

# Climate Change and Future of Large Dams

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Climate Change is no more a fiction but a challenging reality for thinkers, planners, professionals and decision makers in today's world. In fact decision making on development projects would no more be valid unless it takes climate change into account. Countries like Pakistan where economy, social fabric and politics are directly linked with irrigated agriculture, water resources are at the heart of most of the conflicts. Although industry and service sector have also emerged as important contributors of national economy, yet agriculture still dominates the socio-economic horizon and will continue to dominate in the foreseeable future. Hence availability and reliable supplies of water are the key factors to shape the national economy.

Possessing one of the largest and most inefficient networks of irrigation, Pakistan faces a complex challenge of managing water resources. Conflicts on water distribution at head and tail of water courses are frequent and across the provinces are older than the country itself. Construction of series of dams, link canals and barrages has caused deep rooted mistrust among stakeholders. This has been worsened by non-professional attitude of water managers coupled with ceaseless corruption and institutional inefficiencies. This is the picture of the times when climate change has not yet unfolded its consequences with full might. It's every ones guess, how the picture would look like once climate change ushered with its multifarious impacts.

Over past three decades construction of new dams on Indus River system has particularly been a major source of conflict between the upper and lower riparian. The lower riparian Sindh province has been strongly opposing new dams on Indus. One major argument of Sindh against the big dams has been socio-environmental impacts on the province especially on flood plains and delta. Technocrats, politicians and civil society of Sindh also argue that the Indus River System does not have enough flows to divert for storage and that may ruin economy and livelihood of people in the province. Anti Kalabagh dam and Greater Thal Canal movements have specially influenced political scenario in Sindh during the recent years. Environmentalists in Sindh specially refer to massive degradation of riverine forest and mangroves eco system in Indus delta. Almost ten years back, Sindh government officially acknowledged that sea intrusion has occupied over 1.2 million acres of land in delta. Environmental degradation in Indus delta is so conspicuous that even pro-dam lobbies can not deny it. Likewise riverine katchha (flood plain) of Sindh has lost its prosperity due to depleting flows in Indus. Forest, fisheries, agriculture and livestock had been traditionally supporting rural economy of Sindh. Lack of floods due to upstream diversions have ruined this prosper economy and increased poverty to alarming levels in rural Sindh. This has also degraded precious fresh water lakes in Sindh, which provided livelihood to hundreds of thousands of people. The situation is bound to aggravate with Climate Change.

A basic misunderstanding about climate change is that it is mere rise of temperature, which is the truth in part. The actual problem with the phenomenon is unpredictable behavior of climatic manifestations such as precipitation, average temperatures etc. Climate patterns take centuries to set in. Agriculture planning is particularly dependent on the degree of accuracy of weather prediction. Frequency and quantity of precipitation has to define the water resource planning and management. It not

only helps planners and decision makers to make appropriate water allocations for various parts of country at different timings but also helps farmers in determining suitable cropping pattern in their areas. In addition to that water management infrastructure is also designed and regulated on the same basis. Indus River is well known for its erratic flows and if climate change makes it even more unpredictable, the whole water engineering and management would merit cautious revision. Regrettably the water bureaucracy of the country does not seem to be cognizant of the climate change factor. For example Water Vision 2025 of WAPDA does not take climate change into consideration. WAPDA is planning to add 10,000 Mega Watt hydro power through five mega projects by 2016. Estimates for these projects are around 20 billion US Dollars. These include Bhasha, Kalabagh, Akhori and other dams. WAPDA has not even the remotest sense of climate change impact on these plans. While Tarbela and Mangla dams are already losing their capacity owing to heavy silting, newly envisaged dams are bound to meet the same fate as climate change has to result in generating even greater amounts of silt from Himalayas in the coming years.

Most of the flows of Ganga, Indus and Kabul rivers are generated by melting of snow from Himalayas which occur mainly during summer. Whole life cycle of people and their livelihood in the region is dependent on flow pattern of these rivers. Agriculture being major source of livelihood and economy has to suffer in case of variations in flow patterns. Unpredictability resulting from climate change on Himalayas' snow buildup or melting will have profound impact on these basins. According to "The Melting Himalayas", a research report issued by the International Centre for Integrated Mountain Development (ICIMOD) "the Himalayas region, including Tibetan Plateau, has shown consistent trends in overall warming during the past hundred years. Various studies suggest that warming in the Himalayas has been much greater than the global average of 0.74 degree Celsius over the last hundred years. Many Himalayan glaciers are retreating faster than the world average and are thinning by 0.3-1.0 m/year. The rate of retreat for the Gangotri over the last three decades was more than three times the rate during the preceding 200 years. Most glaciers studied in Nepal are undergoing rapid deglaciation. In the last half century, 82 percent of the glaciers in the western China have retreated. On the Tibetan plateau the glacial area has decreased by 4.5 percent over the last 20 years and by 7 percent over the last 40 years." This trend of glacial retreat clearly indicates that the rivers receiving their flows by snow melting will experience higher flows for initial period followed by continued decline. According to the same report, various climate change scenarios will have varied impacts on flow pattern. "One concludes that with a two degree Celsius increase by 2050, 35 percent of the present glaciers will disappear."

It does not need brains to conclude that flow patterns in major rivers fed by Himalayan melting would become more erratic in the years to follow. Typically designing of dam takes into account historical flow data and assumes that almost the same will be maintained in the subsequent years. This assumption will no more be valid due to climate change thus questioning the basic equations of dam feasibility. A report of ICIMOD mentions that the temperatures on Indian sub continent are likely to rise between 3.5 to 5.5 degree Celsius by 2100. Extreme weathers are likely to occur due to climate change. In case of unpredictably higher floods, the dam safety would be the biggest challenge as dams are designed to withhold certain peak floods. In exceptionally high floods, the dams can either burst or their backwaters may inundate areas outside its water boundaries. In both cases loss of life and property can attain horrible proportions. Defrost and heavy flows will bring more debris and

can reduce the dam life by accelerated silting. Himalayas are young mountains and their rate of erosion is very high. Changes in precipitation pattern will have impact on silt flows in rivers. Warsak dam was completely silted and the Tarbela and Mangla are told to have lost almost one third of their capacity. Who can guarantee on earth that the new proposed dams would not meet the similar fate? Technical Paper VI "Climate Change and Water" of Intergovernmental Panel on Climate Change also highlights this fact. It reads "Generally the frequency of occurrence of more intense rainfall events in many parts of Asia has increased, causing severe floods, landslides and debris and mud flows (P-86)."

Similarly low flows and droughts will also question the justification of investment of billions of dollars if the dams remain underperformed. Construction of new dams promises to bring more land under plough which requires additional investment in extension of irrigation network and land development. If the dams could not deliver what they promised, the whole investment will end up in generating new conflicts. Considering the above facts it would be reasonable to conclude that huge investments on dam structures will be at risk in the context of climate change. Miller, K.A, S.L. Rhodes and L.J. Mac.Donnell suggest in their document "Water allocation in a changing climate: institutions and adaptations" that "Water infrastructure, usage pattern and institutions have developed in the context of current conditions. Any substantial change in the frequency of floods and droughts, or in the quantity and quality of seasonal timing of water availability, will require adjustments that may be costly, not only in monetary terms but also in terms of societal and ecological impacts, including the need to manage potential conflicts between different interest groups.

Since Pakistan is located in a region prone to severe climate change impacts, it would be pertinent to recommend that whole water sector management regime should be revisited in the light of climate change phenomenon. Climate change will have significant impacts on water resources in the region therefore all water engineering projects need to take this new dimension into account. Projects like large dams on Indus River System need a thorough understanding and research on climate change impacts before embarking upon. This may call for searching more viable options of water conservation.