WATER USE EFFICIENCY, WATER RESOURCE MANAGEMENT AND THE IMPLICATIONS OF CLIMATE CHANGE IN PAKISTAN

By

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ABSTRACT

It is not difficult to deduce that our very lives revolve around water. The human civilization has always leaned to settle close to water. People move when there is too little of it. People displace when there is too much of it. As a matter of fact it's not only mankind which depends on it, the whole life need it for their survival. But we stand today at the verge of global water crisis. The 20th Century has inherited us with the population and technological explosions which has laid down a massive impact on our water supply. More and more fresh water sources are being consumed and contaminated. The technological advancement has allowed us to exploit much of the world's water for industry, energy, and irrigation but unfortunately the same has been attained at a terrible social and environmental price.

Similarly the water crisis in Pakistan has aggravated with the gradual depletion of water resources and sedimentation in existing reservoirs. The country is facing the worst water shortage of history due to over use of ground water resulting from the drought conditions from the year 2000 till June 2010. The simultaneous effects of agricultural growth, industrialization and urbanization coupled with declining surface and groundwater quantity, intra and interstate water disputes, and inefficiencies in water use practices are some of the crucial problems faced by water sector. The effects of climate variability and change, including reduced water flows from melting glaciers and increasing frequency of extreme phenomena such as floods, tropical storms or droughts, are also creating pressures on scarce water supplies of the country. Immediate and multiple steps backed with proper planning are required to overcome the ever degrading water scenario of Pakistan.

1. INTRODUCTION

Among the water resources in Pakistan, The Indus River is strategically most vital water resource for Pakistan's economy and society. The Indus River system is especially critical since rainfall in the lower Indus valley is scarce. It comprises the main Indus and its major tributaries, the Kabul on the right bank and the Jhelum, the Chenab, the Ravi, the Beas and the Sutlej on the left Bank. The Indus Basin Irrigation system commands an area of 36.2 Million acres and its tributaries on average bring about 152 MAF of water annually. This includes 143 MAF from the three western rivers and 8.4 MAF from the eastern rivers. According to the the average annual flow data, provided by government of Sindh, the average escapage below Kotri is about 32 MAF (1976-2011), while the release requirement downstream of Kotri is only 8.6 MAF. Therefore, it is utmost important to initiate schemes on war footing to utilize the precious water resources before its spilling into the sea.

2. The Issues and Challenges

Pakistan water sector is facing multiple challenges which are briefly described as under;

i) Water Stress

The per capita water availability in Pakistan at the time of independence was 5,600 cubic meters, which has been drastically reduced to only 1,000 cubic meters, placing Pakistan towards one of the water-scarce countries. Further analysis of the agricultural expert's suggest that Pakistan is wasting two-third of its water by following traditional conservation methods and agricultural practices which adds to the water stress fiasco.

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ii) Storage of additional water

The spillage of water into sea and non storage of additional water during rains and floods has been a problem of the country for many years. The irony of the matter is that there is still no mega reservoir taken in hand since 1976 which will resolve this issue in near future.

iii) Ground water Degradation

Ground water is overexploited in many regions, and its quality is deteriorating. The threat to ground water sustainability is rising with the increase in population as the per capita demands are ever increasing. Also the agricultural requirements demand additional wells each year. The excessive exploitation is resulting in saline intrusion, permanent depletion of the aquifer systems, land subsidence and water quality deterioration.

iv) Water Infrastructure

Most of the hydraulic structures are in dire need of proper maintenance. Sukkur Barrage for example had the design capacity of 1.5 million cfs but flaws in design forced ten bays to close which curtailed the barrage capacity to 0.9 million cfs. Since 1973, a series of high floods exceeding 0.9 million cfs upto maximum of 1.2 million cfs caused heavy damages to the Barrage with serious threats to its stability and safety. The Gross Commanded Area (GCA) of the Barrage is 8.24 million acres, thus any severe damage to the Barrage can prove catastrophic to the inhabitants as well as to the agriculture. Similarly most of the canals are unlined and due to the increase in sediment concentration in the Indus Basin, the events of canal breaches have become more frequent resulting not only in the loss of water but also to the properties and human lives as well.

v) Climate Change Impacts on Indus River Basin

The annual mean surface temperatures in Pakistan are on a continuous rise during the past century. A rise in mean temperature of 0.6-1°C in the coastal areas along with a 0.5 to 0.7% increase in solar radiation over southern half of country has been observed The variation in climate change is a potential threat to the agriculture and energy sector of the country as well. Global warming and the associated changes in precipitation, extreme weather events, glacier melt, floods and droughts, are causing considerable impacts on water resources management in Pakistan.

The Indus River Basin is the back bone of economy of the country. Originating from glaciers of Tibetan Plateau it consists of six main rivers (the Indus, Jhelum, Chenab, Ravi, Sutlej, and Kabul) provides irrigation to more than 16 million hectares of agricultural land and has a hydropower potential of 38608 MW. Glacial retreat and changes in precipitation patterns are expected to alter considerably river basin behavior and jeopardize hydropower generation and irrigated agriculture production. Initial short-term increases in water flow may endanger the sustainability of down stream infrastructure but in the long run the reduction in inflows will result in loss of hydropower generation which may directly induce the **carbonization** of the power sector (countries shifting to thermal power plants to compensate the shortfall created by reduction in hydropower generation). A resulting increase in green house gas emissions would contribute further to atmospheric global warming and subsequent glacial melt.

3. Policies and Plans

The River Indus, like other complex river basins, faces a common set of institutional and policy challenges such as:

1. Indus Water Treaty tensions over upstream development.

2. Sectoral integration across water, agriculture, environment, climate, and energy agencies at the national level.

3. National-provincial coordination in a federal system of government.

4. Inter provincial water conflict resolution.

For the systematic and efficient management of these Transborder and provincial issues, the Government of Pakistan has responded in several creative ways, beginning with the establishment of the Water and Power Development Authority (WAPDA) as a semi-autonomous federal water agency, followed by the Indus River System Authority (IRSA) responsible for distribution of water among provinces and The Planning Commission's Vision 2030 on agricultural production, water management, food security, and climate change. WAPDA has launched a comprehensive integrated water resource and hydropower development plan, for development of water resources and hydropower generation summarized in the following Table.

Medium Term Projects (Upto 5 Years)

Project Name	Estimated Cost (Rs Billion)	Gross Storage (MAF)	Live Storage (MAF)	Status
Naulong Dam	18.0	0.24	0.20	Bids opened on 23 July 2013 being evaluated.
Ghabir Dam	11.7	0.07	0.026	Land Acquisition in progress. Bids are being evaluated.
Winder Dam	11.5	0.04	0.0361	Bids on EPC basis invited on 29 October 2013.
Hingol Dam	26.5	1.20		Bids are to be invited.
Kurram Tangi Dam	59.6	1.20	0.90	Land demarcation in progress. US AID funding awaited for award of works.
Daraban Dam	5.8	0.07		EPC bids would be invited on availability of funds.
Tank Zam Dam	59.4	0.35	0.289	Detailed Engineering Design in process.
Bara Dam	14.2	0.09		Detailed Engineering Design in process.
Papin Dam	8.6	0.09	0.048	Release of funds awaited for invitation of Bids on EPC basis.
Garuk Dam	6.9	0.05	0.025	EPC bids would be invited on availability of funds.
Pelar Dam	8.7	0.09		EPC bids would be invited on availability of funds.
Mohmand Dam (Munda)	2.417 (Billion US$)*	1.29	0.490	Feasibility completed. Consultants mobilized for Detailed Engineering Design to be completed by June 2014.
Shyok Dam (Gilgit-Baltistan)	0.159583	10.70	5.40	Feasibility Study is to be taken by WAPDA.

Long Term Projects (7-12 Years)

Project	Estimated Cost (Rs Billion)	Capacity (MW)	Status
Diamer Basha	1268.6	4500	Project infrastructure activities in progress.
Dasu (Phase-II)	124.0	2160	Detailed engineering design completed, contracting will be taken up after Phase-I
Bunji	920.0	7100	Detailed Engineering Design completed, PC-I submitted. Plan for BOOT construction.
Akhori Dam	610.0	600	PC-II approval awaited.
Rehabilitation of Mangla Power House	39.7	310	Prequalification of bidders is in Progress.
Rehabilitation of Warsak (New Power House)	49.4	300	Feasibility Study under finalization.

* Source Water and Power Development Authority (WAPDA)

4. Ongoing Development Projects in Agricultural Sector

The Pakistan Council of Research in Water Resources (PCRWR) under GoP has undertaken several projects to Design, develop and evaluate water conservation technologies for irrigation, however, the extent of these projects are still confined to a limited extent. Some of the ongoing activities are described as under.

1. Different water conservation technologies / practices i.e. bed and furrow irrigation, zero tillage, laser land leveling, growing low delta crops and irrigation scheduling are being evaluated at the farmers' fields, with their participation. The results of these studies showed better crop yield with maximum water use efficiency.

2. Watershed management practices to enhance the ground water recharge in Baluchistan.

3. Construction of storage reservoirs and improvement of conveyance channels i.e. lift and trickle irrigation systems have been installed at various sites in Punjab, Khyber Pakhtun Khwa and Northern Areas for efficient use of water.

5. Conclusion and Recommendations

Pakistan's water resources are diminishing at an alarming rate, as can be concluded from the stated facts in this report. Effective management of this crisis requires close cooperation with neighboring countries in joint watershed management, increasing the efficiency of irrigation and water use, joint development of technologies, sustainable agriculture practices and institutional arrangements to manage food shortages as well as natural disasters. The following recommendations are proposed to overcome with this scenario:

i) Construction of storage reservoirs for hydropower generation, irrigation releases and flood control. It has been observed that some projects get delayed due to non consensus of political parties and social sector. A committee involving technical experts and political representatives of all four provinces may be constituted in order to stream line the

development of water sector projects and to avoid causing unnecessary delays thereby saving valuable economy of the country

ii) Lining of main and branch canals

iii) Lining of distributaries and minor canals

iv) Irrigation system rehabilitation program

v) Change in cropping patterns i.e; cultivating crops having less water requirement

vi) Agriculture is the major contributor to economy and is largely dependent on surface water availability for its consistent flourishing. The international Food Policy Research Institute has estimated that the total (direct and indirect) effect of a $ 1.00 sales increase in agriculture as it multiplies through the economy is $ 2.81 and for electricity (assumed to come from hydropower) the effect is $ 2.74. Therefore, agriculture sector reforms need to be introduced on fast track basis by employing modernized techniques.

vii) Steps may be taken to counter water theft and misuse of irrigation water.

viii) Watercourse Improvement must be undertaken

ix) Increase ground water recharge through catchment restoration, recharge dams, recharge wells, flood management, and other means

x) Measures should be taken to counter pollution of water bodies as many aquifers and open water bodies like lakes, rivers and streams are being increasingly contaminated by pollution from industrial, agricultural and municipal wastes. According to estimates, pollution in River Ravi due to sewage disposal from the city of Lahore claims the lives of over 5,000 tons of fish every year

xi) Proper criteria for water charges (abiana) may be formulated to avoid misuse of water. Existing data suggest that water charges in irrigated agriculture are currently only 5% of the production input values.

xii) Bed and Furrow planting technology permits saving of about 30% irrigation water

xiii) Employment of drip and sprinkler Irrigation techniques

xiv) In coastal areas drinking water can be obtained by installing low cost water treatment plants that use solar energy for the desalination of sea water, the salt obtained from this process can be used in commercial and industrial applications.

xv) Rain water harvesting

xvi) Electronic and Print media can play a significant role in educating the society to employ the conservation of water at house hold level, therefore, awareness may be created among people and at school/college level as well as on the importance and efficient usage of water.

xvii) Awareness among farmers may be promoted through “Farmers Associations”, educating them on the use of water efficient techniques and growth of low delta crops.

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