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CLIMATE CHANGE AND ITS REALITIES FOR PAKISTAN

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Abbreviations:

WWF – P	World Wide Fund for Nature – Pakistan
CC	Climate Change
GCISC	Global Change Impact Studies Center
GDP	Gross Domestic Product
GHG	Green House Gases
GLOF	Glacial Lake Outburst Flood
IPCC	Intergovernmental Panel on Climate Change
MAF	Million Acre Feet

INTRODUCTION

Global Climate Change (CC) resulting from an increasing concentration of Greenhouse Gases (GHGs) in the atmosphere has become an accepted and major theme in today's world. According to the Intergovernmental Panel on Climate Change (IPCC), the average temperature of the earth increased by 0.6 ° C over the last century and it is expected to further increase by 1.4 to 5.8 º C by the end of the current century. These changes in temperature are but the crest of the many environmental, social and political issues which will follow in the wake of the changing climate (LEAD, 2008). Unfortunately the major causes of a rapidly warming climate can be attributed to anthropogenic activities such as the burning of fuel, the depletion of forests and changes in land use (conversion of forest into agriculture land).

Having said this, it is important to note that some levels of GHGs are necessary to maintain temperatures needed to sustain human and animal life. The average mean temperature of the earth is 15°C, without greenhouse gases it would sit at -18 º C, a temperature which is unsuitable for overall life. Recent history points to a rapid increase in both Greenhouse gas emissions and a parallel warming of the earth on a global scale. As such, this is a global problem, which can only be tackled through dedicated global support. It seems CC cannot be defeated through the introduction of a **'one size fits all'** approach: each nation must understand its local context and responsibilities and create a sustainable strategy for climate

change mitigation/adaptation. The Pakistan's government Task Force on CC thinks that adaptation should be the main impetus behind the country's future line of action. Keeping this in mind, this article's purpose is to test the adaptation hypothesis of Pakistan's government. It will further identify the effects of climate change on Pakistan's water, food and energy sectors, and suggest policy recommendations that are contextual and aligned with the development preferences of the country.

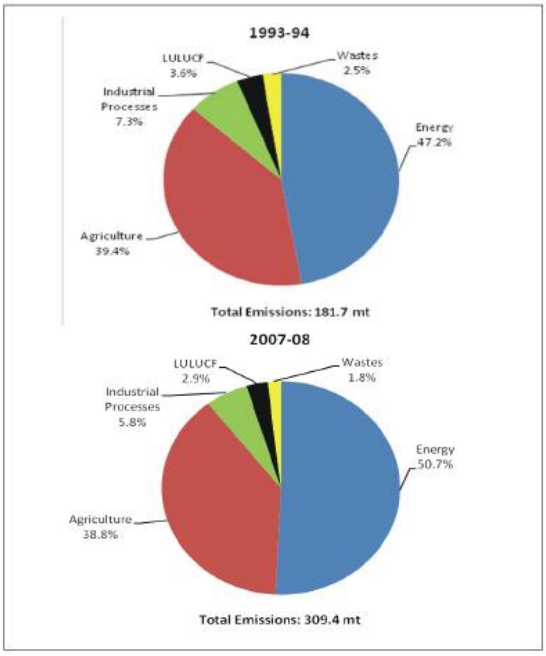

Figure 1: Sectoral Shares in GHG Emissions in 1993-94 and 2007-08 for Pakistan

Source: Planning Commission, 2010.

Pakistan, a country whose range includes high mountains, arid plains and low lying coastal areas, is extremely vulnerable to a whole diversity of CC impacts. It is important to recognize and understand the nation's role in the creation of GHGs (see Figure 1). To do so, let us examine the following figures: Pakistan's total GHG emissions in 2008 amounted to 309 million tonnes (mt) of carbon dioxide (CO_2) equivalent. Pakistan's biggest contributor is the energy sector with a 50% share followed by the agriculture sector (39%), industrial processes (6%) and other activities (5%). Pakistan's GHG emissions have nearly doubled in the past 16 years, but due to the fact that emissions are still only about 0.8% of the global scale, a miniscule amount, they are not yet considered alarming. **In fact, on a global scale Pakistan ranks 135th in per capita GHG emissions amongst the comity of nations** (Planning Commission, 2010).

This information leads to the scientific reality governing all GHG emissions: they are mainly created by the developed world yet their consequences are felt globally. Much like other developing countries, Pakistan is highly vulnerable to the adverse impacts of climate change, putting its water, food and energy security, as

well as the livelihoods of millions of people, at stake. Figure 2 explains the assertion made above:

Country / Region	Per Capita Energy Consumption (toe/capita)	Per Capita CO_2 Emissions (t CO_2 /capita)	CO_2 Emissions Per Unit Energy Consumption (t CO_2/ toe)
World	1.77	4.18	2.37
USA	7.91	19.73	2.49
OECD	4.73	11.09	2.34
China	1.25	3.66	2.93
India	0.53	1.02	2.40
Pakistan	0.49	0.76	1.56
Bangladesh	0.16	0.24	1.47

Source of data: IEA/OECD (2006)

Figure 2: Per Capita Energy Consumption and Emissions by Country

SITUATION AT HAND - WATER, FOOD AND ENERGY SECURITY

In Pakistan, as on a global scale, water, food and energy create a nexus of interdependence whose balance is thrown off by a globally changing climate. The nation's already hot climate and changing patterns of snowmelt and precipitation exacerbate existing social and economic pressures on natural resources. This in turn increases the pressure on valuable ecosystem services provided by the rivers, its delta and the sea, whom which poor communities are entirely dependent for livelihoods and survival. Lack of environmental flows to the deltaic area is likely to expose around 2.26 million people to water scarcity, rising sea levels and food insecurity. However upstream, the areas around the river are under the threat of Glacial Lake Outburst Floods (GLOFs), which collectively are the major climate-related threats Pakistan faces presently. Pakistan's further depreciation from a water-stressed to a water-scarce nation, due to anthropogenic activity and a changing climate, influences the country's capacity for food and energy creation. The facts that the Government of Pakistan has made no action plan to tackle these crises, a low public awareness and limited technical abilities create a more difficult path towards alleviating the CC crisis.

The country is extremely short of freshwater resources. With a continuously increasing population and CC, the water availability that was about 5,650 metres/per person/year in 1951, has decreased to as low as 1,100 cubic metres/per

person/year in 2010 (World Bank, 2006). This has placed the country in the comity of nations which are identified as being 'water scarce'. Projections say that under the existing circumstances it will further be lowered to 800 cubic metres / per person / year by 2026 (World Bank, 2006); these levels would create not only food and energy scarcity but also political tensions. The water situation is worsened by unrestricted ground water abstraction for agricultural and industrial use, further accelerating the crisis. These human elements are then joined by CC repercussions in the form of increased variability of monsoon and winter rains. A loss of natural reservoirs and instability of river flows further exacerbate already critical water issues. According to the World Bank (2006) report: *Pakistan's Water Economy: Running Dry*, the western Himalayan glaciers will retreat for the next 50 years, initially increasing flows in the Indus but in the long term scenario, once the reservoirs are empty, the flows will decrease around 30-40% in the Indus River system.

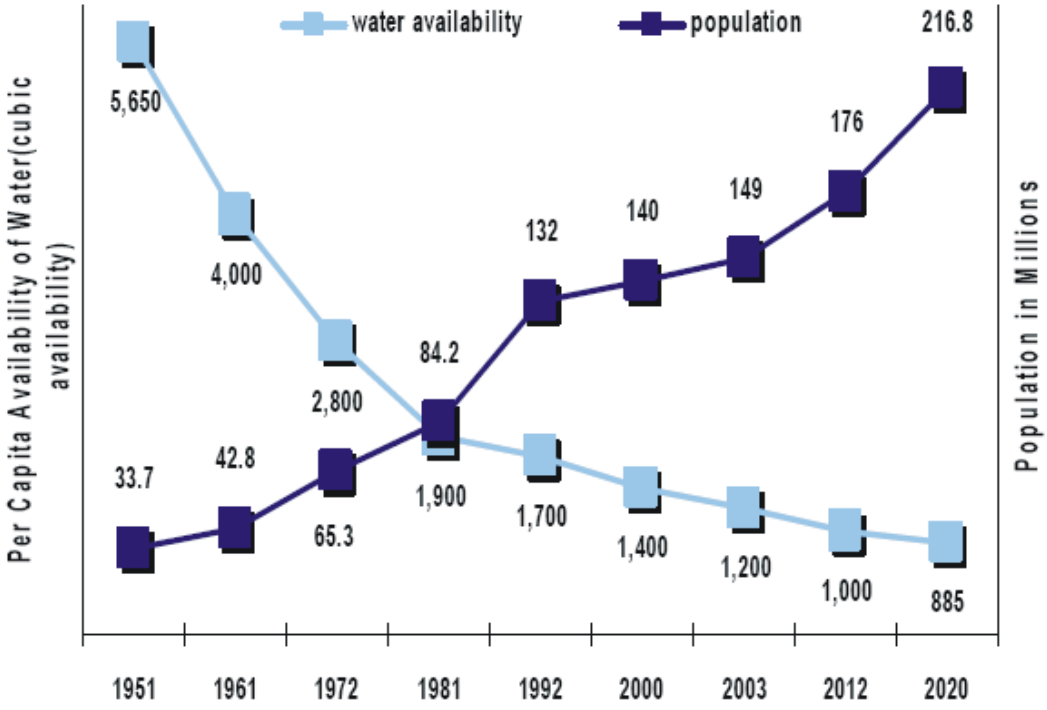

Figure 3: Water Availability vs. Population Growth

Source: Ministry of Population Welfare, Government of Pakistan and UNEP

As CC will have an effect on water availability, in turn it will have an adverse influence on poverty. Water resources are a basis for the health and welfare of the poor, especially vulnerable groups such as children, the elderly, and women. Both the quality and the quantity of water matter greatly in this, and safe and adequate quantities of water are recognized as a precondition for an acceptable standard of development, to meet the UN Millennium Declaration targets for 2015—to halve the proportion of people who suffer from hunger, cannot access or afford safe drinking water, and are without adequate sanitation. Moreover, water

resources are critical to the viability of the ecosystems through which the poor access the natural resources on which many aspects of their livelihoods are based. Even where water is not a direct input into production, other natural resources (such as forestry, fishing, or grazing) contingent on the viability of ecosystem processes depend on the flows of water through these systems. In order to counter these challenges, by 2025 the additional water requirements of the nation will be as shown in Figure 4.

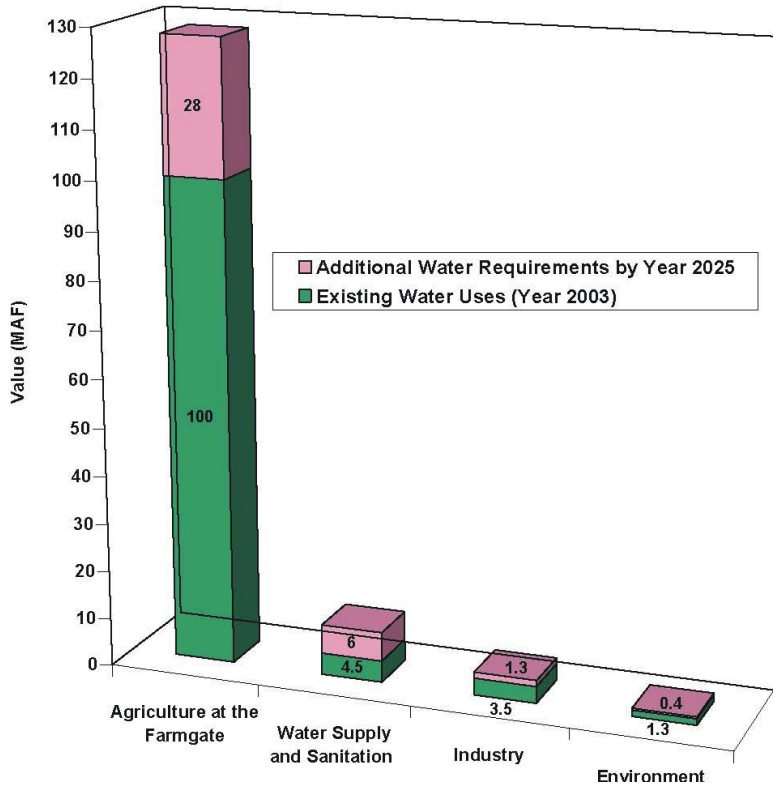

Figure 4: Additional water requirements by 2025

Source: Faizul Hasan background paper "Water rights and entitlements"

Linked to water is the food security of the country: around 90-95% of the freshwater resource is used by the agriculture sector, which contributes 22% to the GDP. Moreover, the sector employs 43% of the total labour force of Pakistan, with around 68% of livelihoods totally dependent on it. According to the United Nations World Food Programme (UNWFP) 60 to 77 million Pakistanis, mostly residing in rural areas, are suffering from food insecurity. This simply means that nearly half of the population of Pakistan is food insecure mainly due to the soaring prices of the commodities (Action Aid, 2008). Analysing the situation for the Rabi crops (Winter Crops), a study was conducted to assess the impact of climate change on the productivity of the wheat crop in four different agro-ecological zones (northern mountainous region, northern sub-mountainous region, southern semi-arid plains and southern arid plains), undertaken by the Global Change Impact Studies Centre (GCISC) in 2009. The study results showed that the length of the growing season for wheat will decrease with an increase in average temperature for all agro-

ecological zones in Pakistan. Keeping the present water regime (irrigation and rain fed) and availability as per projections in perspective, with a temperature increase in the range of 1-5ºC, the wheat yield will increase in the mountainous regions (humid zones) but will drastically decrease in the submountainous, arid and semi-arid areas (GCISC,2009). It is to be noted that more than 90% of wheat is at present grown in arid and semi-arid areas; hence, any such increase in temperature can have a direct effect on the most important food items of Pakistan.

For the time being, the total water situation during the Kharif period (Summer Crop) is generally good allowing for the cultivation of cotton and rice in Punjab and Sindh. The monsoon further facilitates these crops. However both rice and cotton, despite being the prime export crops of Pakistan, are heavily taxing on water and this can have ramifications under CC as rainfall might go through alterations as a result. For example, to produce one kilogram of rice in Pakistan requires 5.10 cubic meters of net water and likewise cotton needs 10.45 cubic meters with existing technology (See Figure 5).

Crop	Net Water Requirements per hectare (m^3)	Yield Per Hectare (Kg)	Water Requirements (m^3) for Producing 1 kg
Wheat	4050	2388	1.70
Rice	10260	2013	5.10
Sugarcane	11810	47300	0.25
Cotton	6500	622	10.45
Fodder	4660	22719	0.21

Figure 5: Water requirement by Crops

Source: Agriculture statistics of Pakistan. 2002-03

Like the crop sector, the livestock sector is vulnerable to the impacts of climate change. Some of the direct impacts of increase in temperature could be physiological stresses in animals due to high temperatures; lower productivity of milk and meat as a result; climate related epidemics and impacts on the animal habitats and environment due to extreme climate events such as floods, droughts, heavy rainfall, etc. Indirect effects could be negative impacts of climate change on the productivity of the fodder; decreased nutritional quality and palatability of forage plants due to increase in CO_2 concentration; competition of land between staple food and fodder and increased water requirements for both animals and crops (Planning Commission, 2010).

Daily electricity load shedding reminds us that Pakistan's energy situation is already grave. The power system is currently short of approximately 3000-5000 megawatts and according to the Planning Commission of Pakistan, the current electricity demand of around 20,000 megawatts (estimate of 2005) will jump to

162,000 megawatts by the year 2030. Power generation, which was historically primarily dependent on hydro sources, shifted towards oil and natural gas based production in the 1970s after which no new Dam was added to the grid as shown in Figure 6.

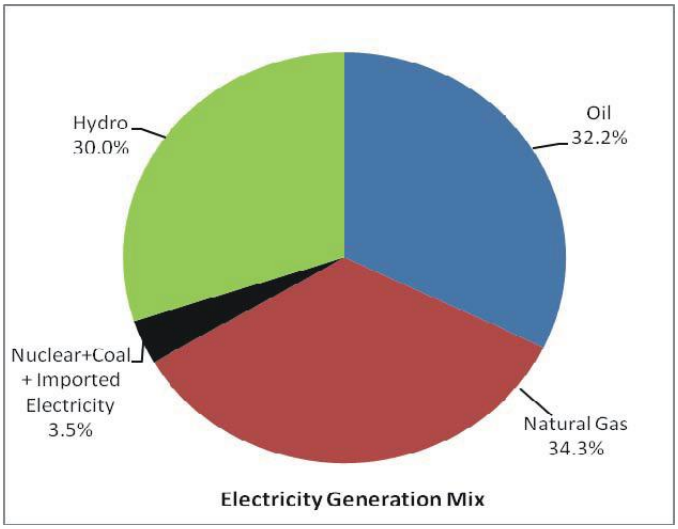

Figure 6: Electricity Generation Mix in 2007-2008 (Planning Comission, 2010)

Over the years the reservoir capacity of Pakistan's Dams has decreased from 17.372 Million Acre Feet (MAF) to 14.28 MAF presently (an 18% percent decrease in capacity) due to siltation as per WAPDA figures of 2004 (Pervaiz, 2005). The Planning Commission claims that now the capacity has decreased to around 33% at present. One of the major reasons behind Dam siltation is deforestation as the country has only 4.8% of the total area under forest as opposed to 25%, which is the global average. Moreover, the deforestation rate of 2.1% is one of the highest in the world (WWF - Pakistan, 2009). Loss of forests, siltation of reservoirs and increase in temperature are intertwining factors further intensifying the effects of climate change.

Name of Reservoir	Gross Capacity (MAF)	Live Capacity (MAF)	Loss of live Capacity (MAF)	% loss in Capacity
Tarbela	11.62	9.68	2.01	18
Mangla	5.882	5.341	0.814	14
Chashma	0.87	0.717	0.28	32

Figure 7: Decrease in Reservoir Capacity

Source: WAPDA 2004 quoted in (Pervaiz, 2005)

Figure 6 depicts that around 2/3rd of the energy is coming from burning of fossil fuels whereas around 50% of the GHGs are produced as a result of the same

(Figure 1). This is of great concern to the country considering its commitment towards the Clean Development Mechanism (CDM). Proponents of new Dams in Pakistan are of the view that in the present circumstances new reservoirs are the only solution to the issues at hand. This is supplemented by the per capita storage of the water in Pakistan which stands at 118 cubic metres as compared to India, China and Australia, that have 130, 2400 and 5000 cubic metres respectively (Pervaiz, 2005).

MITIGATING THE SITUATION – WHAT NEEDS TO BE DONE?

From this discussion, water, food and energy are all closely intertwined and as such, there exists no simple solution for adapting to, or mitigating, climate change in Pakistan. The best strategy is to combine multiple elements including technical advancements and social considerations to give response to this formidable challenge.

The given discussion has highlighted the importance of water for the survival of the people of Pakistan and its economy which is solely dependent on this scarce natural resource. As Pakistan falls in comities of nations which are now moving from water stress to water scarcity, water resource management needs to be reformed under the new considerations relating to CC adaptation. WWF - Pakistan has undertaken a range of freshwater conservation activities in Pakistan for many years. The organisation has done active engagement with all the major stakeholders of water across the country in a consultative process. It has engaged in dialogues with the government, civil society, line departments and experts in the field and has come up with certain policy recommendations that were shared with the concerned ministries for their incorporation.

First and foremost is the issue of the National Water Policy. A transparent and coherent institutional framework and policy, adapted to the demands of the 21st century, which also gives due consideration to CC should be adopted at the earliest. It is really strange that the country does not have a water policy after six decades of its existence. Moreover, a National Drinking Water Policy has been drafted in the absence of a water policy and this raises many concerns for its smooth implementation. Secondly, adoption of an Integrated Water Resources Management (IWRM) approach within the framework of the Water Accord 1991, on the basis of use of both surface water and groundwater is the need of the hour. This needs to be taken up by the Indus River System Authority as unchecked groundwater could lead towards its total depletion. Thirdly, it is important to review the water (re)allocation at the provincial level by harmonizing water availability to cropping patterns. Lastly, recognition and allocation of environmental flows should be coupled with equitable and environmentally / socially / economically sustainable storage, so that the livelihood of the people alongwith the ecosystem supporting the livelihood can be saved.

A careful analysis shows that 90%-95% of Pakistan's freshwater is used (misused) by the agrarian sector. Measures to conserve water must start here. Regarding agriculture, sugarcane and cotton are the most water intensive and

polluting crops grown in Pakistan. Sugarcane consumes more water per unit area of crop than any other crop grown in Pakistan and cotton accounts for 70% of all pesticides applied in Pakistan. Sugarcane and cotton are also part of the economic mainstay of the country, with 66% of the population reliant on agriculture for their livelihoods, including some of the poorest communities in the country. Cotton is a particularly important export commodity, contributing 10% to the GDP and 55% to foreign exchange earnings of the country (WWF – Pakistan, 2010).

In order to minimize the effect of these thirsty crops, Better Management Practices (BMPs) were introduced by WWF - Pakistan in collaboration with the European Union. BMPs, which act as adaptation measures to counter the effects of CC, are agricultural practices which optimise the three pillars of sustainability: social responsibility, environmental integrity and economic viability by marrying together the financial requirements of agriculture, such as high yield, with environmental and social concerns, such as water and pesticide use.

BMP cotton farmers were able to reduce their use of irrigation water by an average of 38% when compared with non-BMP farmers, synthetic fertilizer by an average of 39% and pesticide use by an average of 47%. On the other hand, the sugarcane farmers made crop management decisions which led to reductions in the use of irrigation water by 18%; synthetic fertilizers by 25%; and virtually 100% of all pesticides were eliminated by employing the BMPs.

The discussion so far has suggested a mix of governance and adaptation related measures for alleviating the issues related to water and agriculture. However we can see from Figure 1, that the majority of Pakistan's greenhouse gas emissions come from the agricultural and energy sectors; together these produce a whopping 90% of Pakistan's total GHG emissions. As Pakistan is a signatory to the Kyoto Protocol and has pledged to enforce a Clean Development Mechanism (CDM) for mitigation purposes, it is most significant to focus our attention to these two sectors especially towards the energy related pollution; it is important to note that only cost effective, sustainable and efficient solutions should be introduced for mitigation purposes. As such, the introduction of the following measures could present viable steps towards a solution.

In the energy sector, controlling the percentages of energy created by different means, such as coal, natural gas, nuclear, renewable, oil, etc, can ensure a low carbon energy mix, which would be an excellent option for reducing Pakistan's carbon footprint in the energy sector. Along with this, monitoring energy efficiency, and ensuring that there is less loss of energy occurring during the process ranging from production and transportation to end-use and a reduction in energy theft are major components of conservation. This can be achieved through a technical up-gradation of the infrastructure.

Another socially and environmentally friendly and effective method of reducing both carbon emissions and reliance on energy is through the introduction of widespread and safe public transportation systems in cities. In the United States, the gross reduction of energy and carbon dioxide which comes directly from

switching from single user vehicles (cars) to public transportation is 1.8 billion gallons of gasoline and 16.2 million metric tonnes of carbon dioxide (APTA,2010). For Pakistan the emissions from local road transport stand at around 13,025,000 tonnes and will undoubtedly go on escalating as our transport sector expands at an annual rate of 7.5% (LEAD, 2008). An effective and safe public transportation system can help in saving all these emissions and can contribute towards implementing a CDM ultimately, and mitigating the effect of GHGs.

As Pakistan is facing a severe energy crisis, a lot of stress is being put on development of new hydropower projects. Although it is a fact that Pakistan has one of the lowest per capita storage of water in the world, venturing mega projects for hydropower generation without taking into consideration the environmental effects is not desirable and may have irreversible consequences in the future. No objective environmental NGO would resist the building of Dams if they take into consideration the upstream, onsite and downstream effects through an Environment Impact Assessment (EIA) that is carried by a credible third party. Moreover, it is also incumbent upon the Hydropower Authority that they should think objectively and consider other options by attaining basic data on scenarios for decentralized storage such as (upper-catchment) small (err) Dams, on-farm storage, micro-hydels, groundwater recharge systems (ASR) and demand management in terms of water stored and required, electricity generated and required, people displaced, costs of construction and O&M, and lifetime and ecosystem impacts. It is on this basis that additional storage could be attained either without the negative social and environmental impacts of additional large Dams, or by going ahead with the plans by ensuring that they are the best available option, with minimal effects on environment.

CONCLUSION

As we can see, the effort that needs to be made to counter, adapt and mitigate the negative effects of CC, must come as a collaborative effort from all levels of society and all departments of the government as the proposed solutions cannot be tightly packed in a compartment labeled mitigation or adaptation. However seeing the ground realities of CC, it is pertinent to take adaptation more seriously as identified by government of Pakistan, owing to the debate of the water, food and energy security of the nation. However being a responsible member of international community, Pakistan should also contribute to the global mitigation efforts as discussed above.

Climate Change in the context of Pakistan is posing three big challenges relating to the water, food and energy security of the country. However, a careful analysis shows that all these securities are interlinked and are dependent on each other. A concerted approach by all relevant departments would be beneficial instead of adopting a silo approach. Currently, the stewardship of climate change rests with the Ministry of Environment; however the Planning Commission, and the Ministries of Water, Agriculture, and Industries, the National Disaster Management Authority, and others, along with civil society organisations should also play an active role in finalizing and implementing the climate change agenda. Finally, some general suggestions that need to be incorporated across the board are;

- A CC policy needs to be devised by taking into consideration the water, food and energy security of the country. It should be done in a consultative manner in which all the relevant stakeholders are taken on board;
- Provincial opinions should also be taken while finalizing the CC policy. Provinces should make adaptation action plans in light of the national policy developed, which should be consistent with the existing ground realities;
- Technology no doubt is necessary but is not sufficient alone. The technocentric approach should be complemented by considering the social concerns as well. Doing so would help in building the ownership of the campaign to counter the effects of climate change;
- The institutional capacity of different tiers of government should be built on adaptation measures side by side with the communities;
- The capacity building of vulnerable communities should also be done and adaptation measures should be adopted that are consistent with the socio-economic realities of the beneficiaries.

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