refer to Figure 7.3*), accounting for one-third of its total outbound FDI (Chu et al., 2024). In contrast, Pakistan's SEZs remain underdeveloped and uncompetitive, with 60% of SEZ land still unoccupied as of 2023, despite 11 years since the enactment of the SEZ Act, 2012 (Business Recorder, 2023a).

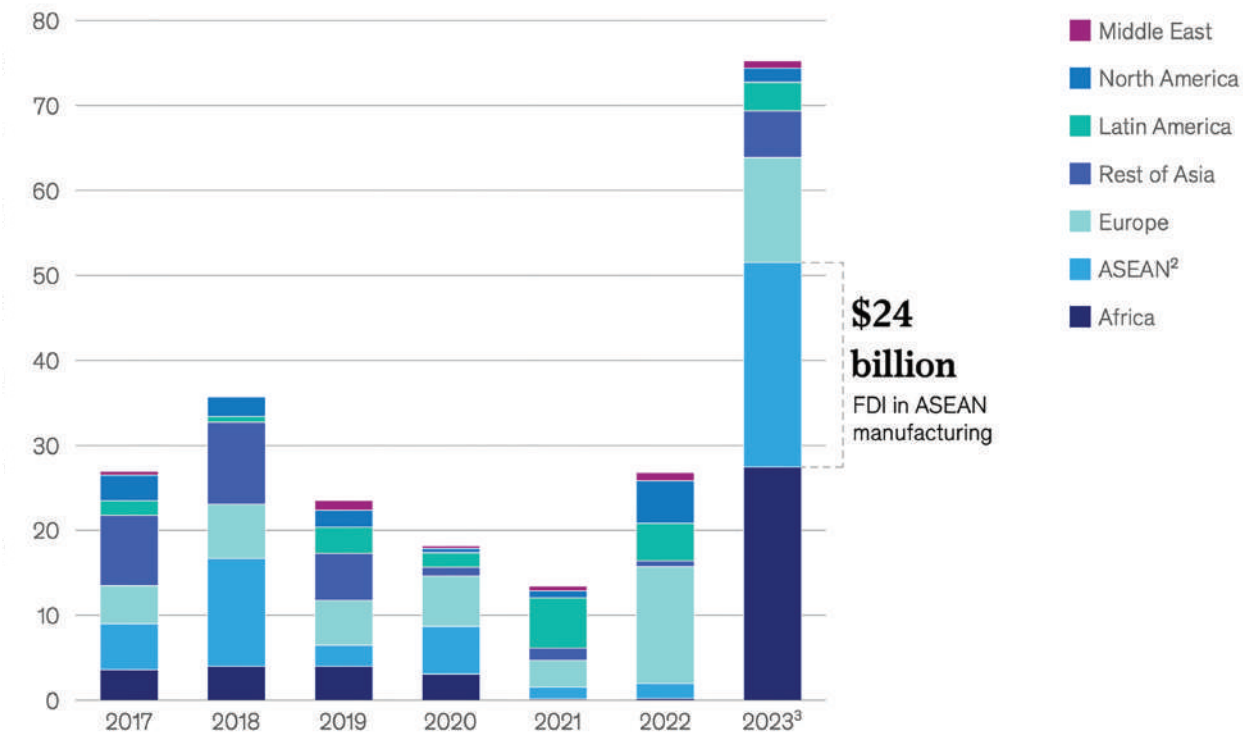



**Figure 7.3:** China's Outbound FDI in Manufacturing (By Recipient, $ Billion)
Source: Chu et al., 2024

## 7.3 Key Bottlenecks in Pakistan's SEZ Competitiveness

The transition from state-owned enterprises (SOEs) dominating the first phase of BRI to a more private-sector-driven approach in the second phase has led to market-based investment decisions. In this new phase, investor confidence is increasingly shaped by regulatory predictability, economic stability, and the availability of competitive incentives. Despite offering fiscal incentives, Pakistan's SEZs continue to underperform due to a range of structural bottlenecks. Addressing these weaknesses is essential to unlock the potential of GSEZs. As CPEC 2.0 shifts towards industrialization, agriculture, and technology transfer through SEZs, unresolved issues from the first phase, including regulatory uncertainty, security risks, and financial arrears, continue to deter new investments.

As of 2024, Pakistan's CPEC power plants have accumulated financial arrears of $1.4 billion, limiting project sponsors' ability to reinvest (Rana, 2024e). The Sahiwal coal-fired power plant and the Port Qasim Electric Power Company (PQEPC) have repeatedly threatened shutdowns due to non-payment, with PQEPC's outstanding receivables reaching Rs 88 billion in October 2024 (Isaad & Sayed, 2025).

China's evolving economic landscape has also contributed to changing investment patterns. The decline of the real estate boom, which accounted for nearly 29% of China's GDP until 2021, has led to a reassessment of outbound investment priorities (Girard, 2024). Hence, as discussed earlier, China's investment strategy has increasingly shifted towards markets that offer more regulatory stability, economic security, and industrial incentives. For example, Indonesia's ban on unprocessed mineral exports has encouraged Chinese firms to invest in local nickel smelting, helping the country position itself as a leader in global EV battery supply chains (Tritto, 2023). Meanwhile, Thailand has transitioned from an EV importer to a major producer, largely due to Chinese investments and supportive government policies like the EV3.5 program, RCEP tariff reductions, and zero duties on imported machine tools, which have attracted $7 billion in Chinese investment across 588 projects (Sgueglia, 2024). China has also expanded its presence in the Middle East, where Gulf nations actively seek Chinese expertise in infrastructure, technology, and renewable energy. Iraq and Iran have similarly received Chinese investments in port development and energy infrastructure (Isaad & Sayed, 2025).

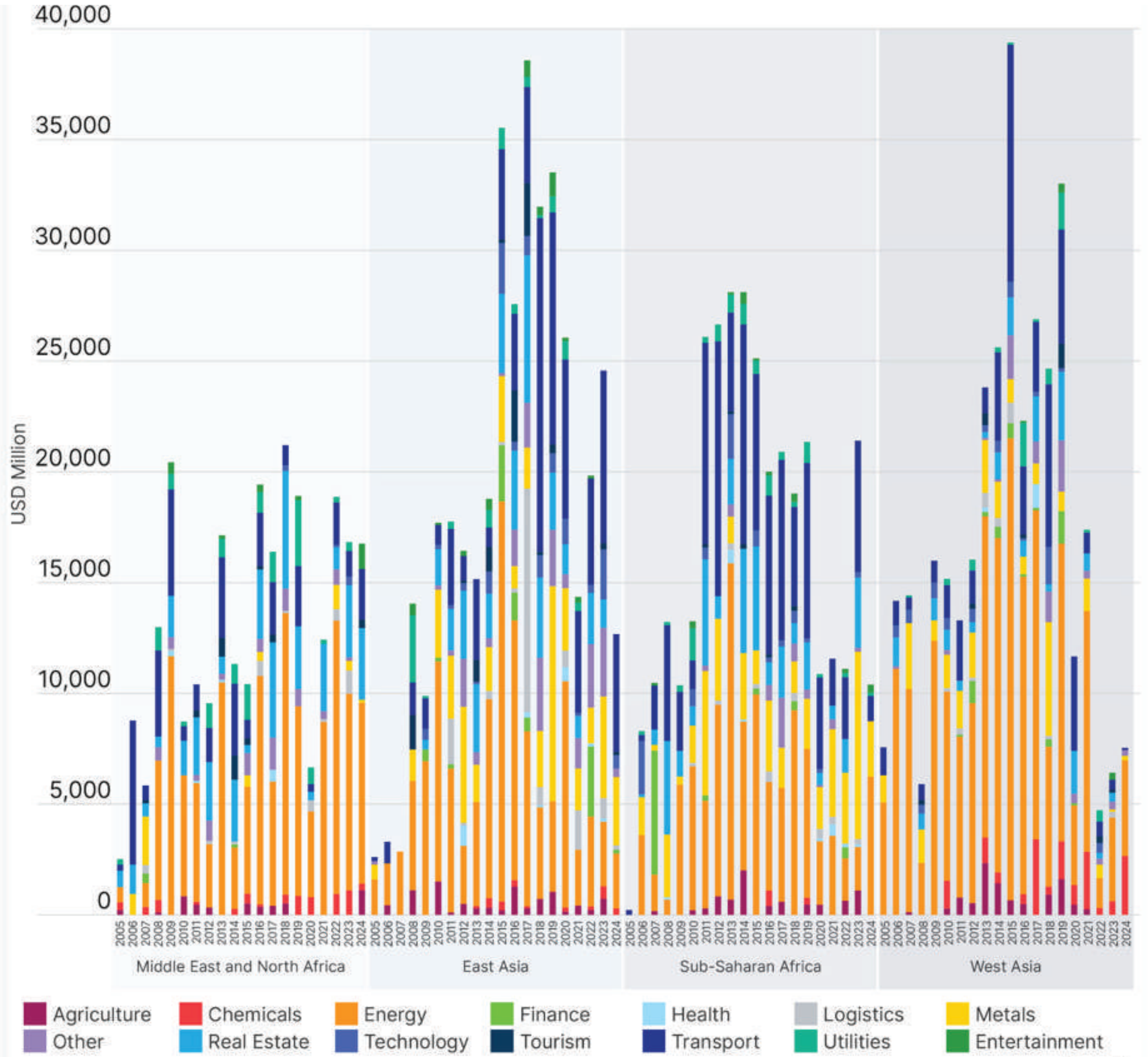



**Figure 7.4:** Shifting Patterns of Chinese Investments across Middle East, Africa & Asia
Source: Isaad & Sayed, 2025

However, Pakistan has struggled to attract Chinese companies for regional expansion. High electricity and gas costs, inadequate infrastructure, and policy unpredictability have hindered competitiveness. By contrast, Southeast Asia has aggressively expanded its manufacturing base and upgraded logistics infrastructure, fueling sustained export growth. Indonesia's exports reached $290 billion in 2023 (CAGR of 12.3%), driven by metals, minerals, and downstream industries, while Vietnam's exports grew from $320 billion in 2019 to $440 billion in 2023, led by electronics manufacturing (Chu et al., 2024). Pakistan's lack of integrated trade and industrial policies continues to limit its ability to compete for these investments.

China's evolving investment approach has also been shaped by its growing emphasis on environmental safeguards and green finance standards such as the Green Development Guidance for BRI Projects. This framework uses a "traffic light" system to classify projects based on their environmental impact, encouraging financing for clean industries while discouraging high-emission ones (BRIGC, 2023). Integrating these guidelines into SEZ planning can position Pakistan as a credible destination for Chinese green manufacturing, particularly in sectors like solar, EVs, and battery supply chains.

## 7.4 Catalyzing GSEZ Competitiveness: Barriers, Enablers and Action Matrix

Given the challenges and growing regional competition, Pakistan must urgently reposition its SEZ strategy. A key question arises: what are the enabling factors that can make Pakistan's SEZs, particularly GSEZs, more competitive? Addressing this requires a clear focus on strategic priorities that enhance GSEZ competitiveness, attract FDI, and promote sustainable industrialisation.

If CPEC 2.0 is to succeed in catalyzing China's RE and EV industry relocation to Pakistan, policymakers must prioritize regulatory stability, derisk large-scale projects, and uphold contractual commitments. Improving Pakistan's competitiveness in the global market requires efforts in areas such as:

- Policy Framework and Implementation
- Infrastructure Development and Service Delivery
- Site Selection and Feasibility Assessment
- Technological Expertise and Capacity Building
- Facilitation of Green Finance and Financial Instruments
- Security and Risk Mitigation

In the following section, the report provides a clear diagnosis of the key challenges hindering GSEZ development discussed earlier, alongside precise, challenge-specific enablers under the way forward. It also presents a detailed responsibility-action matrix, outlining who must act, what needs to be done, how it should be executed, and expected timelines for implementation.

### 7.4.1. Policy Framework and Implementation

**a. Inconsistent Policy Environment Discourages Investment:** Frequent policy shifts, unclear guidelines, and slow bureaucratic procedures create uncertainty for investors. Instances like renegotiating signed agreements undermine investor confidence, while the cumbersome approval process for industrial units, requiring up to 28 NOCs, delays SEZ development (The Express Tribune, 2023).

**Way Forward**

- Fast-track the OSS Act 2023 to reduce bureaucratic delays in SEZ licensing and permits.
- Adopting successful models like Beijing's "application and approval at the same time" reform which cut wait times by over 80% (HAO NAN, 2022).
- Establishing a consistent, long-term policy framework spanning atleast 10 years is critical to attract sustained investment in Pakistan's solar PV manufacturing sector, insulating policy from short-term political and fiscal shifts.

**b. Weak Institutional Coordination and Administrative Inefficiencies:** Effective policy implementation demands coordination across ministries and agencies, yet Pakistan's SEZ framework suffers from fragmented inter-agency coordination, leading to multilayered administrative processes that slow down investment facilitation and cause delays such as machinery being held at customs for up to eight weeks. Provincial SEZ authorities, tasked with application approvals, often lack dedicated staff and a central coordination unit to streamline processes (World Bank, 2020).

**Way Forward**

- Establish transparent accountability mechanisms by introducing structured performance evaluations for SEZ authorities, with independent audits and regular reporting to enhance governance efficiency and investment facilitation.

**c. Overlapping Institutions and Misallocation of Roles:** The proliferation of institutions with overlapping mandates, such as the duplication between the SIFC and the BoI, creates confusion and inefficiencies. Assigning investment promotion roles to underqualified officials further slows decision-making and limits project implementation.

**Way Forward**

- SEZ management such as SEZ authority CEOs and investment promotion heads should be led by experts in industrial management, economic strategy, and international trade based on technical merit, rather than general bureaucratic seniority.
- Specialists with experience in manufacturing, renewable energy, or technology should lead feasibility studies and investment promotion.

**d. Policy Continuity Issues and Regulatory Misalignment:** Pakistan's centralized structure restricts decision-making in investment, finance, and trade unlike China's SEZ model, which empowers local governments where provinces like Guangdong mobilized substantial R&D investment, growing from RMB 300,000 for a Technology Innovation Centre to over one trillion yuan annually for R&D, infrastructure, and carbon reduction (Guangdong Provincial People's Government Portal, 2024).

**Way Forward**

- Ensure full autonomy for SEZ authorities to make operational decisions and reduce inter-agency dependence that causes procedural delays.
- Leadership of SEZ authorities should be appointed for fixed tenures to ensure policy continuity and insulate operations from political interference, following the example of NEPRA. The removal of the KPEZDMC CEO in violation of Clause 190 of the KPEZDMC Act, and the subsequent intervention by the Peshawar High Court, highlights how political interference destabilizes governance and erodes investor confidence (Malik, 2024; DAWN, 2024).
- A clear and well-structured legal framework should be developed for the provision of key public goods and services in SEZs. As seen in the Philippines, the SEZ Act of 1995 clearly defines the public services available to SEZ investors and centralizes their coordination under a single entity, the Philippine Economic Zone Authority (PEZA). This framework streamlines processes such as business registration, land titling, customs services, tax clearance, immigration services, foreign trade formalities, environmental and social services, industrial labor relations, dispute resolution mechanisms, provision of utilities, and OSS—all governed by dedicated SEZ rules (Philippine Economic Zone Authority, 2008). Pakistan can adopt a similar approach by creating a specialized authority that will be responsible for coordinating and overseeing these essential services, ensuring efficiency and regulatory clarity for investors. Such a constitutionally backed, independent oversight body would also ensure uninterrupted leadership and enable long-term investment decisions without fear of abrupt political changes.
- Pakistan must strategically align its SEZ development with export market demand and global industrial relocation trends. This requires using export data to identify high-potential destinations and applying the Flying Geese model to anticipate industrial shifts from more advanced economies, positioning SEZs to attract relocating industries through targeted incentives and bilateral trade engagement.
- Pakistan should adapt successful SEZ models from countries like China, Vietnam, and Malaysia to accelerate industrial development. While direct replication is unfeasible, integrating best practices such as sectoral clustering, targeted tax regimes, and institutional autonomy, adjusted to Pakistan's context, can strengthen SEZ outcomes and investor appeal.

**e. Complex and Fragmented Tax System:** Pakistan's multi-tiered tax system, involving over 35 agencies across federal, provincial, and district levels, burdens firms with complex compliance requirements. Companies operating nationwide must navigate five tax jurisdictions and file up to 62 returns annually (International Growth Centre, 2023). Investors are not willing to trust 10-year tax holiday as FBR applies 1.25 percent minimum turnover tax on SEZ enterprises. This issue of unfair applicability despite the fiscal incentive of "exemption from all taxes on income" given to zone enterprises under Section 37 of the SEZ Act and Income tax Ordinance, 2001 has been highlighted by foreign investors as constraining their investment in Pakistan (Business Recorder, 2023a). There is also an urgent need to reform Pakistan's import tariff and tax regime, which disproportionately burdens critical components like inverters (29%) and batteries (51%), essential for off-grid and hybrid solar systems, thereby limiting affordability and adoption.

**Way Forward**

- Reinforce legal protections for fiscal incentives, ensuring that SEZ tax exemptions are honored without subsequent hidden taxes like the 1.25% minimum turnover tax (Business Recorder, 2023a). This will reassure Chinese investors that these benefits are secure and cannot be revoked, the perceived risk of investment can be reduced.
- Duties on critical components such as batteries should be reduced to accelerate deployment, while long-term strategy should introduce a 10-year consistent, tiered tariff structure: imposing 15–30% duties on fully assembled imports and maintaining 0–5% on raw materials to catalyze local manufacturing.
- Harmonizing sales tax (currently 0% on imports vs. 18% on local goods) will support domestic capacity and reduce Pakistan's $4.1B solar import bill (over the past 4 years), enabling value chain localization under CPEC 2.0.

**f. Weak Stakeholder Engagement:** The lack of structured engagement with the business community limits the effectiveness of SEZ policies. Companies such as Renault, Hayat Kimya, and International Steels abandoned planned investments in Sindh's SEZs due to inadequate consultation and inconsistent policy frameworks (World Bank, 2020). The absence of a robust dialogue platform between public institutions and private investors remains a critical gap.

**Way Forward**

- Institutionalize regular engagement platforms involving Ministry of Industries and Production (MOIP), Ministry of Planning Development and Special Initiatives, the Trade Development Authority of Pakistan, provincial Boards of Investment, SEZ developers, utility providers, Chinese investors, local chambers of commerce, and the Pakistani private sector to ensure policies address industry needs and optimize government resource allocation.
- Align policy designs with industry needs and complement them with skills development, supplier development and technology transfer programs.

| **Action Matrix** | | |
|---|---|---|
| **Timeline** | **Relevant Actors/ Stakeholders** | **Responsibility** |
| Short-Term (1-2 Years) | BoI, Provincial SEZAs, MoIP | Appoint qualified professionals with sectoral expertise in SEZ leadership roles. Conduct feasibility studies and develop investment attraction strategies. |
| | Board of Approval (BoA), Federal and Provincial BoIs, Provincial SEZAs | Establish performance evaluation frameworks with clear KPIs, regular audits, and structured accountability mechanisms. |
| | BoI, MoCC&CE, MoE (Power Division) | Design policy incentives for green infrastructure and renewable energy investments. Develop a green industrial framework with embedded compliance incentives.<br>Align SEZ policies with industry needs based on survey insights. |
| | Federal & Provincial BoIs, FPCCI, MoIP, MoPD&SI, TDAP, SEZ Developer, Chambers of Commerce including Pak-China Joint Chamber of Commerce & Industry (PCJCCI) | Institutionalize stakeholder consultations to refine SEZ policies, ensuring alignment with private sector needs. |
| | SIFC, BOI, Engineering Develeopment Board (EDB), Pakistan Solar Association (PSA), MoIP | Formulate and publish a 10-year solar PV manufacturing policy, ensuring cross-institutional coordination and stakeholder engagement platforms. |
| | FBR, MoF, BOI, PSA | Revise tariff schedules to lower duties on inverters and batteries, harmonize sales tax on solar products, and initiate the design of a 10-year tiered tariff roadmap. |
| Medium-Term (3-5 Years) | BOI, SIFC, Ministry of Commerce, TDAP | Conduct export market mapping to identify high-value trading partners and align SEZ sectoral offerings accordingly. Integrate industrial relocation data into SEZ planning using global trend models (e.g., Flying Geese) and formulate relocation-attraction strategies. |
| | BoA, Ministry of Law & Justice, Provincial SEZAs, Standing Committees on Industries & Production | Grant SEZAs regulatory autonomy with fixed leadership tenures to minimize political interference. Establish an independent oversight body. |
| | Federal & Provincial BoIs, MoIP, Ministry of Law & Justice | Implement the One-Stop Service (OSS) Act to digitize and streamline investor processes, reducing bureaucratic delays. |
| Long-Term (5-10 Years) | BoI, FBR, Finance Division, GoP | Ensure legal protection of SEZ tax incentives, preventing inconsistent application and policy reversals. Strengthen investor confidence in fiscal benefits. |

### 7.4.2. Infrastructure Development and Service Delivery

**a. Underdeveloped Infrastructure at SEZs:** Underdeveloped infrastructure in Pakistan's SEZs presents a major challenge, particularly for the localization of renewable energy manufacturing and low-carbon development. Designed to offer essential facilities like OSS, customs offices, and utilities, many SEZs still lack basic services. This infrastructure gap severely affects industrial growth, investment attraction, and operational efficiency. A notable example is Karachi's industrial sector, particularly the Steel Mill and Port Qasim Industrial Area, where the Karachi Water and Sewerage Board (KWSB) cut the water supply from August 27 to September 24, 2023, severely impacting operations. Industries, including global automotive manufacturers, were left without consistent water supply for nearly a month, disrupting production (The Express Tribune, 2024).

**Way Forward**

- Investors place high value on having all essential services available on-site at the SEZ location to minimize transaction costs and speed up the establishment process (World Bank, 2020). Establish OSS for SEZs that combines multiple government services, such as land registration, tax filing, customs clearance, and labor services, in a centralized location. This would reduce bureaucratic hurdles, improve coordination, and provide investors with a clear and efficient service process.
- Prioritize completion of critical utilities infrastructure (e.g., water treatment plants, sewage systems, OSS) before tenant allocation to minimize operational risks for investors.
- Mandate independent third-party audits of SEZ infrastructure readiness before operational launch to ensure delivery quality.
- Develop and codify mandatory design standards for SEZs that include renewable energy, wastewater treatment, waste recycling, sustainable logistics, and green construction. Make environmental compliance a core SEZ licensing criterion.

**b. Power Supply Issues and Energy Reliability:** Power supply remains a persistent problem, particularly for SEZs aimed at renewable manufacturing industries. Rashakai SEZ has faced acute shortages, leading to the withdrawal of major Chinese investors like Alice, while RSEZDOC has expressed serious concerns (Ghumman, 2024a). Similarly, despite infrastructure upgrades at Khairpur SEZ to enhance load capacity to 5MW, the local utility, SEPCO, failed to meet energy demands (Khan, 2021).

**Way Forward**

- Fast-track B2B renewable energy contracts (solar parks, wind farms) with SEZs to ensure reliable, green power supply.
- Fast-track DISCO licensing reforms, allowing SEZ developers to obtain independent distribution licenses under the new CCoE-approved mechanism.
- Introduce mandatory energy-resilience plans at the SEZ master planning stage, including battery storage and backup generation requirements.

**c. Bureaucratic Delays and Governance Gaps:** SEZ infrastructure development faces bureaucratic hurdles due to slow land acquisition, under-empowered SEZ authorities, and complex regulatory compliance. Rashakai SEZ's industrialization has been stalled largely due to such governance challenges, disrupting timely infrastructure delivery.

**Way Forward**

- Empower SEZ Authorities with land acquisition powers under a fast-track framework, reducing dependency on provincial bureaucracies.
- Set statutory timelines for infrastructure project clearances backed by automatic escalation mechanisms.
- Scaling up business facilitation mechanisms is essential for attracting investment. Expanding BOI's Business Facilitation Center (BFC) model across provinces and institutionalizing it within SEZs, supported by digitized, inter-ministerial service delivery, can significantly improve investor experience and regulatory transparency.

**d. National Grid Constraints and Renewable Energy Integration:** Pakistan's fossil-fuel-dependent national grid (2.71 kg $CO_2$/USD of electricity exports) limits renewable energy integration and makes grid-tied GSEZs less attractive for sustainability-focused investors (World Bank, 2023). Transmission bottlenecks, flexibility issues, and lack of storage options pose serious barriers to low-carbon development.

**Way Forward**

- Develop dedicated Renewable Energy Corridors linking GSEZs to solar, wind, and hydro under CTBCM regime.
- Create financial incentives (e.g., tariff rationalization, concessional finance) for industries adopting on-site solar generation and battery storage within SEZs.
- Update National Grid Company (NGC) grid codes to prioritize renewable energy dispatch for SEZs designated as GSEZs.
- The import of 28 GW of solar panels in just two years, surpassing 50% of national capacity, has been driven by market forces, not policy. To leverage this momentum, CPEC 2.0 must allocate at least 30% of its energy budget to grid upgrades, battery storage, and local value chain development. Fast-tracking the State Bank of Pakistan's Green Taxonomy will be essential to attract Chinese private green capital.

**e. Developer Qualification and SEZ Project Management Gaps:** The SEZ Act's allowance for any entity incorporated under Pakistani law to enter into a development agreement with an SEZ Authority, without specific professional or technical qualifications, poses a major risk. Inexperienced developers and SEZ Authorities lacking PPP capacity threaten the quality and timely delivery of infrastructure.

**Way Forward**

- Amend SEZ regulations to mandate minimum technical, financial, and operational qualification criteria for developers (e.g., prior SEZ experience, minimum capital requirements).
- Create a national SEZ Developer Accreditation System to screen and certify eligible SEZ developers before contract awarding.
- To ensure that SEZs are developed and managed efficiently, clear criteria should be established for selecting developers. These requirements should include technical qualifications (e.g., prior experience in SEZ development and operations), financial capacity (e.g., minimum annual revenue), and institutional requirements (e.g., PPP or joint venture arrangements). These clear criteria will help ensure that only qualified developers are chosen, leading to the successful development of high-quality infrastructure and services within the SEZs.
- Strengthen capacity-building programs for SEZ Authorities on PPP design and transactions, land acquisition, dispute resolution, regulatory compliance, risk allocation, and project financing models to professionalize SEZ infrastructure management.

| **Action Matrix** | | |
|---|---|---|
| **Timeline** | **Relevant Actors/ Stakeholders** | **Responsibility** |
| Short-Term (1–2 Years) | BoA, BoI, MoIP | Draft and enact a legal framework defining SEZ public services and governance, modeled after Philippine Economic Zone Authority (PEZA). |
| | BoI, Provincial SEZAs, FBR, SEZ Committees | Establish a centralized OSS for SEZs to streamline land registration, tax filing, customs clearance, and labor services. |
| | BOI, MoIP, Law & Justice Division, Provincial SEZ Authorities | Scale up Business Facilitation Centers (BFCs) across priority SEZs, implement Guillotine system to eliminate redundant regulations, and fast-track the Asan Karobar Act to improve ease of doing business. |
| Medium-Term (3–5 Years) | BoA, Provincial SEZAs, BoI | Develop selection criteria for SEZ developers, ensuring technical expertise, financial capacity, and expertise in PPP models. |
| | Provincial SEZAs, BoI, Developers, SEZ Committees, Utility Providers (WAPDA, SNGPL, DISCOs) | Guarantee provision of essential utilities (power, water, gas) at SEZ sites to reduce transaction costs for investors. |
| | BOI, MOCC&EC, Provincial SEZAs | Draft and enact a national Green SEZ regulatory framework defining mandatory sustainability standards, including renewable energy use, waste recycling, and environmental management systems, as core SEZ licensing requirements. |
| Long-Term (5–10 Years) | Provincial SEZAs, SEZ Committees, BoI, BoA | Oversee the sustained management and expansion of SEZ infrastructure, ensuring regulatory compliance and investor satisfaction. |

#### 7.4.3. Site Selection and Feasibility Assessment

**a. Suboptimal SEZ Site Selection:** SEZ site selection in Pakistan has often been influenced by factors beyond economic or strategic merit. For example, the selection of Rashakai as an SEZ has faced criticism for lacking alignment with industrial or logistical priorities. In some instances, sites have been selected informally based on deliberations in official meetings, without rigorous site analysis or feasibility studies (Shahid et al., 2021). This ad hoc approach risks establishing SEZs in locations that lack the critical competitive advantages, such as connectivity to logistics hubs, that globally successful SEZs like Shenzhen have effectively utilized to attract investment. Without a structured approach, there is a significant risk that SEZs may emerge as isolated enclaves, disconnected from broader economic clusters or infrastructure networks (World Bank, 2020).

**Way Forward**

- Prioritize strategic site selection based on proximity to ports, airports, and major urban centres to enhance SEZ competitiveness. Jordan's Aqaba SEZ offers a model, where a government-commissioned study, assessed Aqaba's infrastructure, services, port layout, and economic potential and identified key advantages. It proposed a Master Plan, guiding the relocation of key infrastructure such as port relocation, a new airport, and expanded transport links, to optimize its strategic position (Kardoosh, 2005).
- Undertake detailed feasibility studies across potential SEZ sites to assess local resource availability, labour pools, infrastructure readiness, and economic potential. Assessments should benchmark costs (labour, utilities, logistics, capital, taxation) across sites and against alternative urban/industrial centers.
- Ensure the effective implementation of existing regulations requiring feasibility studies and master land utilization plans to mitigate the risk of SEZs becoming enclaves. A clear site selection framework should be enforced, mandating comprehensive environmental and social impact assessments (ESIA), drainage studies, transportation assessments, and market analyses. For example, the Philippines SEZ Act and Regulations explicitly require a series of documentation (proof of site suitability, Master Development Plan, ESIA, feasibility study, etc) as part of the application for SEZ site designation (Philippine Economic Zone Authority, 2008).
- Develop national site assessment guidelines modelled on best international practices to standardize evaluation metrics across provinces and minimise politicization.

| **Action Matrix** | | |
|---|---|---|
| **Timeline** | **Relevant Actors/ Stakeholders** | **Responsibility** |
| Short-Term (1–2 Years) | BoI, BoA, Provincial SEZAs, MOPD&SI | Develop SEZ site selection criteria based on strategic advantages (proximity to ports, airports, cities, and trade routes). |
| | Provincial SEZAs, BoA, Developers, BoI | Conduct feasibility studies, including infrastructure assessments, economic viability, and competitiveness evaluations. |
| Medium-Term (3–5 Years) | Provincial SEZAs, BoA, Federal & Provincial Environmental Protection Agencies (EPAs), MoCC&EC | Implement mandatory environmental and social impact assessments (ESIA), drainage studies, and transportation assessments for SEZ approval. |
| | BoI, Provincial SEZAs, Developers, MoIP | Ensure land titling, zoning approvals, and regulatory compliance for designated SEZ sites. |
| Long-Term (5–10 Years) | Provincial SEZAs, BoA, MoIP | Implement **regular compliance audits** to ensure SEZs adhere to site selection criteria and planned land utilization. |
| | Provincial SEZAs and BoIs, BoA, MoPD&SI | Conduct **periodic evaluations of SEZ performance** to assess whether site advantages are effectively utilized and make adjustments if needed. |

#### 7.4.4. Technological Expertise and Capacity Building

**a. Lack of Feasibility Studies and Market Data for SEZ Planning**: Many SEZs in Pakistan lack effective feasibility studies at both federal and provincial levels, resulting in unclear market demand, infrastructure needs, and integration potential with local economies (World Bank, 2020). The absence of a bankable feasibility study for the past two years underscores a strategic planning gap, increasing the risk of SEZs becoming isolated zones with limited economic impact. Additionally, data on Pakistan's investment competitiveness, SEZ occupancy rates, industry composition, and revenue generation remain largely unavailable on SEZA websites.

**Way Forward**

- Pakistan should commission comprehensive research and feasibility studies to assess its attractiveness as an investment destination, especially for SMEs.
- A benchmark study comparing Pakistan's assets (trade, transportation, labor) with ASEAN nations would help in creating data-driven marketing strategies.
- Feasibility studies ought to ensure that SEZs are designed with a clear understanding of market demand and infrastructure needs, as well as the ability to integrate into the local economy are essential.

**b. Skills Gap Analysis Missing for Renewable Energy Manufacturing in SEZs:** Although localizing RE manufacturing targets Chinese investors, there has been no formal study to identify the skill sets required for these sectors. This results in a mismatch between the skills available in the local workforce and the needs of potential investors, leaving SEZs at risk of becoming disconnected from the local economy and its strengths.

**Way Forward**

- Pakistan should promote partnerships between Chinese and Pakistani firms within SEZs to facilitate technology transfer in advanced manufacturing, green technologies, and industrial automation.
- Collaborations like Mega Motor Company's recent EV partnership with BYD can accelerate EV adoption and infrastructure development.
- Technology transfer can be promoted through joint ventures, staff training, and capacity-building programs. The government's decision to hand over Karachi Industrial Park (KIP), developed on the site of Pakistan Steel Mills, to China is also a key example of this collaboration. This initiative aims to integrate international standards, aligning with China's expertise in industrial park development and green technologies. The transition of KIP to Chinese management is expected to position it as a model SEZ (Khan, 2024).
- Launching accredited green economy awareness and training programs targeting policymakers, SEZ developers, and regulators will build capacity in climate finance, carbon markets, and sustainable industrialization, fostering a knowledgeable ecosystem to support green SEZ development.

**c. Weak Academic Linkages and Limited Focus on Sustainability Education:** Academic institutions in Pakistan work on small-scale projects with limited government funding, often resulting in low-impact outcomes. There is a gap in academic programs that focus on sustainability and environmental issues, with only a few institutions like NUST offering related programs.

**Way Forward**

- Pakistan must develop specialized skills in renewable energy and green technologies through training programs, joint research initiatives, and university incentives for sustainability-focused programs. Initiatives like CPEC Consortium of Business Schools supported by HEC, and CPEC-Collaborative Research Grant (CPEC-CRG) under HEC's initiative "Academic Collaboration under CPEC Consortium of Universities" are imperative to support promising research partnerships between Pakistan and China.
- Universities and research institutions should be supported to collaborate with industry on developing efficient solar technologies, including third-generation solar cells and energy storage solutions. Specialized engineering programs focused on photovoltaic technologies and battery systems must be introduced to cultivate a skilled domestic workforce.
- International technology firms operating in Pakistan, such as Huawei, should be encouraged to establish R&D labs in partnership with Pakistani institutions, ensuring that local capacity is built alongside foreign investment.
- Stronger partnerships between universities, research institutions, and private firms are essential, with the Higher Education Commission (HEC) playing a key role in promoting sustainability and green technology programs. However, these initiatives must be consolidated for greater impact.

**d. Absence of Green Supply Chains and Skilled Workforce:** Pakistan does not have a robust green supply chain or a comprehensive approach to developing green infrastructure in SEZs, which includes a skilled workforce capable of supporting advanced green industries, especially in sectors like renewable energy (e.g. electric vehicles, solar panels) which is crucial for developing sustainable industrial parks like those seen in China.

**Way Forward**

- SEZ authorities need enhanced capacity to handle complex PPP transactions. This can be achieved by hiring professionals with technical expertise in land acquisition, labor laws, and finance.
- To facilitate the development of a green economy, SEZs should be directly linked with Science and Technology Zones (STZs). This collaboration can focus on the joint development of green technologies, including EVs, renewable energy solutions, and sustainable manufacturing practices. Pakistan can draw inspiration from China's integration of its tech zones with industrial parks, which has helped make rapid advancements in clean technology. For example, to contribute to China's carbon peak and neutrality targets, Beijing Zhongguancun Science Park formulated a five-year action plan for green development. It also set up special funds for the construction of ecological and smart parks (HAO NAN, 2022).
- Pakistan should collaborate with China to adopt a phased approach to the green transition within CPEC projects, particularly in SEZs. This phased transition would allow industries to gradually integrate cleaner technologies over an extended timeline, thereby reducing the financial burden on businesses while ensuring the long-term sustainability of CPEC projects. A phased approach could include incentives for early adopters of green technologies and a gradual rollout of environmental regulations.
- Pakistan must undertake sectoral reviews to identify greening requirements in key areas such as electric power, transport, agriculture, and solid waste management. The government should prioritize investments in technologies that support a low-carbon economy, with solar and wind energy being key areas of focus, but not the sole considerations.
- Encouraging joint ventures will leverage existing incentives to build domestic solar manufacturing capacity. Learning from successful industrial relocations from China such as motorcycle manufacturing, Pakistan should reduce allied costs and position itself as a re-export hub to capture new markets amid shifting global trade dynamics such as rising tariffs on Chinese solar exports to the U.S.
- Prioritizing localization of Balance of System (BoS) components, such as inverters, mounting, and installation services, will leverage Pakistan's rapid solar deployment to capture up to 70% of project value domestically while deferring module fabrication to China's cost advantage and instead optimizing around imported modules to rapidly build a competitive local solar supply chain.
- Introducing rigorous quality standards and certification mechanisms aligned with international benchmarks will ensure the reliability and acceptance of locally manufactured solar products. A circular economy approach, including policies for recycling decommissioned PV panels and producer responsibility schemes inspired by China's NDRC, is critical to manage solar waste and sustain sectoral growth.
- Develop targeted partnerships with Global South countries to access green technologies, climate finance, and sustainable industrial practices. Formalize joint initiatives focused on technology transfer, capacity building, and co-financed GSEZ projects through South-South platforms.

| **Action Matrix** | | |
|---|---|---|
| Timeline | Relevant Actors/Stakeholders | Responsibility |
| Short-Term (1–2 Years) | BoI, Ministry of Commerce, MoPD&SI, PBS, TDAP, SIFC | Commission **benchmark studies** comparing Pakistan's investment attractiveness with ASEAN nations, assessing trade, labor, and transportation advantages. Use findings to develop targeted policies. |
| | HEC, Ministry of Science & Technology (MoST), Pakistan Council of Scientific and Industrial Research (PCSIR), Chinese Ministry of Science and Technology, | Launch **joint research programs** between China and Pakistan focusing on R&D in renewable energy, EVs, and industrial automation. |
| | BOI, Provincial SEZAs, PSA | Develop incentives and capacity-building programs to accelerate localization of BoS components and related services within SEZs. |
| Medium-Term (3–5 Years) | Provincial SEZAs, Finance Division, BoI, Public Private Partnership Authority (P3A), SIFC | Strengthen **SEZAs' capacity in PPP transactions, land acquisition, and regulatory compliance** by hiring sectoral experts. |
| | Provincial SEZAs, Special Technology Zones Authority (STZA), BoI, MoCC&EC | Establish **direct linkages between SEZs and Special Technology Zones (STZs)** to drive R&D collaboration and green technology innovation. |
| | MoCC&EC, Pakistan Standards & Quality Control Authority (PSQCA), EPAs, SEZAs | Develop and enforce solar product quality standards and establish PV panel recycling facilities with clear regulatory frameworks. |
| | **MoFA, BOI, MOCC&EC, EAD, Developing-8, Centre for South-South Technical Cooperation (CSSTC), Shanghai Cooperation Organization (SCO) a** | **Develop and implement bilateral and multilateral partnerships with Global South countries focused on green technology transfer, joint GSEZ financing, and capacity-building programs.** |
| Long-Term (5–10 Years) | BoA, MoCC&EC, Pakistan & Provincial EPAs, NEECA | Implement a **phased green transition in SEZs** by gradually enforcing sustainability standards and incentivizing early adopters of clean technology. |
| | BoI, Ministry of Energy (Power Division), EPAs | Conduct **sectoral reviews to identify green investment needs in power, transport, and waste management, prioritizing low-carbon technologies.** |

#### 7.4.5. Facilitation of Green Finance and Financial Instruments

**a. Limited Financial Capital and Weak Incentives for Renewable Energy Investment:** Developing GSEZs requires significant investment in renewable energy infrastructure, with Pakistan needing over $100 billion for a carbon-neutral transition and $50 billion to meet its 60% renewable energy target by 2030 (Profit, 2025). Limited financial capital poses a major challenge, and while private sector involvement can help, investor interest remains low due to perceived risks and weak financial incentives. The lack of a clear and compelling financial framework can deter investment, especially in a cash-strapped economy like Pakistan.

**Way Forward**

- Pakistan can leverage the Belt and Road Initiative International Green Development Coalition (BRIGC) framework to strengthen environmental governance and align CPEC projects with global sustainability standards. BRIGC's Green Development Guidance promotes differentiated financing conditions, where projects with higher environmental risks face higher borrowing costs (BRIGC, 2023). By integrating climate risk assessments and sustainable financing mechanisms, Pakistan can enhance investor confidence and attract green investments under the BRI.
- China's shift towards market-based project financing, rather than G2G strategic projects, presents an opportunity for Pakistan to diversify its funding sources for SEZs. Instead of relying solely on sovereign-backed loans, Pakistan must explore private sector financing mechanisms, including green bonds, sustainability-linked loans, and blended finance models. These instruments can mobilize resources for renewable energy investments within GSEZs, reducing the financial burden on the government while ensuring long-term sustainability.
- Pakistan should adopt a sector-specific incentives regime for GSEZs, following the Philippines' model of dedicated rules for eight targeted sub-sectors (World Bank, 2020). Policies should incentivize green infrastructure, RE manufacturing, and low-carbon development, with industry-aligned incentives guided by the recent SEZ survey rather than blanket tax reductions (Shabbir, 2024). Prioritizing renewable energy manufacturing through targeted tax exemptions, and criteria-based extensions can attract domestic and international investment.
- Pakistan should capitalize on green financing opportunities under CPEC 2.0, leveraging China's Green BRI initiative. Encouraging business-to-business (B2B) collaborations with Chinese companies can help diversify financing sources and reduce reliance on government-backed loans. The Ministry of Energy (Power Division) must take a coordinated approach, ensuring alignment between renewable energy policies like the Alternative & Renewable Energy (ARE) Policy 2019, IGCEP, and Pakistan's Nationally Determined Contributions (NDCs). Improved communication between government agencies and private sector stakeholders will be crucial for streamlining investment decisions in GSEZs.
- To accelerate infrastructure development in GSEZs, Pakistan must secure funding commitments from both federal and provincial governments. Linking sustainability mandates to disbursements, particularly through PSDP and SEZ management companies like FIEDMC, PIEDMC, can ensure long-term climate-aligned industrial growth.

**b. Land Acquisition and Cost Barriers for Renewable Energy Projects:** The high cost and competition for land within SEZs create financial challenges for green projects as renewable energy initiatives like wind and solar farms require large land areas. With various industries competing for space, land acquisition remains a major obstacle.

**Way Forward**

- To enhance financial viability, the government could introduce targeted subsidy, similar to Vietnam and South Africa, where government subsidy allowed the developers to charge land rents 50% lower than in comparable industrial locations nearby (World Bank, 2020). Lower land costs would ease the initial capital burden and encourage renewable energy manufacturing.

**c. Limited Access to Green Financing and Underutilization of International Climate Funds:** Pakistan's renewable energy projects face challenges accessing local financing due to high-interest rates and limited financing options. International climate funds and green financing mechanisms, such as those from the World Bank, often remain underutilized. With countries like Turkey committing millions of dollars to green projects such as Türkiye Green Industry Project, it is crucial to explore alternative financing mechanisms such as green bonds and venture capital funds, specifically targeted at renewable energy and EV projects.

**Way Forward**

- Given Pakistan's high external debt (Rs 26 trillion, 24.5% of GDP, in June 2024), innovative debt restructuring strategies can provide fiscal relief while supporting the clean energy transition (Debt Sustainability Report FY2025-FY2027, 2024). With China holding 22% of Pakistan's external debt (Kiani, 2024), debt-for-climate and debt-for-nature swaps could be negotiated, redirecting repayments toward renewable energy infrastructure. A precedent for this approach is Germany's EUR 40 million debt swap (2008), which funded Pakistan's health sector, a similar arrangement could be designed for GSEZ development (UNDP, 2023). Inspired by Belize's $553 million superbond buyback, Pakistan could negotiate discounted debt repurchases linked to renewable energy investments.
- Climate-backed low-interest loans, such as Belize's $364 million blue loan, could help Pakistan secure financing for clean energy projects with lower debt repayment risks (Owen, 2022).
- Another potential model is the bilateral debt-for-nature swap seen in Seychelles' agreement with the Paris Club. In this case, debt restructuring enabled a loan buyback, where redirected repayments funded conservation and climate adaptation through a dedicated trust (Paris Club, 2015). Pakistan could establish a similar Green Sovereign Wealth Fund to manage climate financing, ensuring transparency, accountability, and long-term investment in renewable energy.
- To accelerate clean energy investment in GSEZs, Pakistan should expand the use of concessional and blended finance to support early-stage project development, including feasibility studies, technical assistance, and risk mitigation. These instruments can significantly enhance project bankability and attract private capital by lowering entry risks. However, to move beyond pilot-scale interventions, Pakistan must moobilize large-scale private investment that requires a coordinated strategy for coupling climate-aligned financial tools with a credible, investor-friendly environment.
- Redirecting revenues from carbon taxes and petroleum levies, especially under international financing programs like the IMF's Resilience and Sustainability Facility, towards renewable energy manufacturing can provide critical funding for solar supply chain development in GSEZs.

| **Action Matrix** | | |
|---|---|---|
| Timeline | Relevant Actors/ Stakeholders | Responsibility |
| Short-Term (1-2 Years) | BoA, BoI, FBR, Finance Division, MoC, MoCC&EC, Provincial Boards of Revenue | Design and implement a **sector-specific incentives package** for green SEZs, including tax exemptions and compliance-based extensions. |
| | BoI, FBR, SBP, Finance Division, MoPD&SI, PSX | Develop and roll out **green financing instruments**, such as green bonds and low-interest credit lines, through commercial banks to support renewable energy manufacturing in SEZs.<br>Establish **criteria for concessional financing** to ensure funds are directed towards priority sectors. |
| | MoF, FBR, SBP, MoCC&EC | Establish a framework to earmark carbon tax and petroleum levy revenues for renewable energy manufacturing and climate innovation projects. |
| | CPEC Authority, BoI, MoFA, Ministry of Commerce, NDRC (China), SBP, Commercial Banks | Negotiate with China under CPEC 2.0 for green financing, B2B partnerships for renewable energy investments and debt swaps to convert CPEC-related liabilities into green SEZ investments.<br>Establish a multi-agency task force for financing implementation and investor facilitation. |
| | Ministry of Finance, SBP, BOI, P3A, MoCC&EC | Design and roll out concessional and blended finance instruments to support early-stage clean energy investments in GSEZs, including feasibility studies and risk-sharing mechanisms. |
| Medium-Term (3–5 Years) | Provincial SEZAs, BoI, SEZ Developers, MoE (Power Division), FBR, Pakistan & Provincial EPAs | Identify and designate **priority land zones** within SEZs for RE manufacturing and develop targeted subsidized **land pricing model.** |
| | MoE (Power Division), PPIB, BoA, MoCC&EC, NTDC, Inter-Ministerial Committee (IMC) | Conduct **regulatory impact assessments** to ensure that **ARE Policy 2019, IGCEP, and NDCs** support renewable energy investments in SEZs.<br>Establish an **inter-agency coordination mechanism** for streamlining investor approvals and project execution. |
| Long-Term (5-10 Years) | BoI, Finance Division, International Development Partners (e.g. World Bank or ADB) | Formulate a **sustainable green investment fund** backed by multilateral institutions to provide long-term financing for green SEZ projects.<br>Launch a **Green SEZ Guarantee Mechanism** to de-risk private investments. |
| | BoI, BoA, MoPD&SI, Finance Division, MoC | Establish a **permanent Green SEZ Investment Authority** to oversee long-term policy implementation, monitor compliance, and develop periodic incentive schemes aligned with global best practices. |

### 7.4.6. Security and Risk Mitigation

**a. Security Threats Undermining Investor Confidence**: Persistent security threats, particularly in Balochistan and along CPEC routes, deter investment and disrupt economic activity. Frequent attacks on Chinese personnel and infrastructure, such as the car bombings and consulate attack, highlight the volatile environment. These threats necessitate heavy security deployments, but concerns persist. At the same time, lack of meaningful engagement with local communities and stakeholders has reinforced negative perceptions and contributed to trust deficits among investors and the public.

**Way Forward**

- Ensuring that SEZs are perceived and experienced as secure, inclusive investment zones requires coordinated efforts between law enforcement, and diplomatic channels to mitigate both internal and external security risks.
- A people-centered strategic communication campaign is essential to build trust in CPEC. Actively engaging local communities in decision-making and ensuring they benefit from infrastructure development, job creation, and industrial growth can help shift negative perceptions.
- Establish a multi-stakeholder dialogue platform to bring together local communities, business leaders, policymakers, and security agencies. This platform should facilitate open communication, address concerns, and promote inclusive development within and around SEZs.

**Action Matrix**

| Timeline | Relevant Actors/Stakeholders | Responsibility |
|---|---|---|
| Short-Term (1-2 Years) | MoFA, Ministry of Interior, Pakistan Army Special Security Division (SSD), Local LEAs, National Counter Terrorism Authority (NACTA) | Monitor emerging risks around CPEC corridors through coordinated inter-agency efforts, with a focus on proactive response and transparency. |
| Medium-Term (3-5 Years) | CPEC Authority, Ministry of Information & Broadcasting (MoIB), PEMRA | Launch a strategic, community-informed communication campaign to build trust in CPEC and SEZs using local engagement, media outreach, and real beneficiary stories. |
| | CPEC Authority, Board of Investment (BOI), Provincial BOIs, Domestic and Foreign Investors (including Chinese enterprises), Community Leaders | Establish a structured, ongoing stakeholder-engagement mechanism that brings together local communities and both domestic and foreign businesses and investors to exchange feedback, address concerns, and strengthen overall investment confidence. |

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# Annexures

| Annex A: Types of Industrial Zones as outlined by the SEZ Act, 2012 | |
|---|---|
| **Type** | **Description** |
| **Existing Zones** | Export processing zones, industrial zones, and similar entities that existed before the enactment of the SEZ Act. |
| **Export Processing Zones** | Economic zones established under the Export Processing Zone Authority Ordinance, 1980, designed to facilitate export-oriented industries. |
| **Extra-Territorial Zones** | Economic zones that are considered outside the customs territory of Pakistan, providing incentives for international trade. |
| **Free Trade Zones** | Zones deemed outside the customs territory of Pakistan, approved by the BoA for special trade, transshipment, and re-export operations. |
| **Hybrid Export Processing Zones** | Economic zones outside the customs territory where goods are manufactured and services provided for both international and domestic markets. |
| **Multilateral Economic Zones** | Zones where enterprises must be owned by nationals, residents, or corporate entities from specific countries. |
| **Reconstruction Opportunity Zones** | Economic zones whose exports are recognized by foreign jurisdictions as eligible for reduced tariffs and trade benefits. |
| **Regional Development Zones** | Zones designed to promote economic activities in specific regions and industries for regional development. |
| **Sector Development Zones** | A subset of regional development zones where economic activities are restricted to specific sectors as notified by the BoA. |

## Annex B: Key Initiatives taken by BoI for SEZ

### Key Initiatives taken by BoI for SEZ Facilitation

- **SEZ MIS MODULE:** A major advancement in SEZ management was the introduction of the SEZ MIS Module on January 1, 2021, by the BoI. This digital platform serves as a one-window solution for all SEZ-related processes, ensuring a transparent and time-bound mechanism for handling zone and enterprise applications. It is integrated with the Securities and Exchange Commission of Pakistan (SECP) to allow only registered entities to apply. Key features include grievance redressal, investment database management, and auditable data access. Additionally, the module addresses long-standing real estate concerns within SEZs, ensuring that only legitimate investors can acquire plots.
- **SEZ Zone Enterprise Sale, Lease and Sub-Lease of Plots Regulations 2021:** The SEZ Zone Enterprise Admission and Plot Regulations 2020, enforced on 15th January 2021, were established to prevent speculative real estate activities in SEZs and streamline the process for enterprise admissions. These regulations promote transparency and fairness in the sale, lease, and sub-lease of industrial plots through an IT-enabled SEZ MIS Module, ensuring efficient and structured allocation to potential zone enterprises.
- **The Sole Enterprise Special Economic Zone Regulations, 2020:** The Sole Enterprise Special Economic Zone Regulations, 2020, notified on 11th December 2020, enable the establishment of single-unit SEZs in Pakistan under the SEZ Act, 2012. These regulations outline procedural guidelines and establish parameters to safeguard the country's socio-economic interests while ensuring that only serious investors qualify. To promote industrialization, the regulations relax these parameters for 67 underdeveloped areas, encouraging investment and supporting import substitution in the top five importing sectors.
- **Special Investment Facilitation Council (SIFC):** Launched on June 20, 2023, the Special Investment Facilitation Council (SIFC) operates as a one-window platform to accelerate investment processes in Pakistan. Chaired by the Prime Minister and comprising federal, provincial, and military leadership, SIFC follows a whole-of-government approach to attract investments in defense, agriculture, mining, IT, and energy. With a goal of securing $60 billion in investments over five years, the council addresses investor concerns such as legal protections, dispute resolution, and fund repatriation. It has implemented a 15-day approval timeline for foreign investments. Additionally, the SIFC Secretariat has established regional and country-specific desks to facilitate proposals, focusing on key regions, including China and the Far East, Central Asia and Russia, the Middle East and Africa, Europe and the Americas, Qatar and Kuwait, and dedicated desks for Saudi Arabia and the UAE.
- **SEZs Survey:** In December 2024, BoI successfully completed a comprehensive survey of 35 industrial zones nationwide to facilitate the relocation of Chinese industries and attract international investment. Using drone technology, the survey assessed infrastructure gaps, utility availability, and the possession status of allotted plots to address barriers to industrialization.

**Annex C: Responsibility Matrix of SEZ Bodies**

| | Infrastructure and Utilities | | | Co-ordinate with Federal Govt. (FG)/ Provincial Govt. (PG) | | | | Facilitate Developer & Enterprise Interaction | |
|---|---|---|---|---|---|---|---|---|---|
| | **Ensure Services Within Vicinity** | **Build and/or Operate/ Distribute Within the Zone** | **To SEZ Zero Point** | **To Facilitate Developer** | | **To Facilitate Zone Enterprise** | | With PG/ LG | With all FG/ PG |
| **Firefighting Facilities** | SEZA | Developer | | | | | | SEZA | BoI |
| **Medical Facilities** | SEZA | Developer | | | | | | SEZA | BoI |
| **Acad. & Voc. Training Facilities** | SEZA | Developer | | | | | | SEZA | BoI |
| **Roads** | | Developer | FG & PG | SEZA | | | | SEZA | BoI |
| **Electricity** | | Developer | FG & PG | SEZA | SEZ Committee | SEZA | SEZ Committee | SEZA | BoI |
| **Natural Gas** | SEZA | Developer | FG & PG | SEZA | SEZ Committee | SEZA | SEZ Committee | SEZA | BoI |
| **Water** | | Developer | FG or PG | SEZA | SEZ Committee | SEZA | SEZ Committee | SEZA | BoI |
| **Sewerage/ Drainage** | | Developer | FG or PG | SEZA | SEZ Committee | SEZA | SEZ Committee | SEZA | BoI |
| **Waste Water Treatment** | | Developer | | | SEZ Committee | SEZA | SEZ Committee | SEZA | |
| **Security** | SEZA/ PG | Developer | | | | | | SEZA | BoI |

Source: State Bank of Pakistan, 2021

**Annex D: Logistical Details of Notified SEZs in Pakistan**

| SEZ | Location | Developer | Public/Private | Area | Businesses Allowed |
|---|---|---|---|---|---|
| Bin Qasim Industrial Park (BQIP) | Karachi, Sindh | National Industrial Parks Development & Management Company (NIP) | Public | 930 | Light Engineering, Auto & Allied, Foundry and Fabrication, Warehousing & Logistics, Mixed Used |
| Khairpur Special Economic Zone (KSEZ) | Khairpur, Sindh | Sindh Economic Zones Management Company (SEZMC) | Public | 140 | Agro Food Processing, Light Engineering & Manufacturing. |
| Korangi Creek Industrial Park (KCIP) | Karachi, Sindh | National Industrial Parks Development & Management Company (NIP) | Public | 220 | Low Density Zone: Light Engineering, & Warehousing/ Logistics High Density Zone: Commercial and Business Centers, Information Technology, Gems & Jewelry |
| Hattar Special Economic Zone (HSEZ) | Haripur, KP | Khyber Pakhtunkhwa Economic Zones Development and Management Company (KPEZDMC) | Public | 440 | Food and beverage, Agro-processing, Textile, Crockery, Paper printing, Chemical, Cement, Engineering |
| M3 Industrial City (M3IC) | Faisalabad, Punjab | Faisalabad Industrial Estates Development & Management Company (FIEDMC) | Public | 4,356 | Textiles, Engineering, Electrical & Electronic, Chemical & Paints, Food Processing, Pharmaceuticals, Automobiles, Packaging and Building Material |
| Value Addition City (VAC) | Faisalabad, Punjab | Faisalabad Industrial Estates Development & Management Company (FIEDMC) | Public | 215 | Textiles, Engineering, Electrical & Electronic, Chemical & Paints, Food Processing, Pharmaceuticals, Automobiles, Packaging and Building Material |
| Oil Village SEZ (OVSEZ) | Rawalpindi, Punjab | FOC-1 | Public | 100 | Storage for Oil Marketing Companies |

| | | | | | |
|---|---|---|---|---|---|
| Rachna Industrial Park (RIP) | Sheikhupura, Punjab | National Industrial Parks Development & Management Company (NIP) | Public | 215 | Auto Parts, Leather Products, Packaging and Food Processing units besides other auxiliary, industries , Mixed Used |
| Rahimyar Khan Industrial Estate (RIE) | Rahim Yar Khan, Punjab | Punjab Industrial Estates Development & Management Company (PIEDMC) | Public | 456 | Oil Mills, Chemical Industry, Ginning Mills, MDF Production, Wood Plastic Composite Production, Pesticides, Polypropylene Woven Bags, Pharmaceutical, Packaging Industry, Storage Industry, Paper Industry, Flour Mills, Plastic Products, Textile, Cold Storage, Warehouse |
| Rashakai Special Economic Zone (RSEZ) | Nowshera, KP | Khyber Pakhtunkhwa Economic Zones Development and Management Company (KPEZDMC) | Public Private Partnership | 1,000 | Light Engineering, Automotive, Construction and Food Processing value |
| Vehari Industrial Estate (VIE) | Vehari, Punjab | Punjab Industrial Estates Development & Management Company (PIEDMC) | Public | 277 | Handicrafts, Chemical Industry, Ginning Mills, Agro-Based Industry, Shoe Industry, Pesti-cides, Pharmaceuticals, Packaging Industry, Storage Industry, Paper Industry, Flour Mills, Plastic Products, Textile, Cold Storage, Warehouse |
| Bhalwal Industrial Estate (BIE) | Sargodha, Punjab | Punjab Industrial Estates Development & Management Company (PIEDMC) | Public | 427 | Citrus Processing Indus-try, Frozen Concentrated Juice Industry, Pharma-ceuticals, Seed & Crops Unit, Packaging Industry, Storage Industry, Paper Industry, Flour Mills, Plastic Products, Foot-wear, Textile, Warehouse |
| Bostan Special Economic Zone (BSEZ) | Pishin, Balochistan | Industries Department, Government of Balochistan | Public | 200 | Fruit processing, Ag-riculture machinery, Minerals and gems, Ce-ramic industries, Ice and cold storage, Electrical appliances, Motor bikes assembly |

| | | | | | |
|---|---|---|---|---|---|
| Hub Special Economic Zone (HUBSEZ) | Lasbela, Balochistan | Lasbela Industrial Estates Development Authority (LIEDA) | Public | 406 | Textile, Pharmaceutical, Cement manufacturing, Chemical Industries, Plastic, Paper Manufacturing, Printing & Packaging, Ceramics, Marble Processing, Mineral Grinding |
| Naushero Feroz Industrial Park (NFIP) | Naushahro Feroze, Sindh | National Industrial Parks Development & Management Company (NIP) | Public | 80 | Agro Food Processing , Agro Non-Food Processing , Light Engineering, Mixed Used |
| Allama Iqbal Industrial City (AIIC) | Sahianwala Interchange, Faisalabad Faisalabad, Punjab | Faisalabad Industrial Estates Development & Management Company (FIEDMC) | Public | 3,217 | Textile, Engineering, Electrical and electronics, Chemical paints, Agriculture and food processing, Steel and packaging |
| National Science and Technology Park (NSTP) | Islamabad, ICT | NUST | Public-Private Partnership (PPP) | 58 | IT & Telecommunications, Engineering, Biotech/ Biopharma, Banking/ Financial services, Defence Technologies, Power and automotive Industries |
| JW-SEZ China-Pakistan SEZ (JWSEZ) | Lahore, Punjab | JWSEZ Group | Multiparty Private SEZ (Zone Enterprise) | 231 | Electric Car Manufacturing |
| Quaid-e-Azam Business Park (QABP) | Sheikhupura, Punjab | Punjab Industrial Estates Development & Management Company (PIEDMC) | Public | 1,860 | Textile and Apparel-related Industries |
| Service Long March Tyres SEZ | Nooriabad, Sindh | Service Long March Tyres (PVT) Limited | Pakistan's first Sole Enterprise (SEZ) | 50 | Steel radial truck/bus tyre plant |
| Siddiqsons Tinplate SEZ | Lasbela, Balochistan | STPL | Sole Enterprise SEZ | 71 | Manufacturing of tin plates, cans, and other steel products for the packaging of cooking oil, fruits, vegetables, seafood, lubricants, etc. |

Source: Authors' own.

| Annex E: Notified SEZs Bodies in Pakistan: Roles and Responsibilities | |
|---|---|
| **SEZ Body** | **Description (Including Responsibilities and Functions)** |
| **Board of Approvals (BoA)** | Chaired by the Prime Minister, the BoA includes top political, technical, and business leaders of Pakistan. It approves or rejects SEZ zone applications and development agreements, formulates regulations, cancels agreements if necessary, and reviews SEZ policies annually. It ensures alignment with national objectives by addressing policy issues submitted by SEZ Authorities or developers and takes steps to advance the SEZ Act's goals. |
| **Approvals Committee** | Chaired by the Chairman of BoI, this committee exercises delegated powers from the BoA, including screening SEZ applications and making recommendations for approval. It operates under the BoA's guidance and submits its decisions for ratification. It also handles zone-specific operational matters, ensuring compliance with SEZ objectives. |
| **Board of Investment (BoI)** | Acting as the secretariat for the BoA and Approvals Committee, the BoI coordinates SEZ activities, processes zone applications, and reviews development agreements. It facilitates both domestic and international investment in SEZs, and supports interactions between developers, enterprises, government or financial institutions. The BoI also acts as the SEZ Authority for Islamabad Capital Territory and provides technical support to provincial SEZ authorities when requested. |
| **Provincial Investment Promotion Authority** | Provincial-level agencies, such as the Sindh Board of Investment or Punjab Board of Investment and Trade, promote both domestic and foreign investment within their jurisdiction. They assist Provincial SEZ Authorities, facilitate land acquisition, ensure infrastructure linkages, and support developers and enterprises in complying with environmental and social requirements. They act as focal entities for investment promotion and inter-agency coordination. |
| **SEZ Authorities** | Independent authorities for each province, responsible for acquiring land under the Land Acquisition Act, 1894 and establishing operational rules subject to BoA approval. These bodies manage SEZ operations within provinces, ensuring compliance with SEZ policies, supporting developers, and resolving issues related to land or infrastructure development. |
| **SEZ Committee** | Established for each SEZ, the SEZ Committee administers and enforces SEZ-specific benefits and regulations. It approves enterprise entry applications, certifies enterprises, oversees compliance, enforces SEZ building codes, and facilitates coordination among developers, enterprises, and government agencies. It acts as the primary point of contact for utilities, approvals, and regulatory compliance within the SEZ. |
| **Developer** | An enterprise responsible for developing and operating SEZs as per the terms of a development agreement. Developers implement development plans, approve and allot land to zone enterprises, and monitor compliance with zone regulations. They ensure alignment with the SEZ's admission criteria and building codes. |
| **Zone Enterprise** | A Zone Enterprise refers to a business approved to operate within an SEZ, having met the admission criteria and regulations set by the developer and SEZ Committee. Zone Enterprises are responsible for complying with SEZ regulations, utilizing the tax and operational benefits provided by the SEZ framework, and contributing to the economic objectives of the zone, including boosting trade, generating employment, and promoting industrial growth within the region. |

**Annex F: Comparison of Fiscal Incentive Structures Across SEZs in Different Countries**

| | Vietnam | India | Indonesia | Bangladesh | Pakistan |
|---|---|---|---|---|---|
| Developer Incentive | No established framework | Yes | Yes | Yes | Yes |
| Type of Corporate Tax Exemption | Abs. exemp. | Abs. exemp | Depends on firm qualifications | Abs. exemp | Abs. exemp |
| Corporate Tax Exemption | 100% | 100% | 20-100% | 100% | 100% |
| Duration of Corporate Tax Exemption | 4 years | 5 years | 5-15 years | 2 years | 10 years |
| Exemption on Withholding Tax | 0% | 0% | 0% | 50% | 0% |
| Property/ Land Tax | Land use tax postponed; depreciation of fixed asset at double rate | 0% | Partial reduction in property tax | 50% | 0% |
| VAT/Sales Tax | 0% | 100% exempt from sales tax (central and state) | 100% exempt from VAT, luxury sales tax, and excise tax on raw materials | 80% exempt from utility consumption tax | 0% |
| Import Duty on Capex | 100% | 100% | 0% | 100% | 100% |
| Import Duty on Input | 0% | 100% | 0% | 100% | 100% |
| Capex Duration | One-time | Perpetual | N/a | Perpetual | One-time |
| *Memorandum Items* | | | | | |
| Legal Framework Year | 2006 | 2005 | 2009 | 2010 | 2012 |
| Minimum Investment Required | None | None | $37mln | None | None |
| Standard Corporate Tax | 20% | 30% | 25% | 25% | 29% |

Source: State Bank of Pakistan, 2021

**Annex G: Alignment of GSEZs with Pakistan's National Climate and Energy Goals**

| Category | GHG Emissions Reduction | Renewable Energy Target | Efficient Transportation |
|---|---|---|---|
| Target | As per its NDCs 2021, Pakistan has committed to reducing its GHG emissions by 50% by 2030 (unconditional emissions reduction target of 15% and a conditional target of 35%). | The government has committed to generating 30% of total energy from renewable sources by 2030. | Pakistan's New Energy Vehicle policy (2025-2030) is aimed at transitioning 30% of all new vehicles — imported and locally manufactured — in Pakistan to electric power by 2030. |
| Alignment with GSEZs | By accelerating the transition towards clean energy and the adoption of green technologies within industrial operations, GSEZs can help in achieving Pakistan's 15% unconditional emissions reduction target. | Through GSEZs, Pakistan can utilize its energy potential through local PV manufacturing and attract investment in R&D of bioenergy (approx. potential of 20,709 MW) and wind technologies (approx. potential of 50,000 MW in Sindh) (Khan et al., 2022). | Escalating the transition towards clean energy via local EV production, GSEZs provide Pakistan with an excellent opportunity to develop its own EV ecosystem, thus facilitating the development of a green supply chain and transforming the transportation sector. |

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Ayesha Naeem has a public policy degree from NUST, graduating as a part of the Dean's Honor List. She is currently spearheading SDPI's program on low-carbon industrial development ranging from renewable energy development under SEZs, localization of RE value chain, and financing mechanisms to support this transition. Ayesha's work reflects a nuanced understanding of policy at the nexus of climate, infrastructure, and global trade, emphasizing evidence-based solutions for sustainable growth and strategic economic planning in developing contexts.

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