ROLE OF ENGINEERS IN ECONOMIC DEVELOPMENT AND POLICY FORMULATION
FOCUS ON MAJOR WATER STORAGES

By

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ABSTRACT

Agriculture Sector is presently contributing about 21.4% to National Gross Domestic Product (GDP). Considering outputs from agro-based and other industries dependent upon its raw material, Agriculture Sector is virtually contributing about 35% to GDP. Thus, this Sector can be considered as backbone of national economy.

Bulk of the agricultural output is being provided by the vast Indus Basin Irrigation System. Most critical input in this regard is water. In turn, the water availability to IBIS is reducing with: progressive reduction in the capacity of on-line storages (Mangla, Tarbela & Chashma); and non-implementation of any major storage project since commissioning of Tarbela in 1977. This is resulting in stinted growth of Agriculture Sector and undermining the food autarky for feeding rapidly growing population.

Energy Sector of the country is also in dire straits and the nation is gripped by the worst load-shedding of its history. This is also affecting the agricultural growth due to non-availability of electricity for about one million tube wells.

To bring out the national economy from this abysmal situation, top priority implementation of at least one major multi-purpose storage project is essential. In this regard, fully engineered and unanimously recommended by all stakeholders, Diamer Basha Dam Project (DBDP) is awaiting launching of core construction since 2009 pending commitment of foreign financing. Recently, however, an effort seems to be afoot for putting this project on bank-burner by the vested interests in collaboration with some International Financial Institutions (IFIs). Consequently, Govt. Of Pakistan (GoP) is being pressurized to discard this project in favour of still being engineered run-of-river Dasu Hydropower Project (DHP).

Now is the time for engineering fraternity, both at collective and individual level, to forcefully bring to the notice of 'Decision Makers' that substitution of DBDP with DHP would have dire consequences upon the growth of national economy. In this regard, Pakistan Engineering Congress should play the leading role.

1 INTRODUCTION

Pakistan, like any developing country, needs to focus on the following key sectors of the economy both in respect of development and management: -

i. Agriculture.

ii. Industry

iii. Infrastructure including: -

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a. Water resources management and development

b. Flood control

c. Communications including roads and transportation

d. Buildings (public and private sectors)

e. Public health facilities

f. Utilities (electricity, gas, civil aviation, etc)

iv. Human resources development through proper education, training and gainful deployment from the level of technician to senior management.

In all of the above identified areas, Engineers have to invariably play their basic role through:-

i. Conceptualization.

ii. Initial planning.

iii. Design.

iv. Obtaining approval of competent authorities.

v. Construction supervision.

vi. Post-construction operation, maintenance and management.

2 STATE OF NATIONAL ECONOMY

2.1 OVERALL

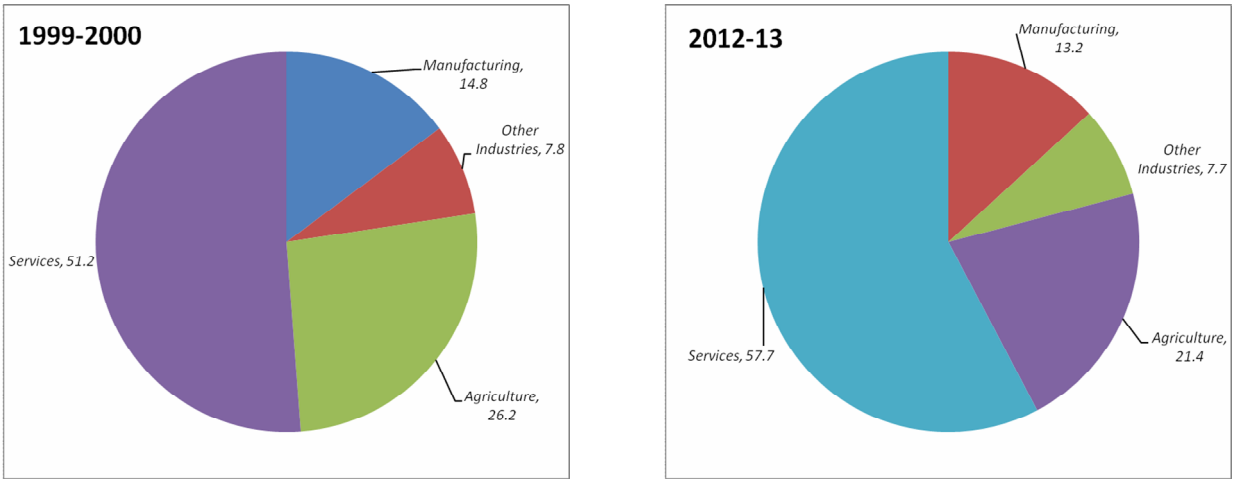
According to Pakistan Economic Survey 2012-13, contribution of various sectors of economy towards Gross Domestic Produce (GDP) was as shown in Table 1.

Table 1: Comparative Contribution of Various Sectors of Economy to Gross Domestic Produce of Pakistan

Sr. No.	Sector of Economy	Contribution to GDP (%)[a]	
		1999-2000	2012-13
1.	Agriculture	26.2	21.4
2.	Manufacturing	14.8	13.2
3.	Services	51.2	57.3
4.	Other industries	7.8	7.7
5.	**Total**	**100.0**	**100.00**

The above comparative picture is also represented through the Pye-Chart in Figure-1.

Figure 1: Contribution of Various Sectors to GDP



2.2 AGRICULTURE SECTOR

Although over the period of 2000 to 2013, contribution of Agriculture Sector has reduced from 26.2 to 21.4%, it still remains central to economic growth and development in Pakistan. Besides contributing 21.4% to GDP, it employs 45% of the country's labour force and facilitates growth in other sectors of the economy. Healthy expansion in agriculture stimulates domestic demand for industrial goods and other services and supplying raw material to agro-based industry notably cotton textile which is the largest subsector of manufacturing sector.

Considering direct linkage between agriculture and outputs from the agro-based and other industries dependent upon its raw material, Agriculture Sector is virtually contributing about 35% of national GDP as shown in Table 2.

Table 2: Virtual Contribution of Agriculture to National GDP

Sr. No.	Sector	Contribution to GDP (%)	
		Total [a)]	Attributable to Agriculture
1.	Agriculture	21.4	21.4
2.	Manufacturing	13.2	6.6
3.	Services Sector (Transport Storage and Communication)	13.7	6.9
4.	**Total**	**48.3**	**34.9**

a) Based on the data of 2012-13

2.3 ROLE OF WATER IN AGRICULTURAL DEVELOPMENT

Most important input to the agriculture is water. Major source in this regard is the surface water conveyed to the end user (farmer) through the vast network of Indus Basin Irrigation System (IBIS). This comprises: large multipurpose storage reservoirs in upper mountainous reaches of rivers; barrages in the plains to divert water into main canals; conveyance system of primary (main) and secondary (branch and distributary) canals; and tertiary system (water-courses) upto the farm gate.

Availability of surface water for canal head diversions is, therefore, a key factor in sustenance of agriculture as demonstrated by Table 3.

Table 3: Annual Canal Head Diversion into IBIS and their Impact on Agricultural Growth

Period	Canal Head Division (MAF)			% age incr / decr. Over Avg.
	Kharif	Rabi	Total	
Average System Usage (Post-Tarbela)	67.1	36.4	103.5	-
2004-05	59.1	23.1	82.2	- 20.6
2005-06	70.8	30.1	100.9	- 2.5
2006-07	63.1	31.2	94.3	- 8.9
2007-08	70.8	27.9	98.7	- 4.6
2008-09	66.9	24.9	91.8	- 11.3
2009-10	67.3	25.0	92.3	- 10.8
2010-11	53.4	34.6	88.0	-15.0
2011-12	60.4	29.4	89.8	- 13.2
2012-13	57.7	31.9	89.6	- 13.4

It can be seen from Table 3 that since 2004-05, IBIS is persistently suffering water shortages varying between 2.5 to 20.6% as compared to post-Tarbela average. Consequently, the annual growth of agriculture sector is almost stagnant around the average of 2.5%. Against this, the mean annual growth should be at least 4% to cope with the food and fiber requirements of our burgeoning population.

The basic reasons for this stinted agricultural growth are: progressively reducing capacity of the on-line storage reservoirs due to sedimentation; and inability to construct any major storage dam after completion of Tarbela in 1977 despite annual escapage of about 35 MAF un-utilized water into the sea.

3 ROLE OF ENGINEERS IN ECONOMIC DEVELOPMENT

3.1 RESTORATION OF TARNISHED COMMUNITY IMAGE

As already mentioned, Engineers can play vital role of development in almost all sectors of national economy. Unfortunately, however, so far the Engineers are virtually excluded, by design or default, from senior level administration / management and particularly policy decision making level for economic development. This may be due to a peculiar mindset of Top Level Administration and Bureaucracy, but has also direct linkage with the existing tarnished image of the Engineers because of the following perceived general attributes: -

i. Faulty conceptualization, planning and preparation of development plans without involvement of the stake holders.

ii. Gross under-estimation of project costs to get them approved from the competent authorities in the first instance.

iii. Very lax construction supervision resulting in sub-standard quality of work and excessive cost.

iv. Indulging into unethical practice of accepting illegal gratification.

Above adversities have to be addressed by the engineering fraternity at personal as well as collective levels. In this regard, the professional bodies like Pakistan Engineering Congress can play a pro-active role.

Pakistan Engineering Congress has developed a detailed Code of Ethics (Annex-01). This can be a very useful instrument for self and collective realization. Salient features of this Code of Ethics are: -

i. Justice, Honesty and Faithfulness

ii. Application of Skill for Human Welfare

iii. Respecting other Professionals

iv. Faithful Fulfilling of Obligations

v. Non-Acceptance of Illegal Gratification

vi. Expressing Professional Opinion Straightforwardly

vii. Not harming Reputation of other Professionals

viii. Rendering Professional Advice based on Knowledge and Facts

ix. Helping each other without Indulgence in Unethical Practices

x. Deciding Matters of Common Professional Interest by Mutual Consultation

xi. Striving individually and collectively to enhance Prestige of Engineering Profession according to Code of Ethics.

3.2 PROFESSIONAL UNITY

Presently, the engineering community is hardly united as reflected in somewhat divergent stances of various professional bodies. This situation could be sufficiently remedied through formation of 'Federation of Engineering Organizations'. It would not only restore the tarnished image of engineers at collective level but bring to notice of Policy Decision Makers: unanimous version regarding technical purport of various national economic developments; and just grievances and demands of the Engineers.

3.3 PARTICULAR FOCUS OF THE PAPER

It is evident that the Engineers can play very effective role in development / management of water, which is key input for agriculture sector. By way of illustration and not limitation, the Engineers can contribute through the following appropriate inputs from grass-root to macro level: -

i. On-farm water development-cum-management through: introduction of water efficient irrigation practices; determination of crop consumptive use requirements with aim to match them to the extent possible with actual water availability; and measures to improve field level water application efficiencies.

ii. Improved design / maintenance of water-course conveyance system for salvage of excessive losses.

iii. Improved operation and maintenance of primary / secondary water distribution system including use of modern analytical tools of water routing models.

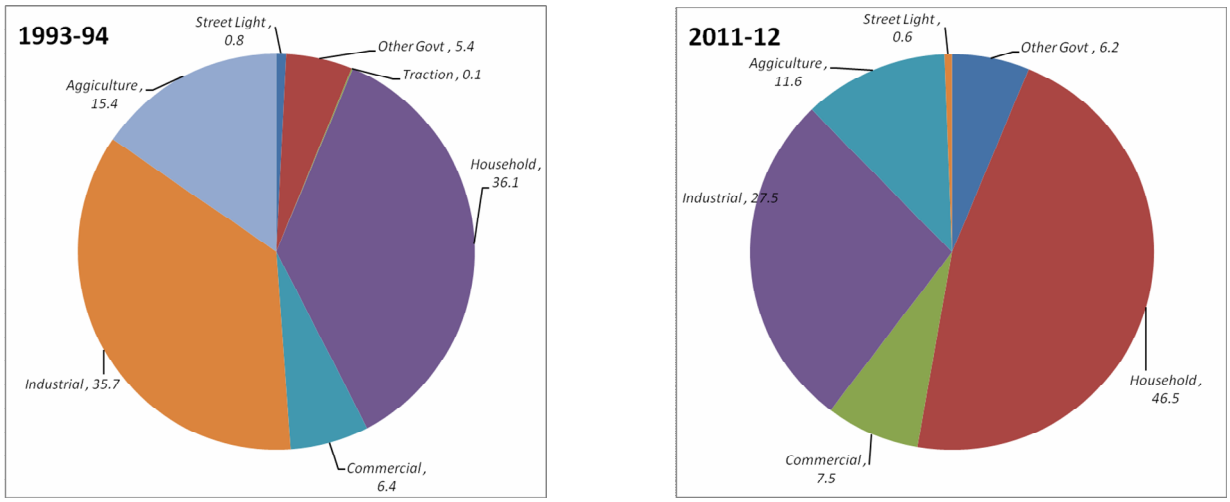
iv. Efficient design, construction and operation of canal diversion structures (barrages etc).

v. Applying the modern management tools such as analytical water routing models with the aim of optimal canal system operation.

vi. Conceptualization, planning and prioritized development of multi-purpose water storage projects for : additional water availability for crops at the time of critical demands; production of electricity at affordable cost; and flood control.

This paper particularly focuses on the last item of multi-purpose storages. Firstly, the major factor, though somewhat obscured, is trickledown effect of very large investment for construction on the local area socio-economic development and alleviation of poverty through substantially enhanced job opportunities. One of the primary benefits during operation stage of a multi-purpose storage is sustenance / development of Agriculture Sector through additionality of irrigation water with consequently increased production. Another major benefit of such storages is production of large chunks of electricity which is a key input to economic growth. For Agriculture Sector, energy has also assumed the role of a vital input for ground water pumping through the huge existing network of about one (1) million private tube wells. This is duly reflected in the comparison of consumption by various sectors of economy as shown in Figure 2.

Figure 2: Comparative Percentage Share of Various Sectors in Electricity Consumption



4 PROJECTED NATIONAL GRAIN PRODUCTION AND WATER REQUIREMENTS TILL 2025

4.1 GRAIN PRODUCTION REQUIREMENT

4.1.1 Projections Through 2025

In 1990, the annual grain production requirements to feed the population were around 20 million tonnes (MT) and being essentially met. However, with increasing population, the current requirements are about 39 MT and may grow to 53 MT by 2025. Against this, the recent (2010) production under serious water constraint for irrigated agriculture was estimated only around 28 MT with consequent shortfall of 11 MT. If no further investment is made in construction of large water storage dams till 2025, this deficit may increase to a yawning gap of 18 MT (refer Annex-02).

4.1.2 Depressed Cereal Yields

Due to chromic water stress during critical crop periods, the cereal yields in Pakistan are the lowest among the producing countries. These are about 31% of Egypt and 90% of even neighbouring country of India (refer Annex-03). To remedy this situation, one of the essential agricultural inputs is adequate and timely availability of water for meeting the crop needs.

4.2 PROJECTED WATER DEMANDS

According to World Bank's 'Country Water Resources Assistance Strategy', 2005, Pakistan's water demands for agriculture, municipal uses and industry in 2003 aggregated to about 110 MAF. Against this, the projected demand of 2025 would aggregate to over 140 MAF (refer Annex-04).

Obviously, the primary instrument for meeting these demands could be the major storages to harness very large unregulated flows of the Indus River System presently escaping to the sea.

5 INDUS BASIN IRRIGATION SYSTEM AND CANAL WITHDRAWALS

5.1 INDUS BASIN IRRIGATION SYSTEM (IBIS)

Pakistan possesses one of the world's largest contiguous irrigation system (refer Annex-05). Presently, the Indus Basin Irrigation System (IBIS) serves 45 canals with a command area of 35 MA (14Mha) through an extensive primary, secondary and tertiary system and three on-line storages with original live capacity of about 15.7 MAF.

5.2 IMMEDIATE POST-STORAGE IMPACT ON CANAL WITHDRAWALS

Before induction of storages as part of Indus Basin Project (IBP), the canal system was receiving run-of-river supplies with wide inter and intra seasonal variation in withdrawals. However, with the regulation provided through storages at Mangla, Chashma and Tarbela under IBP, it was possible to significantly regulate the high flow as well as increase the Rabi supplies from 12% to 21% through seasonal carry-over from Kharif. Consequently, as compared to pre-Mangla (1960-67) period the annual canal withdrawals over post-Tarbela (1976-2008) period showed an overall increase of 15.5%. Particularly, the increase in Rabi was 27.7% with 20% during the low flow period of September to June.

5.3 PRESENT STATE OF CANAL WITHDRAWALS

The present state of canal withdrawals by IBIS is reflected in Table-3. This indicates that the canal system is constantly facing serious shortages compared to post-Tarbela uses. This is primarily due to: rapid sedimentation of on-line storages with resultant depletion of the original capacity by about 1/3rd; and non-availability of supplemental water supplies through construction of additional storages(s).

6 NATIONAL ENERGY SCENARIO

Even on a modest basis, the national peak energy demand of 2008-09 was estimated as 16500 MW. Due to acute energy crises the presently suppressed energy demand is around 18000 MW but it may go upto 60500 MW by 2024-25 if the energy constraint is removed (refer Annex-06). Existing generation capacity of 17830 MW comprises: 11264 thermal including Independent Power Producers (IPPs); and 6566 MW hydel system of WAPDA. Despite this, it is not possible to meet even the suppressed peak demand and the whole nation is now facing one of the worst and prolonged load-shedding of upto 5000 MW. This has been caused by a combination of constraints comprising: no dependable system spare capacity; de-rating of existing thermal units, non-availability of gas for thermal power stations; and seasonal reduction in hydel capability due to drawdown of reservoirs.

As mentioned earlier, Agriculture Sector with an annual electricity consumption of about 12% mostly for groundwater pumping, is being also significantly impacted by this chronic and severe electricity shortage.

According to the proposed 'Generation Expansion Programme' with necessary reserve, it is estimated that for 2024-25 conditions, total hydel installation should be about 23600 MW including an addition of about 17000 MW over the present capacity with bulk contribution from major multi-purpose storage projects (refer Annex-06). On the other hand, conservatively estimated hydropower potential of River Indus alone is over 40,000 MW. Therefore, the basic plan of generation expansion should be maximum harnessing of hydel potential. Besides an environmental friendly source of energy, this would save billions of US dollars to be spent annually on the import of fuel for thermal generation.

7 NEED FOR STORAGES AND CONSEQUENCES OF INACTION

7.1 RATIONALE

According to global criteria, Pakistan is already water stressed semi-arid country with annual per capita availability of over 1000 m^3. The position is worsening with rapidly increasing population and by 2025 this may drop to 550 m^3 representing acute water stressed conditions (refer Annex-07).

Besides this global criteria, the national context would point out to the most compelling need for water storages. This may be due to a combination of various factors such as:

i. Food and fiber requirements of burgeoning population.

ii. Coping with rapidly increasing energy demands at affordable tariffs.

iii. Compensation for rapid depletion of on-line storages (since lost about 1/3rd of original live capacity of about 15.7 MAF).

iv. Large escapages of uncontrolled flood flows into the sea (average of 35 MAF).

The storages would also enable affective river regulation and integration of IBIS. Another relevant, though newly emerging, factor will be the need to harness the anticipated increase in Indus River flows during the first half of 21st century as a result of deglaciation due to global warming.

7.2 LARGE V/S SMALL DAMS

Sometimes it is debated that, as the large dams in Pakistan become controversial, we should concentrate on small dams. It may be pointed out that large and small dams serve altogether different purposes and are not mutually exclusive. Therefore, besides the small dams now being undertaken in all the provinces to serve local needs, the need of hour to get out of the abysmal situation, lies in priority construction of large dams.

7.3 CONSEQUENCES OF NOT BUILDING LARGE DAMS

As already highlighted, irrigated agriculture is the backbone of national economy. Further, the level of agriculture production is directly related to the timely availability and effective use of water as the major input. Therefore, Pakistan has no other choice except to embark upon a programme for sequential construction of at least three large dams till 2025. On the other hand, the consequences of not building the large dams will be almost catastrophic as listed in Annex-08.

8 RECENT WATER RESOURCE DEVELOPMENT STUDIES

Since the start of 21st century, a number of water resource development studies, with primary emphasis on storages, have been carried out by the concerned national agencies and IFIs. The notable amongst these are:

i. WAPDA's Vision 2025 Programme (2001)

ii. ADB's Water Strategy Study (2002)

iii. World Bank's Water Policy Study (2002)

iv. Report by GoP's Technical Committee on Water Resources (2005)

v. World Bank's Report on Pakistan, Country Water Resources Assistance Strategy (2005).

The relevant recommendations were also reflected in GoP's 'Medium Term Development Framework' (2005). In particular, 'WAPDA's Vision 2025 Programme' approved by the Federal Cabinet in 2001 envisaged development of 26 MAF of storages to ensure national water security (refer Annex-09).

9 MINIMUM ADDITIONAL STORAGE REQUIREMENT BY 2025

To sustain the agricultural economy as well as ensure national food autarky through the mainstay of IBIS, an estimate has been made of the minimum additional storage requirements by 2025. Accordingly, the minimum additional storage requirement by 2025 (refer Annex-10) would be 18 MAF comprising:

i. 6 MAF for replacement of on-line storage loss

ii. 18 MAF for bridging the gap between projected irrigation demand and anticipated canal withdrawals without investment in storage.

10 CONSTRUCTION OF ADDITIONAL LARGE STORAGE DAMS

10.1 CURRENT STATUS OF ENGINEERING PREPAREDNESS

Taking cognizance of the disturbing emerging scenario, in 2005 the Federal Cabinet took decision to construct five large dams, which was conveyed to the nation through the Presidential Pronouncement. Accordingly the five large dams comprised: Kalabagh; Diamer Basha; Akhroi; Munda; and Kurram Tangi (refer to Annex-11 for locations). As a sequel to the above policy decision of GoP, the engineering studies were pursued by WAPDA, particularly of the large dams to store surplus Indus flows. On the recommendation of 'Technical Committee on Water Resources (2005)', Skardu (Katzara) Dam on Indus was also added to the list. Current 'Engineering Preparedness Status' of the four large dams indicates that:-

i. Kalabagh Dam is ready for implementation since 1987 subject to national consensus through the Council of Common Interest (CCI).

ii. Diamer Basha Dam, after completion of design and tenders (2008) and approval of GoP in August 2009 backed by unanimous recommendation of CCI, is ready for implementation pending commitment of foreign financing.

iii. Feasibility Study of Akhori Dam has been completed and go ahead for tender design awaited.

iv. Pre-feasibility Study of Skardu Dam is under way.

10.2 PROPOSED SEQUENCING OF LARGE DAMS

Based on the current status of 'Engineering Preparedness' the three candidate large dams for sequential implementation through 2025 are: already approved Diamer Basha with live storage of 6.4 MAF; Kalabagh with live storage of 6.1 MAF subject to national consensus (2017-24); and Akhori with live storage of 6.0 MAF (2020-25). Coincidentally the aggregate live capacity of 18.5 MAF to come from these three dams would be adequate to meet the minimum additional storage requirement of 18.0 MAF by 2025 (refer Annex-10).

'Proposed Way Forward' for achieving this objective is: -

i. Priority launching of Diamer Basha Dam Project with adequate local / foreign funding commitments.

ii. Start of parallel efforts to achieve national consensus regarding need and sequencing of two additional storages for meeting 2025 requirements.

iii. Engaging IFIs (WB/ADB/USAID) in conceptually / financially supporting the needed reservoir infrastructure.

10.3 DIAMER BASHA DAM PROJECT

It also seems pertinent to highlight various salient features of Diamer Basha Dam Project, which is awaiting launching of the core implementation stage. It is proposed to be located on Indus River about 40 km downstream of Chilas, the district headquarter of Diamer in Gilgit-Baltistan (refer Annex-12). The dam will be 272 m high roller compacted concrete (RCC) structure with two 2250 MW each underground powerhouses on both sides. It will have a live storage capacity of 6.4 MAF to provide for the directly needed supplemental water for IBIS. The installed capacity of 4500 MW would yield an average annual generation of 18100 GWh at site. Due to cascading effect an additional generation of 2400 GWh will be possible at the existing downstream facilities of Tarbela, Ghazi-Barotha and Chashma. Even from the international standard, environmental impacts of the project will be also relatively moderate for a large dam of this size (refer Annex-13). These would comprise: total land acquisition of 37,400 acres with agricultural land of 3100 acres only; directly affecting a population of about 30,000 in 32 villages to be resettled in the Model Villages around reservoir periphery; and submergence of about 94 km of existing Karakoram Highway (KKH).

11 CURRENT SUBTLE EFFORTS TO PUT DIAMER BASHA DAM PROJECT ON BACK-BURNER

11.1 EARLIER IMPLEMENTATION OF DASU INSTEAD OF DIAMER BASHA DAM PROJECT

It is disturbing to note that recently (since July 2013) some subtle efforts, by design or default, are under way by the anti-dam lobby to put Diamer Basha Dam Project on back-burner. The basic reasoning being advanced in this regard is non-commitment for the needed US$ 14 billion funding of this mega project. This particular effort recently surfaced through lobbying with Government of Pakistan to launch first, still being engineered, run-of-river Dasu Hydropower Project instead of Diamer Basha Dam Project. This campaign was apparently spearheaded by World Bank under the garb of: -

"Donor agencies are urging Pakistan to build the Dasu Hydropower plant before the Diamer Basha Dam as they see the latter project as 'unworkable".

Taking note of this effort, concerned engineering fraternity approached the national print media to bring out the following facts: -

i. a. Sustained viability of Dasu Project will be dependent upon prior construction of Diamer Basha Dam. Now it is proposed to be implemented in stages comprising: Phase 1 in 5 years with 1080 MW installed capacity; Phase II in 6-7 years with another 1080 MW capacity; and followed by Phases III and IV with additional installation of 1080 MW each. If implemented in this staged manner, Dasu Project may span over 15-20 years with ultimate investment of much higher than $ 6 billion being mentioned by the World Bank.

b. Engineering design and tender documentation for Dasu Project are still in the process of finalization. PC-1 Proforma for project implementation is under preparation and yet to approved by GoP. There is no funding commitment for core construction of Dasu Project and so far World Bank has expressed willingness to only provide a peanut credit for $700 million through its affiliate International Development Agency (IDA) for land acquisition and resettlement. An RCC dam at Dasu with height of 242 m will have to be built in single stage even under the proposed four stage implementation. Thus, civil works under Stage I will include: Spillway; Power Intakes; Headrace Tunnels; and half Power House with Transformer Cavern. The proposal to construct Dasu Dam in stages with Stage I comprising only one power tunnel and installation of 3 units with aggregate capacity of over 1080 MW seems unworkable. As mentioned above, the remaining 3 tunnels each after interval of 5 years under subsequent phases will also extend the overall project implementation to at least 15 years with accumulated cost much higher than currently mentioned $ 6 billion. Both cost and time schedules for Phase I Dasu seem unrealistic and over-optimistic. Therefore, these need to be reviewed by independent Consultants / Panel of Experts.

c. It is also pertinent to point out that the small re-regulating reservoir of Dasu, with live capacity of 0.7 MAF necessary for peaking, would get filled with sediments in 10-12 years in the absence of Diamer Basha Dam. Afterwards, plant utilization factor under all the phases would reduce drastically along with severe abrasion of turbines. Thus, every year one to two turbines will have to be decommissioned for major repairs. Alternatively, to mitigate the effects of rapid sedimentation on Dasu Project, regular reservoir flushing would be required at least during the two high flow months of June and July with power house completely closed. This would drastically reduce the annual power output of Dasu and bring into question the long term sustainability of the project. It is estimated that upon full development, Dasu will provide annual energy of about 13,600 GWh with continuous flushing of one month. On the other hand with Diamer Basha this energy will be enhanced by over 60% to 21,500 GWh.

ii. a. Diamer Basha Dam is a multipurpose project. It would store 6.4 MAF of water to ensure food security as well as mitigate floods. It would also produce 18.1 billion units of energy at site through installed power capacity 4500 MW. Regulated outflows from Diamer Basha Dam would have cascading effect on Dasu, Pattan Thakot, Tarbela, Ghazi-Barotha, Chashma and any other project on river Indus. The on-line projects of Tarbela, Ghazi-Barotha and Chashma would have additional energy output of about 2.4 billion units due to storage releases from Diamer Basha Dam. Most importantly, as mentioned above, fully completed Dasu without Diamer Basha would produce annually about 13600 GWh of energy. On the other hand, with Diamer Basha the annual energy output from Dasu will increase by over 60% to 21,500 GWh.

b. PC-1 of Diamer Basha Dam Project was approved in 2009. The project was unanimously recommended by the Council of Common Interests (CCI) for priority implementation. During 2009, ADB also showed keen interest in its financing and a couple of MOUs were also exchanged. Although later on ADB became lukewarm, it recently reassured the newly elected national Government to help in lining up international financing for the project.

c. As regards the preparedness for implementation of Diamer Basha Dam Project, Engineering Design and Tender Documents are ready since 2008. Environmental Management and Resettlement Plans have since been upgraded according to the guidelines of ADB with particular focus on social safeguards. Preliminary evaluation for prequalification of contractors for Lot 1, 2, & 3 was also completed in 2009 but 'put on hold' till ADB's financial commitment. 'Request for Proposal (RFP) for Procurement of Consultancy Services For Construction Design and Construction Supervision and Contract Administration' was issued by WAPDA to the short-listed Joint Ventures. These proposals were received by WAPDA on 01 October 2013 and are now undergoing evaluation for early engagement of the Consultants.

d. As part of preliminaries, land acquisition for the project is underway with schedule to complete it as soon as possible. In addition, for construction of Project Colony to accommodate construction stage staff of WAPDA / Consultant, thirteen (13) out of 16 contracts have been awarded for construction of Offices, Rest Houses, Residential Accommodation, Schools, Hospital, Power House, Water Supply and Sewerage and Roads. These are expected to be completed before the end of 2014. Simultaneously, work is in progress to construct a Composite Model Village with modern amenities to resettle the project affectees in vicinity of Chilas.

iii. a. Diamer Basha Dam would entrap all the sediments and enhance the useful life of Tarbela dam by 35 years. Presently, Tarbela reservoir sediment delta is at about 8 km from the dam and may take another 10-15 years to reach the dam. At that stage there would be a lot of wear and tear of turbines due to passage of coarser sediments.

b. For Dasu Project, this trapping of sediment, would be instrumental in not only enhancing the life of small regulatory stage, but increase its annual energy output by over 60%.

iv. Updated (June 2012) investment cost of Diamer Basha Dam Project is US$ 13.7 billion including about $4 billion for Interest During Construction. Base Cost of civil and electromechanical works proposed to be implemented through five lots is only about $ 5.7 billion. Sometime back, it was being considered to initiate core project implementation through Lot 1 for construction of Main Dam and Appurtenants including access, utilities and accommodation for other main contractors. It was anticipated that through this project launching, a number of international investors would be attracted for construction of the Power House. Reportedly, some renowned European / Chinese manufacturers had expressed keen interest to supply on credit, the machinery including turbines, generators and transformers.

v. Total completion time of Diamer Basha Dam is 9 years and not 12-14 years, as being mentioned by the adversaries. First partial filling of reservoir and testing of power units will start in 8th year. It is estimated that full project benefits will enable payback of its cost in 8 years.

vi. It is considered that touting for assigning priority to Dasu over Diamer Basha would be tantamount to putting on the back-burner this high priority national project which is dire need of the country as well as backed by consensus of provinces and unanimous recommendation by CCI.

11.2 USAID INITIATIVE

For the past some time, USAID had been showing interest in lining up of financing for implementation of Diamer Basha Dam Project. However, the following recently unfolding events smack of a conspiracy being brewed to put this project on the backburner: -

i. Reporter from Washington DC filed a front page news in Dawn of 25 July 2013 regarding advocacy of potential US sponsors (World Bank / USAID) to give first priority to Dasu Hydropower Project.

ii. Later on, US Ambassador to Pakistan offered to the Finance Minister funding to carry out Feasibility Study of Basha Dam Project, knowing fully well that the project was only awaiting foreign financial commitment. Thus, the top US Diplomat in Pakistan assigned only Pre-Feasibility Level engineering preparedness to Diamer Basha.

iii. On 26 August 2013, Finance Minister stated that “why should we waste time in making preparations for Basha and I have decided to immediately start work on Dasu”.

As follow-up of the hidden agenda, during September 2013 USAID issued documents requesting proposals from short-listed consultants to conduct ‘Data information Collection & Review of DBDP’ with the following broad purposes / TOR:-

“The purpose of this Task Order is to collect data, information and copies of studies and reports prepared for the proposed DBDP by the Government of Pakistan and other partners, including the World Bank and the Asian Development Bank (ADB), to review the materials collected to identify gaps in the existing data, information and analyses in comparison to international best practices, to develop statements of work (SoW) for the recruitment of international consultants to carry out further evaluation, assessment and design modifications related to environmental and technical aspects and develop an SoW for the recruitment of international consultants to prepare a financing plan and dynamic financial model for this mega project.”

Reportedly, WAPDA voiced its concern that this solo venturing by USAID, when GoP and WAPDA stand committed for the construction of DBDP on top priority, would not only be a duplicating effort but also cause further delay on this most needed water / hydropower project considered to be key solution to the national water & energy crises.

11.3 REALISTIC APPROACH FOR IMPLEMENTATION OF DIAMER BASHA DAM PROJECT

It is certain that this effort on the part of USAID is not at all required and is being mounted without consulting or involving the main stakeholder i.e. WAPDA. It should be looked into once again and USAID convinced to discuss the matter with WAPDA before taking any further action on the proposed studies.

As a matter of fact, the project has been studied extensively at all stages since 1981 to 2008 including concurrent review by specially established Panels of Experts. This covered: site investigations; surveys and numerous other related investigations / studies required during the process; two feasibility studies; and finally detailed engineering design and tender documentation. PC-I was prepared on these basis and approved by ECNEC in 2009.

As per current status, WAPDA has since received proposals from short-listed three consortia comprising joint ventures of foreign / local consultants for engagement as 'Construction Design & Supervision Consultants'. TOR of this RFP, besides the construction design-cum-supervision, specifically includes:-

i. Review of all the studies conducted to-date.

ii. Review of design / planning with respect to improvement / saving in time & cost, keeping in view remote dam location, seismicity & logistical problem.

11.4 PROPOSED WAY FORWARD

Considering the above preparedness status and forthcoming engagement of Consultants by WAPDA, the proposed studies by USAID will be virtually an unneeded duplication. Therefore, If USAID is really interested in reassessing the project, it should join hands with WAPDA by financing the Consultants going to be appointed shortly. ToR of these Consultants could be suitably modified to cater for the specific requirements of USAID for Due Diligence. For further confidence, USAID could appoint an independent Panel of Experts (PoE) to review the work of WAPDA's Consultants.

12 CONCLUSIONS AND RECOMMENDATIONS

12.1 CONCLUSIONS

i. Engineers should play their role in economic development by active participation in the related activities from micro to macro level.

ii. Unfortunately, so far the Engineers are required to play only sub-serviant role by way of performing services to create infrastructure or facilities under the command of decision makers.

iii. Engineers are almost totally excluded from the decision making process. This can be attributed to:

a. Tarnished image among the public at large as well as the senior bureaucracy and the political rulers.

b. Professional disunity among the engineers and particularly various technical entities like Institution of Engineers, Pakistan Engineering Congress etc.

c. Lack of initiative and drive at personal as well as professional levels.

iv. Whereas Engineers are involved in almost each development activity, this particular paper focuses on sustenance / development of Agriculture Sector through priority construction of multi- purpose water storage projects.

v. Presently the irrigation supplies for agriculture are seriously constrained due to :

a. Rapid sedimentation of the three on-line storages (Tarbela, Mangla & Chashma).

b. Non-implementation of any major storage reservoir since completion of Tarbela in 1977.

c. Scarcity of energy even for ground water pumping (almost equaling the surface water delivery at farm gate).

vi. Future projections upto 2025 indicate that the country would require an additional minimum storage capacity of about 18 MAF to meet the food and fiber requirements of its burgeoning population.

vii. While there is need for additional storage reservoirs about 35 MAF of water is escaping to the sea unutilized.

viii. a. Presently, already engineered three multi-purpose storages aggregating to over 18 MAF are available, which need to be implemented under a prioritized sequence till 2025.

b. Chief candidate in this regard is fully engineered Diamer Basha Dam awaiting launching of core construction due to non-commitment of foreign funding.

c. Unfortunately, however, some subtle moves are afoot to put the high priority Diamer Basha Dam Project on the back-burner by diverting focus of the decision makers to run-of-river Dasu Hydropower Project. Interestingly enough, long term sustainability of Dasu Project is dependent on the upstream located Diamer Basha Dam Project.

12.2 RECOMMENDATIONS

i. The Engineers should play pro-active role in economic development of the country instead of the present subservience to the biased Bureaucracy and Decision Makers.

ii. The first step in this regard should be to erase the tarnished image of Engineers by strictly following the Code of Ethics (such as one prescribed by Pakistan Engineering Congress).

iii. National Engineering Institutions, such as Pakistan Engineering Congress, should assume a proactive role by:

a. By highlighting Engineer's actual role in various economic development activities.

b. Adopting a systematic strategy for improving the tarnished image of the engineers.

c. Keeping their members abreast with the latest technological developments / improvements.

d. Frequent inter-action through holding technical moots, seminars, symposia, special lectures, etc.

e. Establishing a 'Standing Experts Think Tank' to watch the important technical issues of national importance and render advice to the Congress for timely recommendations to the decision makers.

f. Forcefully project through print / electronic media the concerns and problems of Engineers to attract the attention of intelligent and public sector agencies involved in national economic development.

iv. In the context of particular focus of this paper, both at collective / individual level the Engineers should be to: -

a. Emphasize the need for priority implementation of multi-purpose storages with priority for sequential construction in keeping with respective status of engineering preparedness.

b. Focus upon immediate start of construction on fully engineered Diamer Basha Dam Project and already on the high priority on the basis of consensus / recommendations by all the stakeholders.

c. Subvert some recent subtle moves to put Diamer Basha Project on the back-burner by assigning priority to the downstream located run-of-river type Dasu Hydropower Project. Needless to emphasize that this would be retrograde step with dire consequences for development of national economy. This effort should be pursued through a systematic and persistent campaign spearheaded by the Engineering Congress.

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ANNEX-01

PAKISTAN ENGINEERING CONGRESS

CODE OF ETHICS

1. **Justice, Honesty and Faithfulness**
   "Allah commands you to render back your trust to those to whom they are, and that when you judge between people, you judge with justice. Allah admonishes you with what is excellent." (4 : 58)

   You shall be honest, faithful and just and shall not act in any manner derogatory to the honour, integrity or dignity of the engineering profession.

2. **Application of Skill for Human Welfare**
   "Give full measure and weight justly and defraud not men of their things, and act not corruptly in the land, making mischief." (11 : 85)

   You shall use your knowledge and skill of engineering for human welfare and render professional service and advice which reflects your best professional judgement.

3. **Respecting Other Professionals**
   "And let not hatred of a people incite you not to act equitably, Be just; that is nearer to observance of duty." (5 : 8)

   You shall not injure maliciously, directly or indirectly, the reputation or employment of another Engineer, nor shall you fail to act equitably while performing professional duty.

4. **Faithful Fulfilling of Obligations**
   "Fulfill the obligations" (5 : 1)

   You shall faithfully observe and fulfill your obligations.

5. **Non-Acceptance of Illegal Gratification**
   "And swallow not up your property among yourselves by false means, nor seek to gain access thereby to the judges, so that you may swallow up a part of the property of men wrongfully while you know." (2 : 188)

   You shall not abuse your position or power, nor accept illegal gratification of any sort.

6. **Expressing Professional Opinion Straightforwardly**
   "And speak straight words." (33 : 70)

   You shall express your opinion on engineering or other matters in a frank, open and straightforward manner.

7. **Not Harming Reputation of Other Professionals**
   "Avoid most of suspicion for surely suspicion in some cases is sin; and spy not nor let some of you backbite others." (49 : 12)

   You shall not criticize another Engineer's work without his knowledge, nor malign or injure his professional reputation.

8. **Rendering Professional Advice Based on Knowledge and Facts**
   "And follow not that of which thou hast no knowledge. Surely the hearing and sight and heart, of all these it will be asked." (17 : 36)

   Your professional advice shall be based on full knowledge of facts and honest conviction, and you shall not write articles or advertise in self-laudatory language or in any manner derogatory to the dignity of the profession.

9. **Helping Each Other Without Indulgence in Unethical Practices**
   "And help one another in righteousness and piety, and help not one another in sin and aggression, and keep your duty to God." (5 : 2)

   You shall help one another in upholding and doing what is right, and shall not associate with those who transgress and those who indulge in unethical practices.

10. **Deciding Matters of Common Professional Interest By Mutual Consultation**
    "And whose affairs are decided by counsel among themselves." (42 :38)

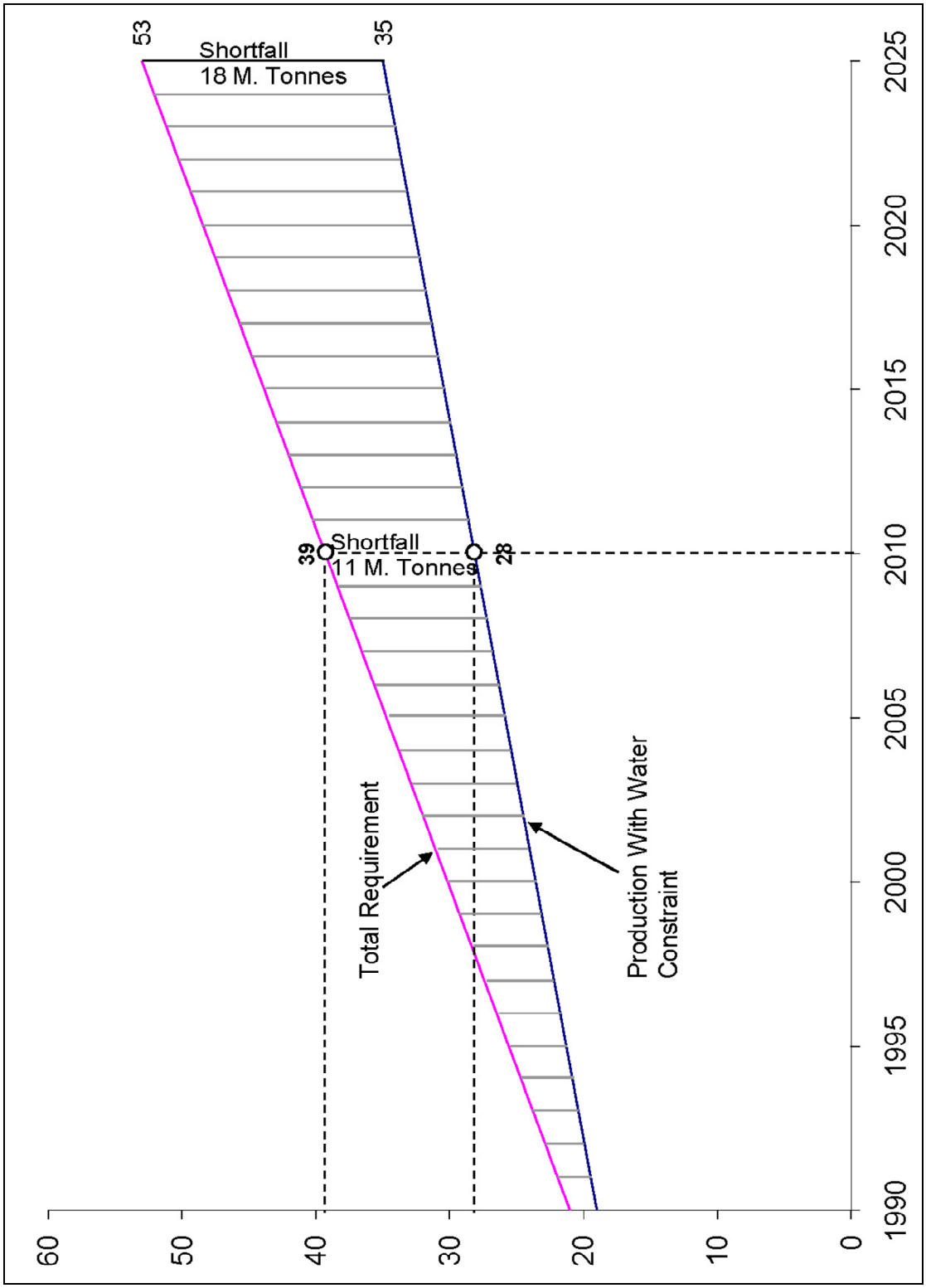
    You shall decide matters of common professional interest by mutual consultation.

11. **Striving Individually and Collectively to Enhance Prestige of Engineering Profession According to Code of Ethics**
    “And hold fast by the covenant of God all together and be not disunited.” (3 : 103)

    You shall strive individually and collectively to enhance the prestige of the engineering profession by ordering your conduct in accordance with this Code of Ethics and shall not be disunited.

ANNEX-02

PAKISTAN - GRAIN PRODUCTION REQUIREMENT AND PRODUCTION



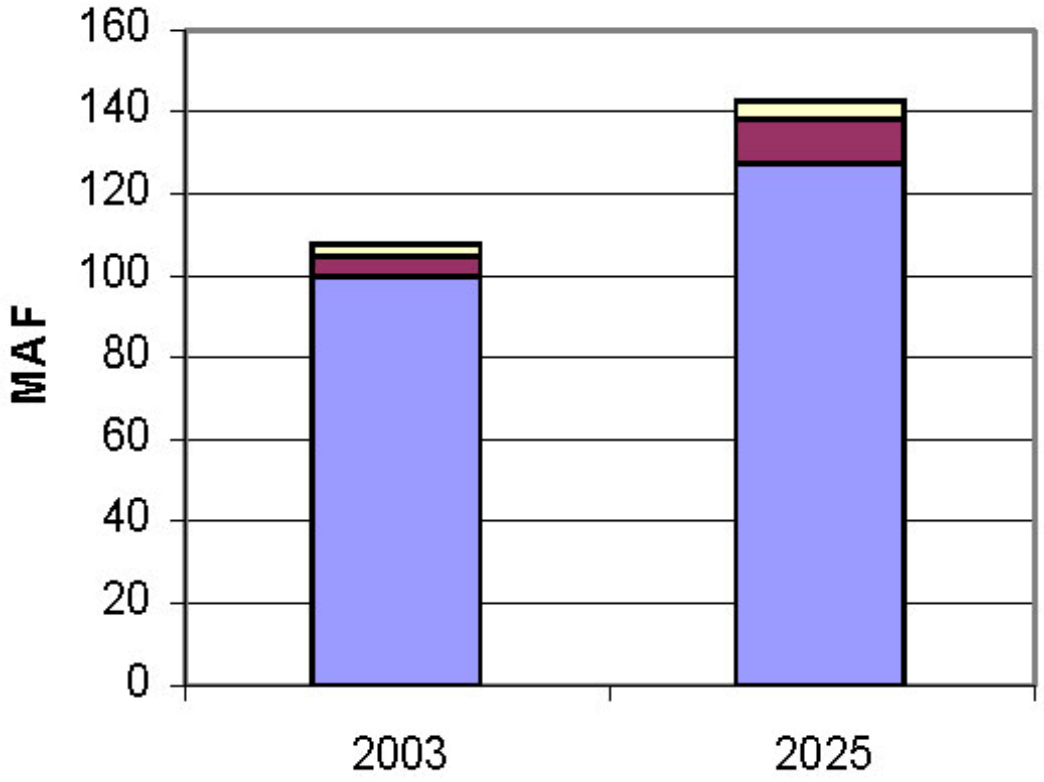
ANNEX-03

CEREAL YIELDS IN DIFFERENT COUNTRIES

Sr. No.	Country	Yield (kg / ha)
1.	United Kingdom	6609
2.	France	6517
3.	Egypt	5921
4.	Korea	5815
5.	Japan	5588
6.	Germany	5588
7.	USA	5092
8.	Italy	4739
9.	China	4482
10.	India	2062
11.	Pakistan	1860

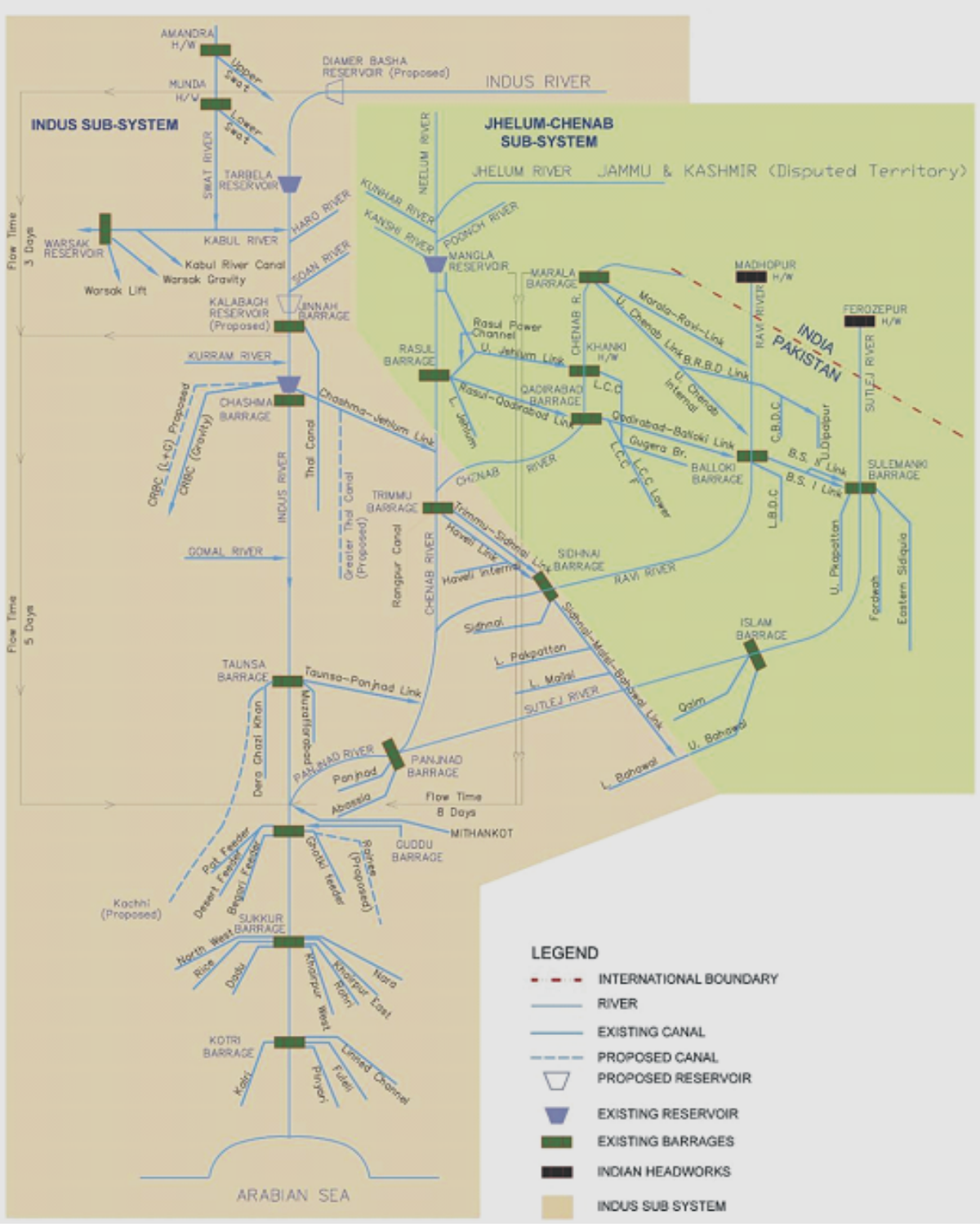
Source: World Bank

PROJECTED DEMANDS FOR WATER



ANNEX-05

SCHEMATIC DIAGRAM – INDUS RIVER IRRIGATION SYSTEM



ANNEX-06

ESTIMATED ENERGY GENERATION, PEAK DEMAND AND GENERATION EXPANSION PROGRAMME

Year	Energy Requirement		Proposed Generation Capacity (MW)		Total / Hydel Ratio
	Generation (GWh)	Demand (MW)	Total	Hydel b)	
2008-09	94000	16500	17830 [a]	6566	2.72:1
2008-09	102100	17900	19919	6638	3.00:1
2009-10	111500	19400	22174	6864	3.23:1
2010-11	121300	20900	27033	6985	3.87:1
2011-12	131800	22500	27706	6985	4.25:1
2012-13	142700	24100	32646	7205	4.53:1
2013-14	154400	25900	34590	7289	4.75:1
2014-15	167000	28000	37808	8669	4.36:1
2015-16	180000	30200	41995	11026	3.81:1
2016-17	193600	32500	45445	12646	3.59:1
2017-18	208000	34900	50600	14771	3.43:1
2018-19	225800	37900	54785	15896	3.45:1
2019-20	245000	41100	60600	17021	3.56:1
2020-21	265100	44600	66245	18146	3.65:1
2021-22	287000	48200	71305	18146	3.93:1
2022-23	310200	52100	76825	19946	3.85:1
2023-24	334500	56200	82885	21746	3.81:1
2024-25	360100	60500	90695	23546	3.85:1

a) Including system reserve

b) Actual existing generation capacity

Source: WAPDA

ANNEX-07

WATER SCARCITY INDICATORS (BY FALKENMARK)

> 1700 m^3 / Capita	Water Scarcity Rare
< 1700 m^3 / Capita	Country Faces Seasonal or Regular Water-Stressed Conditions
<1000 m^3 / Capita	Water Shortages Hamper the Health and Well Being of the Human Beings
<500 m^3 / Capita	Shortages are Severe Constraints to Human Life

CONSEQUENCES OF NOT BUILDING LARGE DAMS

- Progressive loss of existing storage capacity with resultant shortfall in committed irrigation supplies.
- Recurring Inter-provincial disputes on water sharing, particularly during early Kharif (in the prevailing drought) when even existing irrigation uses cannot be sustained in the absence of additional storage(s).
- Serious undermining of national food security.
- Stinted growth of domestic industrial and agricultural sectors.
- Non-utilization of large water escapage to sea providing an excuse to upper riparians (India / Afghanistan) to make harmful unauthorized abstractions from the Western Rivers.
- Enhanced dependence on thermal power generation through imported fuel causing prohibitive rise in the power tariff.

ANNEX-09

OBJECTIVES OF WAPDA'S VISION 2025 PROGRAMME [a)]

- Development of 26 MAF of Storages
- Development of 23,000 MW of Hydro, Coal and Gas Power Stations
- Development of low head hydels on canals
- Encourage private sector investment (foreign / local) and private / public sector joint ventures
- Support economy and poverty alleviation in backward areas

a) Approved by Federal Cabinet in 2001

ANNEX-10

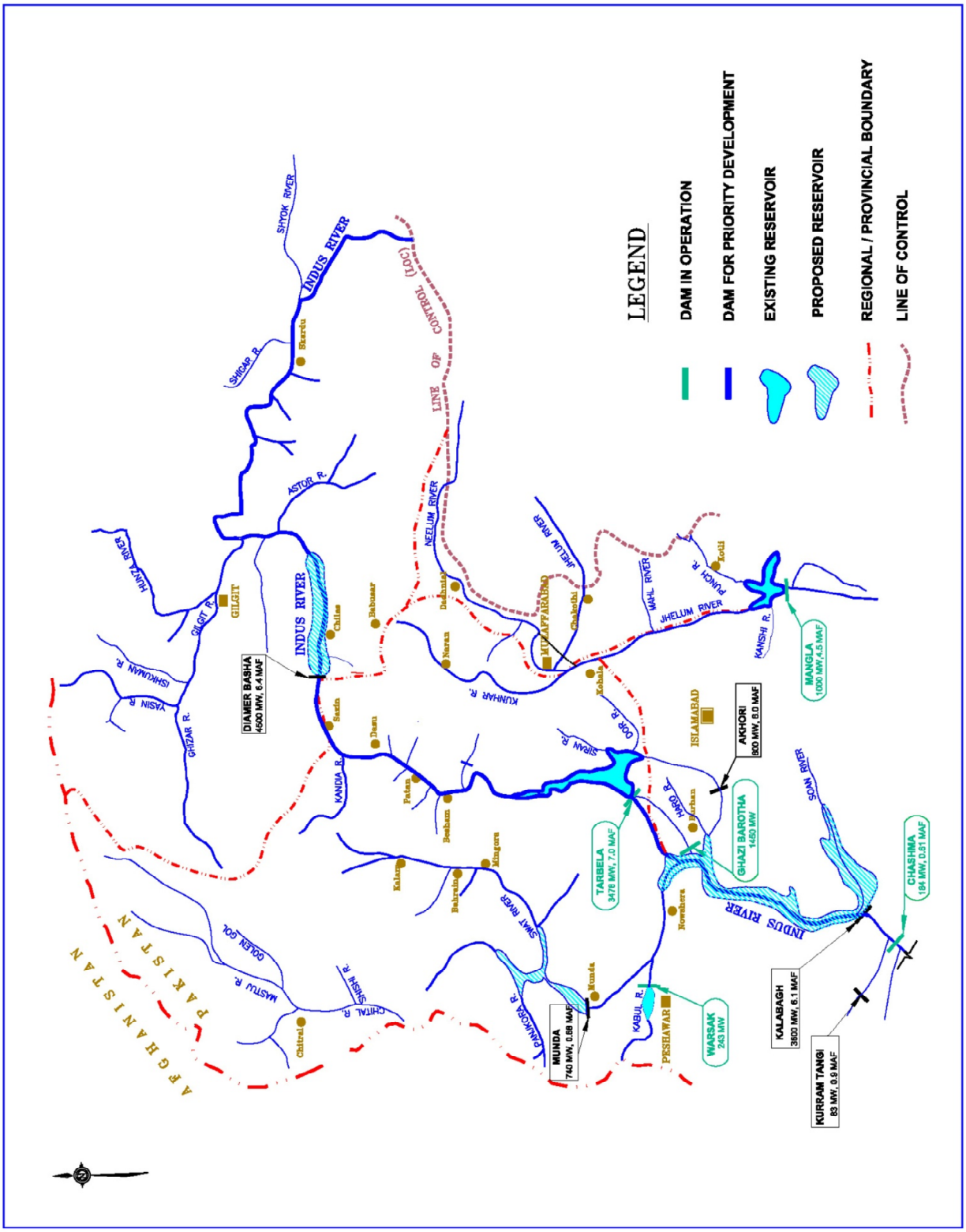
ESTIMATED MINIMUM ADDITIONAL STORAGE REQUIREMENT [a] BY 2025

		MAF
1.	**Replacement of On-line Storage Loss**	**6**
2.	**Meeting shortfall between projected demand and anticipated withdrawals of 2025:-**	
i.	Minimum Demand	125
ii.	Anticipated Withdrawals Without Additional Storage	105
iii.	Corresponding Storage Requirement @ 60% of 20 MAF Shortfall	12
3.	**Total Storage Requirement [1+2(iii)]**	**18**

a) Corresponding to WAPDA's Vision 2025 Programme and ADB's Water Strategy Study

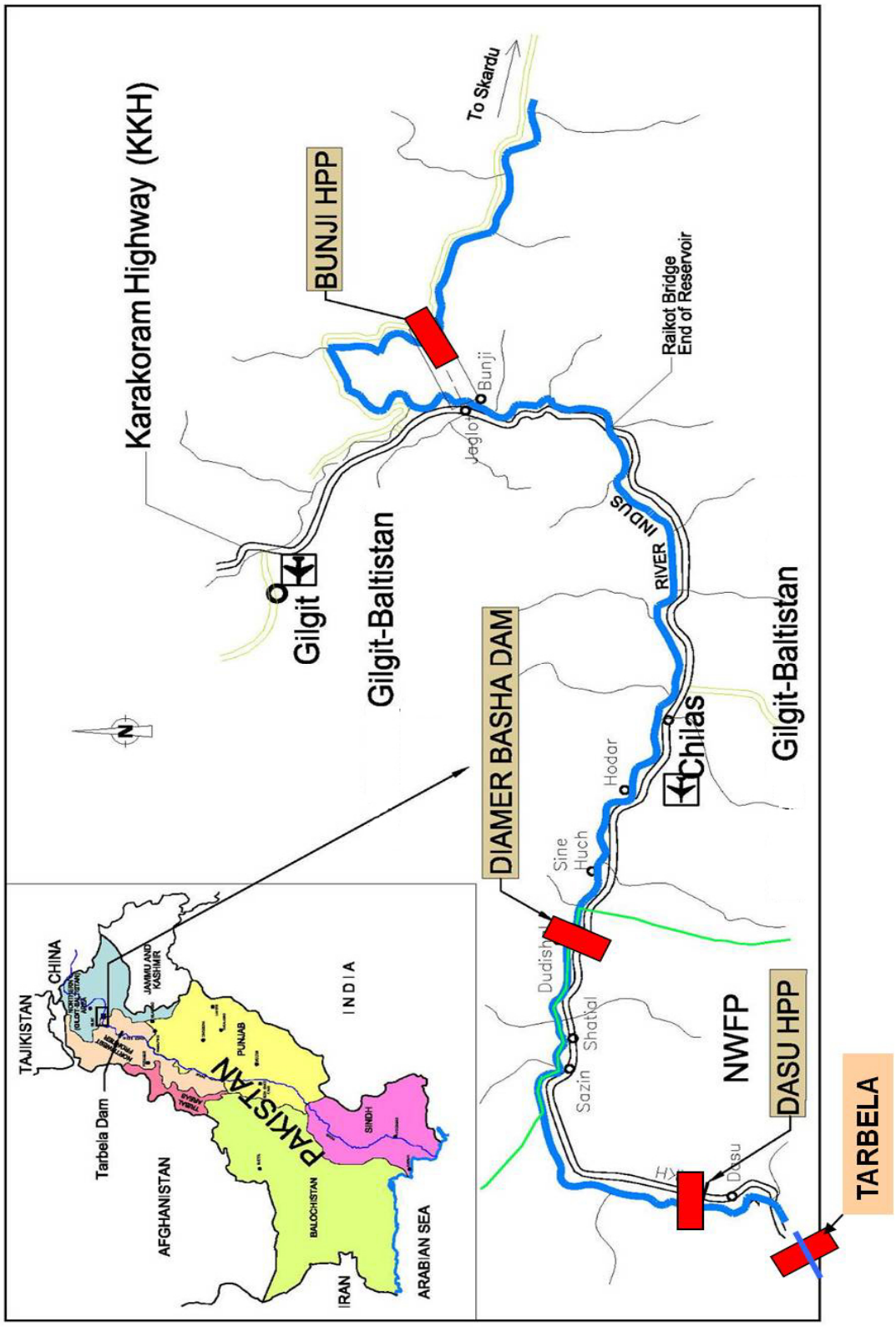
ANNEX-11

EXISTING AND PROPOSED MULTIPURPOSE DAMS IN PAKISTAN



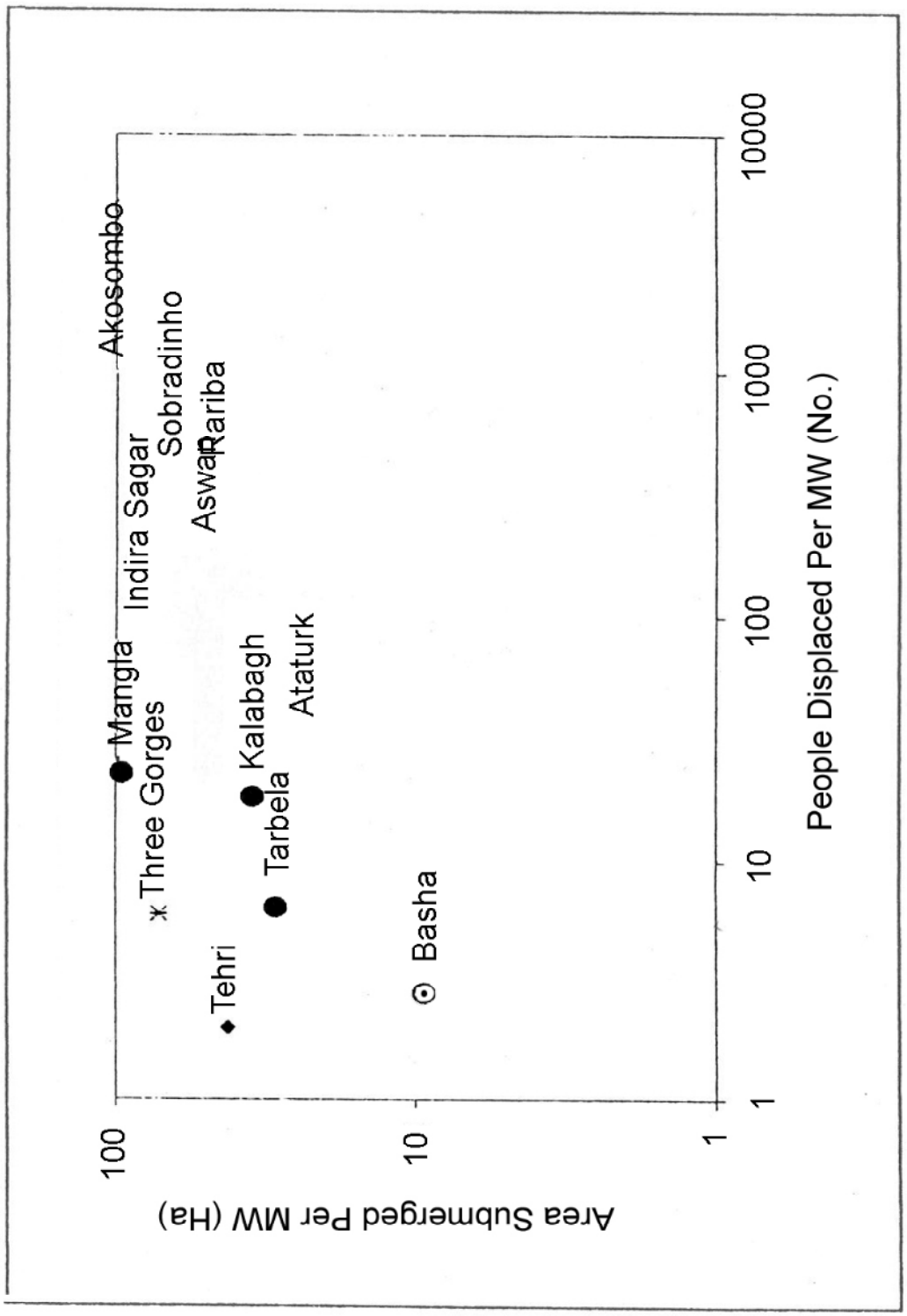
ANNEX-12

DIAMER BASHA DAM & VICINITY MAP



ANNEX-13

PARTIAL ENVIRONMENTAL AND SOCIAL INDICATORS FOR SOME MULTIPURPOSE DAMS



Source: FODP - Water Sector Task Force Report