



HYDRO POTENTIAL IN PAKISTAN



PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY

(November 2011)

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

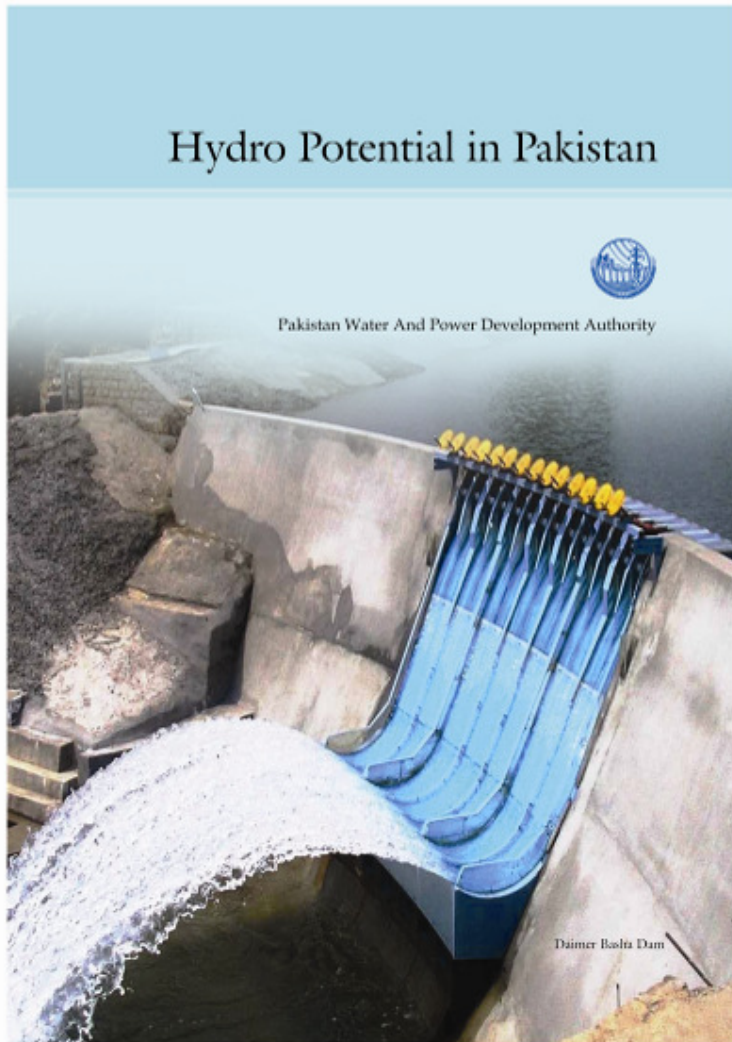
وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ حَيٍّ

And We have made from water Every living thing
Al-Quran (21:30)

Hydro Potential in Pakistan



Pakistan Water And Power Development Authority



Daimir Bolta Dam

PREFACE

Energy and water are the prime movers of human life. Though deficient in oil and gas, Pakistan has abundant water and other energy sources like hydel power, coal, wind and solar power.

The country situated between the Arabian Sea and the Himalayas, Hindukush and Karakoram Ranges has great political, economic and strategic importance. The total primary energy use in Pakistan amounted to 60 million tons of oil equivalent (mtoe) in 2006-07. The annual growth of primary energy supplies and their per capita availability during the last 10 years has increased by nearly 50%. The per capita availability now stands at 0.372 toe which is very low compared to 8 toe for USA for example.

The World Bank estimates that worldwide electricity production in percentage for coal is 40, gas 19, nuclear 16, hydro 16 and oil 7. Pakistan meets its energy requirement around 41% by indigenous gas, 19% by oil, and 37% by hydro electricity. Coal and nuclear contribution to energy supply is limited to 0.16% and 2.84% respectively with a vast potential for growth.

The Water and Power Development Authority (WAPDA) is vigorously carrying out feasibility studies and engineering designs for various hydropower projects with accumulative generation capacity of more than 25000 MW. Most of these studies are at an advance stage of completion. After the completion of these projects the installed capacity would rise to around 42000 MW by the end of the year 2020. Pakistan has been blessed with ample water resources but could store only 13% of the annual flow of its rivers. The storage is fast depleting due to sedimentation. In contrast US has developed 497% storage capacity of annual flow of River Colorado; Egypt possesses 281% of River Nile and India 35% on Sutlej-Bias Basin. All these statistics warrant construction of number of reservoirs to enhance availability of water which stands at 1070 cubic meter per capita. Anything below 1000 cubic meter tantamount to a crisis situation. The hydropower potential in Pakistan is over 100,000 MW with identified sites of 59000 MW. Currently, studies under way include Diamer Basha (4500 MW), Bunji (7100 MW) and Kohala (1100 MW) amongst many others.

Pakistan with 185 billion tons of coal reserves, the fourth largest in the world, is under utilizing this resource. In the overall energy mix, the share of coal power is only 7% as compared to world average of 40%. Coal is the main source for producing cheaper electricity and the Government has decided to enhance the share of coal in the overall energy mix of upto 18% in 2030. The Government is striving hard to minimize the gap between consumption and generation of electricity at affordable rate.

The Government Power Policies of 1995 and 2002 have encouraged many private sector foreign and local investment through the Independent Power Producers (IPPs).


Muhammad Imtiaz Tajwar
Secretary WAPDA

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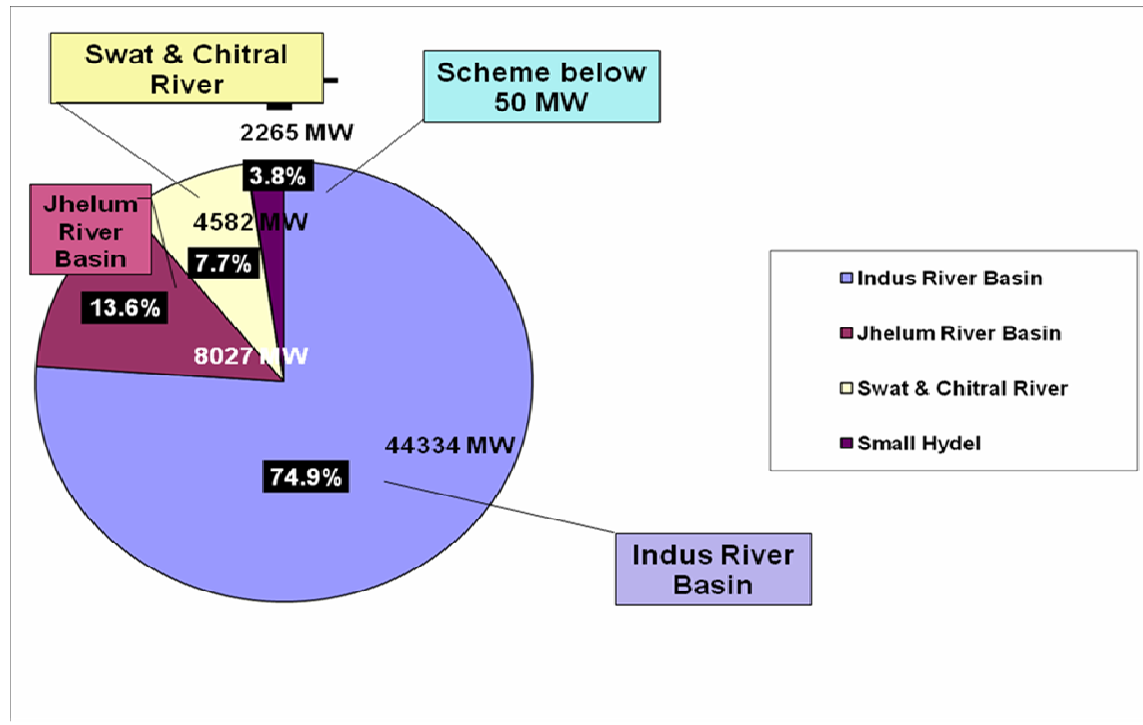
WATER AND POWER SECTOR DEVELOPMENT

- Irrigated agriculture is the backbone of Pakistan's economy. The agriculture sector is the major user of water and its consumption will continue to dominate the water requirements. Direct rainfall contributes less than 15 percent of the water supplied to the crops. The major user of water for irrigation is the Indus Basin Irrigation System. About 105 Million Acres Feet (MAF) out of 155 MAF of surface water is being diverted annually for irrigation while around 48 MAF is pumped from groundwater.
- Pakistan has a total 196.72 MA area out of that 72.70 is cultivable. The cultivated area (Irrigated & Barani) has come to 52.31 MA, whereas 47.62 MA is area under all sort of irrigation sources. (27 MA is the area under canal irrigation).
- With large cultivable land base of 77 Million Acres (MA) of which only 27 MA are canal commanded, Pakistan still has the additional potential of bringing about 20.3 MA of virgin land under irrigation.
- With increased population, Pakistan is fast heading towards a situation of water shortage. Per capita surface water availability was 5260 cubic meters in 1951 when population was 34 million, which reduced to 1038 cubic meter in 2010 when the estimated population is 172 million. The minimum water requirement to being a "water short country "is 1,000 cubic meters. In the year 2012, Pakistan will have reached the stage of" acute water shortage"
- According to the 1960 Indus Water Treaty, signed between India and Pakistan with the good offices of World / Bank, India was allowed exclusive rights to use waters of Ravi, Sutlej and Beas rivers, whereas the waters of Western Rivers, Indus, Jhelum and Chenab were assigned to Pakistan. Under the 1960 Treaty, the Indus Basin Replacement Works comprising two major dams, 5 barrages and 8 link canals were constructed to alleviate the problems. However, due to excessive sediment inflows in the river water, all the three storages (Tarbela, Mangla, Chashma) are rapidly losing their capacities. By the year 2025, these storages would lose 37% (6.27 MAF) of their capacity, which virtually means loss of one mega storage project.
- An annual average of over 35.2 MAF escapes below Kotri varying from 9 MAF to 92 MAF. However this surplus water in the river system is available in about 70-100 days of summer only. To save and utilize available water, construction of additional storage facilities is essential for sustainable irrigated agriculture, which supports about 70% of the population of Pakistan.
- National demand of electricity has been and would keep on growing rapidly. Based on the present generation capacity, the hydel:thermal mix in the country is 31:69, which is almost the reverse of an ideal hydel - thermal mix, which should be 70:30 for overall economic development of the Pakistan. Though induction of thermal generation initially helped in overcoming load shedding, it resulted in substantial increase in power tariff. Therefore, a sizeable injection of cheap hydropower through multipurpose storages is a viable option to keep the cost of electricity within affordable limits.
- To facilitate the process of economic development and to ensure greater social stabilization in Pakistan, it is imperative that employment creation and poverty reduction issues are addressed on priority. Additional water storages and power generation would form the basis of this strategy during the next decade.
- At present the rated electric power generating capacity in Pakistan is only 21000 MW with the demand growing at 10% annually. The average per capita consumption is only 482 units. Power shortage in the industrial, agricultural and domestic sectors has been evident for the past few years with the shortage assuming critical proportions last year. The water shortage is even more acute. To feed a population of nearly 172 million people, existing water storage capacity of 15 Million Acre Feet (MAF) needs to be tripled in the years ahead so that the remaining 20 million acres of cultivable land can be brought under plough. Water conservation and increased water productivity must also be encouraged.
- It is an economically unsustainable fact that the total water storages capacity in the country is only 15 MAF representing 13% of the total annual flows of 136 MAF. Countries

in Asia, Africa and the Americas have a storage capacity many times greater. To address this problem the Government of Pakistan (GoP) is developing feasibility and detailed engineering studies for nearly 20 MAF of water storage and 25,000 MW of hydel power. This is apart from thermal power being developed by the private sector, Independent Power Producers (IPPs) and the Government.

- Pakistan has a total area of 197 million acres (MA) out of that 73 Million Acres is cultivable out of that 56 MA is irrigated. Pakistan still has the potential to bring about 20 MA of rain fed land under irrigation. Pakistan had a storage capacity of 15.74 MAF in 1976 which has been reduced to 12.10 MAF in 2010 due to excessive sediment inflows in the river water. The three storages (Tarbela, Mangla, Chashma) are rapidly losing their capacities and by 2025, it is expected that we may lose 37% (6.27 MAF) of their capacity which virtually means loss of one mega storage project. To save and utilize available water and to ensure the water availability, construction of additional storage facilities is essential for sustainable irrigated Agriculture. Accordingly, serious efforts were made for the construction of large reservoirs during **2008-11** when **Diamer Basha Dam** (to store 8.1 MAF & to generate 4500 MW) was approved in 2009 whereas construction work has commenced in 2010. On completion of **Diamer Basha Dam**, the water availability will be restored to the level of 1976. Besides, **Mangla Dam Raising** project has been completed in 2010 which will store 2.88 MAF of water in addition to existing capacity of 5.37 MAF. In addition, multipurpose **Gomal Zam Dam** in **South Waziristan** Agency to store 1 MAF of water and to generate 17 MW of power has been substantially completed in 2010. **Satpara Dam** in Skardu (Gilgit Baltistan) to store 93000 Acre Feet & to generate 17.3 MW of power has been substantially completed and its two power units are generating 8 MW of hydropower. **Mirani Dam** in Turbat (Balochistan) (storage capacity of 3 lac Acre Feet) & **Sabakzai Dam** Zhob (Balochistan) (storage capacity of 33000 Acre Feet) have been completed in 2009 respectively. **Munda Dam** (1.3 MAF) & **Kurram Tangi Dam** (1.2 MAF) will be constructed in near future to mitigate flood & to generate cheap hydropower to irrigate the barren & undeveloped areas, Mega canals were built during these years i.e. **Greater Thal Canal** (Punjab) completed and handed over to Govt of Punjab in 2009 whereas work on **Katchhi Canal (Balochistan)** and **Rainee Canal** (Sindh) will be completed by December 2011.
- The installed power generation capacity was 18000 MW in year 2007 which has been increased to 21036 MW in year 2011. Out of that 6,516 MW is produced through Hydropower, 3,580 MW by Government (GENCOs), 8,295 MW by Independent Private Power Producers (IPPs) and 594 MW through Private Rental. **WAPDA is producing this Hydropower @ Rs.1.06 per unit as compared to Rs.9.07 per unit of Thermal Power being produced by IPPs and Rs.14.74 of thermal power produced by Rental Power.** The demand of power is currently about 20,000 MW which will rise to 36,000 MW in the year 2015. WAPDA has added 72 MW to the system in 2010 whereas it will add 1556.76 MW when **Duber Khwar HPP (130 MW), Allai Khwar (121 MW), Jinnah HPP (96 MW), Gomal Zam Dam (17.4 MW), Satpara Dam (17.36 MW), Rehabilitation of Tarbela (100 MW)** will produce power **within 2011-12** whereas **Golen Gol (106 MW)** and **Neelum Jhelum HPP (969 MW)** will produce power in year 2015-16. In addition, WAPDA has initiated activities to produce 19194 MW in next 5 years through **Diamer Basha Dam (4500 MW), Kurram Tangi Dam (84 MW), Tarbela 4th Extension (1410 MW), Munda Dam (740 MW), Dasu Dam (4320 MW), Bunji Dam (7100 MW) and Kohala Dam (1100 MW)** respectively. It is worth mentioned that WAPDA has generated **27614 GWH** in year **2009-10** which were enhanced to **31511 GWH in year 2010-11 @ Rs.1.06 per unit** whereas equivalent thermal unit is being produced **@ Rs.10.00 per unit thus WAPDA made a saving of Rs.65847 million in one year.**
- To achieve the above objectives the GoP through WAPDA and the private sector plans to concentrate on the following water and power projects in the next few years: (i) Construction of large dams including Diamer-Basha Dam for Public/Private Partnership (ii) Construction of Hydropower Projects (iii) Construction of Medium/Small Water Storage Dams (iv) Construction of Canals (v) Construction of Transmission Lines for dispersal of Power from Hydropower Project to Load Centres of National Grid. These projects would create additional water storages, generate cheap indigenously developed electricity and prevent flood damages. All these measures would also ensure food security, employment generation and above all poverty alleviation.

PAKISTAN'S HYDROPOWER POTENTIAL



SUMMARY OF HYDROPOWER POTENTIAL (RIVERWISE)

Sr. No.	River/ Tributary	Power (MW)
A	Hydropower Projects above 50 MW	
1	Indus River	38608
2	Tributaries of Indus in Gilgit-Baltistan	1698
3	Tributaries of Indus in Khyber-Pakhtunkhwa	4028
	Sub Total (1-3)	44334
4	Jhelum River	4341
5	Kunhar River	1455
6	Neelum River & its Tributaries	1769
7	Poonch River	462
	Sub Total (4-7)	8027
8	Swat River & its Tributaries	2297
9	Chitral River & its Tributaries	2285
	Sub Total (8-9)	4582
	Total A	56943
B.	Hydropower Projects below 50 MW	
1	On Tributaries	1591
2	On Canals	674
	Total B	2265
	TOTAL (A+B)	59208

HYDEL STATIONS IN OPERATION

Sr. No.	Power Station	Installed Capacity (MW)	Energy Generation (GWh)	Commercial Operation Date
1	Tarbela	3,478	15,801	1977-93
2	Ghazi Barotha	1,450	7,037	2003-04
3	Mangla	1,000	5,443	1967-94
4	Warsak	243	1,009	1960-81
5	Chashma	184	959	2001
6	Rasul	22	63	1952
7	Dargai	20	162	1952
8	Nandipur	14	32	1963
9	Chichoki	13.2	23	1959
10	Shadiwal	13.5	38	1961
11	Other Small Hydel	6	29	1925,1975,1982
12	Khan Khwar	72	306	2011
TOTAL		6,516	30,900	

HYDROPOWER PROJECTS – UNDER CONSTRUCTION

Sr #	Name of Project	PC-I Cost (Rs. Billion)	Hydropower (MW)	Progress/ Completion
1.	Mangla Dam Raising Mirpur, AJK	62.558	Addl 644 GWh	Substantially completed
2.	Gomal Zam Dam, South Waziristan Agency	12.829	17.4	71% Feb 2013
3.	Satpara Dam Skardu	4.806	17.36	99.4% Nov 2011
4.	KHAN KHWAR Besham, KPK	8.301	72	Substantially Completed Feb 2011
5	DUBER KHWAR Kohistan, KPK	16.324	130	80.5% Dec 2011
6.	ALLAI KHWAR – Battagram, KPK	8.578	121	79.5% Feb 2012
7.	JINNAH HYDROPOWER, Jinnah Barrage	13.546	96	89.5% Dec 2012
8.	NEELUM JHELUM Neelum, AJK	84.502	969	27.5% Oct 2015
9.	Repair & Maintenance of Units 1,3 & 4 of Tarbela Power House	1.403	100	Dec 2011
10.	Golen Gol – Khyber Pakhtunkhwa	7.035	106	Feb 2015
Total		219.882	1628.76	

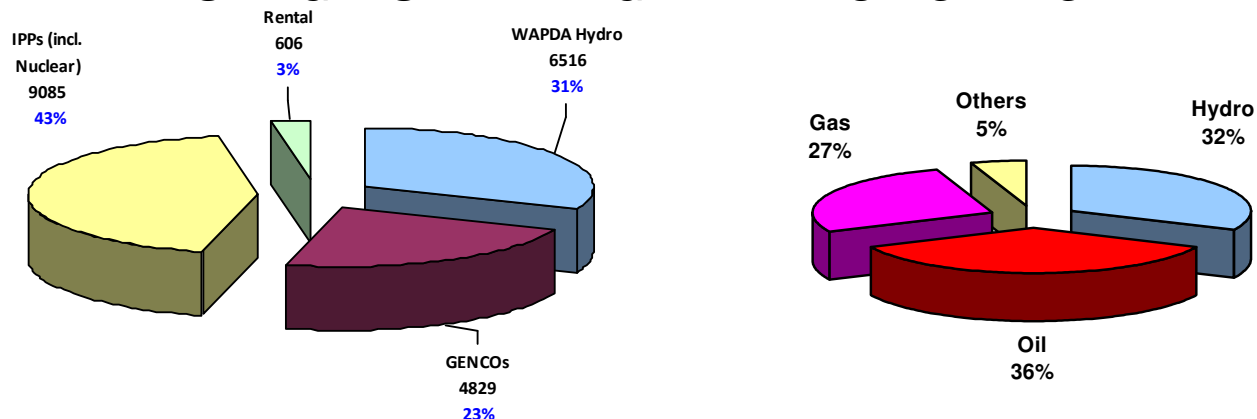
HYDROPOWER PROJECTS WHICH CAN BE UNDERTAKEN FOR IMPLEMENTATION DURING NEXT FIVE YEARS

S#	Project	River	Capacity (MW)	Storage (MAF)	Estimated Cost (US\$ Million)	Earliest Project Initiation	Status
1.	DIAMER BASHA – Gilgit Baltistan	Indus	4500	8.1	11178	2011	Ready for Construction
2.	KURRAM TANGI – FATA/KPK	Kurram	84	1.2	700	2011	Ready for Construction.
3.	TARBELA 4TH EXT. – Khyber Pakhtunkhwa	Indus	1410	-	826	2011	Detailed Engineering and Design is under process.
4.	MUNDA – FATA/KPK	Swat	740	1.3	1401	2012	Feasibility Completed. RFP under issue for Detailed Engineering and Design.
5.	KOHALA – AJK	Jhelum	1100	RoR	2212	2012	Feasibility Study, Detailed Engineering & Design completed. LOI issued by PPIB.
6.	BUNJI – Gilgit Baltistan	Indus	7100	RoR	6800	2012	Feasibility Study completed. Detailed Engineering & Design completed and under review by WAPDA experts.
7.	DASU– Khyber Pakhtunkhwa	Indus	4320	1.15	6000	2014	Feasibility Study completed. Selection of Consultants for Detailed Engineering & Design is under process.
8.	Lower Spat Gah(496), Lower Palas Valley(665), Mahl(600)		1761	RoR		2011	Projects for Public Private Partnership
Total			21015	11.75			

HYDROPOWER PROJECTS FOR PUBLIC PRIVATE PARTNERSHIP (PPP)

- Lower Palas Valley Hydropower Project (Khyber Pakhtunkhwa) – EOIs invited last date is 18th November, 2011, also available on WAPDA website www.wapda.gov.pk.
- Lower Spat Gah Hydropower Project (Khyber Pakhtunkhwa) – EOIs invited last date is 18th November, 2011, also available on WAPDA website www.wapda.gov.pk.
- Lawi Hydropower Project (Khyber Pakhtunkhwa)
- Mahl Hydropower Project (AJK)
- Hingol Dam Project (Balochistan)

EXISTING INSTALLED GENERATION CAPACITY



ELECTRICITY GENERATION BY FUEL

HYDROPOWER PROJECTS

1. Diامر Basha Dam Project
2. Transmission Scheme for Dispersal of Power from Diامر-Basha Hydropower Project to Major Load Centres in the National Grid
3. Kurram Tangi Dam Multipurpose Project
4. Tarbela 4th Extension
5. Transmission Scheme for Dispersal of Power from Tarbela 4th Extension Hydropower Project to Gatti Faisalabad
6. Kohala Hydropower Project
7. Transmission Scheme for Dispersal of Power from Kohala Hydropower Project to Gujranwala
8. Munda Dam Project
9. Transmission Scheme for Dispersal of Power from Munda Dam Project to Peshawar
10. Bunji Hydropower Project
11. Transmission Scheme for Dispersal of Power from Bunji Hydropower Project to Major Load Centres in the National Grid
12. Keyal Khwar Hydropower Project
13. Golen Gol Hydropower Project
14. Dasu Hydropower Project
15. Transmission Scheme for Dispersal of Power from Dasu Hydropower Project to Major Load Centres in the National Grid
16. Lower Spat Gah Hydropower Project
17. Lower Palas Valley Hydropower Project
18. Akhori Dam Project
19. Thakot Hydropower Project
20. Pattan Hydropower Project
21. Phandar Hydropower Project
22. Basho Hydropower Project
23. Lawi Hydropower Project
24. Harpo Hydropower Project
25. Yulbo Hydropower Project
26. Suki Kinari Hydropower Project
27. Shyok Dam Project
28. Trappi Hydropower Project
29. Matiltan Hydropower Project
30. Mahl Hydropower Project
31. Gulpur Hydropower Project
32. Kotli Hydropower Project
33. Transmission Scheme for Dispersal of Power from Neelum-Jhelum Hydropower Project to Rawat & Gujranwala
34. Ultra Mega Power Project/Park
35. Rehabilitation of Tarbela, Mangla & Warsak Hydel Power Stations

REGIONAL DAMS

36. Winder Dam Project
37. Darawat Dam Project
38. Ghabir Dam Project
39. Tank Zam Dam Project
40. Naulong Dam Project
41. Hingol Dam Project
42. Garuk Dam Project
43. Pelar Dam Project
44. Nai Gaj Dam Project
45. Bara Multipurpose Dam Project
46. Daraban Dam Project
47. Papin Dam Project
48. Supleji Dam Project

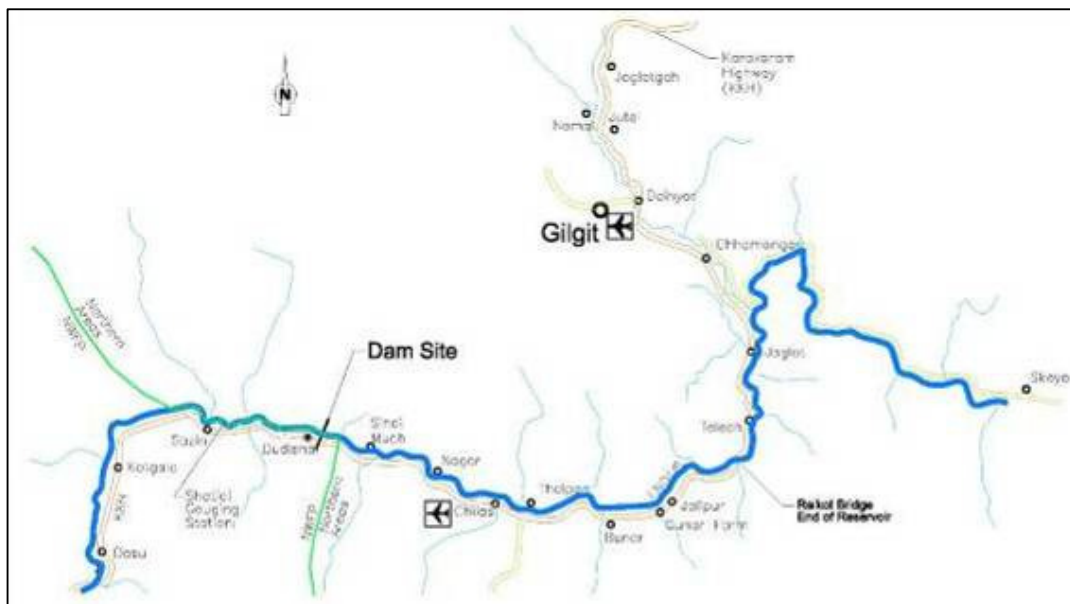
DIAMER BASHA DAM PROJECT

GENERAL

Government of Pakistan decided to construct 5 multi-purpose storages in the country during next 10 -12 years. Diamer Basha Dam Project will be undertaken in the first phase. President of Pakistan performed the groundbreaking ceremony of the project. Detailed engineering design of the dam and allied structures is completed and tender documents are ready. Project work is divided into five lots, which would be implemented by contractors through international competitive bidding.

THE PROJECT

The project is located on Indus River, about 315 km upstream of Tarbela Dam, 165 km downstream of the Gilgit-Baltistan capital Gilgit and 40 km downstream of Chilas (refer location map). The proposed dam would have a maximum height of 272 m, and impound a reservoir of about 8.1million acre feet (MAF), with live storage of more than 6.4 MAF. Mean annual discharge of Indus River at the site is 50 MAF. Thus the dam will impound 15% of the annual river flow. The dam project would cover an area of 110 km² and extend 100 km upstream of the dam site upto Raikot Bridge on Karakoram Highway (KKH).



The dam is located at the boundary of Gilgit-Baltistan (GB) and Khyber Pakhtunkhwa (KPK) in such a way that the right abutment and the right Power House is in GB while the left bank of the dam and the left Power House is in Khyber Pakhtunkhwa. WAPDA offices and Colony including that of the Consultants shall be in the Thor Nallah Valley in GB while the Contractor's Camp and fabrication yard and workshop shall be in Khyber Pakhtunkhwa

NEED OF THE PROJECT

Agriculture is the backbone of Pakistan's economy. Pakistan today is among one of the World's fastest growing population, now estimated as over 150 million. Due to lack of large river regulation capability through sizeable storages, the country is already facing serious shortages in food grains. Given the present trend, Pakistan could soon become one of the food deficit countries in the near future. Therefore, there is a dire need to build storages for augmenting agriculture production.

Tarbela, Mangla and Chashma reservoirs have already lost about 5.3 MAF due to sedimentation. It is estimated that by year 2016, this loss would increase to 6.6 MAF, almost equal to the original combined capacity of Mangla and Chashma reservoirs. Due to complete stoppage of any sizable multi-purpose storage development after commissioning of Tarbela Dam in 1976, sustainability of existing irrigated agriculture of Pakistan is in serious jeopardy.

The present demand of electricity in country is above 18,000 MW, which is estimated to cross 30,000 MW by the year 2017. A large-scale injection of power thus becomes inevitable. Hydropower will provide the required electricity at affordable price. Contribution of 4500 MW power from Diamer Basha Dam will go a long way in alleviating this situation.

MAIN FEATURES

➤ Main Dam	
Maximum Height	272 m
Type	Roller Compacted Concrete (RCC)
➤ Diversion System	
	2 No. Diversion tunnels
	1 No. Diversion channel
	Upstream and Downstream Cofferdams
➤ Reservoir Level	1160 m
Gross capacity	8.1 MAF (10.0 BCM)
Live capacity	6.4 MAF (7.9 BCM)
Min. operation level	El.1060 m
➤ Power House(s)	2
Total installed capacity	4500 MW
Location and type	Two, one each under the right and left abutment
No. of units	12 each of 375 MW
Average generation	19000 Gwh/year
➤ PC-I approved cost	Rs.894,257 million (US\$ 11.178 Billion)
➤ EIRR	15.3%

PROJECT BENEFITS

- Availability of about 6.4 MAF annual surface water storage for supplementing irrigation supplies during low flow periods
- Harnessing of renewable source of clean and cheap energy through installed capacity of 4500 MW
- Average Annual Generation 19208 GWh
- Extend Life of Tarbela reservoir by blocking the sediments
- Additional Annual Generation at Tarbela 1111GWh
- Reduction of dependence on thermal power, thus saving foreign exchange
- Employment opportunities (direct employment = 70,426 persons & indirect employment = 2.78 million persons), particularly to the locals during the construction and operation 7633 worker to be trained.
- Creation of massive infrastructure leading to overall socio-economic uplift of the area and standard of living of people
- The Project will pay back its cost in 8 years

FINANCIAL BENEFITS

- Financial Benefits of electricity produced – US\$ 1.9 Billion (19 Billion units x 10 cents)
- Financial Benefits of water stored – US\$ 0.660 Billion
- Water impounded by reservoir shall help to mitigate downstream flood losses. The avoidance of flood damages cost would be even much more than Rs.2, 331 million per annum.
- Savings in Foreign Exchange of Equivalent electricity on imported oil - US\$ 2.85 Billion
- Carbon Credit Benefits – US\$ 0.300 Billion
- Had Diامر Basha Dam constructed before 2010, it could saved the flood devastation occurred amounting to US\$ 10 billion.

ENVIRONMENT AND CULTURAL HERITAGE IMPACT ASSESSMENT

- | | |
|------------------------------------|-------------------------------|
| ▪ Total Villages affected | 32 |
| ▪ Household/Families affected | 4228 |
| ▪ Persons affected | 30350 |
| ▪ Total Area to be affected | 37419 acres |
| ▪ Agricultural land submerged | 2660 acres |
| ▪ Existing Length of KKH submerged | 100 km |
| ▪ Length of KKH relocated | 140 km |
| ▪ Pre-historic rock carvings | 33000 |
| ▪ Infrastructure | Electricity Lines, Roads etc. |
| ▪ Total land to be acquired | 37,419 Acres |
| | (Private Land = 18,014 Acres) |
| | (Govt. Land = 19,405 Acres) |
- Nine Model Villages with all the amenities shall be built for resettlement of the affectees.
 - Selected important rock carvings shall be displayed in a museum in Chilas others shall be preserved in situ.
 - Resettlement and Environment management plans have been prepared on the international norms.

ADB's SAFEGUARDS

- National consensus in the form of approval of the Project preferably from the Parliament or Council of Common Interests (CCI) is required to proceed further;
- Strong adherence to ADB’s safeguard policies for resettlement and environment protection, and full compliance with ADB’s procurement guidelines; and
- It has to be a country driven project demonstrating political will, technical capability and ownership at the highest level of the Government.

RESETTLEMENT ACTION PLAN

Top priority has been accorded to resettle and rehabilitate the affected households by the project intervention. A comprehensive Resettlement Action Plan (RAP) has been drawn up, covering all activities with specific timelines. The plan ensures the relocation of affected families to model villages, safety of their livelihoods through income generation schemes and improvement of socio-economic conditions.

SALIENT FEATURES

A Land Acquisition and Resettlement (LA&R) Wing was created by WAPDA for the first time for hydropower projects in Pakistan and specialists were hired in the following disciplines:

- | | |
|---------------------------|----------------|
| ✓ Environment | ✓ Anthropology |
| ✓ Monitoring & Evaluation | ✓ Agronomy |
| ✓ Gender Development | ✓ Soil Science |
| ✓ Social Welfare | ✓ Irrigation |
| ✓ Community Development | ✓ Livestock |
| ✓ Tribal Area Development | |

ENVIRONMENT MANAGEMENT PLAN

The objective of Environmental Management Plan is to conserve and restore natural forests, improve biodiversity, limit damage to environment, safe endangered species, enforce mitigation measure and limit degradation of natural water springs. The following are the main features:



S#	Activities	Cost (US\$ in millions)
1	Ecological Conservation Plan to be executed by WWF (World Wide Fund For Nature)	7.52
2	Environmental Management Cell	1.46
3	Environmental Monitoring and Mitigation 1 Integrated Water Resource Management Plan 2. Climate and Air Management Plan 3. Health Protection & Safety Management Plan	0.44
4	Environmental Research,	0.66
Total		10.08

SAFEGUARD REVIEW ON LAND ACQUISITION & RESETTLEMENT

Requirement of Land

The land requirement for the Diamer Basha Dam Project is as under:

- Private Land 18014 acres
- Government Land 19405 acres

Total 37419 acres

Land Compensation Rates

For the purpose of deciding the rates for land compensation for this project, a committee was formed in which all the stakeholders were taken on board. This committee included Federal Ministers, Govt. of Gilgit Baltistan (Chief Secretary / Revenue Commissioner), District Collector of Diamer, Representatives of Affected of DBDP, Dam Action Committee, Religious leaders, Members of Legislative Assembly (G-B), Civil Societies, Local Jirgas, Ministry of Water & Power and WAPDA. This Committee, after a series of meetings, taking into consideration various categories of lands and locations, decided the land compensation rates as under:

S#	Location	Commercial/ Cultivated land per kanal (Rs.)	Uncultivated land per kanal (Rs.)	Barren land per kanal (Rs.)
1.	Chilas (Municipal Area)	11,00,000/-	4,00,000/-	1,50,000/-
2.	Harpin Das (Model Villages Land)			2,50,000/-
3.	Thore	8,00,000/-	2,59,000/-	1,00,000/-
4.	Hudur	8,00,000/-	2,07,000/-	1,00,000/-
5.	Guner Das/Kino Das			1,00,000/-
6.	Khinar	8,00,000/-	2,07,000/-	1,00,000/-
7.	Thak	8,00,000/-	2,07,000/-	1,00,000/-
8.	Gonar Farm and Guner Das	8,00,000/-	224,960/-	1,00,000/-
9.	Gais to Shing Nullah	8,00,000/-	2,07,000/-	1,00,000/-
10.	Khanbari	8,00,000/-	259,000/-	1,00,000/-

Phases of Land Acquisition

Land acquisition in accordance with Phases was planned as under:

During Phase-I (Year 2011-2012), land to be acquired = 6793 acres

During Phase-II (Year 2012-2013), land to be acquired = 11221 acres

Total: = 18014 acres

Current Status of Land Acquisition

Sr. No.	Land Acquired (acres)	Purpose	Area	Compensation (Rs. in Million)	
				Rs. in Million	US\$ in Million
1.	149.30	WAPDA Colony	Thore Valley Chillas	964.00	11.34
2.	162.00	Contractor's Camp	Bushi Das, Chad Das	92.00	1.08
3.	278.00	Reservoir	Khan Bari	1500.00	17.64
4.	686.40	Model Village	Harpin Das	1372.83	16.14
Total	1275.70			3928.83	46.20

Relocation

The relocation/resettlement plan of 4228 affected households has been drawn up. During Phase-I in the year 2013, first batch of affectees 2500 households will be resettled in Composite Model Village at Harpin Das. The remaining affectees will be accommodated subsequently in Composite Model Villages at Thak Das and Kino Das respectively. The land at Harpin Das was acquired in August this year and the work for construction of Model Village has been allotted.

To improve communication between communities on either side of River Indus, a bridge at Thakot had been recently been constructed at cost of Rs 646 Million (\$7.6 Million).

Livelihood Restoration & Development Program

A project Non Government Organization (NGO) is being engaged for effective implementation of these plans by mobilizing local communities. It will also be utilized for monitoring various stages of resettlement activities. The Various Schemes had been devised after number of stakeholder meetings and their need analysis, keeping in view the social sensitivity of the tribal society. The objective is to engage communities and to provide them food security by ensuring their livelihoods. The activities are listed below:



S#	Activities	Cost (US\$) (US\$ in millions)
1	Project NGO	6.00
2	Agriculture and Livestock	13.31
3	Irrigation and Rural Sanitation	7.54
4	Community Infrastructure	9.20
5	Gender Action Plan	3.50
6	Non Formal Education	5.90
Total		45.45



Corporate Social Responsibility

As a corporate social responsibility, WAPDA has Initiated a number of projects in the following fields:-

S#	Activities	Cost (US\$) (US\$ in millions)
1	Education	21.19
2	Health	1.18
3	Social Safety Net	0.55
Total		22.92

WAPDA has planned to **construct 4 schools** in different valleys, improve and **upgrade two High Schools, one Vocational Training Institute**, improve hospitals and establish **one Trauma Centre** at Chilas District. Due to remoteness of the area, WAPDA plans to organize medical camps in project area in which Specialist doctors from WAPDA hospital Lahore would participate and also train local staff.

B) ENVIRONMENT MANAGEMENT PLAN

(i) The objective of Environmental Management Plan is to conserve and restore natural forests, improve biodiversity, limit damage to environment, safe endangered species, enforce mitigation measure and limit degradation of natural water springs. The following are the main features:

S#	Activities	Cost (US\$ in millions)
1	Ecological Conservation Plan to be executed by WWF (World Wide Fund For Nature)	7.52
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3	Environmental Monitoring and Mitigation 1. Integrated Water Resource Management Plan 2. Climate and Air Management Plan 3. Health Protection & Safety Management Plan	0.44
4	Environmental Research,	0.66
Total		10.08

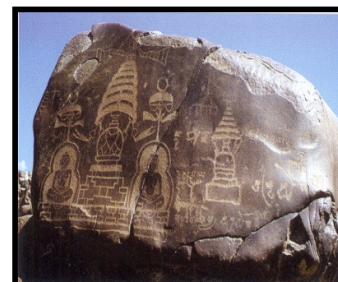


The **Worldwide Fund for Nature (WWF)** had entered into a partnership with WAPDA for conservation and restoration of the ecology of the project area. A mechanism is developed whereby the local communities will be provided with appropriate incentives to help conserve forests, freshwater, pastures and wildlife.

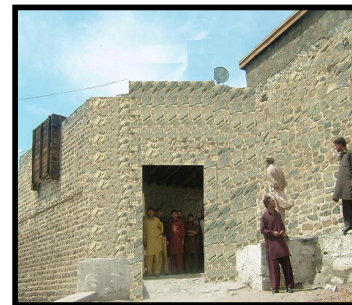
II) *CULTURE AND HERITAGE MANAGEMENT PLAN*

The project area is known for about 33,000 prehistoric rock carving along the Indus Gorge. LA&R Wing has improved and devised a Culture and Heritage Management Plan which includes:

- Documentation and preservation of world famous rock carvings in close collaboration with **Dr. Hauptman and his team of experts from Heidelberg Academy, Germany**. WAPDA is acquiring British Colonial Chilas Fort from Gilgit – Baltistan Government. After renovation, the Fort would be converted into a museum where some of the rock carvings would be placed for posterity.



- Within this museum, the German Embassy has also shown interest to finance WAPDA in developing a special gallery for Mountaineering History. This is in relation to Nanga Parbat (Killer Mountain) which was first scaled by German Mountaineer. An audio Video Library, Archives, cultural center and some shops for local handicraft would also be established in the fort. WAPDA has already restored an old Colonial Dak Bungalow in Thore Valley.



(iii) Promotion of Eco Tourism And Culture

In the Northern Areas of Pakistan, Polo is a household game. Keeping up with popular trends, WAPDA has decided to adopt Polo Team of Chilas and will help Gilgit – Baltistan Government in organizing Babusar Polo Mela. The Babusar Mela alongwith the Polo tournament planned at the highest polo ground in the world would be a major attraction for both local as well as foreign tourists. It will generate economic activity and will also contribute as an additional source of income to the local population. Recreational parks, pony trails, development of lake and promotion of handicraft are other salient features of Culture and Heritage Plan.



S#	Activities	Cost (US\$) (US\$ in millions)
1	Petroglyphs and its Preservation (Dr. Hauptman & Heidelberg Academy)	3.36
2	Chilas Fort, Museums, Library, Culture Center	0.60
3	Promotion of Echo-Cultural Tourism	2.44
Total		6.4

C) GENDER

The project area had particular social sensitivities due to tribal societies and adherence to age old customs. Women had little control over resources, opportunities for personal income generation are low and had negligible levels of literacy. The Gender Unit of LA&R Wing worked out a comprehensive Gender Action Plan (GAP) with a total budget of Rs 487 Million (\$5.73 Million). The salient features of the plan include:

- Capacity Building of Gender
 - Women Skill centre
 - Domestic income schemes
 - Community level supportive health services
- Non-formal education schemes for women and girls

Land Acquisition

- Priority Land Acquisition has started.
- Economic Coordination Committee (ECC) of the Cabinet, GoP on 29.06.2010 has approved the revised Compensation Rates recommended by Ministerial committee constituted by Prime Minister. Federal Cabinet in its meeting held on 14.07.2010 has endorsed decision of the ECC of the Cabinet, resultantly Land Compensation Cost has increased from Rs.26.4 billion to Rs.41.8 billion.
- One Window Compensation Cell has been established by Deputy Commissioner, Diamer.
- Rs.3.969 billion have been released to the Government of Gilgit-Baltistan for acquisition of land as mentioned below:-
- Rs.1964.333 million for Project Colony at Thor. The Award of Acquisition of Land for Project Colony at Thor has been announced by DC, Chilas on 05.01.2011 and land has been handed over to WAPDA Authorities.
- Rs.372.825 million for Model Village at Harpan Das.
- Rs.1540 million for Khanbari valley. The verification & assessment work of submerged area of Khanbari Valley is completed and evaluation work is in progress.
- Rs.92 million was released in 2009 to D.C. Kohistan as part payment for 1298 kanal & 12 marla, land acquisition of Khyber Pakhtunkhwa area.

- DOR Kohistan & DC Diامر both have been written to start the process of acquisition of KKH Bypass (Shatial-Thor-Existing KKH).

KKH Relocation

Draft summary submitted to Ministry of Water & Power to change execution of KKH Bypass from NHA to WAPDA.

Project Colony in Thor Valley

Wapda has planned construction of Project Colony in Thor Valley, Chilas, Distt. Diامر through 15 packages. 11 contracts have been awarded, work at site is in progress.

Composite Model Villages

The construction work of Composite Model Village-II (Harpan Das) is planned through 7 contract packages. One package has been awarded.

DIAMER BASHA DAM STAKEHOLDERS SEMINAR



PROJECT IMPLEMENTATION

Implementation of the dam appurtenant structures shall be through international competitive bidding comprising of the following five lots:-

Sr. No.	Description of work	US\$ Million			
		Local	Foreign	Total Cost	Const. Period (Yrs.)
1.	Contract Lot-1 (Concrete Dam and Related Structures including Diversion Tunnels and Permanent Access Bridge)	1,096	731	1,827	9
2.	Contract Lot-2 (Underground Works and Related Structures (Left and Right Banks))	512	173	685	6.4
3.	Contract Lot-3 (Hydro-Mechanical Equipment and Hydraulic Steel Structures)	42	380	422	8
4.	Contract Lot-4 (Power Plant Generation Equipment (Left and Right Bank))	103	927	1,030	7
5.	Contract Lot-5 (Electrical High Voltage Equipment and Power Plant Electrical Equipment (Left and Right Bank)).	109	954	1,063	7
Total		1,862	3165	5,027	

INDICATIVE FINANCING PLAN OF DIAMER BASHA DAM PROJECT COST

Description	Total	Gop Grants/ WAPDA Hydel Source	ADB	USAID	M.East Donors	Supplier Credit	Private Investment
Land Acquisition	419	419					
Resettlement	332	332					
KKH Relocation (Shatial Bypass)	70	70					
KKH Portion upto Raikot Bridge	216			216			
Construction Camp at Thor	59			59			
Project Construction Cost	5027		1827	700	600	1600	300
Eng. & Project Management	302	80	222				
Physical Contingencies	151		151				
Duties & Taxes	86	86					
Escalation during Construction	2277		964			1013	300
IDC	3139	1300	1039			200	600
Grand Total	12078	2286	4203	975	600	2813	1200
Financing Ratio	100%	19%	35%	8%	5%	23%	10%

Note:

The financing proposals are indicative plans

The capital cost estimates are at 2009 price levels therefore, also include over lapping cost of approx US\$ 1 billion.

PRESENT STATUS

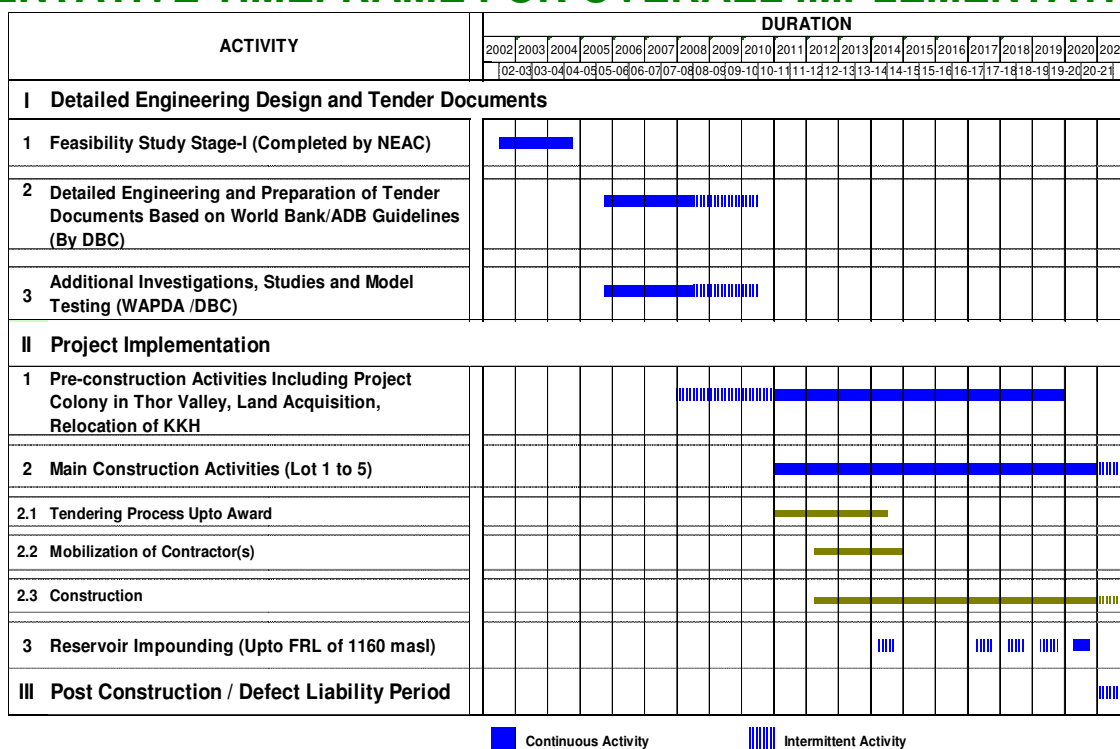
- Detailed Engineering Design of Diamer Basha Dam Project (DBDP) was completed in June-2008.
- PC-I for Land Acquisition and Resettlement was approved by Executive Committee of National Economic Council (ECNEC) on 6.11.2008 for Rs. 60 billion.
- Main PC-I for DBDP was approved by ECNEC on 20.08.2009 for Rs.894.257 billion.
- Resolution on Consensus of Diamer Basha Dam Project approved from Council of Common Interest (CCI) on 18.07.2010 headed by Prime Minister of Pakistan.
- Bridge at Thakot on Indus River is completed by NHA for transportation of material and heavy machinery for construction of Diamer Basha Dam Project.
- Priority Land Acquisition has started.
- 149.3 acres of land for WAPDA colony at Thor has been acquired. An amount of Rs 1964.33 million paid to land owners. Possession of land taken over by WAPDA.
- For acquisition of 278 acres land in Khanbary valley, an amount of Rs 1540 million for compensation paid to Land Acquisition Collector Chilas.

- For 686.4 acres of land in Harpan Das for model village has been acquired, an amount of Rs 372.83 million paid to Land Acquisition Collector Chilas.
- 162 acres of Land for Contractors camp in Kohistan District has been acquired. An amount of Rs 92.0 million paid to District officer Revenue Kohistan
- Uptill now total amount of Rs 3.969 billion paid for land acquisition and 1000 acres has been acquired.
- The land acquisition for KKH by Pass, dam foot prints and model villages is in progress.
- For the administrative and construction supervision staff of WAPDA and Consultants, a project colony shall be constructed in Thor valley about 10 km upstream of the dam site.
- Bids for Project Colony in Thor Valley, District Diamer, Gilgit-Baltistan are almost completed. 7 Contracts have been awarded. Contractors have started works.
- A vocational Training Institute has been setup.
- Inauguration ceremony for commencement of works of Diamer asha Dam Project has been carried out by the Prime Minister of Pakistan on 18.10.2011.

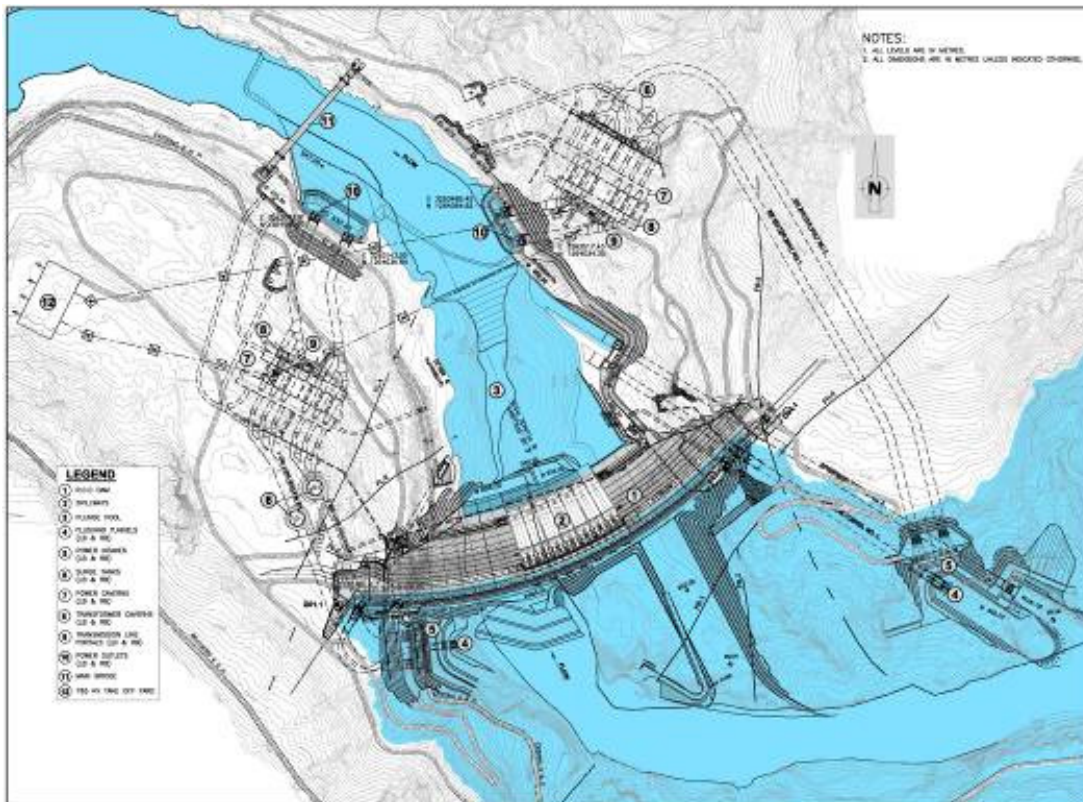
FINANCING ARRANGEMENTS

- GoP is approaching different donor agencies for financing construction of Diamer Basha Dam Project. Asian Development Bank (ADB) and Islamic Development Bank (IDB) have shown their willingness in this regard.
- Islamic Development Bank (IDB) is agreed for partially financing.
- Kuwait Fund and Saudi Fund also agreed for partially financing.
- USAID has agreed to finance / reimburse a part of the expenses made by WAPDA so far.
- Japan Bank of International Cooperation (JBIC) has also been approached for financing.
- During the visit of honorable President of Pakistan, the Kuwait Fund for Arab Economic Development has been agreed to finance the project. WAPDA has requested Economic Affairs Division (EAD) GoP to approach the Kuwait Fund for lending of their technical & commercial group for appraisal of the project.
- The Economic Coordination Committee (ECC) of the Cabinet considered the summary dated 6th January, 2011, submitted by Ministry of Water & Power on “Proposal for Funding of PKR 20 Billion for Diamer Basha Dam Project” and allowed WAPDA to raise funds of Rs.20 billion (with tax exemption) under Government of Pakistan guarantee from the market through TFCs/SUKUKs to be repaid by WAPDA from its own resources. WAPDA is negotiating for loan from Employees Old Age Benefit Institution (EOBI).

TENTATIVE TIMEFRAME FOR OVERALL IMPLEMENTATION



PROJECT LAYOUT



TRANSMISSION SCHEME FOR DISPERSAL OF POWER FROM DIAMER BASHA DAM PROJECT

Diemer Basha Dam Hydro Power Project (HPP) has a generation capacity of 4500 MW and it is expected to be commissioned by year 2018-19. The location of Diemer Basha HPP is on Indus River, 315 km upstream of Tarbela Dam. The 765 kV HVAC Transmission Scheme for Dispersal of Power from Diemer Basha HPP to the major load centers in the National Grid is envisaged as under:

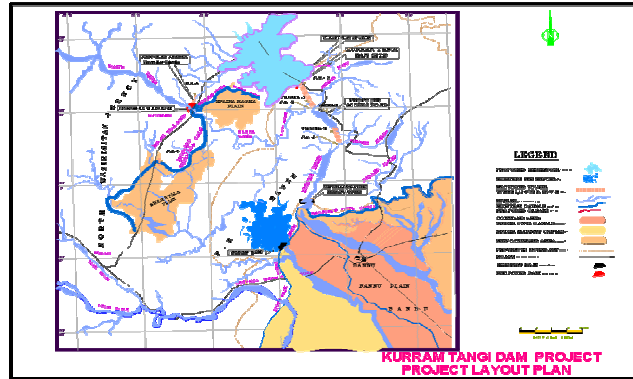
- 765 kV Transmission Lines from Basha HPP to a newly proposed 765 kV Substation at Gujar Khan (3x407 km)
- 765 kV Transmission Lines from Gujar Khan to a newly proposed 765 kV Substation at Lahore (2x260 km)
- In & Out of 500 kV Rewat – Gujranwala Transmission Line at Gujar Khan
- A new 765 kV Substation at Gujar Khan
- A new 765 kV Substation at Lahore

The contract for feasibility study for evacuation of power from Northern Areas has been awarded to JV comprising of P.B. (UK), Teshmont (Canada) and Mirza Associate Pakistan on 26.06.2009.

KURRAM TANGI DAM MULTIPURPOSE PROJECT

Location

The proposed project site is located across Kurram river in North Waziristan Agency about 22 KM up-stream of Kurram Garhi Head works and 32 KM North of Bannu City in Khyber Pakhtunkhwa.



This project was conceived by WAPDA for a multipurpose dam in North Waziristan on Kurram River about 22 km upstream of Kurram Garhi Head works and 32 KM North of Bannu City in NWFP with storage capacity of 1.20 MAF of water and **power generation of 83.4 MW**. It **will irrigate 362,380 Acres of land** and will provide cheap hydropower to the area being a positive impact on the socio economic conditions in North Waziristan Agency. USAID has shown willingness to fund this project.

Salient Features

- | | |
|--|---|
| • Dam Height | 322 ft |
| • Gross Storage | 1.20 MAF-1.48 BCM |
| • Live Storage | 0.90 MAF-1.11 BCM |
| • Power Houses (5 Nos) | 83.4 MW (350 GWh) |
| • Command Area | 3,62,380 ACRES (including new area of 84,380 Acres) |
| • Supplementing existing System of Civil & Marwat Canals | 277,500 Acres |

Project Benefits

- Irrigated Agriculture Development
 - Hydropower generation
 - Socio-economic uplift of the area.
 - Employment opportunities during the construction and maintenance of the Project.
 - Development of Fisheries.
- Rs.125.60 Million
- Approved by ECNEC on 25.02. 2005
- Rs. 59 Billion**
(Equivalent to **US\$ 700 Million**)
- M/s Pakistan Engineering Services (PES) JV appointed as Consultants for the preparation of feasibility and Detailed Engineering Design of the project.

PC-II Cost

Approving Authority

PC-I Cost

Consultants

Present Status

- Feasibility study, detailed engineering design and tender documents completed in July 2007 with an elevated height to enhance the storage capacity.
- 210 acres lands have so far acquired and Rs. 17.0 million has been paid to DCO/DOR Bannu.
- Government of KPK assured total support alongwith all out security arrangements with the desire to take care of the entire stakeholder during construction of the project.
- EOI for pre-qualification of Contractors received on February 28, 2011. Five firms / Joint Ventures submitted the EOI documents.
- Three firms pre-qualified (M/s. DESCON, M/s. SAMBU – SARCO JV and M/s. FWO – LIMAK JV) for participation in the tendering process. Tender documents are under review by Project Supervision Consultants for issue.
- M/s. Mot McDonalds International Joint Venture has been appointed as Project supervision consultants. Consultancy Contract signed on 17 Nov. 2011.
- The Revised PC-I amounting to Rs. 59.561 Billion submitted to Ministry of Water and Power for arranging approval of ECNEC.
- USAID has shown interest to finance the Project.

TARBELA 4TH EXTENSION PROJECT

LOCATION

Tarbela Dam

Existing Installed Capacity 3478 MW

This project will play significant and sustainable expansion in Pakistan's **hydropower generation by installing about 1410 MW hydropower plant on the already existing Tunnel 4 of Tarbela Dam**, thus reducing exposure to many social and environmental challenges generally associated with large dams projects. The project is considered a low hanging fruit and it is a "low-risk- high reward" operation aimed at **providing over 3,84 billion units annually** of least-cost low-carbon renewable energy. The expected saving of Foreign Exchange US\$ 900 Million on import of one million tons of furnace oil for equivalent generation of electricity from Thermal resources.



SALIENT FEATURES

Tunnel-4	(Already constructed)
• Purpose	Irrigation
• Type	Concrete/Steel Lined
• Diameter	45 ft to 36 ft
• Length	2997 ft
Dam	(Already constructed)
• Height	485 ft (147.82 m)
• Length	9000 ft (27434 m)
Spillway	(Already constructed)
• 4 th Extension estimated Installed Capacity	1410 MW
• Estimated Project Cost	US\$ 935 Million

PRESENT STATUS

- The revised PC-II of the subject project stands approved by Central Development Working Party (CDWP) on 08.06.2010.
- Contract Agreement duly approved by World Bank signed on 10th June 2010 with JV of Mott MacDonald – UK and Coyne et Billier – France now called as the "Tarbela 4 Consultants JV".
- Design work on various component of the project in progress.
- Geological Survey, Drilling & Investigation Works in progress at site.
- Contract signed with the member of Panel of Experts and International Review Consultants.
- Feasibility Report submitted by the Consultants and circulated to all POE members on 24.12.2010.
- Consultants/World Bank Experts have explored the possibility to generate 1410 MW.
- Completion of the Consultancy Services expected by September, 2011.
- World Bank is financing the design work at a cost of US \$ 5.5 Million whereas the finances to the tune of US \$ 908 Million would be required for implementation / construction of the project. World Bank is inclined to provide the financing for this project.

TRANSMISSION SCHEME FOR DISPERSAL OF POWER FROM TARBELA 4TH EXTENSION HYDROPOWER PROJECT

Tarbela 4th Extension Hydropower Project has a generation capacity of 1410 MW and it is expected to be commissioned in six years. The location of Tarbela 4th Extension Hydropower Project is on Indus River present Tarbela Dam's already constructed 4th tunnel. The 500 kV Transmission Scheme for Dispersal of Power from Tarbela 4th Extension Hydropower Project to Faisalabad the major load centers in the National Grid is envisaged as under:

- 500 kV Transmission Lines from Tarbela 4th Extension Hydropower Project to Faisalabad.

The estimated cost of the above Power Dispersal Scheme for Tarbela 4th Extension Hydropower Project is about US\$ 150 million.

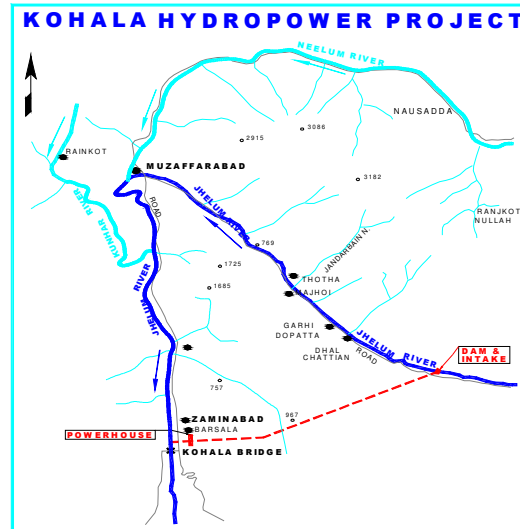
KOHALA HYDROPOWER PROJECT

LOCATION

The project is located in Muzaffarabad District, Azad Jammu & Kashmir. The dam site is proposed just upstream of Domel on Jhelum River, 30 km and 174 km from Muzaffarabad and Islamabad, respectively and powerhouse is located 7 km upstream from Kohala Bridge.

SALIENT FEATURES

Installed Capacity	1100 MW
Gross Head	320 m
Design Discharge	425 m ³ /sec
Mean Annual Energy	4800 GWh
No. & Type of Turbines	4 (Francis)
Type of Dam	RCC
Height of Dam	57 m
Head race Tunnel length	17760 m
Total Base Cost	US\$ 2155 Million
EIRR	19.9%
Benefit Cost Ratio	1.83
Estimated construction period	6 years



BACKGROUND/ PRESENT STATUS

- Feasibility Study completed by WAPDA in December, 2008 by Joint Venture of National and International Consultants.
- Detailed Engineering Design and Tender Documents completed in November 2009 by the same Consultants.
- The project is being developed in Private Sector through Private Power and Infrastructure Board (PPIB).

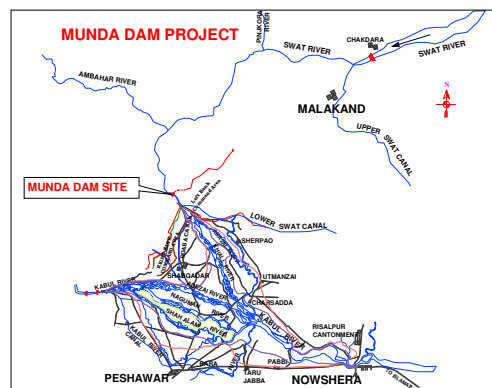
Transmission Scheme for Dispersal of Power from Kohala Hydropower Project to Gujranwala – Estimated Cost of US\$ 130 million.

MUNDA DAM MULTIPURPOSE PROJECT

LOCATION

This project is proposed to be constructed on Swat River about 5 Km upstream of Munda Head Works in Mohmand Agency (FATA), Khyber Pakhtunkhwa.

Munda Dam was envisaged to be constructed on Swat River about 5 km upstream of Munda Headworks in Mohmand Agency (FATA), Khyber Pakhtunkhwa with gross storage of 1.29 million **acre feet (MAF) to irrigate 15098 Acres of land and to generate 740 MW**. This project will play a significant role in Flood Mitigation, Power Generation & Economic Development of Pakistan. This project was initially awarded to AMZO (a private company) & had the Dam construction started by this private party in 2002, the massive floods in Nowshera/Charsadda in 2010 could have been controlled Subsequently, WAPDA has awarded the preparation of Detailed Engineering Design to M/s SMEC (JV) in February 2011 which will be completed within two years. The estimated cost of this study is US\$ 7.6 million whereas the estimated cost of this project will be US\$ 1401 Million.



SALIENT FEATURES

Type of Dam	Concrete Faced Rock fill Dam
Height of Dam	698.820 Ft.
Gross Storage	1.290 MAF
Live Storage	0.676 MAF
Dead Storage	0.314 MAF
Flood Storage	0.081 MAF
Power Houses Installed Capacity	740 MW (Annual Energy 2407 GWh)
Command Area	16940 Acres
Left Bank Culturable Command Area	10057 Acres
Project Cost	Rs 119 Billion (US\$ 1401 Million)
EIRR	13.2%
Construction Period	7 Years

PRESENT STATUS

- Feasibility completed in March 2000 under JICA grant.
- M/s AMZO submitted the Feasibility Report to PPIB in July 2006. The dam height was reduced to 200 m as compared to JICA study with a height of 213 m, resultantly reducing storage capacity from 1594 million Mm³ to 1240 Mm³ and reduced the flood mitigation potential of the project as well as irrigation water for irrigation and power generation.
- Govt. of Khyber Pakhtunkhwa & WAPDA advocated for Munda Dam as Multipurpose Project and raising of dam to accommodate flood mitigation and irrigation.
- The Ministry of Water & Power reassigned Munda Dam Project to WAPDA for carrying out detailed engineering design and construction of the Project.
- Revised PC-II amounting to Rs.648.324 million approved by CDWP subject to availability of foreign funding.
- EOI for short listing of Consultants for detailed engineering design and preparation of tender documents received on November 23, 2010. Nine Firms / Joint Ventures submitted EOI documents. 05 Firms/JVs short listed and RFP issued to short listed firms.
- Technical and financial proposals from short listed firms for detailed engineering design and preparation of tender documents invited on June 15, 2011.
- M/s SMEC JV has been ranked 1st and financial proposals is under evaluation for award.

Transmission Scheme for Dispersal of Power from Munda Dam Project to Peshawar – Estimated Cost of US\$ 22 million.

BUNJI HYDROPOWER PROJECT

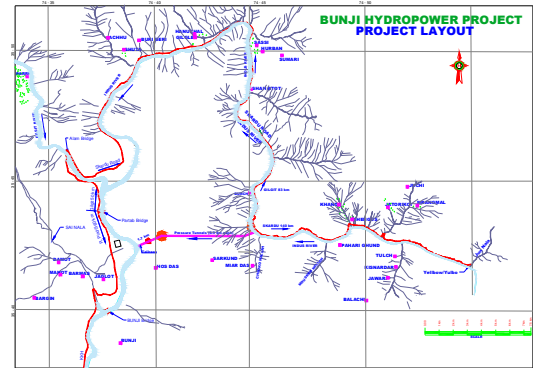
LOCATION

The project is located on Indus River near Gilgit.

Power House and Dam sites are 560 km & 610 km, respectively from Islamabad.

SALIENT FEATURES

Installed Capacity	7100 MW
Gross Head	445 m
Design Discharge	1900 m ³ /sec
Mean Annual Energy	24088 GWh
No. & Type of Turbine	20 (Francis)
Type of Dam	Gravity RCC
Height of Dam	190 m
Headrace Tunnels	5 No (7.8 km long)
Estimated Project Cost	US\$ 6.8 Billion
Estimated construction period	9 Years



PRESENT STATUS

- WAPDA completed the Pre-Feasibility report in March 2005.
- Consultancy Contract Agreement signed on 25.4.2007 for Feasibility study, Detailed Engineering design and preparation of tender document with a joint Venter of M/s Mott MacDonald Ltd, U.K (Lead Partner), M/s Sogreah Consultants SAS, France, M/s Nippon Koei Co. Ltd., Japan, M/s MM Pakistan (Pvt) Ltd, Pakistan and M/s DMC, Pakistan.
- Feasibility report was submitted by the Consultants in March 2009.
- Draft Detailed Design and Draft Tender Documents of different lots has been submitted by the Consultants.
- As the project is located in a very complex geological formation field investigations are required to be continued for updation of information and finalization of detailed design which will take about 24 months.

Transmission Scheme for Dispersal of Power from Bunji Hydropower Project to Major Load Centres in the National Grid – Estimated Cost of US\$ 1.6 billion.

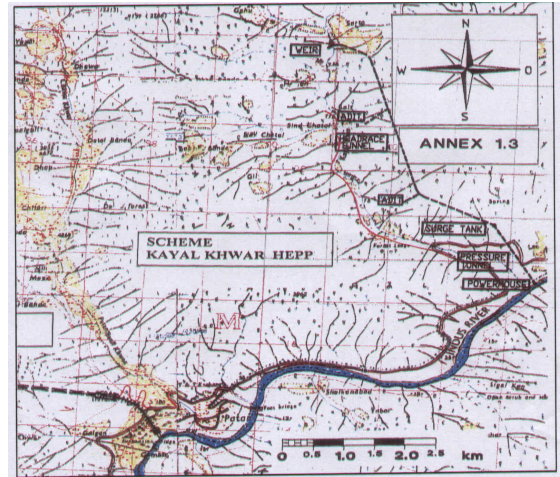
KEYAL KHWAR HYDROPOWER PROJECT

LOCATION

The project is located in the Khyber Pakhtunkhwa Province of Pakistan on Keyal Khwar in Kohistan District. The project is accessible by road and is at a distance of 310 km from Islamabad. Keyal Khwar is the right bank tributary of Indus River.

SALIENT FEATURES

Installed Capacity	122 MW
Gross Head	732 m
Design Discharge	22 m ³ /sec
Mean Annual Energy	426 GWh
No. & Type of Turbine	2, Pelton
Type of Dam	Concrete gravity
Height of Dam	42.5
Estimated Project Cost	180 million EURO
EIRR	15.50%



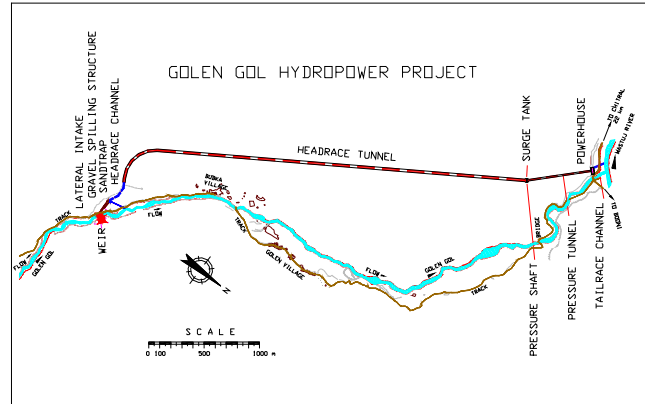
PRESENT STATUS

- Feasibility Report completed in October, 2007.
- Loan Project Agreement Euro 79 Million between GOP and KfW of Germany signed on November 11, 2008 for implementation of the Project. Supplementary Loan Agreement Euro 20 Million signed on 11-04-2009.
- The Consultant JV comprising M/s Lahmeyer Germany as Lead Firm in association with M/s NDC and EASE PAK have been engaged for conducting Detailed Engineering Design and preparation of Tender Documents.
- Detailed Design Report would be finalized by the Consultants by the end of November 2011

GOLEN GOL HYDROPOWER PROJECT

LOCATION

The project is located on Golen Gol Nullah, a tributary of Mastuj River, 25 Km from Chitral Town in Khyber Pakhtunkhwa. The project is about 550 km from Islamabad. On completion this project will **produce 106 MW** with annual **energy 436 million KWh**. The construction period is 4 years. The contract for the main dam has been awarded to M/s SAMBU-SARCO JV (Korean Firm) which has commenced its activities. Pre-qualification of Transmission Lines has also been completed. The Consultancy Agreement for construction supervision has been awarded to M/s Fichtner JV. (Germany)



SALIENT FEATURES

Installed Capacity (MW)	106
Gross Head	435
Design Discharge (m ³ /sec)	30
Mean Annual Energy (GWh)	436
No. & type of Turbine	3, Pelton
Estimated Project Cost (Mill. US\$)	130
Implementation Period (Months)	48

PRESENT STATUS

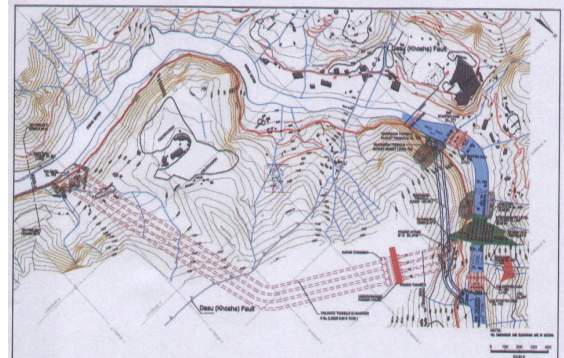
- Feasibility Study completed by HEPO/GTZ in 1997 is updated in 2005.
- Study for Detailed Design and preparation of Tender Documents completed by a joint venture of PES, FICHTNER, Engineering Associates.
- Construction of O&M WAPDA Staff Colony is in progress and will be completed in 2011.
- Lot-2 & Lot-3.1 Civil Works & Power house, the contract has been awarded to M/s SAMBU, agreement signed and the contractor is being mobilized.
- Pre-qualification of contractor for Lot-3.2 E&M Works has been finalized and tender documents issued to the contractor and last date of submission is extended upto 31.03.2011.
- Pre-qualification documents of firms for Lot-4 Transmission Line have been vetted by the Donors and Tender will be floated shortly.
- M/s Fichtner-PES-DMC-BAK JV has been appointed consultants for construction supervision.
- Cost of Works has been agreed by the following donors:
 - Saudi Development Fund for Civil Works (US\$ 40 Million)
 - Kuwait Development Fund for E&M Works (US\$ 37 Million)
 - OPEC for Transmission Lines (US\$ 30 Million)

DASU HYDROPOWER PROJECT

LOCATION

Dasu hydropower project is a run of river scheme 7 km upstream of Dasu village on Indus River, 74 km downstream of Diamer Basha Dam and 345 km from Islamabad.

The project is located at 7 Km upstream of Dasu village on Indus River about 345 Km from Islamabad. On completion, this project will generate 4320 MW (21300 GWh annual energy) of electricity. The Feasibility Study of this Project has been completed on 28th February, 2009 by a Joint Venture of M/s NESPAK (Lead Firm), ACE, MWH and COLENCO in association with Binnie & Partners. World Bank has offered financing for Detailed Engineering



Design and Tender Documents and Project Construction if project would be developed in stages. Technical Evaluation of the proposals has been completed as per Bank's guidelines. WAPDA in Consultation with World Bank has awarded the Detailed Engineering Studies to M/s Nippon Koi JV (Japan, Australia & USA) on 18.08.2011. The PC-I will be prepared on the outcome of the Detailed Engineering Design. World Bank agreed to provide financial assistance to this Project.

SALIENT FEATURES

- Capacity 4320 MW
- Annual Energy 21300 GWh
- Gross Head 201 m
- Design Discharge 2600 m³/s
- Dam Height 233 m above bed rock
- Type of Dam Roller Compacted Concrete
- Total Base Cost US\$ 5206 million
- Estimated Construction period 14 years

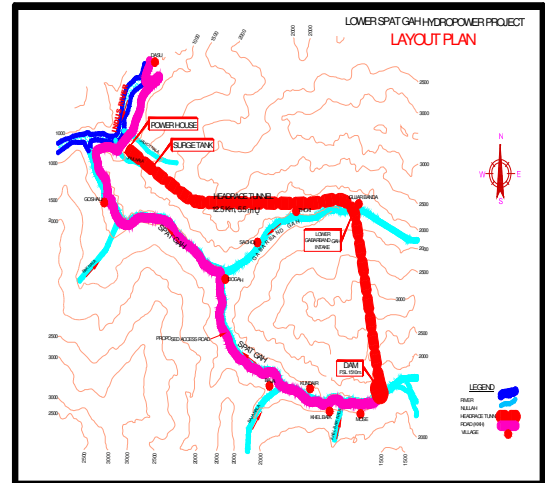
PRESENT STATUS

- The Feasibility Study of the Project completed on in 2009 by a Joint Venture of M/s NESPAK (Lead Firm), ACE, MWH and COLENCO in association with Binnie & Partners.
- World Bank offered financing for Detailed Engineering Design and Tender Documents and Project Construction if project would be developed in stages.
- Consultancy Contract Agreement signed between WAPDA & DHC a joint venture lead by Nippon Koei Japan on August 18, 2011.

LOWER SPAT GAH HYDROPOWER PROJECT

LOCATION

Spat Gah is the left bank tributary of Indus River with its confluence 8 km downstream of Dasu town in Kohistan District, Khyber Pakhtunkhawa. The project layout has been planned on the right bank with powerhouse 7 km from Dasu and 345 km from Islamabad.



SALIENT FEATURES

Installed Capacity	496 MW
Gross Height	745 m
Design Discharge	81 m ³ /sec
Mean Annual Energy	2106 GWh
No. & Type of Turbine	3, Pelton
Type or Dam	CFRD
Height of Dam	57 m
Headrace Tunnel	12.6 km
Pressure Shaft	1100 m
Construction Period	5 Year
Estimated Project Cost	US\$ 697 Million
EIRR	18.4%
FIRR	13.5%

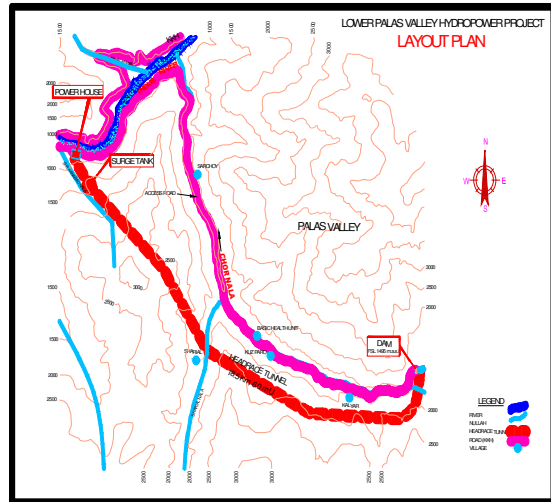
PRESENT STATUS

- The feasibility report has been prepared by a Joint Venture: ILF (Germany), Poyry (Austria) and ACE (Pakistan) and report has been finalized in June 2010 under a general firm kfw.
- The detailed engineering design and tender documents would take 24 months.
- The project is being developed in Public Private Partnership (PPP) mode.
- EOI documents for PPP mode implementation have been issued. The last date for submission of EOI documents is November 18, 2011.

LOWER PALAS VALLEY HYDROPOWER PROJECT

LOCATION

Palas valley (Chor nullah) is the left bank tributary of Indus River with its confluence 12 km upstream of Patan in Kohistan District, Khyber Pakhtunkhwa. The project layout has been planned on the left bank with powerhouse, 2 km from Patan and 310 km from Islamabad.



SALIENT FEATURES

Installed Capacity	665 MW
Gross Head	805 m
Design Discharge	101 m ³ /sec
Mean Annual Energy	2590 GWh
No. & Type of Turbine	3, Pelton
Type or Dam	CFRD
Height of Dam	55 m
Headrace Tunnel	18.5 km
Pressure Shaft	1200 m
Construction Period	5 Year
Estimated Project Cost	US\$ 763 Million
EIRR	20.8%
FIRR	15.6%

PRESENT STATUS

- The feasibility report has been prepared by a Joint Venture: ILF (Germany), Poyry (Austria) and ACE (Pakistan) and report has been finalized in June 2010 under a general firm kfw.
- The detailed engineering design and tender documents would take 24 months.
- The project is being developed in Public Private Partnership (PPP) mode.
- EOI documents for PPP mode implementation have been issued. The last date for submission of EOI documents is November 18, 2011.

AKHORI DAM PROJECT

LOCATION

Akhori Dam site is located near Akhori Village across Nandna Kas, a small tributary of Haro River in Attock District of Punjab, Akhori Reservoir is an off-channel storage, which will draw water from Siran Pocket of Tarbela Reservoir through conveyance channel.

OBJECTIVES

- (i) Storage of water for:
- Supplementing Indus Basin Irrigation System and
 - Power Generation

SALIENT FEATURES

Main Dam

Dam Type	Earth & Rock fill
Height	400 feet
Gross Storage	7.6 MAF
Live Storage	6.00 MAF

Saddle Dam

Height	213 feet
Length	4.78 Miles

Conveyance Channel

Conveyance Channel Length	23 Miles (37 Km)
Conveyance Channel Capacity	60,000 Cusecs
Bed Width	249.3ft (76 m)
Depth	32.8ft (10 m)

Installed Capacity

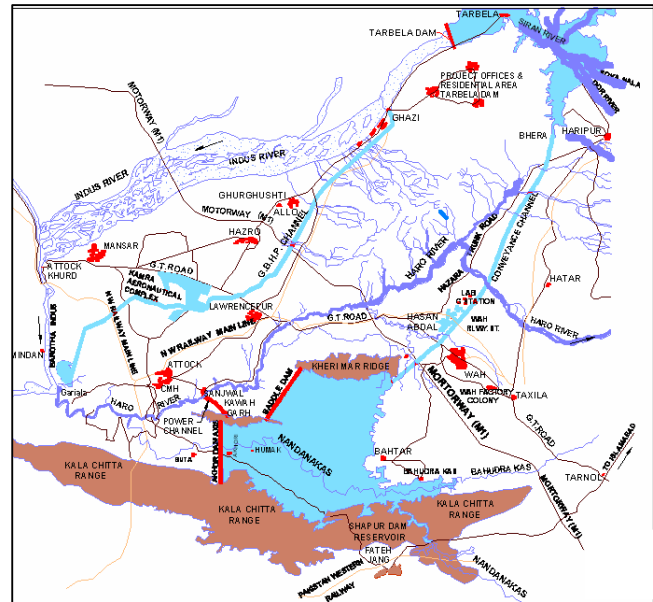
Hydel Power Potential	600 MW (2155 GWh/Annum)
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Environmental and Resettlement

- No of Affectees 55800
- No of Houses 9270
- Land Submergence 65976 Acres
- Estimated Cost US\$ 4.4 Billion
- Construction Period 5 Years

PRESENT STATUS

- Feasibility Study Report completed on Jan. 26, 2006.
- PC-II for Detailed Engineering Design and Tender Documents of the Project amounting to Rs. 818.00 Million submitted on June 23, 2006 for approval of ECNEC which is awaited.
- PC-I for land acquisition and resettlement of affectees under approval of ECNEC.
- Pre-qualification of consultants for detailed engineering design completed.
- RFP for inviting financial and technical proposals of Consultants for detailed engineering design in progress.



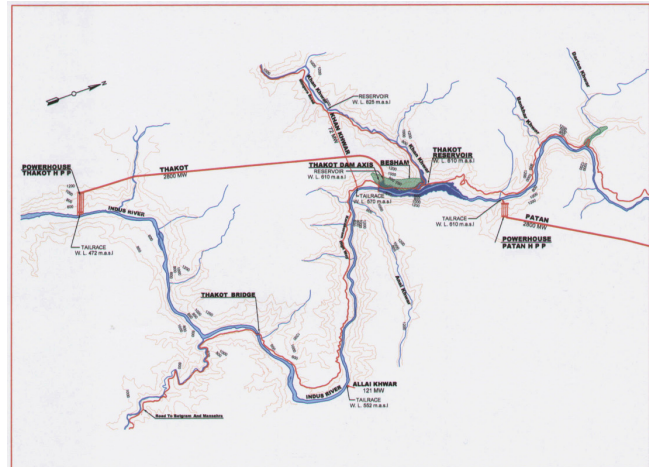
THAKOT HYDROPOWER PROJECT

LOCATION

Thakot dam site is located in a narrow section of Indus River, about 3 km downstream of Besham. Distance from Islamabad is about 240 km.

SALIENT FEATURES

Installed Capacity	2800 MW
Gross Head	138 m
Design Discharge	2900 m ³ /sec
No. & Type of Turbines	8, Francis
Mean Annual Energy	14095 Gwh
Height of Dam	60 m
Tunnel Length	19.8 km
Estimated Project Cost	US\$ 6 Billion
Study period	24 months



PRESENT STATUS

- Identified by MONENCO in “Inventory and Ranking Study” in November 1984.
- Capacity reviewed and updated by Hydro Planning Organization (HPO), WAPDA.
- Cost of Feasibility study is Rs.719.628 Millions.
 - Local Cost Component Rs.416.488 Millions
 - Foreign Cost Component Rs.303.139 Millions
- PC-II for Feasibility Study submitted to Planning and Development Division (GOP) for approval.

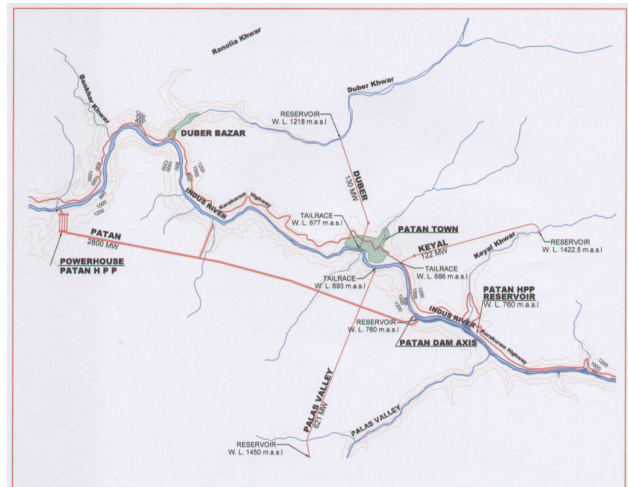
PATAN HYDROPOWER PROJECT

LOCATION

Patan dam site is located on the Indus River about 4 km upstream of village Patan downstream of Keyal Khwar. The power house (underground) is situated on the left bank 8 km upstream of Besham and 275 km from Islamabad.

SALIENT FEATURES

Installed Capacity	2800 MW
Gross Head	150 m
Design Discharge	2600 m ³ /sec
No. & Type of Turbines	8, Francis
Mean Annual Energy	15230 Gwh
Height of Dam	104 m
Tunnel Length	18 km
Estimated Project Cost	US\$ 6 Billion
Study period	24 month



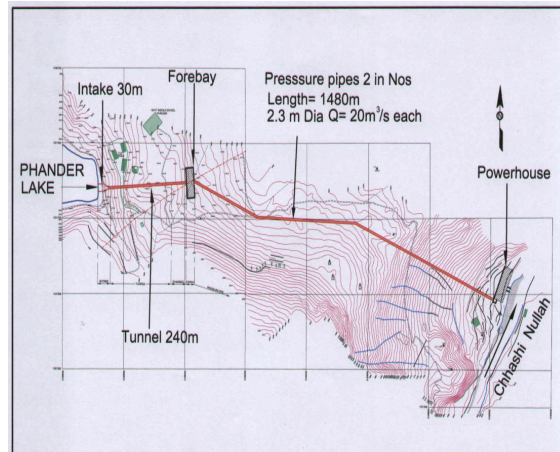
PRESENT STATUS

- Identified by MONENCO in “Inventory and Ranking Study” in November 1984 and reviewed by Hydro Planning Organization, WAPDA.
- Capacity reviewed and updated by HPO.
- Cost of Feasibility study is Rs.731.233 Millions.
 - Local Cost Component Rs.373.731 Millions
 - Foreign Cost Component Rs.357.502 Millions
- PC-II for Feasibility Study has been approved by CDWP on 17.09.2009.
- Six firms/JVs have been short listed.
- RFP for preparation of Feasibility Study has been issued to short listed firms on 16-08-2011. Last date for submission is 18-11-2011.
- The study will be completed in 24 Months.

PHANDAR HYDROPOWER PROJECT

LOCATION

The project area is located between Phandar Lake and Chhashi Gol, near the Chhashi village on the right side of Ghizar River in Ghizar District of Northern Areas. Phandar Lake is located about 160 km north-west of Gilgit town and 772 km north of Islamabad.



SALIENT FEATURES

Installed Capacity	80 MW
Gross Head	237 m
Design Discharge	40 m ³ /sec
Mean Annual Energy	350 GWh
No. & Types of Turbine	4, Pelton
Estimated Project Cost	US \$ 70 Mill
Study Period (months)	18 Months
Implementation Construction Period	48 Months

PRESENT STATUS

- Feasibility was completed by HPO, WAPDA with GTZ of Germany under Technical Assistance Program in 2003.
- PC-II for Detailed Engineering Design and preparation of Tender Documents was approved by CDWP on 30.04.2007 for Rs. 120.0 million.
- Consultancy Contract Agreement by WAPDA and Phandar Hydro Consultants (PHC) has been signed on 22.10.2010.
- Preparation of Detailed Engineering Design and Tender Documents is in progress and the study will be completed by May 2012.

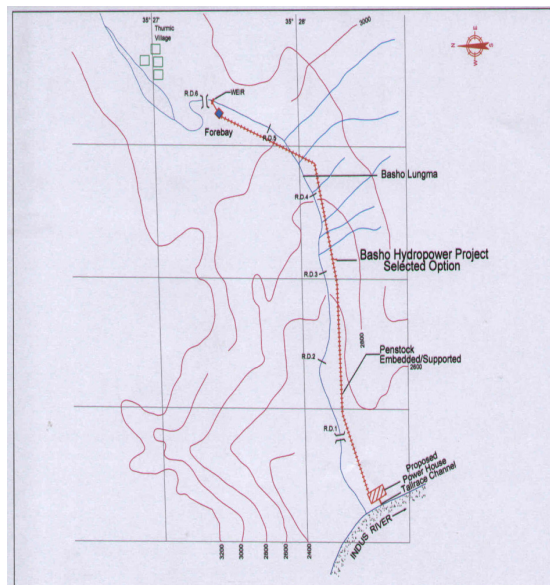
BASHO HYDROPOWER PROJECT

LOCATION

The proposed scheme is identified along the Basho Nala (Lungma), a left tributary of Indus River. The confluence of Basho Nala with Indus River is located about 40 km downstream of north-west of Skardu town and 704 km north-east of Islamabad.

SALIENT FEATURES

Installed Capacity	28 MW
Gross Head	949 m
Design Discharge	3.5 m ³ /sec
-Mean Annual Energy	135 GWh
No. & Type of Turbine	3, Pelton
Type of Weir	Tyrolean Weir
Length of Penstock	4478 m
Estimated Project Cost	US\$ 40 Million
Study Period for updation/review of Feasibility Study	7 Months
Implementation Construction Period	48 Months



PRESENT STATUS

- Feasibility study was completed by HEPO (WAPDA) with technical collaboration of GTZ of Germany in year 2002.
- Afd/KfW fact finding mission visited the project sites of BASHO/HARPO in July, 2009. The mission agreed to finance Updation/Review of feasibility study of Basho & Harpo HPP's from "**GRANT**" in the 1st Phase and after successful review/ updation of feasibility study financing will be provided for Detailed Engineering Design, preparation of Tender Documents and construction of projects from "**LOAN**" in the 2nd Phase.
- Accordingly Afd has appointed M/s Sogreah in Association with M/s FHC to undertake Updation of Feasibility study and complete the task within Six months. The Consultants mobilized on 01.06.2011.
- Updation of Feasibility Study is in progress and expected to be completed by December 2011.

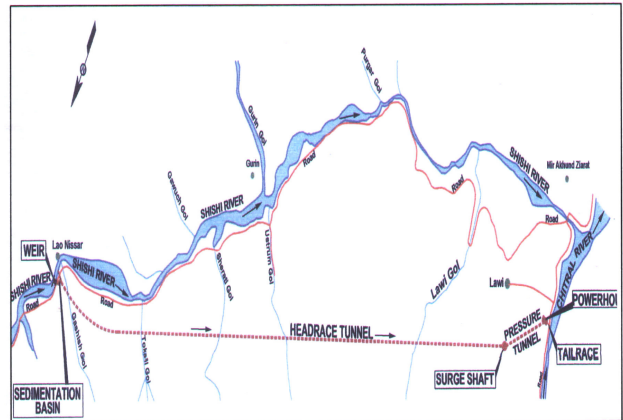
LAWI HYDROPOWER PROJECT

LOCATION

The project area is located on the right bank of Shishi River, a left tributary of Chitral River. The project involves diversion of Shishi River into Chitral River. The Project is about 350 km from Islamabad.

SALIENT FEATURES

Installed Capacity (MW)	70 MW
Gross Head (m)	413 m
Design Discharge	20 m ³ /sec
Mean Annual Energy	303 Mil. KWh
No. & Type of Turbine	3 (Pelton)
Project Base Cost	US\$ 120 Mill
EIRR	18.51%
Implementation Period	4 Years



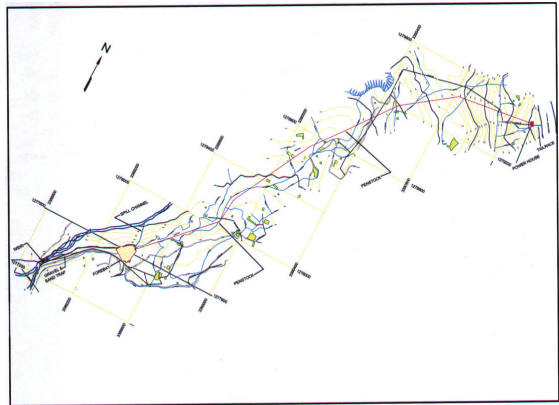
PRESENT STATUS

- Feasibility study of 69 MW Lawi Hydropower Project has been completed by Hydro Planning Organization, WAPDA in 2008.
- Government of Khyber-Pakhtunkhwa has decided to construct Lawi Hydropower Project through their own resources.

HARPO HYDROPOWER PROJECT

LOCATION

The proposed scheme is identified along 2.5 km lower stretch of Harpo Nala (Lungma), a left tributary of Indus River in Rondu Area, district Skardu. The project area is located 75 km north-west of Skardu town and 670 km north-east of Islamabad.



SALIENT FEATURES

Installed Capacity	33 MW
Gross Head	716 m
Design Discharge	5.5 m ³ /sec
Energy Generated	187 GWh
Penstock Length	2885 m
No. of Units	3 Pelton
Project Cost (including T. Line)	US\$ 46 Million
Study Period for updation/ review of Feasibility Study	7 Months (Extended as per requirement)
Implementation Construction Period	48 Months

PRESENT STATUS

- Feasibility report was completed by Hydro Planning Organization (WAPDA) with the technical collaboration of GTZ of Germany in February 2002.
- AFD/Kfw committed to finance updation/review of feasibility study from “**GRANT**” in the 1st Phase and after successful review/updation of feasibility financing will be provided for Detailed Engineering Design, preparation of Tender Documents and construction of projects from “**LOAN**” in the 2nd Phase.
- Financing Agreement among Kfw, EAD (GoP) & WAPDA has been signed on 6th September, 2010 for grant of 675000 Euro's.
- Consultancy Contract Agreement for Updation/Review of Feasibility Study has been signed between WAPDA and Harpo Hydropower Consultants (JV) on 20-12-2011.
- The consultant (JV) has been mobilized from March 01, 2011.

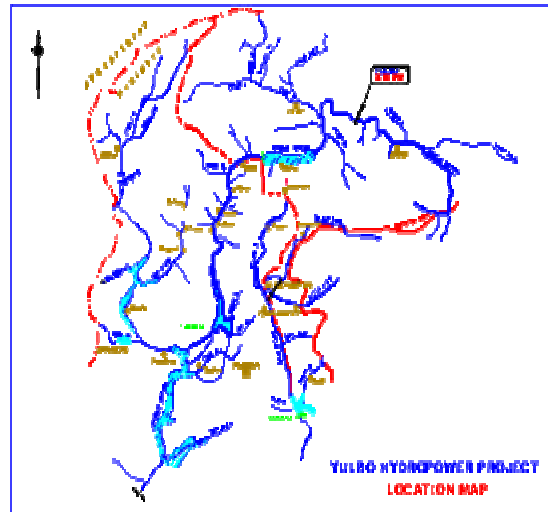
YULBO HYDROPOWER PROJECT

LOCATION

The dam site is to be located on Indus River 6 km upstream of Silbo and Yulbo villages and the powerhouse is some 9 km upstream of village Shengus in Skardu District (Tehsil Dambudas).

LAYOUT

The dam axis is located some 1 Km downstream of the Astak Nala 92 Km downstream of Skardu Town. The river is about 80 m wide at this site. The headrace tunnels would be about 12 km on the right bank of Indus river. The powerhouse would be underground approximately 7 km downstream of Chutran village.



SALIENT FEATURES

• Generation Capacity	2800 MW
• Drainage Area	114,200 Km ²
• Average Flow	990 m ³ /s
• Dam Height	140 m
• Head Water Level	1920 m
• Tail Water Level	1796 m
• Length of Power Tunnel	12.1 km
• Gross Head	238 m
• Net Head	211 m
• Design Discharge	1500 m ³ /s
• Annual Energy	11400 GWh
• Plant Factor	45.8%

PRESENT STATUS

- The project is identified by MECO under CIDA grant during 1984 for a capacity of 710 MW.
- Desk Study and field reconnaissance done.
- The capacity has been upgraded 2800 MW by HPO, WAPDA.

SHYOK (YUGO) HYDROPOWER PROJECT

LOCATION

The dam site is to be located on Shyok River near Yugo village, 60 km from Skardu city. The powerhouse site is located just downstream of Dam.

SALIENT FEATURES

• Generation Capacity	520 MW
• Average Flow	365 m ³ /s
• Dam Height	165 m
• Head Water Level	2590 m
• Tail Water Level	2440 m
• Length of Power Tunnel	1.0 km
• Gross Head	150 m
• Net Head	146 m
• Design Discharge	500 m ³ /s
• Mean Annual Energy	2080 GWh
• Plant Factor	45.6%

PRESENT STATUS

- The project is identified by MECO under CIDA grant during 1984.
- The capacity has been studied by HPO, WAPDA.

TUNGUS HYDROPOWER PROJECT

LOCATION

The dam site is to be located on Indus River 2 km upstream of Tangus village and 53 km downstream of Skardu city. The underground powerhouse site is located near Skoyo village, 5 km downstream of Tormic nullah and 6 km upstream of Dambudas about 65 km downstream of Skardu.

SALIENT FEATURES

Generation Capacity	2200 MW
Drainage Area	113,000 km ²
Average Flow	962 m ³ /s
Dam Height	127 m
Head Water Level	2110 m
Tail Water Level	1920 m
Length of Power Tunnel	11.3 km
Gross Head	190 m
Net Head	170 m
Design Discharge	1500 m ³ /s
Mean Annual Energy	8800 GWh
Plant Factor	46.4%

PRESENT STATUS

- The project was identified by MECO under CIDA grant during 1984 for a capacity of 685 MW.
- The capacity has been upgraded to 2200 MW by HPO, WAPDA.

SKARDU DAM PROEJCT

LOCATION

Skardu Dam site is located on Indus river, 35 Km downstream of the Skardu city and 5 km downstream of Ayub Bridge.

SALIENT FEATURES

River	Indus
Generation Capacity	1600 MW
Distance from mouth	2550 Km
Dam height	230 m
Head Water Level	2260 m
Tail Water Level	2134 m
Live Storage	7.50 MAF
Dead Storage	5.0 MAF
Average Flow	951 m ³ /s
Mean Annual Energy	9300 Gwh

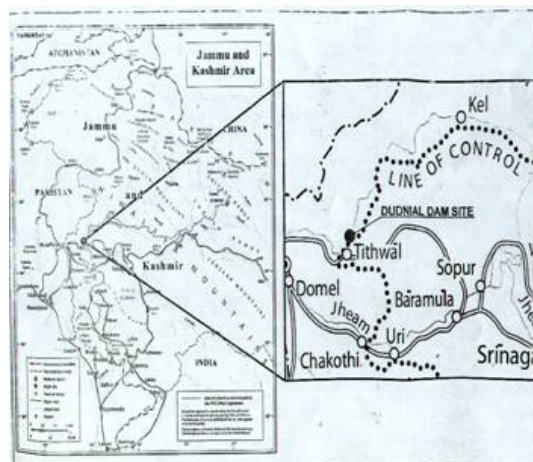
PRESENT STATUS

- The Project is identified for storage during inventory and ranking study of major hydropower projects carried out by MECO under CIDA grant in 1984.
-

DUDHNIAL HYDROPOWER PROJECT

LOCATION

The project is located on the right bank of Neelum river, 103 km north east of Muzaffarabad in AJK. Dam site is to be located 2 km upstream of Dudhnial village and Powerhouse near Dowarian village 63 km upstream of N.J. HPP Dam site. The project area is accessible from Muzaffarabad, through truckable road, 240 km from Islamabad.



SALIENT FEATURES

Installed Capacity	960 MW
Net Head	368 m
Design Discharge	300 m ³ /sec
Mean Annual Energy	5425 GWh
No. & Type of Turbine	4 Francis
Height of Dam	210 m
Headrace tunnel length	9.3 KM
Reservoir length	38 KM
Tentative Live Storage	1.0 MAF

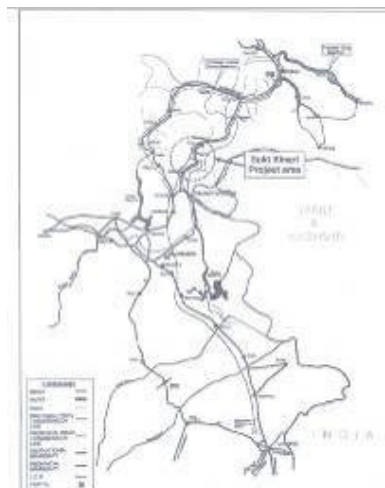
PRESENT STATUS

- The project was initially conceived in early 80's. Hydro Planning Organization studied the project to generate 960 MW in addition to live storage 1 MAF.
- PC-II Proforma for Pre-feasibility study has been submitted to the Ministry of Water & Power on 29.09.2009 for approval.
- After clarification of the queries raised by the Ministry of Water & Power updated PC-II was submitted on 20.10.2010 for clearance and obtaining approval.

SUKI KINARI HYDROPOWER PROJECT

LOCATION

The Suki Kinari hydropower project is located in KHYBER PAKHTUNKHWA on Kunhar River with a dam 10 km upstream of Kaghan, a 21.4 km long headrace tunnel and an underground power station near Paras village.



SALIENT FEATURES

- | | |
|----------------------------|--------------------------------------|
| ▪ Installed Capacity | 840 MW (4 × 210 MW, Pelton Wheel) |
| ▪ Estimated Annual Energy | 2958.1 GWh |
| ▪ Plant Factor | 40.2% |
| ▪ Type | Run-of-River |
| ▪ Net Head | 823.5 meters |
| ▪ Tunnel length | 21.4 km |
| ▪ Construction Period | 6 years |
| ▪ Estimated Cost | US \$ 1138.93 million (2008 level) |
| ▪ Proposed Interconnection | 500 kV line to Neelum Jhelum (85 km) |

BACKGROUND

Letter of Interest (LOI) was issued by PPIB on 15-11-2005 under the 2002 Power Generation Policy to a private power company, M/s SK Hydro (Pvt.) Ltd. for the development of the project. The company hired Mott McDonald as consultant for conducting the feasibility study of the project. A Panel of Experts monitored the feasibility study as per the requirements of the 2002 Policy.

The Feasibility Study was completed in March 2008 and has been subsequently approved by the PPIB.

PRESENT STATUS

- The tariff approved by NEPRA on 18-11-2008
- The Generation License is under process in NEPRA
- LOS issuance is in process in PPIB

KUNDAL SHAHI HYDROPOWER PROJECT

LOCATION

The project is proposed on the right bank of Neelum valley with diversion weir just downstream of Dudhnial village and powerhouse near Kundal Shahi, 75 km north of Muzaffarabad.

SALIENT FEATURES

Gross Head	280 m
Design Flow	300 m ³ /s
Installed Capacity	700 MW
Annual Energy	3750 GWh
Dam Type	RCC weir
Dam Height	32 m
Tunnel Length	16.0 km
Tunnel Size	10.5 m dia
Power House Type	Underground
No. of Units	4
Type of Units	Francis

STATUS

- The Project has been identified by Hydro Planning Organization, WAPDA

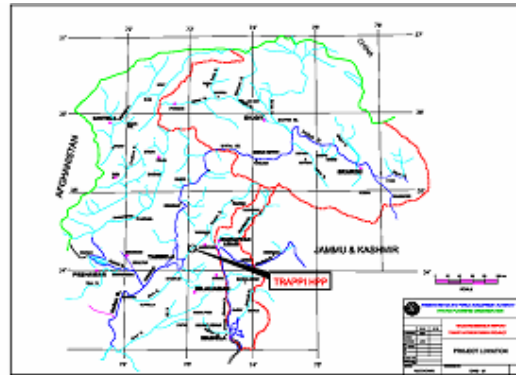
TRAPPI HYDROPOWER PROJECT

LOCATION

The project area is located on the Sirran River near Trappi Village. The Project is 18 km from Mansehra in Khyber Pakhtunkhwa Province and about 160 km from Islamabad.

SALIENT FEATURES

Installed capacity	32 MW
Mean Annual Energy	232 GWh
Maximum gross head	171 m
Dam height	146 m
Dam Crest	450 m
Reservoir Maximum Operating Level	2600 ft
Tentative Live Storage	200,000 Acre-ft
Pressure pipe/tunnel	1500 m
Design discharge	25 m ³ /s
Plant factor	80.9%
Feasibility Study	18 months



PRESENT STATUS

- Project identified by Hydro Planning Organization (HPO), WAPDA.
- Reconnaissance study was carried out by HPO and Reconnaissance Report issued in May 2010.
- Commitment for a grant of Euro 950,000 for financing the feasibility study of the project was made by KfW on 17th January, 2011.
- Financial Agreement signed by KfW, WAPDA and Government of Pakistan on July 15, 2011.
- TOR/EOI has been finalized and will be published in the Newspaper as soon as PC-II is approved.

RAJDHANI HYDROPOWER PROJECT

LOCATION

Rajdhani Hydropower Project is proposed on Poonch River, 20 km downstream of Kotli. The project is about 175 km from Islamabad.

SALIENT FEATURES

▪ Capacity	132 MW
▪ Energy	694 GWh
▪ Project Type	Run of River
▪ Dam Height	201 m
▪ Design Discharge	201 m ³ /s
▪ Gross Head	79 m
▪ Plant Factor	60%

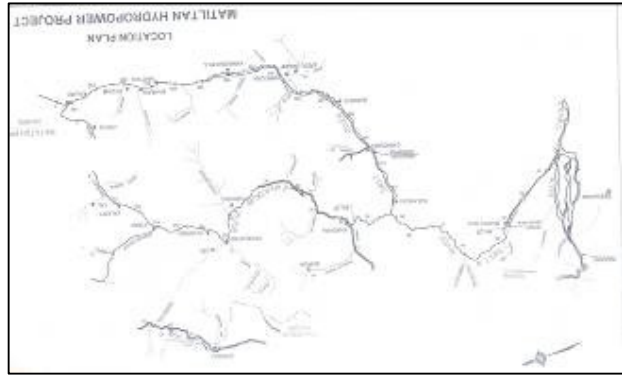
PRESENT STATUS

- The Project was identified by HEPO, WAPDA-GTZ during Comprehensive Planning of Hydropower Resources in Jhelum River Basin, Punch Catchment, Medium Scheme in AJ&K
- The Project is being developed in Private Sector through Private Power and Infrastructure Board (PPIB)

MATILTAN HYDROPOWER PROJECT

LOCATION

The Matiltan hydropower project is located on Ushu River (tributary of Swat River) with its project structures at a distance between 8 km and 15 km from Kalam.



SALIENT FEATURES

▪ Installed Capacity	84 MW (3 × 28 MW, Francis turbines)
▪ Firm Capacity	19 MW
▪ Estimated Annual Energy	346 GWh
▪ Plant Factor	47%
▪ Type	Run-of-River
▪ Gross Head	201 meters
▪ Tunnel length	6.5 km
▪ Construction Period	4 years
▪ Estimated Cost	US \$ 133 million (2002 level)
▪ Proposed Interconnection	132 kV line to Madyan Grid Station (110 km)

BACKGROUND

Feasibility Study of the project was carried out under the supervision of SHYDO by Sir William Halcrow & Partners Ltd. UK in 1996. LOS for developing the project in the private sector was issued by the Government of KHYBER PAKHTUNKHWA on 17-07-1996 under the 1995 Hydel Policy. It was originally valid upto 16.01.98 and was extended from time to time and as per last extension, it was valid until December 31, 2002 and its validity has now expired. The original LOS was issued to M/s Sachal Engineering who later entered into partnership with M/s Synergic Hydro Asia and proposed to develop the project with their collaboration.

However, the project development could not be started mainly because the up-front tariff offered by GOP in the 1995 Hydel Policy was withdrawn in 1997 and subsequent tariff negotiations failed to reach a satisfactory conclusion.

CURRENT STATUS

- The foreign partners (M/s Synergic Energy) of the sponsors have withdrawn and it does not seem likely that they would be able to implement the project because of lack of expertise/resources. However, the sponsors have not withdrawn their right to develop the project.
- WAPDA was offered to implement the project with the collaboration of the Govt. of Khyber Pakhtunkhwa. However, the Govt. of Khyber Pakhtunkhwa will negotiate with the sponsors for an amicable solution for implementation of the project.

MAHL HYDROPOWER PROEJCT

LOCATION

Mahl is a run of river hydropower project proposed on Jhelum River from 4 to 5 km upstream of Mahl River confluence with the Jhelum River upto tail water level of Kohala Hydropower Project. The access road to Dam and Powerhouse sites is available from Rawalpindi to Tain Dhel Kot through Lehtrar Road or from Rawalpindi to Murree to Kohala to Project Area along Jhelum River. The Project site is 100 km from Rawalpindi.

The salient features of Mahl Project by WAPDA-GTZ are:

- Project Location 34⁰ 55' N, 73⁰ 34, E
- Normal reservoir level 557 masl
- Tail water level 504 masl
- Rated discharge 550 m³/s
- Gross head 53 m
- Net head 52 m
- Rated capacity 600 MW
- Dam height 75 m
- Diversion tunnel 2 No. 14.2 m dia and 950 m length
- Bottom outlet 10 No. 13 m x 12 m
- Design flood 33,200 m³/s

PRESENT STATUS

- Mahl Hydropower Project would be implemented on Public Private Partnership (PPP) mode by WAPDA after formal approval by Govt. of AJK.
- Govt. of Punjab and the Private Sector would be invited to join the Project.
- The Project would be developed under PPP mode under the "Policy for Power Generation Projects 2002" through ICB process.

GULPUR HYDROPOWER PROJECT

LOCATION

Gulpur Hydropower Project is proposed on Poonch River, 4 km downstream of Kotli.

SALIENT FEATURES

▪ Gross Head	57.5 m
▪ Design Flow	194 m ³ /s
▪ Installed Capacity	100 MW
▪ Annual Energy	465 GWh
▪ Dam Type	RCC weir
▪ Dam Height	32 m
▪ Tunnel Length	3.12 km
▪ Tunnel Size	7.75 m dia
▪ Power House Type	Surface Reinforced Concrete
▪ No. of Units	3
▪ Type of Units	Francis

ENVIRONMENTAL IMPACT

- No adverse environmental impact

PRESENT STATUS

- The Project was identified by HEPO, WAPDA-GTZ during Comprehensive Planning of Hydropower Resources in Jhelum River Basin, Punch Catchment, Medium Scheme in AJ&K
- The Project is being developed in Private Sector through Private Power and Infrastructure Board (PPIB)

KOTLI HYDROPOWER PROJECT

LOCATION

The project is located on Punch River near Kotli in AJK. The project area is accessible from along Punch River Mangla Dam and from Muzaffarabad via Bagh.

FEATURES

Installed Capacity	100 MW
Gross Head	10 m
Design Discharge	135 m ³ /sec
Mean Annual Energy	465 million KWh

BENEFITS

Cheaper power to National Grid

ENVIRONMENTAL IMPACT

- No adverse environmental impact
- Run of River project

TRANSMISSION SCHEME FOR DISPERSAL OF POWER FROM NEELUM-JHELUM HYDROELECTRIC PROJECT

Neelum-Jhelum Hydroelectric Project has a generation capacity of 969 MW and it is expected to be commissioned by year 2016. The location of Neelum-Jhelum Hydroelectric Project is on Neelum River. The 500 kV Transmission Scheme for Dispersal of Power from Neelum-Jhelum Hydroelectric Project to Gujranwala the major load centers in the National Grid is envisaged as under:

- 500 kV Transmission Lines from Neelum-Jhelum Hydroelectric Project to 500 kV Ghakkar Grid Station, Gujranwala

The estimated cost of the above Power Dispersal Scheme for Neelum-Jhelum Hydroelectric Project is about US\$ 225 million.

ULTRA MEGA POWER PROJECT/PARK

- Ultra Mega Power Project is aimed to generate Power through Private Entrepreneurs by imported Coal, Synthetic Gas, LNG & other fuel sources. The desired infrastructure will be developed by GoP through WAPDA where as the power plants will be installed by Private Entrepreneur. The Power will be dispersed through National Transmission and Despatch Company (NTDC).
- GoP may undertake detailed consultation process with various stakeholders
- Large scale capacity additions needed to address the country's poverty alleviation agenda
- Economies of scale and competitive bidding expected to benefit consumers through lower tariffs
- GoP may stipulate use of supercritical technology because it results in lower carbon emissions
- Coastal area of Pakistan near Karachi will be selected for the first UMPP to be awarded in near future. The Power will be dispersed through National Transmission and Despatch Company (NTDC).
- Project will sell competitively-priced power and provide affordable energy to consumers
- Growth in port and power transmission capacity will further create infrastructure and employment opportunity for the country
- GoP may make a comprehensive assessment of Pakistan's future energy needs and alternatives for energy supply. Access to electricity is essential for reduction in poverty and improved health, education and economic development

UP-GRADATION AND REFURBISHMENT OF GENERATING UNITS OF MANGLA POWER STATION

Mangla Dam Project completed in 1967 is located on River Jhelum at about 120 Km from Islamabad. The Power House was completed in four stages, the initial phase comprising four units of 100 MW each was completed in 1967~1969. The first extension of Units 5~6 (2X100 MW) was completed in 1974 while second extension comprising units 7~8(2X100 MW) was completed in 1981. The project attained its maximum capacity of 1000MW with the final extension of units 9&10(2X100 MW) in 1993-94.



Mangla reservoir capacity reduced to 4.674 MAF from 5.88 MAF due to sedimentation. As such Raising of Mangla Dam height by 30 ft. was carried out (2004~2009). The Project will provide additional water storage of 2.88 MAF, increase of water head by 40 ft and additional power generation of 644 GWh per annum will be achieved.

In the light of increase in aforesaid parameters, WAPDA intends to carry out a Feasibility Study for Up-gradation & Refurbishment of the old Generating Units and Allied Equipment of Mangla Power Station to ensure their optimized, reliable and sustainable operation in the Post Raised Mangla Dam Scenario. Electrical & Mechanical Equipment after having spent nearly 40 years of their useful lives have deteriorated due to aging effects resulting in reduction of efficiency and dependability.

The Feasibility Study is aimed to assess the present operating conditions of existing Civil Structures & Plant Machinery, Study of various options of Refurbishment of E&M Equipment and to recommend the most viable option for Up-gradation / Refurbishment of Power House Generating Units for achieving optimum benefits as a result of enhanced water availability and increased head after Mangla Dam Raising.

PROJECT COST

Cost of the Consultancy Services for Feasibility Study is **US\$ 2.0 Million**.
Total cost of the Rehabilitation Project is estimated to be **US \$ 518 Million**.

PRESENT STATUS

M/s MWH (USA) – NESPAK (Pakistan) JV have been engaged to carry out Feasibility Study of the Project. The Consultancy Agreement was signed in 27th April 2011 with eight (08) months completion time i.e upto December, 2011.

After completion of Feasibility Study, Detail Engineering Design, preparation of Tender Documents etc. will be started, requiring six (06) months period, followed by the Bidding.

REPAIR AND MAINTENANCE OF UNITS 1, 3 & 4 OF TARBELA DAM

WAPDA operates Tarbela Hydroelectric Power Station having total installed capacity of 3478 MW from 14 Generating Units installed on three Power Tunnels. The plant is capable to deliver upto 3700 MW during high flow months of summer but sometimes fails to reach its maximum capacity due to the several reasons e.g. Generator windings for Units 1, 3 & 4 (175 MW each) have developed problems due to aging; there is shortage of essential spare parts for extensive maintenance of Generating Units, and maintenance skills are deficient due to lack of training.



An assistance agreement for implementation of Emergency Supplemental Funding has been concurred between Government of Pakistan through Ministry of Water & Power and USAID. The Implementation Letter (IL) dated January 13, 2010 commits an amount of US\$16.5 million for carrying out a program to support the Project Funding will be provided through Reimbursement Agreement to be signed with WAPDA. The activity is estimated to be completed within 24 months from date of IL. Agreement was signed with USAID in May 2010.

Accordingly, WAPDA has planned to implement a short term Repair & Maintenance program which includes replacement of old Class-B Winding of Generators 1, 3 & 4 with the latest Class-F Winding which will enhance output of these machines under overload conditions by about 100 MW and additional energy generation of 200 GWh per year. Reliability of the Power Plant is also likely to increase due to replacement/upgradation of some old systems.

An agreement has been signed between GoP/WAPDA and USAID for an assistance of \$17 million for this project. WAPDA has initiated the proceedings to execute \$ 320 million (Rs.27 billion) work which is in progress. The hydropower equipment for Rehabilitation of Tarbela Power House (1st Trench) has been arrived at Tarbela on 22.01.2011. Additional upgradation of equipment such as Digital Static Excitation for Unit 1-4, 200 KV Circuit Breaker, Turbine Air Injection Compressor could be finalized in 4 weeks.

UP-GRADATION, REHABILITATION AND MODERNIZATION OF WARSAK HYDROELECTRIC POWER STATION

Warsak Hydel Power Station is located on River Kabul at 30 KM in North – West of Peshawar. The Project was completed under Colombo Plan under two phases and financed by Canadian government. The first phase completed in 1960 consisted of construction of Dam, irrigation tunnels and installation of four power generating units, each of 40 MW capacity with 132 KV transmission system which was completed in 1960. Two additional generating units each of 41.48 MW capacities were added in 1980-81 in the second phase. The total installed capacity of the station thus became nearly 243 MW.



WAPDA intends to carry out a Feasibility Study for Rehabilitation, Up-gradation & Modernization of Electrical & Mechanical Equipment of Warsak Hydroelectric Power Station to ensure its reliable and sustainable operation at the total installed capacity of 243 MW. The Electrical & Mechanical Equipment of the existing units having spent 50 years (Units 1~4) and 30 years (Units 5~6) of their useful lives, have deteriorated due to aging effects resulting in reduction of reliability and dependability.

The Feasibility Study is aimed to study and determine viable solutions and required Works for Rehabilitation, Up-gradation and Modernization of old E&M Equipment, recommend necessary remedial measures to overcome the defects in Civil Structures and to carry out Sedimentation Management Studies. preparation of Detail Design, Tender Documents and PC-I for Warsak Rehabilitation Project will also be a part of the required Consultancy Services.

PROJECT COST

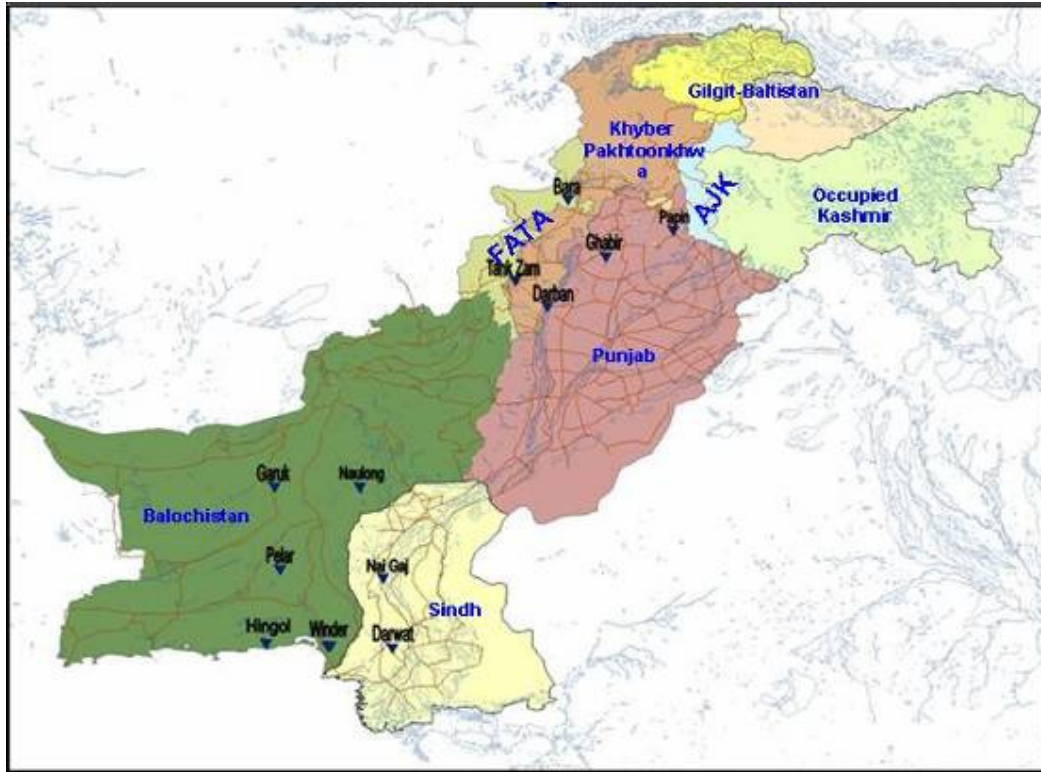
Cost of Consultancy Services for Detail Design etc. is **US\$ 4.0 Million.**

Total cost of the Project is estimated to be **US \$ 308 Million.**

PRESENT STATUS

Joint Venture of RSW (Canada)-DCE (Pakistan) has been appointed as Consultants to carry out Feasibility Study, Detail Engineering Design and Tender Documents with 12 months completion time.

REGIONAL DAMS



32 SMALL/MEDIUM DAMS IN PAKISTAN

PHASE-I – (2010-2014)

<p>BALUCHISTAN</p> <ul style="list-style-type: none"> Winder Dam Naulong Dam Hingol Dam Garuk Dam Pelar Dam 	<p>Khyber Pakhtunkhwa</p> <ul style="list-style-type: none"> Daraban Zam Dam Tank Zam Dam Bara Dam
<p>SINDH</p> <ul style="list-style-type: none"> Nai Gaj Dam Darawat Dam 	<p>PUNJAB</p> <ul style="list-style-type: none"> Ghabir Dam Papin Dam

PHASE-II – (2011-2015)

<p>BALUCHISTAN</p> <ul style="list-style-type: none"> Sukleji Dam Basol Dam Badinzai Dam 	<p>KHYBER PAKHTUNKHWA</p> <ul style="list-style-type: none"> Chaudwan Zam Dam Sheikh Haider Dam Chashmai Akor Dam Chowkas Dam Totakan Dam Kuhai Dam
<p>SINDH</p> <ul style="list-style-type: none"> Salari Dam Nali Dam Khenji Dam Naing Dam Sita Dam Project Upper Makhi Dam 	<p>PUNJAB</p> <ul style="list-style-type: none"> Kot Fateh Dam Mujahid Dam Lawa Dam Mohra Shera Dam Jamalwal Dam

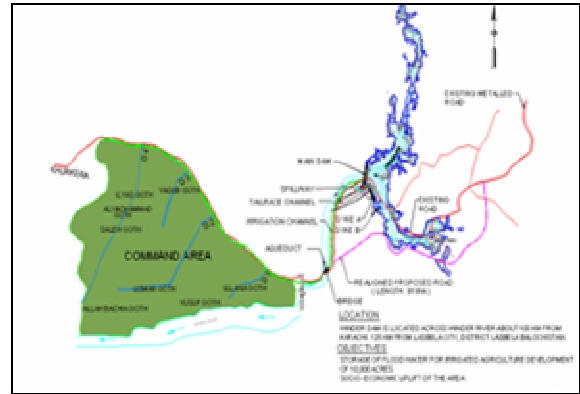
WINDER DAM PROJECT

LOCATION

Winder dam site is located across Winder River about 100 kms from Karachi in district Lasbela (Balochistan).

OBJECTIVES

- Irrigated agriculture development of 10,000 acres of culturable command area.
- Hydropower generation of 300 KW.
- Socio-economic uplift, poverty reduction and women emancipation.



SALIENT FEATURES

- Type of the Dam	Earth Core Rock fill
- Height of Dam	102 ft
- Length of Dam	1,696 ft
- Gross Storage	36,484 AF
- Live Storage	36,167 AF
- Culturable Command Area	10,000 acres
- Annual Benefits	
- Agriculture	Rs. 1.386 billion
- Power	Rs. 0.017 billion
- Fisheries	Rs. 0.007 billion
- Employment Generation	
- Construction Period	1,500 Nos.
- Agriculture Sector	5,000 Nos.
- Hydropower Generation	300 KW
- Revised Project Cost	
- Phase – I (Dam & appurtenant structures)	Rs.10.026 billion
- Phase – II (HEIS Development)	Rs. 1.000 billion
Total	Rs. 11.026 billion

CURRENT STATUS

- Project approved by ECNEC in its meeting held on 3 September 2009; revised approval being sought for construction.
- Groundbreaking ceremony was graced by the President of Pakistan on 1 January 2010.
- Letter of Acceptance (LOA) issued to M/s. Techno Engineering - RSWI JV on 15 February 2010.
- Unsuccessful bidders submitted writ petition in Lahore High Court against award of the project.
- Due to non-submission of performance guarantee by M/s Techno Engineering – RSWI JV issued LOA alongwith tendering process cancelled.
- Lahore High Court petition settled against the petitioner.
- Project will be re-tendered after undertaking detailed engineering design and tender documents of the project.

DARWAT DAM PROJECT

LOCATION

The proposed Darawat Storage Dam site is located at about 70 kms West of Hyderabad and 135 kms North East of Karachi across Nai Baran River in Thata / Jamshoro districts of Sindh Province.

OBJECTIVES

- Irrigated agriculture development of 25,000 acres of culturable command area.
- Hydropower generation of 450 KW.
- Socio-economic uplift, poverty reduction and women emancipation.



SALIENT FEATURES

- Type of Dam	Concrete Faced Rock fill Dam (CRFD)
- Height of Dam	118 FT
- Length of Dam	820 FT
- Gross Storage	121,790 AF
- Live Storage	87,264 AF
- Cultivable Command Area	25,000 Acres
- Cropping Intensity	200%
- Annual Benefits	
- Agriculture	Rs. 2.541 billion
- Power	Rs. 0.018 billion
- Fisheries	Rs. 0.019 billion
- Hydropower Generation	450 MW
- Construction Period	3 Years
- Employment Generation	
- Construction Period	4,450 Nos.
- Agriculture Sector	12,500 Nos.
- Revised Project Cost	
- Phase – I (Dam & appurtenant structures)	Rs.11.132 billion
- Phase – II (HEIS Development)	Rs. 2.500 billion
Total	Rs. 13.632 billion

CURRENT STATUS

- PC-I approved by ECNEC in its meeting held on September 3, 2009. Revised PC-1 amounting to Rs. 11.132 billion submitted to MoW&P for arranging approval of ECNEC.
- Ground Breaking Ceremony was graced by the President of Pakistan on January 2, 2010.
- Project awarded to M/s. Sinohydro-MAJ JV on February 15, 2010. The Contractor mobilized to site w.e.f June 30, 2010.
- The Contractor's camp and Engineer's office established at site. Engineering Design of the Project completed based on soil investigations. Completed the topographic survey of Dam Axis, Spillway and the topographic survey of command area.
- WAPDA established a school in the project area, where substantial number of students from near vicinity has been enrolled for better education of the people of the Project area.
- Construction work at Dam Site is in progress.

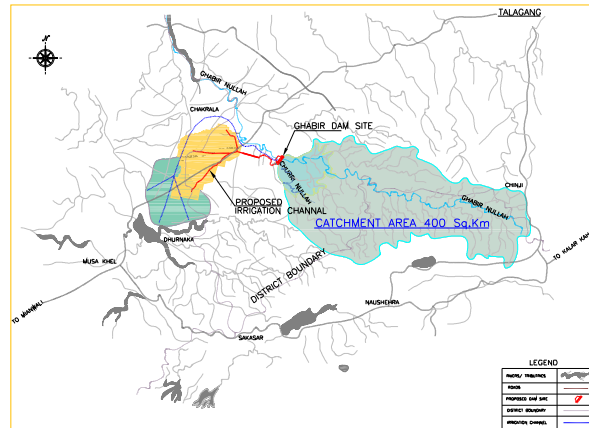
GHABIR DAM PROJECT

LOCATION

The Ghabir Dam project is proposed across the Ghabir River, a tributary of Soan River, little upstream of confluence of Ghabir River and Churi Khas a tributary of Ghabir River. It is located 9 km from village Danda Shah Bilawal and about 60 km from Talagang Mianwali Road.

OBJECTIVES

- Irrigated agriculture development of 15,000 acres of culturable command area.
- Hydropower generation of 150 KW.
- Socio-economic uplift, poverty reduction and women emancipation.



SALIENT FEATURES

- Type of Dam	Earth Core Rock fill Dam
- Height of Dam	138 FT
- Length of Dam	3,117 FT
- Catchment Area	161 Sq. Miles
- Mean Annual Flow	38,428 AF
- Gross Storage Capacity	66,200 AF
- Live storage Capacity	26,000 AF
- Reservoir Area	1,544 Acres
- Spillway Design Flood	47,675 Cusecs
- Cultivable Command Area	15,000 Acres
- Cropping Intensity	200%
- Annual Benefits	
- Agriculture	Rs. 1.973 billion
- Power	Rs. 0.001 billion
- Fisheries	Rs. 0.001 billion
- Power Generation	150 KW
- Employment Generation	
- Construction Period	2,380 Nos.
- Agriculture Sector	7,500 Nos.
- Revised Project Cost	
- Phase – I (Dam & appurtenant structures)	Rs.10.179 billion
- Phase – II (HEIS Development)	Rs. 1.500 billion
Total	Rs.11.679 billion

CURRENT STATUS

- PC-I approved by ECNEC on Sept. 03, 2009. Revised PC-1 amounting to Rs. 11.679 billion submitted to MoW&P for arranging approval of ECNEC.
- Letter of Acceptance on EPC basis issued to the lowest bidder M/s Dongfeng-Technical Associates & Habib Construction JV at a Contract Price of Rs. 6.01 billion on September 09, 2010.
- Due to non submission of performance guarantee, Letter of Acceptance issued to M/s Dongfeng-Technical Associates & Habib Construction JV has been cancelled.
- Proposal of 2nd lowest bidder is under consideration.

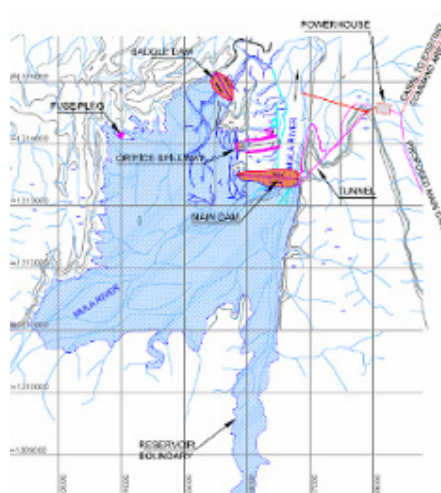
NAULONG DAM PROJECT

LOCATION

The proposed dam site is located on Mula river at Sunt about 30 kms from Gandawa City in tehsil and district Jhal Magsi (Balochistan).

OBJECTIVES

- Irrigated agriculture development of 47,000 acres of culturable command area.
- Hydropower generation of 4.4MW.
- Flood Mitigation.
- Socio-economic uplift, poverty reduction and women emancipation.



SALIENT FEATURES

- Dam Type	Earth fill
- Dam Height	186 ft
- Gross Storage	242,452 AF
- Live Storage	200,000 AF
- Culturable Command Area	47,000 acres
- Cropping Intensity	200%
- Annual Benefits	
- Agriculture	Rs. 2.017 billion
- Power	Rs. 0.413 billion
- Fisheries	Rs. 0.018 billion
- Flood protection	Rs. 0.122 billion
- Employment Generation	
- Construction Period	4,300 Nos.
- Agriculture Sector	23,500 Nos.
- Power Generation	4.4 MW
- Annual Energy	26.6 GWh
- Revised Project Cost	
- Phase – I (Dam & appurtenant structures)	Rs.21.549 billion
- Phase – II (HEIS Development)	Rs. 4.700 billion
Total	Rs. 26.249 billion

CURRENT STATUS

- Feasibility study and detailed engineering design of the Project completed in 2009.
- Project approved by ECNEC in its meeting held on 3 September 2009. Revised PC-1 amounting to Rs. 21.55 billion submitted to MoW&P for arranging approval of ECNEC.
- Tenders for construction received and opened on 17 April 2010.
- Letter of Intent (LOI) issued to the lowest bidder M/s. Descon - Zargoan JV. (Bid Price: Rs. 15.600 billion).
- Government of Balochistan assured full security to the contractor including Chinese contractors.
- M/s Sinohydro (China) is preparing proposal with M/s. Descon JV for construction of the project.
- Contractor is likely to mobilize by January 2012.

HINGOL DAM PROJECT

LOCATION

The dam site is located at a distance of 260 kms north-west of Karachi and about 16 kms north of bridge across Hingol River on Makran Coastal Highway in district Lasbela (Balochistan).



OBJECTIVES

- Irrigated agriculture development of 65,000 acres culturable command area.
- Hydropower generation of 1 MW.
- Socio-economic uplift, poverty reduction and women emancipation.

SALIENT FEATURES

– Dam Type	Central Core Zoned Dam
– Height of Dam	171 ft
– Length of Dam	2,170 ft
– Gross Storage	1,205,752 AF
– Culturable Command Area	65,000 acres
– Cropping Intensity	200%
– Annual Benefits	
– Agriculture	Rs. 4.524 billion
– Power	Rs. 0.102 billion
– Fisheries	Rs. 0.024 billion
– Project Employment	
– Construction Period	5,500 Nos.
– Agriculture Sector	32,500 Nos.
– Installed capacity	1 MW
– Revised Project Cost:	Rs. 26.463 Billion

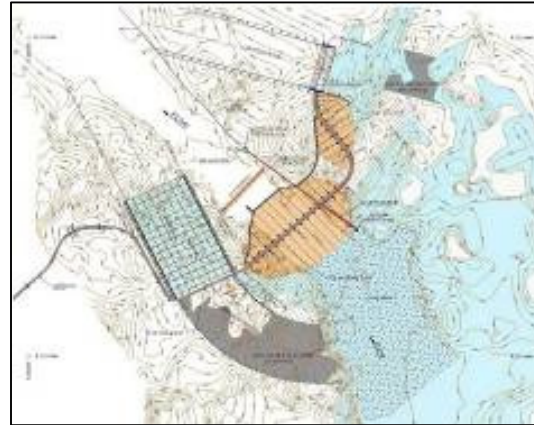
CURRENT STATUS

- WAPDA prepared feasibility study and detailed engineering design of Hingol Dam Project with dam site at Aghor.
- Hindu community raised objections due to submergence of their holy places.
- WAPDA identified new site and prepared feasibility study and detailed engineering design at an additional Project cost of Rs. 4 billion.
- Abu Dhabi Fund may partially finance the project. Terms and conditions to be finalized.
- Government of Balochistan agrees to participation of Abu Dhabi for corporate farming.
- PC-I Proforma (new site) considered by Central Development Working Party (CDWP) in its meeting held on 19 November 2009 and cleared for approval of (Executive Committee of National Economic Council) ECNEC.
- Project Planning Report prepared by consultants and is under review for finalization.
- Tenders for construction will be invited after the approval of PC-I of the project.

GARUK DAM PROJECT

LOCATION

The dam site is located about 47 kms south east of Kharan Town across Garuk River in District Kharan (Balochistan).



OBJECTIVES

- Storage of flood water for irrigated agriculture development of 12,500 acres of culturable command area.
- Hydropower generation of 300 KW.
- Socio-economic uplift, poverty reduction and women emancipation.

SALIENT FEATURES

– Type of Dam	Earth Core Rock fill
– Height of Dam	184 ft
– Length of Dam	2,323 ft
– Reservoir Capacity	50,695 AF
– Culturable Command Area	12,500 acres
– Cropping Intensity	200%
– Annual Benefits	
– Agriculture	Rs. 1.022 billion
– Power	Rs. 0.002 billion
– Fisheries	Rs. 0.034 billion
– Drinking water	Rs. 0.001 billion
– Project Employment	
– Construction Period	1,300 Nos.
– Agriculture Sector	6,250 Nos.
– Power Generation	300 KW
– Revised Project Cost	
– Phase – I (Dam & appurtenant structures)	Rs. 6.671 billion
– Phase – II (HEIS Development)	Rs. 1.250 billion
Total	Rs. 7.921 billion

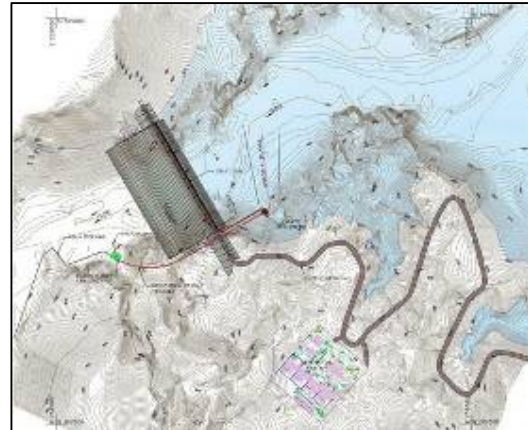
CURRENT STATUS

- PC-I approved by ECNEC in its meeting held on 3 September 2009. Revised PC-I is prepared and under submission for approval.
- Tenders of Garuk Dam on EPC basis invited on 3 Oct and 19 Nov 2009, 20 Feb, 24 Mar, 20 Oct and 23 Dec 2010. No bid received.
- WAPDA proposed the Project through local district contractors by subletting the various components to increase participation of the local community and local monetary benefits.
- Government of Balochistan suggested transferring the Project to I & P Department of Balochistan for execution as it is not safe for WAPDA's staff to execute the Project due to high security risk in the Kharan district.

PELAR DAM PROJECT

LOCATION

The dam site is located about 160 kms from Awaran Town in District Awaran (Balochistan).



OBJECTIVES

- Storage of flood water for irrigated agriculture development of 25,650 acres of culturable command area.
- Hydropower generation of 300 KW.
- Socio-economic uplift, poverty reduction and women emancipation.

SALIENT FEATURES

- Type of Dam	Concrete Gravity
- Height of Dam	60 ft
- Length of Dam	714 ft
- Reservoir Capacity	99,175 AF
- Culturable Command Area	25,650 acres
- Cropping Intensity	200%
- Annual Benefits	
- Agriculture	Rs. 1.195 billion
- Power	Rs. 0.003 billion
- Fisheries	Rs. 0.027 billion
- Drinking water	Rs. 0.002 billion
- Project Employment	
- Construction Period	2,400 Nos.
- Agriculture Sector	12,825 Nos.
- Power Generation	300 KW
- Revised Project Cost	
- Phase – I (Dam & appurtenant structures)	Rs. 7.505 billion
- Phase – II (HEIS Development)	Rs. 2.565 billion
Total	Rs.10.070 billion

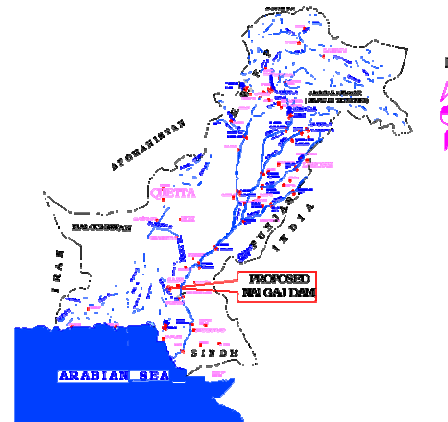
CURRENT STATUS

- PC-I approved by ECNEC in its meeting held on 3 September 2009. Revised PC-I is prepared and under submission for approval.
- Tenders of Pelar Dam on EPC basis invited on 30 Sep and 12 Nov 2009, 20 Feb, 17 Mar, 27 Oct and 29 Dec 2010. No bid received.
- WAPDA proposed the Project through local district contractors by subletting the various components to increase participation of the local community and local monetary benefits.
- Government of Balochistan suggested transferring the Project to I & P Department of Balochistan for execution as it is not safe for WAPDA's staff to execute the Project due to high security risk in the Awaran district.

NAI GAJ DAM PROJECT

LOCATION

The Nai Gaj Dam Project is envisaged to be located on Gaj River about 0.5 miles west of Gaj Inspection Bunglaw in district Dadu of Sindh Province.



OBJECTIVES

- Storage of flood water for irrigated agriculture development of 28,800 acres of culturable command area.
- Hydropower generation of 4.2 MW.
- Socio-economic uplift, poverty reduction and women emancipation.

SALIENT FEATURES

- Dam Type	Earth Core Rock Fill Dam
- Height of Dam	194 ft
- Gross Storage Capacity	300,000 AF
- Live Storage Capacity	160,000 AF
- Culturable Command Area	28,800 Acres
- Cropping Intensity	200%
- Annual Benefits	
- Agriculture	Rs. 6.325 billion
- Power	Rs. 0.420 billion
- Fisheries	Rs. 0.086 billion
- Flood mitigation	Rs. 0.212 billion
- Power Generation	4.2 MW
- Project Employment	
- Construction Period	6,350 Nos.
- Agriculture Sector	14,500 Nos.
- Revised Project Cost	
- Phase – I (Dam & appurtenant structures)	Rs.56.534 billion
- Phase – II (HEIS Development)	Rs. 2.880 billion
Total	Rs.59.414 billion

CURRENT STATUS

- PC-I approved by ECNEC in its meeting held on Sep. 3, 2009. Revised PC-1 amounting to Rs. 21.55 billion submitted to MoW&P for arranging approval of ECNEC.
- Tenders for construction opened on July 16, 2010. Letter of Acceptance issued to M/s NEIE – SMADB JV on 13.01.2011 (Bid Price = Rs. 38.702 Billion). Contract Agreement has been signed on April 12, 2011.
- Funds amounting to Rs. 4,000 Million required for mobilization of contractor.

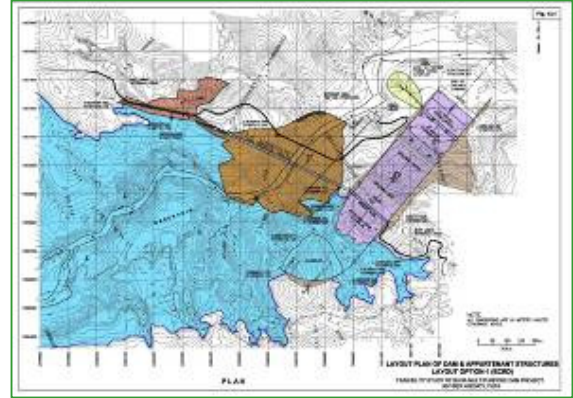
BARA DAM PROJECT

LOCATION

The proposed dam is located across Bara River at the confluence of Mastura River in Khyber Agency, FATA, Khyber Pakhtunkhwa.

OBJECTIVES

- Storage of flood water for irrigated agriculture development of 41,729 acres of culturable command area.
- Hydropower generation of 5.8 MW.
- Socio-economic uplift, poverty reduction and women emancipation.
- Assured irrigation supplies to the existing irrigation schemes.



SALIENT FEATURES

- Type	Earth core Rock fill
- Height of Dam	302 Ft
- Length of Dam	1477 Ft
- Gross storage Capacity	85,363 AF
- Reservoir Capacity	85363 AF
- Command Area	41,729 Acres
- Cropping Intensity	200%
- Power	5.8 MW
- Cost of the Project	Rs.14.208 Billion

CURRENT STATUS

- Feasibility Study completed in 2008.
- PC-I approved by ECNEC on September 3, 2009.
- Tenders of Bara Dam on EPC basis invited on Oct 09, Nov 05, Dec. 19, 2009, Apr 08, 2010. No bid received.
- WAPDA appointed consultants for preparation of Project Planning Report and Tender Documents based on Detailed Engineering Design to invite Tenders on measurement (BOQ) basis.
- Detailed Engineering Design of the Project is in progress, to be completed by December, 2011.
- Detailed Level EIA and RAP Studies are in Progress.
- Tenders for construction will be invited on finalization of Project Planning Report and Tender Documents and on availability of funds for the Project.

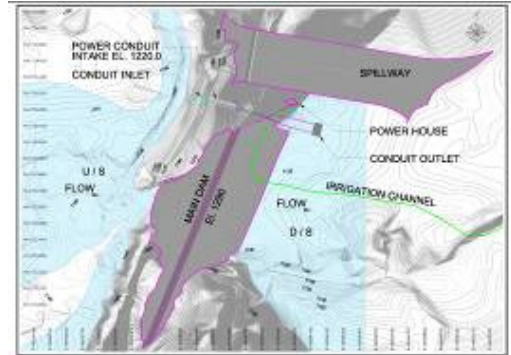
DARABAN DAM PROJECT

LOCATION

The dam is located on Khora River near existing Zam Burg Tower, 69 KM South West of D.I Khan.

OBJECTIVES

- Storage of flood water for irrigated agriculture development of 15,000 acres of culturable command area.
- Hydropower generation of 0.75 MW.
- Socio-economic uplift, poverty reduction and women emancipation.



SALIENT FEATURES

- Type of Dam	Earth Core Rock fill
- Height of Dam	154 FT
- Length of Dam	1426 FT
- Catchment Area	410 Sq. Miles
- Mean Annual Flow	50,274 AF
- Gross Storage	69,739 Acres
- Cultivable Command Area	15,000 Acres
- Cropping Intensity	200%
- Power Generation	0.75 MW
- Cost of the Project	Rs.5.828 Billion

CURRENT STATUS

- PC-I amounting to Rs.2.751 Billion approved by ECNEC on Sept. 03, 2009.
- Tenders for construction on EPC basis invited / received on July 20, 2010. M/s DESCON submitted bid, evaluated and post-qualified.
- WAPDA Authority in its meeting held on January 19, 2011 deferred the construction of the Project keeping in view of non allocation of funds in PSDP for the Project and inauspicious security situation in the Project area and it was decided to conduct Detailed Engineering Design of the Project to invite tenders on measurement (BOQ) basis.
- Revised PC-I is under preparation.

PAPIN DAM PROJECT

LOCATION

The dam is located on Wadala Kas at a distance of about 22 KM on Rawat Dhudhial road in District Rawalpindi.

OBJECTIVES

- Storage of flood water for irrigated agriculture development of 18,000 acres of culturable command area.
- Hydropower generation of 200 kW.
- Socio-economic uplift, poverty reduction and women emancipation.



SALIENT FEATURES

- Type of Dam	Concrete Gravity
- Height of Dam	105 FT
- Length of Dam	460 FT
- Catchment Area	417 Sq. Km
- Mean Annual Flow	136,426 AF
- Gross Storage Capacity	89,600 AF
- Live Storage	48,600 AF
- Reservoir Area	2,790 Acres
- Design Flood	46,900 Cusecs
- Cultivable Command Area	18,000 Acres
- Cropping Intensity	200%
- Installed Capacity	200 KW
- Cost of the Project	Rs.8.609 Billion

CURRENT STATUS

- PC-I amounting to Rs. 1.136 Billion approved by ECNEC in its meeting held on September 3, 2009.
- Revised PC-1 amounting to Rs. 8.609 Billion submitted to Ministry of Water & Power for arranging approval of ECNEC.
- Tenders for construction will be invited on allocation / release of funds and approval of PC-I of the Project.

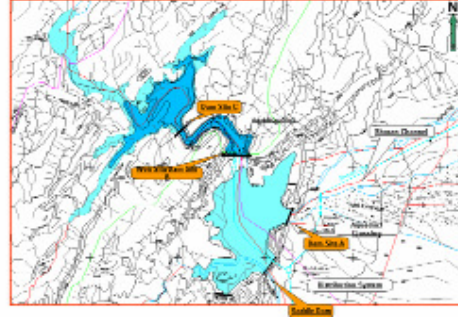
SUKLEJI DAM PROJECT

LOCATION

The proposed Dam is located across Sukleji river about 7 Km west of Shoran, Tehsil Sunny of Bolan District in Kachhi Plain of Balochistan

OBJECTIVES

- Storage of flood water for irrigated agriculture development of 12,000 acres of culturable command area.
- Hydropower generation of 150 kW.
- Socio-economic uplift, poverty reduction and women emancipation.



SALIENT FEATURES

- Dam Height	110 ft
- Dame Length	1466 ft
- Gross Storage Capacity	42,000 AF
- Canal Capacity	70 Cusecs
- Command Area	12000 Acres
- Power Generation	100/150 KW

CURRENT STATUS

- PC-II Proforma (Rs. 38.603 million) for Feasibility Study, Detailed Engineering Design & Tender Documents was approved by DDWP on Oct. 10, 2005.
- Inception report received from the Consultants in August 2006.
- The Consultants concluded that the dam at site A is not technically feasible and recommended to carryout the studies at site X.
- PC-II for carrying out the studies at Site C is under preparation.
- Consultants M/s. BARQAAB along with WAPDA Engineers visited the site on June 10-14, 2008 and will submit their report on Site-C shortly.

TREATMENT OF EFFLUENT WATER OF RBOD (PILOT PROJECT)

- WAPDA in line with the directives of the President of Pakistan in October 2009, engaged M/s EASE-PAK Consultants to carryout the detailed feasibility study with a completion period of six months.
- The Consultants have submitted the draft feasibility study which is under review with WAPDA.
- The initial findings are:
 - The project is technically feasible, economically viable and environment friendly.
 - In-situ analysis of effluent through Prototype plant is planned to authenticate the exact quantity of recoverable salts.
 - The Prototype laboratory plant has been shifted from USA and is functioning on Site since 15th May, 2010.
 - The RBOD effluent must be used as such or after treatment for drinking, agriculture, fishery or other economical uses.
 - The excess quantity of Parameters like calcium carbonate, magnesium make effluent harder which is hazardous for irrigation. After Treatment, excess quantity of calcium carbonate and magnesium shall be removed.

FLOWS AND QUALITY IN RBOD (RD + 93 MNV DRAIN)

SEASON	FLOWS (cfs)	Total Dissolved Solids (PPM)	Sodium Adsorption Ratio (SAR)	Residual sodium Carbonate (RSC)
Kharif	1145	690 – 1900	6-9	0
Rabi	198	1910 – 8360	7-16	0

Useable Flows	=	28% (376 cfs)
Marginal Flows	=	23% (309 cfs)
Hazardous Flows	=	49% (658 cfs)
Treatment Plants to be Installed	=	5 Nos. (40 cfs each)

Benefits of Pilot Project

- 40 cfs of water after treatment will irrigate upto 10,000 acres of barren land
- Project Base Cost. = Rs.3891 M
- Project Revenues (Annual) = Rs. 644 M
- Project O&M Cost (Annual) = Rs. 237 M
- Project Life = 30 years
- Benefit Cost Ratio = 1.18:1
- EIRR = 15.06 %

Total Project:

- Total additional water available after treatment 985,000 AF
- Additional area to be irrigated 350,000 Acres
- Net annual benefits (Revenue) Rs13.227 Billion
- Cost of one plant of 40 cfs (Pilot Project) Rs2 Billion/US\$ 24 Million
- Cost of five plants of 40 cfs each Rs10 Billion/US 120 Million

This project is submitted for the US Assistance under FODP for 05 Plants of 40 cfs for treatment of effluent water for drinking, agriculture, fishing and other economic uses.

CANAL LINING

Canals / Distributaries Lining – 11% lined (5100 km out of 46,400 km length)

Proposed Lining of Canals (Sindh)

– Rohri Canal	-	335 km	16500 Cusec
– Dadu Canal	-	212 km	5738 Cusec
– Rice Canal	-	132 km	13770 Cusec

Benefits

- Saving of 2881 cusecs (5700 AF per day) can irrigate an additional area of 0.492 MA
- Agriculture benefits of Rs11.305 billion per year from saving of canal water seepage
- Reduction in water-logging
- Increase in yields and increase in conveyance efficiency
- Provision of extra jobs and contribution to enhancing per capita income.

COST / BENEFITS OF THE PROJECT

CANALS \ CCA (M Acres)	LENGTH MILES	DISCHARGE CUSEC	SAVINGS CUSEC	ADDITIONAL AREA ACRES	ADDITIONAL BENEFITS Rs M/Year	Cost of Lining (Rs. In Billion)
ROHRI CANAL / 2.46	208.0	16,500	1736	520,800	9912	135
DADU CANAL / 0.48	131.5	13,600	755	226,499	5104	65
RICE CANAL / 0.47	82.0	5,600	777	39,072	354	52
TOTAL / 3.41	421.5 648.5 km	35,700	3,268*	786,371 HEIS (1,258,193)	15,370**	252***

* 9.1% of total discharge

**Rs768 billion in 50 years life

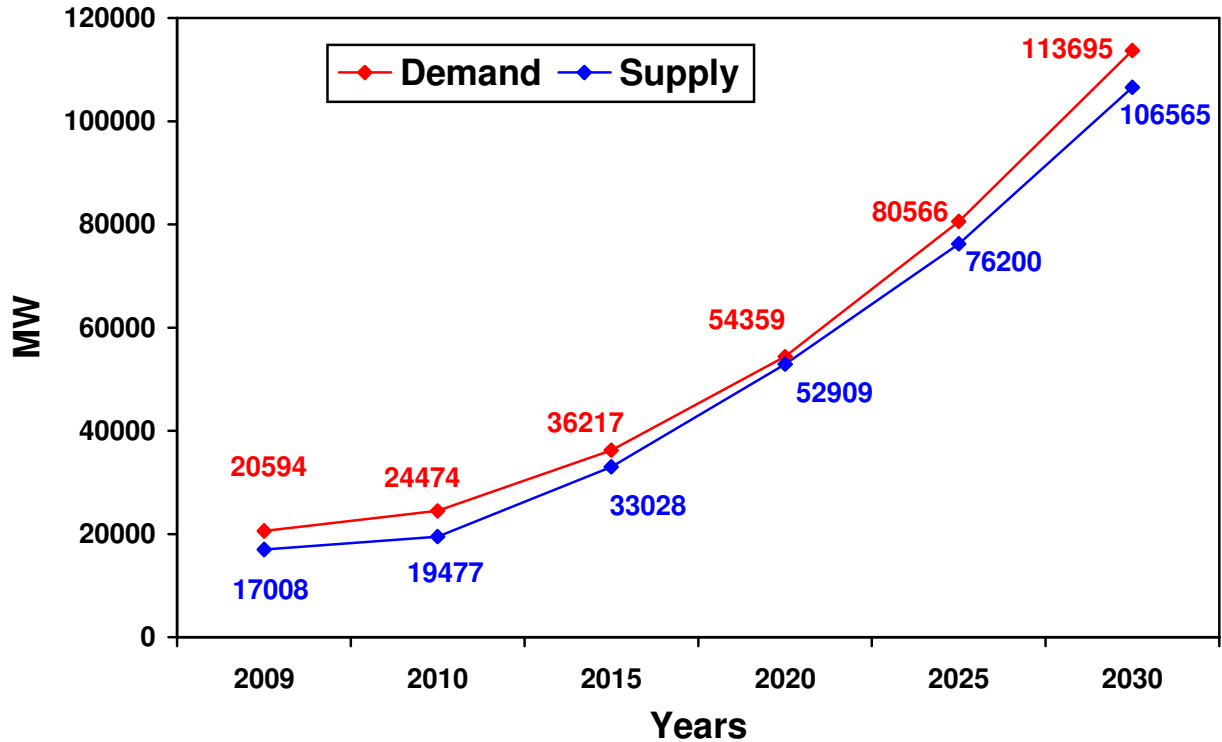
***Rs 388.6 M / km

STATUS

- A team of M/s Huesker Germany, headed by Mr. Christoph Hensing arrived in Pakistan on April 14,2010 and visited Sukkur Barrage and three canals on April 15-16,2010.
 - M/s. Huesker Germany confirmed after site visit that lining under flowing water is technically feasible using Incomat material.
 - Pilot Project of 5km length at Rohri Canal from rd 135 to RD 150 (26 miles d/s of Sukkar Barrage) to be implemented before taking up entire project.
 - M/s. Huesker have agreed to take-up pilot project and start the work within two months time.
 - PC-I for Pilot project is to be completed by June 30, 2010 costing Rs.2,413 million for 5 km.
 - Pilot Project to be implemented in 9 months.
- | | | |
|-------------------------|----------|--|
| • Cost of Pilot Project | = | Rs2.5 Billion / US\$ 30 Million |
| • Cost of Total Project | = | Rs252 Billion/ US\$ 3,000 Million |
| Total | = | Rs.254.5 Billion/US\$ 3,030 Million |

Pilot Project/Main Project in submitted for German Assistance in the field of Lining of Canal and Transfer of technology of the production/local manufacturing of INCOMAT Material produced by M/s HUESKER Germany

PEAK DEMAND PROJECTIONS* (WHOLE COUNTRY) 2009–2030



*Projected demand includes captive power also. Average growth rate is expected to be about 8%

DEMAND FORECAST (2009 - 2030)

Fiscal Years		MW						
		2009	2010	2015	2016	2020	2025	2030
Net Dependable Capability	MW	17008	19477	33028	36560	52909	76200	106565
	Growth Rate	9%	15%	9%	11%	10%	8%	8%
Peak Demand	MW	20594	24474	36217	40555	54359	80566	113695
	Growth Rate	7%	9%	8%	8%	9%	8%	7%
Surplus/ Deficits		-3586	-2876	324	1147	4066	4031	5087