KALABAGH DAM

A Multi-purpose Project of
NATIONAL WATER RESOURCES DEVELOPMENT PROGRAMME
A Long-term Solution to National Water & Power Problems
Sent to CP by

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INTRODUCTION

Irrigated agriculture is the backbone of Pakistan's economy. At the same time with world's fastest growing population estimated to 150 million, there is a dire need to increase agricultural production. If nothing is done, there would be approximately 25% shortfall in food grain requirements by the year 2000. Judging from current (1997) two million tones import of wheat, by that time, Pakistan could be one of the major food deficit countries in the world.

Due to complete stoppage of any sizeable surface water resources development after full commissioning of Tarbala Dam during, 1976, even sustainability of existing irrigated agriculture is in serious jeopardy.

With a large arable land, Pakistan still has the potential of bringing several million acres of virgin land under irrigation. An important impediment in the way of this development is insufficient control over flood water of the rivers. With virtually no limit on availability of land, it is unfortunate to willingly let large quantities of water into the sea. In post-Tarbala 20 years, an annual average of over 38 million acres feet (MAF) escaped below Kotri; after adjustment of future abstraction out-side Indus Basin, this could still be around 32 MAF. Out of this, an average of over 26 MAF per year could be effectively controlled and efficiently utilized to bring about prosperity to millions, particularly, in backward areas of Pakistan through national water resources development approach.

Besides recurring irrigation water shortage, the country passes through periodic calamity caused by the phenomenon of floods (1992 followed by 1994 very large floods should act as eye-openers) Monsoon rains result in swollen rivers which spill over their banks, bringing in the wake loss on a colossal scale. Floods are detrimental, not only in financial terms, but also in the form of sever undermining of productive system, which should logically be free from uncertainties and frequent dislocations. In the context of Peshawar Valley above Nowshera, frequent flooding takes place due to entrance of Kabul River into confined channel below this point.

Similarly, national demand of electricity has been and would keep in growing rapidly. From the present 10500MW, peak power requirement of the country is estimated to cross 13000 MW by the year 2000. Recently, Federal Government has entered in to a number of agreements with international private sector to install over 3,000 MW of thermal power over next 3-4 years. Though it may help in overcoming the load-shedding, the

power cost is increasing substantially. Therefore, a large scale injection of cheap hydropower through multi-purpose storage's is the only answer if the cost of electric supply is to be kept within affordability of the consumers.

If the present inaction towards development of national surface water resources continues, Pakistan would be faced with innumerable socio-economic problems at the dawn of 21st Century. It is, therefore, imperative to launch urgently a national water resources development programme including major multi-purposes storage, remodeling of some existing projects and construction of new irrigation schemes, particularly in backward areas of all provinces.

River Indus and its tributaries, un-questionably, are the larges national resources. Besides sizeable surplus water still going out to sea, Indus System has over 30,000 MW of economically developable hydropower potential. For effective harnessing of these renewable resources, most of which is run-of-river type, it would be necessary to build multi-purpose storage. These would generate sizeable blocks of cheap electricity and thus check the excessive tariff increases due to anticipated large scale induction of costly thermal power. In particular, these would provide means for; substituting the continuous capacity loss of on line storage's to sustain the existing irrigation; development of new irrigation projects, and effective flood control.

Taking into account all the above factors, a 25-year (2000-2025) National Water Resources Development Programme (NWRDP) has been formulated including multi-purpose projects. It is a package, including Kalabagh Dam Project, based on the concept of unified approach to tackle the threatening water shortages and anticipated large increase in power tariff due to predominance of thermal power.

THE PROJECT

Kalabagh Dam Project would be located on river Indus 100 miles south-west of Pakistan’s capital Islamabad.

This multi-purpose project would have a live storage capacity of 6.1 million acre feet (MAF).Besides making up for the capacity loss in reservoirs, it would make substantial contribution to firming up the irrigation supplies not only for new projects but additional allocation agreed by the provinces under Water Apportionment Accord (WAA) of 1991. Further, it would add a large amount of cheap hydropower to the National Grid through its 2400 MW (Ultimate 3600 MW) installed power.

KALABAGH DAM MULTI-PURPOSE PROJECT

SALIENT FEATURES

HYDROLOGY (Indus River at Site):-

Catchments Area	110,500 sq. Miles
Maximum Recorded Flood (1929)	1,200,000 Cusses
Average Annual Flow	91.4 MAF

RESERVOIR

Storage Capacity

Gross	7.9 MAF
Live	6.1 MAF

Retention Level:

Maximum	915 Feet Above Mean Sea Level
Minimum	825 Feet Above MSL

DAM

Type	Zoned Fill Embankment With Clay Core
Maximum Height Above River Bed	260 Feet
Total Length	11,000 Feet

Total Fill Volume		60 Million Cu. Yds

SPILLWAYS

Overflow Spillway Capacity	1,070,000 Cusses	
Orifice Spillway Capacity		980,000 Cusses

POWER FACILITIES

Unite Size	300 MW	
Penstocks		12 No.
Turbines		Francis Type
Turbine Design Head		170 feet
Power House	Indoor Type	
Installed Capacity		2400 MW (Initial); 3600 MW (Ultimate)
Average Annual Energy		11400 GWH

COST

Estimated Total Investment (June 1997) Rs. 250 Billion

* June 1992 cost converted at Rs. 45 per US dollar

ITS ROLE

Utilization of the irrigation and hydropower potentials of river represents the least cost option available to Pakistan to sustain as well as expand its irrigation and power generation capacity. Whereas the Indus Basin Project in the late 1960's provided basic infra-structure for integration of our largest irrigation system. Kalabagh Dam could assume similar role for making an earnest start towards further unified national water resources

development-cum-management. As the project is ready for implementation since late 1980's effort should be to have it commissioned by the start of 21st Century.

Kalabagh Dam Project would play very important role by way of:-

a. Replacing storage lost by sedimentation in existing reservoirs at Mangala, Chashma and Tarbala (estimated about 3 MAF by the year 2000).

b. Providing additional storage to meet existing water shortages during early Kharif sowing period of April-June (particularly critical for cotton crop in Sindh).

c. Providing effective regulation of Indus River to meet additional Kharif allocations of the provinces under WAA, 1991.

d. Regulation and control of high flood peaks in the Indus to enable provision of perennial tube well irrigation to the rive rain area in Sindh.

e. Generating a large chunk of hydro-power for meeting the growing demand of agricultural, industrial and domestic consumers through low cost option.

f. Reducing dependence on imported fuels.

g. Creating employment for 30,000 persons during construction and significant numbers after commissioning.

APPREHENSIONS

As part of controversy on Kalabagh Dam, a number of apprehensions/doubts have been expressed both by upper (NWFP) and lower (Sindh) riparian provinces. Most of these are based either on lack of information or hear say. In addition, there have been reservations in the mind of some quarters without any apparent rhyme or reason. Consequently, the Project has been thoroughly reviewed and revised/modified to remove the apprehensions and doubts, which in the past may have blocked its implementation.

The apprehensions and the factual position, in the light of critical examination/supporting studies, are presented in the following.

Apprehensions of NWFP

i) It is feared that historic flooding of Peshawar Valley including Nowshera town would be aggravated in the event of recurrence of 1929 record flood.

ii) Drainages of surrounding area of Mardan, Pabbi and Swabi plains would be adversely affected by the reservoir thus creating water-logging and salinity.

iii) Operation of Mardan SCARP would be adversely affected.

iv) Fertile culturable land would be submerged.

v) Large number of people would be displaced.

Answer:

i) a. In the modified design of the project the reservoir conservation level has been lowered by 10 feet from 925 to 915 feet above mean sea level (MSL) thus eliminating the need for construction of any protective dyke near Nowshera. At maximum conservation level of 915 feet, the back-water effect of Kalabagh Lake would end about 10 miles downstream of Nowshera. A state-of-art computer based study, backed by physical modeling in Pakistan, has established that recurrence of record flood of 1929 would not affect the water level at Nowshera even after 100 years of sedimentation in reservoir. It may be noted that this completely ignores the effect of Tarbela reservoir, which is now factually providing relief by attenuating flood peaks. It is also notable that flood warring system at Tarbala provides a minimum of 48 hours advance warning before the arrival o large flood peaks.

b. Real causes of flooding at Nowshera and Peshawar Valley upstream are entrance of Kabul river at Nowshera into confined channel at the end of Peshawar valley; and backing effect of Attock Gorge downstream through which Indus River has to pass after its confluence with Kabul River. Before the confluence, Indus River flows through a wide valley of over 8,000 feet and is then forced to pass through 1000 feet wide gorge for 5 miles. This constriction forces the river water to back up thus raising flood levels in Kabul River up To Nowshera. Whereas Kalabagh should not adversely affect flooding in Nowshera and Peshawar Valley above, an upstream dam on Swat River could provide effective assurance against this chronic inherent problem. Consequently, Munda Dam multi-purpose project is being included in NWRDP.

ii) Lowest ground levels at Mardan, Pabbi and Swabi areas are 970,962 and 1000 feet above MSL respectively, as compared to the maximum conservation level of 915 for Kalabagh. This maximum Kalabagh reservoir level would be maintained only for 3 to 4 weeks during September and October after which it would deplete as water is released for Rabi crops and power generation. Ultimately it would go down to dead storage level of 825 feet by early June. This operation pattern of reservoir, by no stretch of imagination, could block the drainage and thus cause water-logging or salinity in Mardan, Pabbi and Swabi areas.

iii). The invert level of main drain of the Mardan SCARP are higher than maximum elevation of 915 feet. Thus, these drains would keep on functioning without any obstruction.

iv) Total culturable land submerged under the reservoir elevation of 915 feet would be 27,500 acres (24,500 acres in Punjab and 3000 acres in NWFP). The submerged irrigated land would be only 3000 acres (2,900 acres in Punjab and 100 acres in NWFP). It may be noted that about 1,000 acres of irrigated land acquired for Mardan SCARP alone.

v) a. The estimated population to be affected by the project would be 83,000 with 48,500 in Punjab and 34,500 in NWFP. A liberal resettlement plan would provide alternate irrigated lands to the affected families. The affected population would be resettled along the reservoir periphery in extended/new model villages with modern facilities of water supply, electricity, roads, dispensaries, school and other civic amenities. The affectees would enjoy and improved environment.

b. Another major incentive provided for the affectees in this case, not previously practiced in Pakistan, would be to fully compensate the frames for the land on the reservoir periphery above normal conservation level of 915 feet that could be flooded once in five years. This land would remain the property of the original owners for cultivation with the only undertaking that they would not claim any damages to crops for occasional flooding.

c. The comprehensive resettlement package proposed for Kalabagh is in fact most innovative and attractive then those previously adopted for Mangla and Tarbala Dams. The basic objective being that “at the end of day”, the affectees should find themselves in a better socio-economic environment.

Apprehensions of Sindh

i) The anxiety that the project would render Sindh into a desert.

ii) There would be no surplus water to fill Kalabagh reservoir.

iii) High level outlets would be used to divert water from the reservoir.

iv) Cultivation in rive rain (Sailaba) areas would be adversely affected.

v) Sea water intrusion in Indus estuary would accentuate.

vi) Mangrove forest, which are already threatened, would be further affected adversely.

vii) Fish production and drinking water supply below Kotri would be adversely affected.

Answers:

i) Dams don't consume any water. Instead these store water during flood season and then make it available on crop demand basis for the remaining dry periods of the years. The real demonstration of this came after full commissioning of Tarbala Dam in 1976. During pre-storage era of 1960-67, average annual canal withdrawals of Sindh were 35.6 MAF. After Tarbala the corresponding figure rose to 44.5 MAF with over 22 percent increase in the Rabi diversions alone increased from 10.7 to 15.2 MAF. It is estimated that after Kalabagh, canal withdrawals of Sindh would further increase. A indicated in -V, most of this increase would come in regarding desertification of Sindh defies even the basic logic of a storage reservoir.

ii) A. WAA of 1991 has allocated, on the average, about 12 MAF additional supplies to the provinces almost all of which is in Kharif season. On the other hand, factually the surplus water is an available only within 70-100 days flood period. It is estimated that to provided additional allocated water over the year, a storage of about 3.6 MAF would be needed (out of this, 2.2 MAF would be in the early Kharif season of April to July).

iii) Initial studies have indicated that construction of high level outlets at Kalabagh is economically unviable. Notwithstanding this, if any province wants to build, then its share of water would be strictly governed by WAA, 1991.

iv)a An impression is also prevailing that with Kalabagh Dam, rive rain areas of Sindh, commonly called " Sailaba" would got out of production due to control over floods. It can be appreciated from configuration of rive rain area that "Sailaba' crops are grown on the land adjacent to main river and the creeks. Though crops are sown on the soil moisture soon after the floods, these need more than one watering to mature. As a result 'Sailba' lands give poor yields. Consequently, frames are generally required provide irrigation facility through shallow tube wells or lift pimps. Prime movers on these tube wells have to be removed during the flood season to avoid damage.

b Sindh has presently 660,000 acres of ' Sailaba cultivated area form Guddu Barrage to sea. This area is initially sown due to the moisture provided by flooding with river stage of 300,000 cusecs and above.

c. Flood peaks above 300,000 cusecs would still be coming after Kalabagh, without much detriment to the present cultural practices, while large floods would be effectively controlled. This would, in fact, be conductive to installation of permanent tube wells to provide perennial irrigation facility in rive rain areas. Towards this end, a separate scheme is being included in NWRDP.

v)a. The fear that present extent of sea water intrusion in the Indus Delta would be further aggravated by Kalabagh is not substantiated by factual data. Studies indicate that presently the total effect of Indus estuary is only limited to the lower most portion of Delta and get dissipated below Garho and Chowgazo gagues heights at Garho are completely insensitive to Indus discharges of up to 700,000 cusses. Therefore, the sea water intrusion, which seems to be at its maximum even now, is unlikely to be aggravated further by Kalabagh Dam.

b Another apprehension is that sea water intrusion into existing aquifer system would cause serious quality deterioration. The groundwater contained in the aquifer is effectively saline as far north as Hyderabad. Therefore, intrusion of sea water along shore line

of Delta is of little consequence. This is further supported by the fact that there is southward oriented groundwater gradient throughout this aquifer. Considering the very low transmissivities of the aquifer in Delta region, upward sea water intrusion can be almost ruled out.

vi)a. Out of the total 1.53 million acres(MA) tidally inundated historic Indus Delta, mangrove forest cover an area of almost 0.32 MA In this forest, spreading from Karachi in the west to Rann of Kutch in the east, 95% of the population now consist of a salt tolerant variety.

b. Extent of the active delta area (as distinct from the historic delta area described above) is about 294,000 acres. Out of this, the mangroves cover only 7,400 acres or 2.5% of the area. Most of the remaining area is in form of mud-flats. The reason for this area being too small could be a combination of factors. Recently, NED University of Engineering and Technology has carried out a study titled “What Really Threatens us and Our Mangroves”. This brings out that reduction in mangroves is essentially due to frequency of tidal inundation being too small instead of fresh water reduction caused by upstream abstractions, which started with Sukkur Barrage in 1932. Other major causes are uncontrolled overgrazing and cutting due to extreme population pressure of Karachi.

c. Therefore, in order to revive the mangroves, real need is for replanting salt tolerant varieties with provision for controlled doses of fresh water. Obviously, this possibility would be much enhanced with an upstream storage facility like Kalabagh.

vii)a. A recent study has shown that there is no clear evidence to suggest that fisheries stocks in the river reach below Kotri have declined due to progressive reduction in the surface water supplies. On the other hand, fish production has been constantly increasing as indicated by statistical data. As such, Kalabagh Dam is unlikely to have any adverse effect on fish production in the area.

b. In the rive rain area downstream to Kotri Barrage, groundwater is predominantly saline or brackish and as such unsuitable for either irrigation water supply. After Kalabagh, winter supply in the river would improve thus assuring more drinking water.

PROJECT BENEFITS

Kalabagh would store surplus water in the flood season and make it available for controlled utilization during the low flow season. This water would thus be used for sowing and final maturing of the Kharif crops and entire Rabi crops.

Irrigation oriented operation of the project gives the highest overall economic return. Thus the full live storage of 6.1MAF would be available for guaranteeing assured irrigation supplies throughout the year including replacement of the storage loss on the three existing reservoirs.

Power

Kalabagh with its installed capacity of 2400 MW (ultimate 3600 MW) would add to the system a very large chunk of cheap hydro-power. In an average year, 11413 million kilowatts hours (MKWh’s) of electricity would be generated at Kalabagh. Further, as a result of conjunctive operation an additional 336 million MKWh’s and up to 600 megawatts (MW) of additional peak power would be generated at Tarbela. To put these figures in perspective, if Kalabagh was in position today, there would have been no load-shedding in Pakistan.

The energy generated at Kalabagh would be equivalent to 20 million barrels of oil per year.

Flood Alleviation

Kalabagh would reduce the frequency and severity of flooding along the Indus particularly between the dam site and Indus/Punjab confluence, 300 miles downstream.

For the rive rain areas lower down in Sindh, it would enable conversation of the existing 'Sailaba' areas to the year round tube well irrigation.

Overall Benefits

On a conservation basis, the overall direct benefits of Kalabagh Dam would be around Rs. 25 billion per annum. Thus the investment cost of project would be repaid within a very short period of 9-10 years.

CONSEQUENCES OF NOT BUILDING KALABAGH DAM

i) National food security would be jeopardized, thus subjecting the economy to additional burden of importing food grains.

ii) Loss of storage capacity of the on-line reservoir due to sedimentation would result in shortage of committed irrigation supplies causing serious drop even in existing agriculture production.

iii) For implementation of Water Apportionment Accord 1991, a new storage project like Kalabagh is essential. In its absence it would give rise to bitter inter-provincial disputes and recriminations particularly in a dry water year. Dispute between Punjab and Sindh on shortage of about 0.2 MAF water during Rabi maturing/Kharif sowing 1993-94 should be eye-opener. It may be worth mentioning that Rabi 1993-94 had a normal river inflow pattern.

iv) The annual energy generated at Kalabagh is equivalent to 20 million barrels of oil. This annual import of fuel for thermal generation, including augmentation of transportation infrastructure, would be an additional burden to the economy.

v) Recently, Federal Government has entered into agreements with international private sector to install over 3,000 MW of thermal power over next 3-4 years. Though it may help in overcoming the load-shedding, the power cost will increase substantially. Therefore, large scale injection of cheap Kalabagh hydropower would help to keep cost of electricity within affordability of the consumers.

vi) Growth of domestic industrial and agriculture sectors would be impended due to high power costs.