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The Climate-Economy Nexus: Why Pakistan Must Act Now?

Recommendations



Build a Strong Climate Policy & Institutional Foundation



Enhance Climate Capacity & Awareness

Introduce specialized climate change programs in universities to build skilled human resources. Launch targeted awareness campaigns across public and private sectors, with a focus on local media, social media, with special consideration to directly affected communities, women, and children.

Strengthen Carbon Market Governance

Ensure the Carbon Market Policy is backed by a robust legal framework with independent regulatory oversight. Establish capacity-building programs to prepare the private sector for meaningful carbon trading participation.

Align Sectoral Policies with NDC Commitments

Ensure that development policies in energy, transport, and agriculture align with Pakistan's NDC targets. This requires cross-ministerial coordination, integrated planning, measurable sector-specific targets, and accelerated implementation of climate strategies like the EV Policy.



Advance Green Energy and Trade Compliance



Revise Tax on Solar Panels

Govt. should reduce the 18% tax on all solar panels, imported (Recently proposed tax in budget FY26) and local, to ensure affordability and sustain adoption. Additional, incentives like other tax breaks, financing, and quality support can boost local manufacturing, protect consumers, and keep Pakistan on track with its NDC goals.

Include EU Green Deal Readiness

Ensure Strategic Trade Policy Framework 2025–30 supports businesses in compliance with the EU Green Deal and CBAM by promoting low-carbon production, green certification, and emissions reduction in key export sectors.



Secure and Mobilize Climate Finance



Enforce Climate Finance Commitments

Actively pursue fulfillment of climate finance pledges made by developed countries, particularly post-2022 floods. Advocate for timely disbursement and accountability for the unmet USD 100 billion annual climate finance target via sending targeted delegations in COPs.

Explore Debt-for-Nature Swaps

Leverage Pakistan's Debt-to-GDP position to negotiate debt-for-nature swaps, modeled after Barbados and Gabon, for climate resilience and environmental restoration. Ensure transparency through measurable outcomes such as emissions reduction and deforestation metrics.

Expand and Monitor Green Sukuk Initiatives

Scale Green Sukuk to provincial and municipal levels with allocations linked to priority climate projects. Strengthen investor confidence through public awareness and third-party verification for fund transparency.



Invest in Climate-Resilient Agriculture & Water Security



Promote Climate-Smart Agriculture

Prioritize climate-vulnerable regions in GCF project planning, strengthen institutional capacity, and expand financing options for smallholders. Promote technologies like laser land leveling, drip irrigation, and solar-powered systems.

Strengthen Agricultural R&D

Enhance agricultural research in collaboration with universities to scale adaptive farming. Improve extension services using mobile apps to deliver real-time guidance to farmers for efficient outreach.

Strengthen Water Security

Fast-track National Water Policy targets by upgrading irrigation systems, lining watercourses, and completing delayed dam projects. Improve efficiency via water pricing reforms, micro-irrigation, groundwater regulation, and real-time monitoring systems.



Nature-Based & Technological Solutions for Resilience



Ensure Success of Ecosystem-Based Solutions

Strengthen nature-based projects like the 10 Billion Tree Tsunami by focusing on post-plantation care, land conflict resolution, and survival rate monitoring through satellite imagery and independent audits.

Mitigate Flood Risk

Remove blockages and encroachments from natural drainage systems to prevent urban and rural flooding, supporting ecosystem integrity and disaster risk reduction.

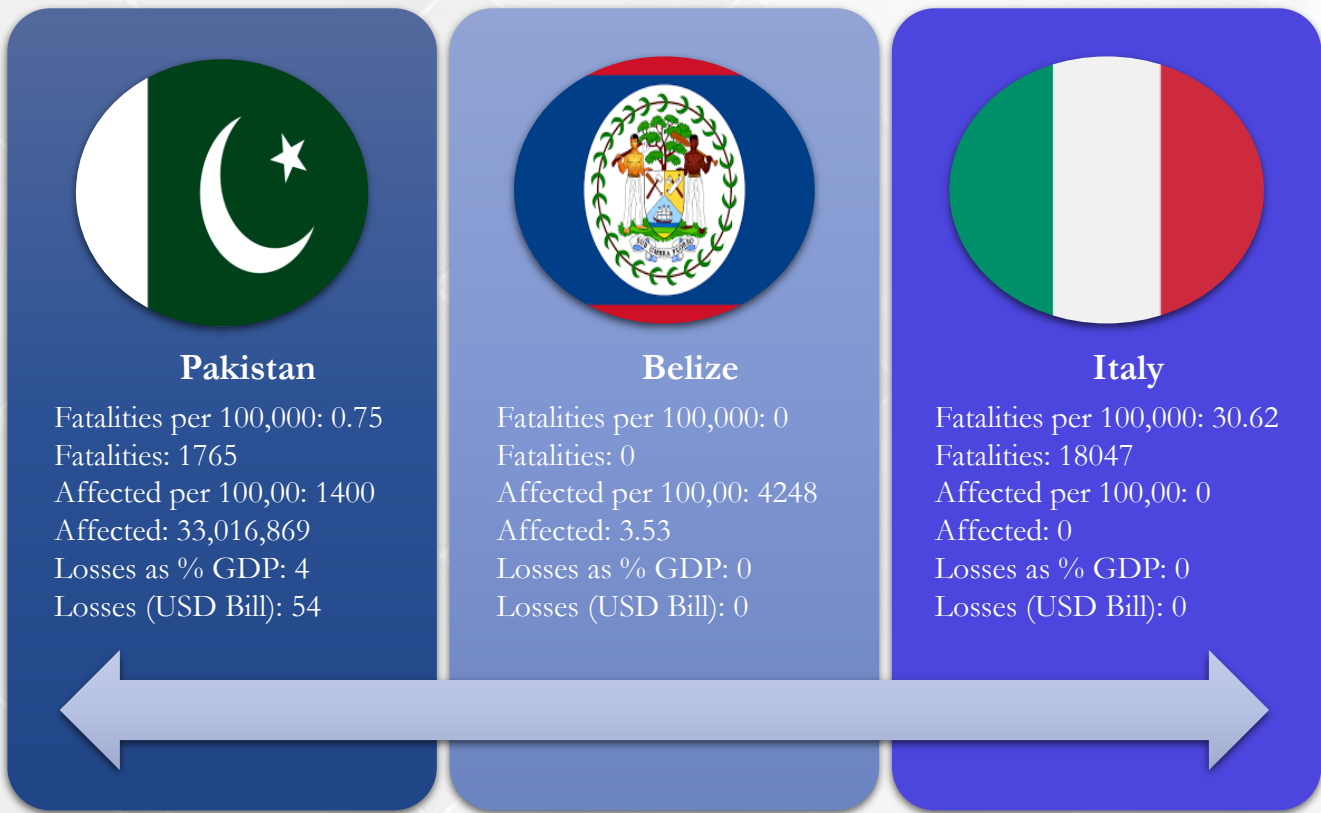
Deploy Innovative Solutions like Liquid Trees

It is recommended to integrate liquid trees, algae-based technology, into municipal emission reduction strategies. These innovative systems offer faster air purification than traditional trees, helping meet NDC targets and improve urban air quality swiftly.

1. Overview of Climate Vulnerability

Pakistan consistently ranks among the top ten countries globally most vulnerable to the impacts of climate change and climate-induced disasters. Over the past century, the country has experienced a rise of approximately 0.63°C in its annual mean temperature (MoCC, 2022). According to the Climate Risk Index (2025) by Germanwatch, Pakistan ranked as the most climate-vulnerable country, surpassing Belize and Italy, based on recent assessments.

Figure 1: Climate Risk Index – Pakistan (2025)



Source: Germanwatch

Climate projections indicate that Pakistan’s annual mean temperature is expected to increase by approximately 3°C to 6°C by the end of the 21st century, contingent upon global greenhouse gas emission scenarios (ADP, 2017). Sea level rise is projected to reach up to 60 cm, placing southern coastal regions, particularly Ketu Bander and the Indus River Delta, at elevated risk (Dawn, 2019). These changes are likely to exacerbate environmental challenges, including increased soil salinization, accelerated coastal erosion, and the displacement of vulnerable populations. Moreover, the frequency and severity of extreme climate events are anticipated to increase, further intensifying climate-related risks.

Coastal areas, especially along Karachi’s shoreline, are experiencing rising sea levels, averaging 1.1 mm per year historically, with a sharper increase of 3.6 mm per year recorded between 2006 and 2015 (ADB, 2017; IFRC, 2021). These rising sea levels have already submerged more than 485,000 hectares of agricultural land, devastated mangrove forests, and displaced coastal populations, including communities in Ketu Bandar, forcing thousands to migrate inland in search of safer, higher ground (Mongabay, 2025). In particular, rainfall in the arid plains and coastal regions has declined by 10%–15%, contributing to the accelerated degradation of wetlands and mangrove ecosystems (WB, 2021).

2. Economic Loss and Disaster Frequency

Pakistan has suffered a staggering \$100 billion loss due to climate change over the past two decades, a reflection of the growing intensity and frequency of climate-related disasters across the country. The data reveals alarming trends in both the number of disasters and the scale of human impact, highlighting the urgent need for climate resilience and adaptation measures.

- The **frequency of climate-related disasters** in Pakistan has increased significantly over the past three decades, rising from 48 events in 1995–2005 to 66 events in 2015–2024.
- The **number of people affected by climate disasters** has increased more than six-fold, from about 16 million in 1995–2005 to over 42.7 million in 2015–2024.
- **Floods** are the most frequent and damaging type of disaster, with the number of flood events increasing from 23 in 1995–2005 to 44 in 2015–2024. The number of people affected by floods rose from 13.4 million to over 37 million in the same period.
- **Extreme temperature events** have become more common and impactful, growing significantly in 2015–2024. The number of people affected increased significantly, from just 224 to over 87,000.
- **Droughts**, while infrequent, continue to have a high human impact. Only few droughts were recorded across the entire period, but they affected around 7 million people in total, especially during the most recent decade.
- **Wildfires** have emerged as a new climate threat, with no recorded events in the first two decades and one event affecting 4,004 people in the most recent decade.

These climate-induced disruptions are expected to deepen food insecurity, economic burden, extreme poverty, and malnutrition, undermining national progress on human development indicators.

In addition to direct impacts via extreme weather events, climate change is expected to:

Figure 2: Impact of Climate Change

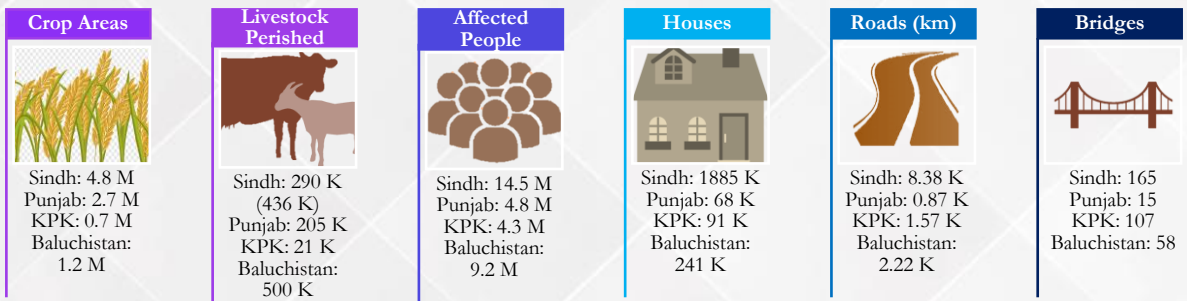


3. Impact of Climate Change on Key Economic Sectors

3.1. Agriculture and Food Security

Climate change is significantly undermining the productivity and resilience of Pakistan’s agriculture sector. Rising temperatures, erratic rainfall, prolonged heatwaves, and shifting wind patterns are placing immense stress on both Rabi and Kharif crop cycles. Key crops such as wheat, rice, sugarcane, maize, fruit and vegetables are increasingly vulnerable, with studies predicting an 8%–10% decline in agricultural output by 2040 due to rising temperatures (Cradock-Henry et al., 2020). This threat is further compounded by the lack of investment in agricultural research and development, which limits the development of climate-resilient crop varieties and adaptive farming techniques. The sector’s vulnerability was tragically illustrated in the 2022 floods, which caused an estimated USD over 30 billion in damages, destroying 9.4 million acres of farmland, killing 1 million livestock, and ruining over 21,000 animal shelters. These growing risks underscore the urgent need for climate-adaptive strategies and investment in sustainable agricultural innovation to protect food security and rural livelihoods.

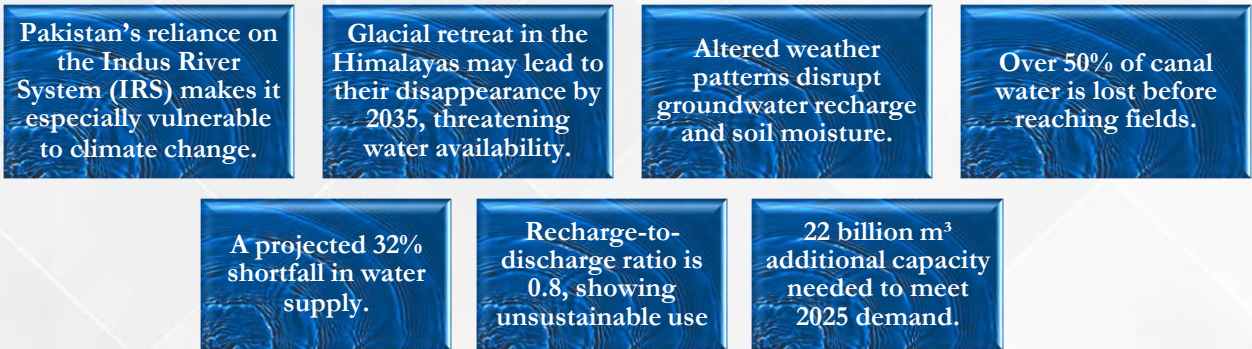
Figure 3: Impact of 2022 Floods



Source: FAO & NDMA

3.2. Water Resource Availability and Security

Pakistan, ranked 14th among the most water-stressed countries, now faces per capita water availability below 1,000 cubic meters, down from 5,260 in 1951. Climate change has intensified this crisis through erratic rainfall, rising temperatures, glacial melt, and frequent droughts. With 95% of water used in agriculture, outdated irrigation systems waste over 60% of it. The country’s storage capacity covers only 30 days, far below the recommended 1,000 days for climate-vulnerable nations. Groundwater depletion in Punjab and Sindh further aggravates the situation. This fragile scenario is compounded by India’s threats to suspend the Indus Waters Treaty, posing a grave risk to national water security.



3.3. Energy

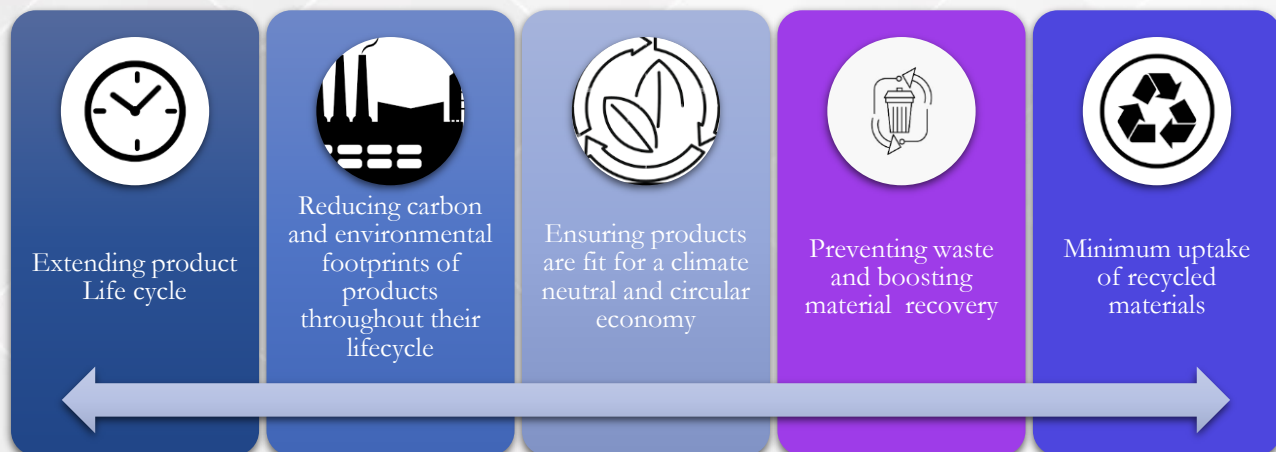
In Pakistan, the energy sector is highly vulnerable to the impacts of climate change. Reduced river flows from glacial retreat and unpredictable precipitation patterns are threatening hydropower generation, which constitutes a major portion of the country's energy mix. Increased frequency of heatwaves has escalated the demand for cooling, causing peak electricity loads and straining an already fragile power grid. Additionally, extreme weather events like floods damage energy infrastructure, disrupt electricity supply, and result in significant economic losses. The changing weather patterns are also altering long-term electricity consumption trends, which, if not anticipated and addressed, could lead to persistent mismatches between energy supply and demand across the country. In response to high energy costs, many households and businesses turned to solarization; however, the recently announced 18% tax in Federal Budget FY26 on solar imports threatens to undermine this transition and limit the adoption of clean energy solutions.

3.4. Industry, Manufacturing and Trade

Climate change is increasingly disrupting Pakistan's industry, manufacturing, and trade, posing a serious threat to long-term economic resilience. Repeated floods and heatwaves have damaged roads, ports, and logistics infrastructure, disrupting supply chains, delaying exports, and increasing transaction costs. Export-oriented SMEs, particularly in textiles and agribusiness, are highly vulnerable due to limited adaptive capacity. Additionally, climate-induced food and energy shortages have increased import dependency, fueling inflation and widening the trade deficit. Despite these growing risks, Pakistan still lacks a climate-aligned trade policy, missing opportunities in green technologies and sustainable product markets.

Compliance with evolving international climate regulations, such as the EU Green Deal and Corporate Sustainability Due Diligence Directive (CS3D), is becoming costlier. However, non-compliance risks exclusion from key markets. Major exports like mangoes, rice, cotton, and textiles face quality deterioration, higher certification costs, and growing barriers to trade, undermining Pakistan's competitiveness. The proposed EU Regulation on Eco-design for Sustainable Products, part of the EU Green Deal, further raises sustainability and traceability standards at the product design stage. For Pakistan, failure to comply could significantly restrict market access for key exports; while emerging global carbon tariffs may penalize high-emission goods, worsening the country's already fragile economic outlook.

Figure 4: Eco-design for Sustainable Products

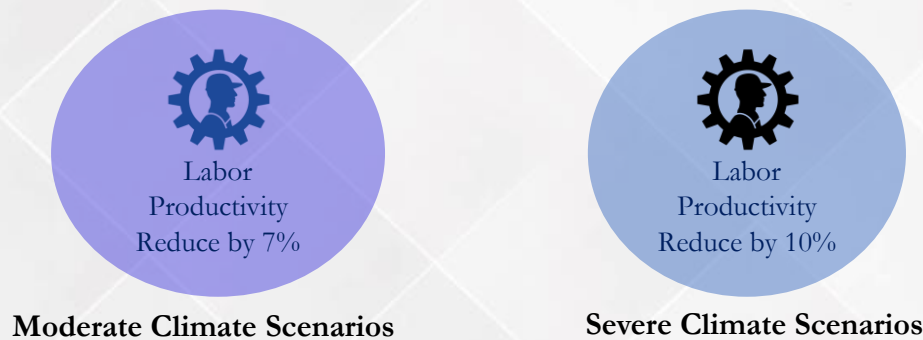


Source: APTMA

3.5. Public Health and Labor Productivity

Climate change poses severe threats to health and productivity in Pakistan, where around 40% of the economy is informal and employs nearly 73% of the labor force, largely in labor-intensive sectors like agriculture, industry, and retail. Rising temperatures and worsening air quality, particularly in cities like Lahore and Karachi, worsen health risks and reduce labor capacity. Climate-sensitive diseases such as malaria, dengue, cholera, and typhoid are expected to rise significantly, with a 12–27% increase in malaria and 31-47% in dengue outbreaks. These health burdens, combined with heat stress, are projected to reduce labor productivity by 7% under moderate (RCP 4.5) and 10% under severe (RCP 8.5) climate scenarios. Additionally, rising livestock diseases linked to climate impacts threaten food security and further strain the healthcare system, which already incurs costs exceeding a billion dollars annually.

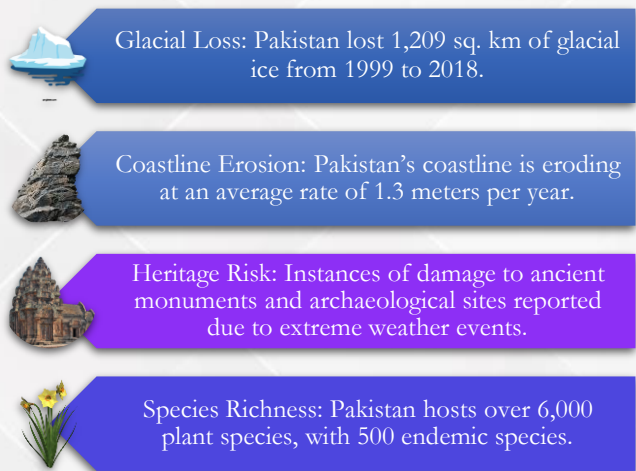
Figure 5: Climate Change Impact on Labor Productivity



Source: Pakistan Economic Survey 2023-24

3.4. Tourism

Climate change is increasingly threatening Pakistan’s tourism sector, which contributed 5.9% to the country’s GDP and supported around 4.2 million jobs in 2022. Extreme weather events, including floods, landslides, and heatwaves, are damaging key tourist destinations like Swat, Hunza, and Skardu, disrupting access and infrastructure. These disruptions damage infrastructure, limit tourist mobility, and increase travel fears (tourophobia). Coastal areas face rising sea levels and cyclones, while heritage sites and wildlife reserves suffer from environmental degradation. As tourist numbers decline, local economies that rely on tourism face job losses and reduced income. Without climate-resilient infrastructure and sustainable tourism practices, Pakistan risks losing both natural beauty and cultural heritage.



4. Critical Analysis of Climate Change Policies & Initiatives

Policy/Initiative	Objectives	Implementation Status (2025)	Critical Remarks
Green Pakistan Programme (2025 Budget)	Scale reforestation, pollution control; pollution budget increase. Rs2.2 billion will go toward Phase-I	Projects funded; early stage; oversight needed.	<ul style="list-style-type: none"> Significant budget increase, but risks of mismanagement and uneven provincial allocation persist. Needs strong accountability and oversight.
Carbon Market Policy (2025)	Enable carbon trading; fund mitigation via private investment.	Launched; pilots planned; no outcomes yet.	<ul style="list-style-type: none"> Regulatory framework incomplete, causing uncertainty. Private sector lacks readiness to participate effectively. Risk of elite capture due to limited. Governance capacity needs urgent strengthening.
Green Sukuk (2025)	Raise Rs 30B for renewables, green projects via Islamic bonds.	Projects in early stages.	<ul style="list-style-type: none"> Positive step, but scale remains too small to close the \$100B NDC financing gap. Limited investor awareness and risk of misallocation. Early-stage projects lack impact evidence.
Recharge Pakistan (2025)	\$77M for flood management; restore wetlands, water resilience.	Projects in early stages. Wetland restoration in Sindh; scaling pending.	<ul style="list-style-type: none"> Important flood initiative, but limited scope and unclear sustainability. Needs broader coverage and scaling plan.
Uraan Pakistan (2024)	Integrate climate resilience into economic growth; green jobs.	Renewable projects funded; adaptation slow.	<ul style="list-style-type: none"> Promising initiative, but climate priorities are vague and adaptation is sidelined. Funding commitments unclear, affecting credibility and focus.
National Adaptation Plan (NAP, 2023)	Build resilience to floods, droughts, heatwaves; secure water/food.	Few projects active; provincial buy-in low.	<ul style="list-style-type: none"> Critical policy, but ineffective without strong local governance and provincial ownership. Top-down approach limits implementation; gender and youth perspectives largely excluded.
National Climate Change Policy (NCCP, 2022)	Mainstream climate in energy, agriculture, water; promote resilience.	Partial; monitoring and enforcement lag.	<ul style="list-style-type: none"> Strong framework; needs better coordination. Weak sectoral integration; provincial disconnect; gender gaps.
Nationally Determined Contribution (NDC, 2021)	50% emissions cut by 2030 (15% unconditional, 35% conditional); 60% renewables, 30% EVs by 2030.	7% renewables; EVs <1%; conditional targets stalled.	<ul style="list-style-type: none"> Ambitious targets set (50% emissions cut by 2030), but progress remains limited. Severe underfunding, with conditional goals relying on \$100B in external climate finance. Policy misalignment across sectors hinders effective implementation. High fossil fuel dependency.
Alternative and Renewable Energy Policy (2019)	20% renewables by 2025, 30% by 2030; expand solar, wind, hydro.	Hydropower leads; solar/wind lag; behind targets.	<ul style="list-style-type: none"> No major incentives to boost renewable adoption. Solar panel import taxes hinder affordability & uptake. LNG dependency is rising, refuting clean energy goals.
Pakistan Climate Change Act (2017)	Establish institutions (Council, Authority, Fund) for climate action.	Operational but slow; Fund impact limited.	<ul style="list-style-type: none"> Institutional framework exists, but implementation lacks momentum and active engagement.
10 Billion Tree Tsunami	Plant 10B trees for carbon sinks, biodiversity, ecosystem restoration.	Floods devastated an estimated 38.5 thousand acres of forest; survival rates vary.	<ul style="list-style-type: none"> Ambitious project, but long-term success depends on maintenance. Faces weak tree care, land disputes, and monitoring gaps.

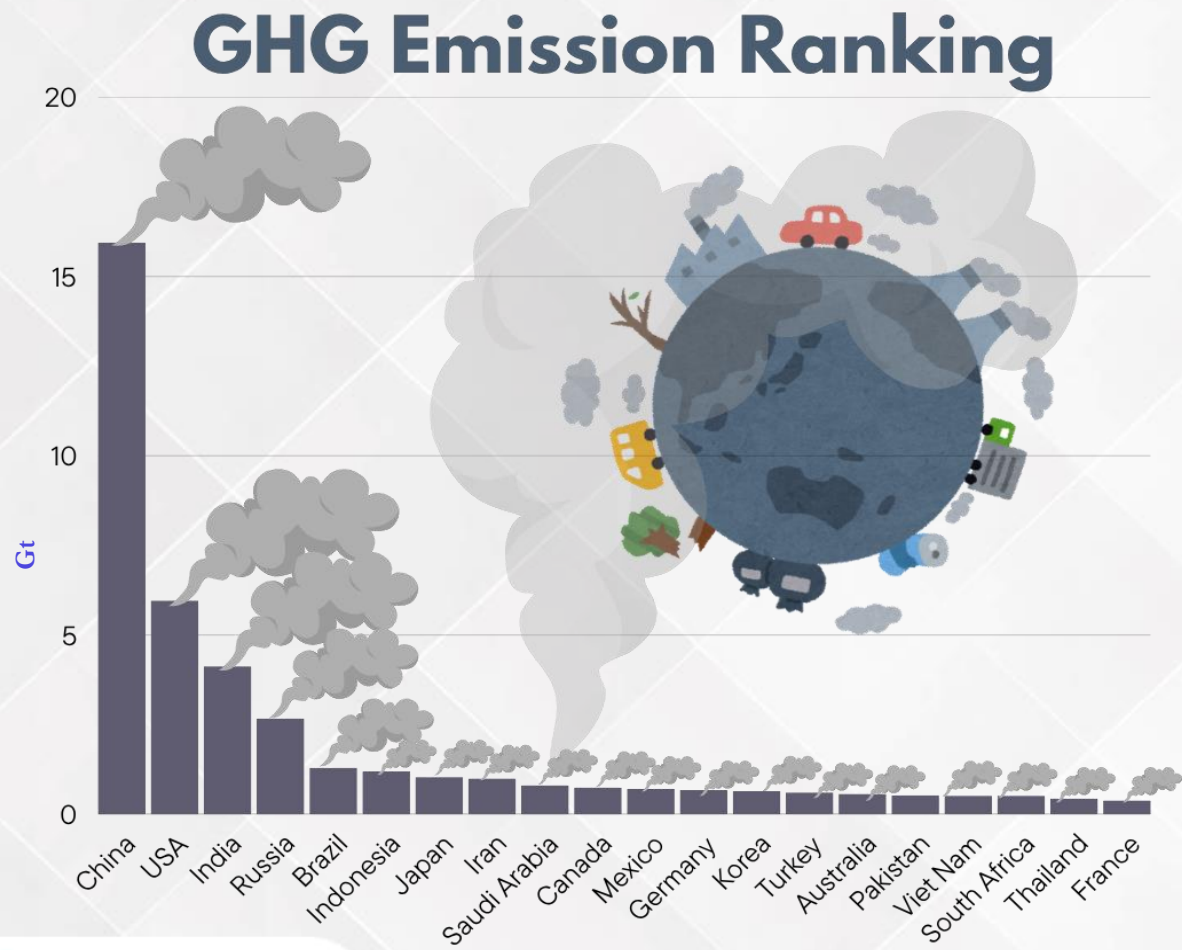
5. GHG Emission by Pakistan

In 2023, Pakistan emitted 0.53 billion tonnes of carbon, ranking it 16th among the top 20 greenhouse gas emitters globally. As the fifth most populous country, with over 230 million people, Pakistan is highly vulnerable to climate change, grappling with severe impacts despite its relatively low per-capita emissions. The nation’s ongoing energy and economic crisis, pushing it toward bankruptcy, is exacerbated by a heavy reliance on fossil-fuel imports. This dependency persists despite Pakistan’s significant potential for renewable energy, particularly through its ongoing solar boom, which offers a pathway to reduce emissions and address energy challenges.

In 2023, the top 20 carbon-emitting countries contributed around 40 billion tonnes of greenhouse gases, highlighting stark contrasts between the Global North and Global South in emissions.

- China emitted 15.94 billion tonnes, over 41% of the total, driven by coal-heavy industry and manufacturing.
- USA’s High Per-Capita Emissions contributed 5.96 billion tonnes, reflecting energy-intensive lifestyles and industrial activity.
- India produced 4.13 billion tonnes, fueled by population growth and economic expansion.
- Pakistan’s Vulnerability: Emitted 0.53 billion tonnes, ranking 16th, notable for a climate-vulnerable nation reliant on fossil-fuel imports despite solar potential.

Figure 6: Global GHG Emission by Country

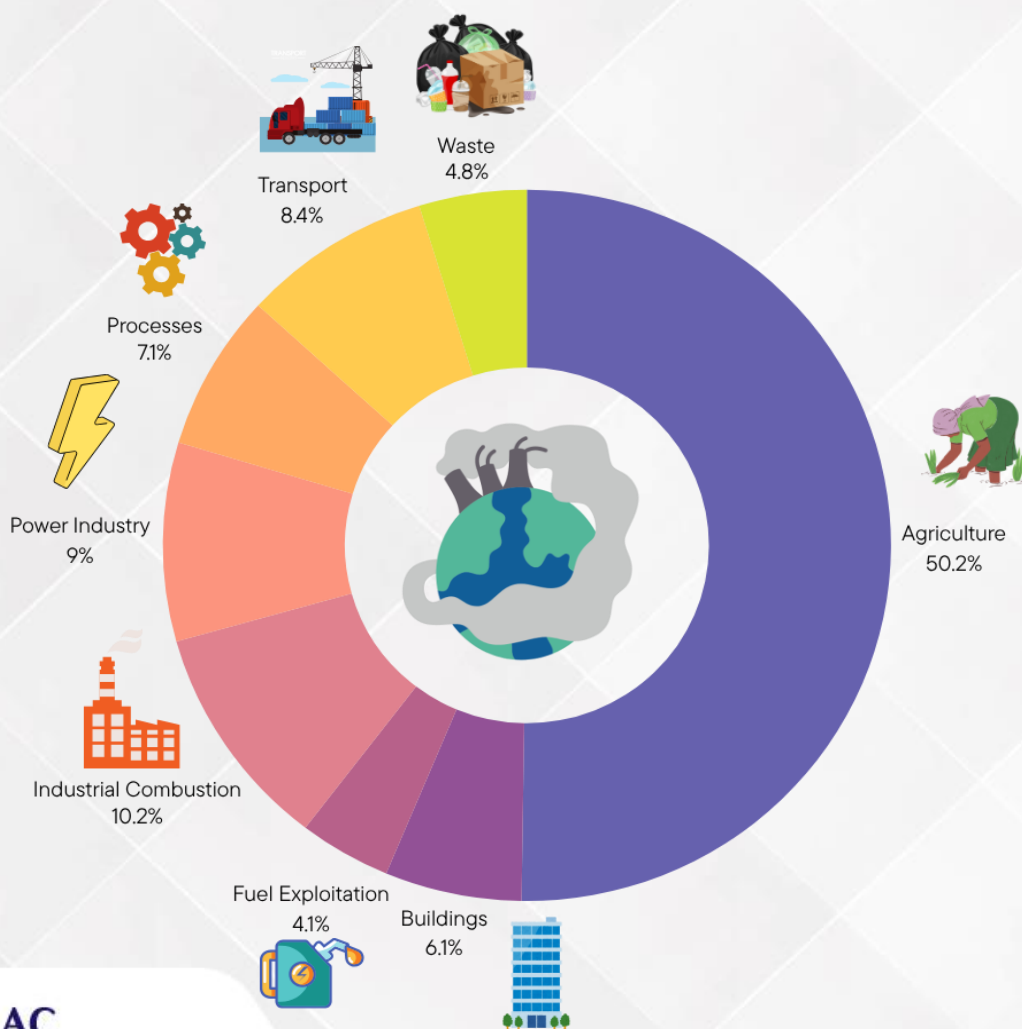


6. Greenhouse Gas Emissions by Sector

The sectoral distribution of greenhouse gas (GHG) emissions in Pakistan reveals a significant dominance of the agriculture sector, contributing 50.2% to the national emissions inventory. This substantial share is primarily attributed to methane emissions from livestock enteric fermentation and rice cultivation, coupled with nitrous oxide emissions from fertilizer application. Industrial combustion accounts for 10.2% of emissions, driven by fossil fuel consumption in manufacturing and construction activities. The power industry contributes 9.0%, reflecting Pakistan's reliance on thermal energy sources, including coal, oil, and natural gas, for electricity generation. The transport sector, encompassing road, rail, air, and marine activities, represents 8.4% of emissions, predominantly from petroleum-based fuel combustion. Industrial processes contribute 7.1%, while emissions from buildings account for 6.1%. The waste sector constitutes 4.8%, and fuel exploitation, involving fugitive emissions from fossil fuel production, contributes 4.1%. This sectoral breakdown underscores the critical role of sectoral breakdown in Pakistan's GHG emissions profile, necessitating targeted policy interventions to align with national and global climate objectives.

Figure 7: Pakistan's GHG Emission by Sectors

GHG Emission by Sectors



Source: EDGAR

7. Pakistan’s Role in COP

Pakistan’s participation in the UNFCCC’s Conference of the Parties (COP) reflects over three decades of proactive engagement on global climate policy. As one of the most climate-vulnerable countries, Pakistan has consistently underscored the need for climate justice, accessible finance, and enhanced adaptation. From its initial involvement in 1994 to its instrumental role in the establishment of the Loss and Damage Fund at COP27, Pakistan has positioned itself as a leading voice for developing nations, advocating for equitable support mechanisms, resilience-building, and low-carbon development pathways.

Figure 8: Timeline: Pakistan at COP (1994–2024)

