

⇒ Q? Discuss in detail the climate mitigation and adaptation keeping in view the climate change risk index of Pakistan. (Marks = 20)

### ⇒ Introduction:

Pakistan ranks 8th globally in the climate change risk index, making it highly vulnerable to climate change impacts. Rising temperatures, altered precipitation patterns, and increased frequency of extreme weather events threaten Pakistan's economy, infrastructure, and human well-being. To mitigate and adapt human to these risks, Pakistan needs comprehensive strategies. Climate mitigation strategies focus on reducing greenhouse gas emissions to limit global warming and prevent catastrophic climate change impacts.

### 1 ⇒ Climate Mitigation Strategies:

Climate change poses an existential threat to human societies, ecosystems, and economies worldwide. Mitigation efforts focus on reducing greenhouse gas emissions to limit global warming.

## (A). Energy Sector Mitigation:-

Energy Sector Mitigation refers to strategies and actions to reduce greenhouse gas emissions from the energy sector, which accounts for approximately 65% of global GHG emissions.

### Energy Sector Mitigation objectives:-

1. Reduce dependence on fossil fuels
2. Decrease GHG emissions
3. Enhance energy security
4. Promote sustainable development.

### Energy Sector Mitigation strategies:-

1. Renewable Energy Transition (solar, wind, hydro)
2. Energy Efficiency (building insulation)
3. Fuel Switching (natural gas, biomass)
4. Carbon Capture and Storage
5. Nuclear Energy
6. Smart Grids and Energy Storage
7. Green transportation (electric/hybrid vehicles)
8. Energy-Efficient Buildings

### Energy Sector Mitigation Benefits:-

1. Reduced GHG emissions
2. Improved air quality
3. Economic benefits
4. Water conservation

## Energy Sector Mitigation Challenges:-

1. High upfront costs.
2. Infrastructure constraints
3. Policy and regulatory frameworks.
4. Technological limitations.

## ⇒ Pakistan's Energy Sector Mitigation:

1. Renewable Energy Policy (2019)
2. Alternative Energy Development Board
3. Pakistan Renewable Energy Society.
4. Energy Efficiency and Conservation Act (2016)

## (1) Renewable Energy Transition:-

A key Energy Sector Mitigation Strategy. The energy sector accounts for approximately 65% of global greenhouse gas emissions. Transitioning to renewable energy sources is crucial for mitigating climate change.

## Renewable Energy Sources:-

1. Solar Energy
2. Wind energy
3. Hydroelectric power
4. Biomass Energy
5. Geothermal Energy.

## ⇒ Transition Strategies:-

1. Increase renewable energy share in energy mix
2. phase out fossil fuel subsidies

3. Implement policies and incentives.
4. Promote decentralized energy generation.
5. Invest in grid infrastructure and storage technologies.

### ⇒ Pakistan's Renewable Energy Potential:-

1. Solar: 1.09 million MW.
2. Wind: 346,000 MW.
3. Hydro: 60,000 MW.
4. Biomass: 3,000 MW.

### Pakistan's Renewable Energy Targets:-

1. 20% renewable energy share by 2025.
2. 30% renewable energy share by 2030.

### ⇒ Energy Efficiency:-

Energy efficiency involves reducing energy consumption while maintaining or improving economic output and quality of life.

### Energy Efficiency Measures:-

1. Building Insulation and Design.
  2. Efficient Lighting (LED, CFL).
  3. Smart Grids and Metering.
- Energy Management Systems.

### Benefits of Energy Efficiency:-

1. Reduced GHG emissions (up to 40% by 2030).
2. Energy cost savings (up to 30%).

3. Enhanced economic competitiveness.

### Energy Efficiency Technologies:-

1. Energy-efficient HVAC systems.
2. Smart thermostats.
3. Power-saving electronics.
4. Energy-efficient motors.

### B => Transportation Mitigation:-

Reducing Emissions from the world's most polluting sector. The transportation sector accounts for nearly 15% of global greenhouse gas emissions, making it one of the largest contributors to climate change. Transportation mitigation strategies aim to reduce GHG emissions from various modes of transportation, including road, air, rail, and maritime.

### The Urgency for Transportation Mitigation:-

1. Rapid growth in global transportation demand.
2. Increasing emissions from transportation.
3. Air pollution and public health concerns.
4. Energy security and economic implications.

### Transportation Mitigation Objectives:-

1. Enhance air quality

2. Promote sustainable transportation modes
3. Support economic growth and development.
4. Reduce GHG emissions from transportation

### Key Transportation Mitigation Strategies:

1. Sustainable transportation modes.
2. Smart transportation systems.
3. Electrification of transportation.

### Pakistan's Transportation Mitigation Context:

1. Rapid Urbanization and transportation growth.
2. Increasing air pollution and public health concern.
3. Need for sustainable transportation infrastructure.

### Pakistan's Transportation Mitigation Initiatives:

1. National Transport Policy (2018)
2. Electric Vehicle Policy (2020)
3. Public Transportation Projects.
4. Cycling and Walking Infrastructure Development

### → C. Industrial Mitigation:-

The industrial sector accounts for approximately 21% of global greenhouse gas emissions, making it the largest emitting sector worldwide. Industrial mitigation sector aims to reduce GHG emission from various industrial processes.

1. Cement Production.

2. Steel manufacturing
3. Chemical Processing
4. oil refining
5. Paper and Pulp Production

### The Urgency for Industrial Mitigation

1. Resource depletion and waste management concerns
2. Climate change impacts on industrial operations
3. Rapid industrial growth in emerging economies

### Key Industrial Mitigation Strategies:-

1. Circular Economy Practices (recycling, waste reduction)
2. Carbon capture and storage

### Pakistan's Industrial Mitigation Context:-

1. Rapid industrialization and urbanization
2. Need for sustainable industrial development

### Pakistan's Industrial Mitigation Initiatives:-

1. National climate change Policy
2. Industrial Energy Efficiency Program

### 2) Climate Adaptation Strategies:-

Building Resilience to a changing climate

Climate change impacts are unavoidable, and adaptation is essential for building resilience and minimizing harm. Climate adaptation strategies aim to adjust natural and human systems to cope

with climate-related stresses.

### The Urgency for Adaptation:-

1. Devastating climate-related disasters and economic losses.
2. Vulnerable populations and ecosystems at risk.
3. Insufficient global adaptation efforts.

### Adaptation Objectives:-

1. Reduce climate-related risks and vulnerabilities.
2. Enhance resilience and adaptive capacity.
3. Protect human health, livelihoods, and ecosystems.

### Key Climate Adaptation Strategies:-

1. Infrastructure Adaptation (sea walls)
2. Ecosystem-based Adaptation (ecosystem restoration)
3. Social Adaptation (water management)
4. Economic Adaptation.
5. Institutional Adaptation (Policy, governance)

Explain both mitigation and adaptation properly  
Add profound analysis

### Pakistan's Adaptation Context:-

1. High climate vulnerability ranking.
2. Water scarcity and agricultural challenges.
3. Frequently extreme weather events.

### Pakistan's Adaptation Initiatives:-

1. National climate change Policy (2012)
2. Climate change Adaptation plan (2018)
3. Climate-Resilient Agriculture Programme.



# Challenges and Opportunities

1. Limited financial resources.
2. Institutional capacity gaps.
3. Climate information and early warning systems.

