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"HOW TO MITIGATE EFFECTS OF CLIMATE CHANGE"

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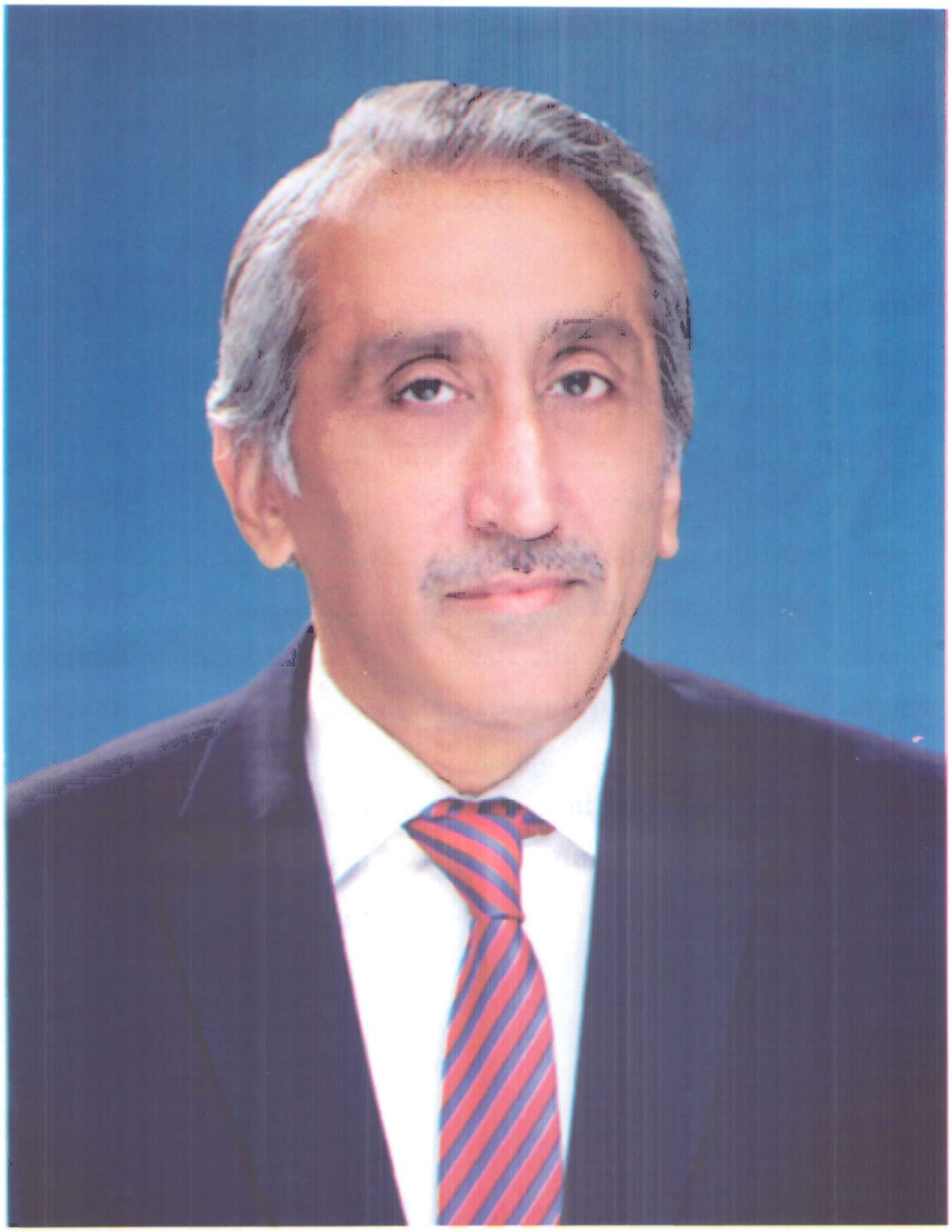
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Engr. Najam Waheed obtained his Bachelor's Degree from University of Engineering & Technology, Lahore in Civil Engineering. He has over thirty years of multifaceted professional experience leading and pursuing development and engineering projects which includes planning, project management, preparation of technical reports and contract documents. He is well-versed in various national and international codes, regulations, quality standards and their implementation. He worked on various prestigious and technically complex projects.

Engr. Najam Waheed has been a Council Member of Pakistan Engineering Congress for more than two decades. He has been an active member of the Congress serving as Secretary, Joint Secretary, Treasurer, and Convener of all important Committees of the Congress, and was elected as the President of the Pakistan Engineering Congress in December 2021. His vision has been manifested in a digital transformation of the Congress's services and has laid a strong foundation for future growth and developments of Engineers Communities.

His dedication to engineering development and the Pakistan Engineering Congress played a significant role in developing effective synergies with important professional bodies in the country, which would significantly contribute to engineers professional competence in a challenging environment of disruptive technologies and sustainable development.



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Paper No. 359

HOW TO MITIGATE THE EFFECTS OF CLIMATE CHANGE

Engr. Ch. Ghulam Hussain

HOW TO MITIGATE THE EFFECTS OF CLIMATE CHANGE

By:

ENGR. CH. GHULAM HUSSAIN[1]

1. Introduction

Pakistan is vulnerable and most affected by the adverse impacts of climate change, which can create strategic challenges. Pakistan faced a terrible heat wave in 2022 with temperatures exceeding 120° F in some parts of the country. At least 65 people have reportedly died due to the heat wave, actual numbers may be higher. Furthermore, it caused massive flooding and infrastructure damages in Gilgit – Baltistan, Balochistan, broader Sindh Province and South Punjab. Despite monsoon rains beginning in late June – many parts of the country still swelter. These climate disasters warrant a full-fledged national security emergency before they stake complete that adds further stress amid the country's other numerous challenges.

The rising temperatures are causing rapid melting of glaciers in northern areas and unusual rains as happened in monsoon this year have created huge destruction through floods, unprecedented in Pakistan's history in last 30 years. United Nations Secretary General Antanio Guterres stated that Pakistan is facing "the unrelenting effects of epochal effects of rains and flooding". The human and material losses are enormous. Accordingly,

Pakistan is likely to face water crisis, food shortages and various implications for human security. Reacting to the recent flood situation in Pakistan, the former Finance Minister Mr. Miftah Ismail stated that "Pakistan is dealing with the worst effects of the climate change, which has caused over US$ 30 billion loss to Pakistan's economy and displacing 33 million people. The impacts of climate change on the availability, usage and storage of water in Pakistan are explored in this paper. The drought and floods of year 2022 have been taken as case study for analyzing the impacts of climate change across Pakistan by sampling both rural and urban areas.

The exceptional monsoon rains of 2022 generated extraordinary floods across the country, with huge human and material losses. The evolving trends indicate that Pakistan is most vulnerable to climate change. The floods have devastated the agriculture, livestock, and infrastructure. The survey and data analysis of past two and half decades reveal that Pakistan confronted from absolute dry and drought situations to devastating floods to the extent of witnessing both phenomenon in one calendar year as happening in the ongoing year 2022. A study as published by Journal of Environment and Public Health, in November, 2022, has been completed by considering drought and floods data from primary and secondary sources with particular focus on this year. The field visits to rural and urban areas of Sindh, Khyber Pakhtunkhwa (KPK) and

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Baluchistan were conducted for obtaining the first-hand information and data on the impacts and flood situation. The relevant officials in the ministry of climate change and meteorological offices were also interviewed and their views have been incorporated in the study for developing a comprehensive picture, conducting rationale analyses, and arriving at workable findings.

2.0 Impact of Climate Change on Pakistan

Climate remains the most debated yet least addressed issue for decades. World leaders have often joined heads to tackle this global phenomenon but with little to no success. From motivational speeches to documentaries and movies on the effects of climate change on he Earth has been narrated time and again but to no avail. The developed countries remain aloof of devastating effects that greenhouse gas emission is causing to the ozone layer. The growing depletion of the ozone layer is resulting in increased Ultraviolet (UV) radiations level on the surface of Earth, which has detrimental impact on human health resulting in cancer and weak immune system. These UV radiations have devastating effect on the agriculture sector as well due to low yield of the crops. Experts have been talking about the infamous "black hole" in the Antarctic region for years. But the recent research in the year 2022 has discovered a hole in the Tropics, the region of the Earth near the equator, which is seven times bigger than the Antarctic region. The more alarming situation is that, despite all this, the industrialized countries are less concerned by the deteriorating ozone and increase in global warming. Various protocols and initiatives like Kyoto Protocol, Copenhagen accord, and Paris accord had been initiated by the United Nations Framework on Climate Change (UNFCC). Due to the Sovereign status of the global order, these agreements were not a binding, therefore, the industrial powers contributing the most carbon dioxide and greenhouse gases to the environment withdrew from these accords as it did not serve their economic interests.

3.0 Floods Devastations in Pakistan in Year 2022

Most of Pakistan's economy is dependent on the Agricultural sector; however, the industrial sector also contributes a great deal in the economic growth of Pakistan. The growing population is directly impacting the environment as the number of vehicles on roads and the number of industries to accommodate these individuals will also increase. The population of Pakistan as per 2021 census is 225 million. Although, Pakistan remains significant low on the global CO_2 emissions list, yet the effects of global warming have reached Pakistan in a sweeping manner. The issue that industrialized countries failed to realize that the environment does not belong to a single country and when one country damages the ozone layer, the entire world would pay the price for that. The year 2022 was one such year for Pakistan when the effects of climate change brought heavy rain-falls in Pakistan with major loss of lives, infrastructural damage, and massive economic losses to the tune of US$ 30 billion.

3.1 Water Security

Food and energy security is directly influenced by water security for agrarian society like Pakistan, which contributes more than 23% in national GDP Agriculture is the backbone of Pakistan as it employs more than 40 million population and guarantor of breadbasket of the country. Therefore, "the loss of major river systems in the past had a domino effect on the thriving civilizations, which became extinct one after the other". Pakistan is

transitioning from water strained country with declining "per capita fresh drinking water which is less than 1800 cubic meters per year (m^3/y) to water scarce country (per capita less than 1000 (m^3/y) projected by 2035. Similarly, river water also receding to 800 (m^3/y) is expected in 2026 due to growing population. Therefore, "water security is emerging threat of Pakistan". Pakistan is a lower riparian state reliant on the nature and other countries for river's water. India has constructed more than fifty big and small dams on the rivers coming to Pakistan, which are a constant source of irritation in the bilateral relations and vital for Pakistan's water and energy security. Likewise, Afghanistan is also considering construction of dams on the Kabul River, which is likely to create two front dilemmas for Pakistan. The situation is even challenging when viewed in the context of availability of only two major dams in Pakistan. Tarbela and Mangla which were constructed in late 1960s and 1970s; however, "their capacities are reducing due to silting." While construction of new dams is highly politicized, charged with massive outrage from political parties and, therefore, not likely to happen in near future. It is expected that the availability of less water is likely to increase food shortages and create conflict among the federating units and the federation. Similarly, the negative impacts of climate change can cause melting glaciers and unusual pattern of rains, which may lead to flooding as we are witnessing in year 2022.

3.2 Food Security

The Indus Basin, which is the bedrock of agriculture support in Pakistan is seriously threatened by the negative impacts of climate change. The changing weather patterns may result in the reduction of crops yield (15-20% in cereals) and livestock (20-30%) impacting negatively the dairy and poultry as the agriculture and livestock sectors are the "back-bone of Pakistan's economy, which contributes 23% to GDP and accounts 60% exports of country". The food security is vulnerable to climate change due to reduction in crops and adversarial influences on livestock. Reduced water in real harvesting season is changing the crops patterns and levels are vulnerable to droughts and flooding as well, which also results in massive migration. The devastations of on-going floods have created serious food shortages and all time high inflation in the country. Prime Minister of Pakistan has already declared that Pakistan is vulnerable to serious food shortages. It is apprehended that essential food items will have to be imported next year as most of the cultivable lands are under flood waters.

4.0 Implication of Climate Change on the National Texture of Pakistan

4.1 Competition over Water Resources

Due to consistently increasing population, Pakistan is unable to supplement its growing needs of depleting water resources alongwith other socioeconomic challenges, the drastic impacts of climate change have also increased its economic and political challenges, while the insufficiency of water reservoirs is creating serious concerns of inter-provincial disharmony. The rising population has not only affected the quantity of water reservoirs but has also adversely affected quality in the same manner. The increase in anthropogenic activities is causing water stress on natural reservoirs, while since independence in 1947, the country is facing persistent decline in the availability of water year on year basis due to multitude of factors examined above.

4.2 Causes of Water Shortages

The cause of water shortages in Pakistan exist in two types: (a) incidental causes related to poor water management policies at local level, (b) operational causes include the political conflicts (over the water resources on provincial / institutional level) and the societal differences over water management and distribution. Water issue is not only related with the environmental degradation, but also linked with the social factors as abnormal population growth causes rise in demand of clean water resources, disturbance of equilibrium between communities, provinces, and water resources distribution. As Pakistan consists of multiple ethnicities and diversified geographical terrain but competition over the access of water resources has often created tensions and conflicts among the federating units. The growing vulnerabilities of communities over the insufficiency of water reservoirs promote lawlessness, antistate sentiments and sense of deprivation among its own nationals. Due to lack of strong monitoring mechanism over channelization of available water, for creating a balanced approach between demand and supply of available water, the population is incentivized for illegal water proliferation. The tacit approval from the water management departments has resulted in water theft cases mostly in Southern Punjab.

Being a lower riparian, Sindh is often complaining about the water shortage, especially in the pre-monsoon period each year. The claims made by Sindh government at numerous occasions regarding Punjab stealing its share of water have been denied by Indus River System Authority (IRSA). After the 18th amendment, the allocation of resources to the provinces has been ensured to be judicious; however, the internal distribution of these resources to the rural and urban areas is the responsibility of the provinces. The IRSA is mandated to address, regulate, and develop standard operating procedures (SOPs) for water allocation to the provinces. Regrettably, each province has its own peculiarities in terms of agricultural needs and population, therefore, making the interpretation and implementation of the accord more difficult. To resolve water distribution issues on sustainable basis, the "whole of government approach" is recommended along with on-site consultative visits by the representatives of provincial and federal governance and political leaders for expeditious resolution of conflicting issues. Creating unnecessary fault lines is detrimental to national integration, which should be avoided at all costs.

4.2.1 Role of Governance

The role of administration is highly crucial in controlling the catastrophic constructions in the water ways and lessen the pressure on water consumption. The unprotected constructions along rivers, lakes, and streams often cause blockage of natural water channels particularly in monsoon and rainy season resulting into loss of lives, road network, and infrastructure damage. The enormity of flood damages to clean water channels is immeasurable. In 2010 floods, Pakistan witnessed unimaginable losses as around 20 million people were victims, 436 healthcare centres were devastated, 80% food reserves were smashed, 2.9 million households were severely damaged, nearly 1.1 million houses were damaged and $ 9.7 million economic loss in 135 districts. While the issues of accessing the safe water channels was still in demand after flood (96.8% before vs 96.7%) in year 2022 floods. These losses have increased manifolds and caused unprecedented damages to natural water resources. Around 33 million people are direct victims, death troll rising above 1500, while 110 districts of Baluchistan

(Quetta, Pishin, Killa Saifullah, Nushki, Jafferabadad Washuk), Punjab (Koh- e-Suleman ranges, Rajanpur, D.G. Khan). Sindh (MIrpu Khas, Thatta, Sajawal, and Shaheed Benazir Abad) and Khyber Pakhtunkhwa (Swat and lower / upper Dir) are declared as the most calamity hit areas. While 30% water channels are severally affected and 63% flood victims are struggling for sufficient clean water channels. The economic losses have been estimated to the tune of US$ 30 billion. The analyses amply highlight the insufficiency of available water and demand, compounded by adverse effects of floods during this year.

5.0 Negative Impact of Climate Change on Agriculture Sector

Pakistan is heavily relying on agricultural sector for its international exports and domestic food demands, but in the presence of water crisis and conventional irrigation system for its agricultural production, the country will face severe challenges of water scarcity in the times to come. According to Global Food and Security Index 2021, Pakistan ranked 80 out of 113 countries and Global Food and Security Index 2022, it has further slipped by four numbers and now ranks 84 out of 113 countries. Pakistan lags behind all South Asian countries food insecurity. The lack of progress in agricultural sector is also linked with the mismanagement of land and water resources, unsatisfactory policies of water governance, exponential population growth, and the negative impacts of climate change. Pakistan has also failed to adopt new strategies like advanced water management in agricultural sector, usage of adaptation methods in yield productions to enhance water consumption in eco-friendly manner, educate farmers about the water recycling and water productivity techniques. While water scarcity is a highly charged political issue in Pakistan as there is a turf war between the provinces and the federation. Nevertheless, Punjab government took good initiative and introduced national water policy of Pakistan to ensure regularization of water governance system in the country. In the presence of fragile agriculture sector development, climate degradation impacts have worsened the livelihood and yield production. Therefore, on a year-on-year basis, the agriculture yield is squeezing, demand of water is increasing, and unplanned urbanization is resulting into loss of precious agriculture land. The overall impact of these issues is creating negative repercussions on agriculture production and aggravating food security situation in Pakistan.

5.1 Contaminated Water

40% of mortality rate is caused by the contaminated water intake, while the frontline victims of waterborne diseases are pregnant women, newly born babies and early teenage groups. It is also important to note that the primary source of water in Pakistan is surface water channels, which ovr a period have become the hub of different variants of pathogens. According to World Health Organization (WHO) report, approximate, 2.5 million deaths occur annually in Pakistan from widespread diarrheal diseases caused by bacterial and protozoan agents present in inferior quality of drinking water. Around 80% population is exposed to unsafe water as UNICEF Pakistan has also shared the alarming fact that the well-being and health standards of youngsters are of risk; therefore, each year, 53,000 children under the age of 5 years lose their lives due to unhygienic water as 70% of household work and domestic usage of water in Pakistan is dependent on bacterial water sources. The floods of 2022 have compounded the problems of availability and access to clean drinking water. The field visits to rural and

urban Sindh, KPK, and Baluchistan vindicated scarcity and contamination of drinking water, which has been reported by several NGOs and media as well. The stagnant water has been contaminated due to mixing of sewage water and created ideal breading grounds for bacteria causing serious health risks. Non-availability of compatible medical support, inaccessibility, and non-disposal of flood water have created many health risks and entire population in affected areas is vulnerable to adverse effects of contaminated water. In most areas, the disposal of flood water is left to the nature and the government agencies have demonstrated inability to manage it, therefore, spread of waterborne diseases will continue for prolonged period in future.

6.0 Court Response

Pakistan Supreme Court also took notice of Pakistan's climate change vulnerabilities. In a recent decision, the court noted that in urban areas in particular, relevant government authorities should take into consideration "adaptation, climate resiliency and sustainability... as they are essential to actualize the fundamental rights of the people."

While some government agencies have been more effective in preparing for climate related disasters, others have not. In Gilgit Baltistan, the heavy wave caused a massive glacial flood, but thanks to continuous monitoring by the relevant local government authorities, people living in vulnerable locations were relocated to safer places before the floods. After the 2020 floods in Karachi, the provincial government decided to address the causes that lead to the severe flooding after the waters subsided. However, their heavy handed actions---such as tearing down settlements along the *nalas* or waterways, that should have drained the flood waters without considering proper plants to resettle or adequately compensate those displaced from the settlements --- led to a number of protests from the effected community and civil society activists.

7.0 Recommendations

7.1 Aggressive action against Climate Change

One of the most common arguments against taking aggressive action to combat climate change is that doing so will kill jobs and cripple the economy. But this implies that there's an alternative in which we pay nothing for climate change. And unfortunately, there isn't. In reality; not tackling climate change will cost a lot, and cause enormous human suffering and ecological damage, while transitioning to a greener economy would benefit many people and ecosystems around the world.

Let's start with how much it will cost to address climate change. To keep warming well below 2 degrees Celsius, the goal of the Paris Climate Agreement, society will have to reach net zero greenhouse gas emissions by the middle of this Century. That will require significant investments in things like renewable energy, electric cars and charging infrastructure, not to mention efforts to adapt to hotter temperatures, rising sea-levels and other unavoidable effects of current climate changes. And we'll have to make changes fast. Estimates of the cost vary widely. One recent study found that keeping warming to 2 degrees Celsius would require a total investment of between $4 trillion and $60 trillion, with a median estimate of $16 trillion, while keeping warming to 1.5 degree Celsius could cost between $10 trillion and $100 trillion, with a median estimate of $30 trillion. (For reference the entire world economy was about $88 trillion in 2019).

Some studies suggest that climate change has slashed incomes in the poorest countries by as much as 30 percent and reduced global agricultural productivity by 21 percent since 1961. Given the steep price of inaction, many economists say that addressing climate change is a better deal. It's like that old saying an ounce of prevention is worth a pound of cure. In this case, limiting warming will greatly reduce future damage and inequality caused by climate change. It will also produce so-called co-benefits, like saving one million lives every year by reducing air pollution, and millions more from eating healthier, climate-friendly diets. Some studies even find that meeting the Paris Agreement goals could create jobs and improve global economy.

The challenge is that we need to reduce emissions now to a void damages later, which requires big investments over the next few decades. And the longer we delay, the more we will pay to meet the Paris goals. But even if we miss the Paris target, the economies still make a strong case for climate action, because every additional degree of warming will cost more – in dollars, and in lives.

7.2 Legislation for Inter-ministerial Coordination

The ministry of climate change should take a lead role and coordinate with all the provinces on the issues of water security. All related agencies and departments should work in harmony with this ministry for synergetic response. Likewise, international engagements would be essential component for successful policy implementation; therefore, Ministry of Foreign Affairs and Ministry of Climate Change should remove overlaps and avoid duplications wherever required.

7.3 Proper Enforcement of Legislation

"Pakistan Water Apportionment Accord 1991" highlights the judicious distribution of Indus River System (IRS) water among the federating units of Pakistan. However, this accord was unable to deal with the conflicts arising due to unfair distribution of water at times. To resolve this issue, "Indus River System Authority" (IRSA) was established in 1992, through an act of Parliament to work as an institution for Indus water resources regulation and monitoring in Pakistan. However, the problem related to fair water distribution, monitoring and installation system, and the treatment plants lagged during the implementation phase. Despite establishment of "Council of Common Interest" (CCI) to resolve the grievances of provinces, the issues still persist due to weak implementation mechanism and poor governance. The devolution of power under 18th Amendment of the Constitution, devolved the water distribution among the rural and urban areas of each province as an internal matter of the provinces, however, water crises remain at large seriously impacting inter-provincial harmony.

7.4 In order to obviate the flood / rain damages to human; their properties and infrastructure, all the unprotected / illegal construction along rivers, nullahs and lakes that can block the natural waterways should be tear downed regardless of their public or private ownership.