



**PAKISTAN
WATER & POWER DEVELOPMENT AUTHORITY**

**PROJECTS FOR
FRIENDS OF DEMOCRATIC PAKISTAN
(FODP)**

March 2011

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VISION

- Pakistan's Vision about Development of Water Resources is the optimum utilization of Water Resources for irrigation and generation of Energy for sustainable Economic Growth

GOALS

- Development of projects in water sector for irrigation, water supply and drainage.
- Development of projects in power sector for generation, transmission and distribution of power
- Prevention of Water-logging, salinity and reclamation of Waterlogged and saline land.
- Flood Mitigation
- Conservation of Water
- Transfer of technology through expertise in Water & Power sectors

PRIORITIES

- Large Reservoirs
 - Diamer-Basha Dam (6.1 MAF Live Storage, 4500 MW Power, 19 Billion Units)
- Hydel Power Projects
 - Kurram Tangi
 - Tank Zam Project
 - Golen Gol
 - Satpara Dam
 - Mangla E&M Upgradation
 - Tarbela (Generators Winding)
 - Rehabilitation of Warsak Hydel Project
- Increase Water Efficiency
 - Introduction of high level micro irrigation techniques (Drip & Sprinkle Irrigation System)
 - Canal Lining
 - Treatment of Effluent Water
 - Establishment of underground water reservoirs
- Capacity building of WAPDA staff by strengthening and upgradation of training institutes of WAPDA (Staff College, Engineering Academy).
- Training of WAPDA officers/staff in USA & Pakistan through exchange programme

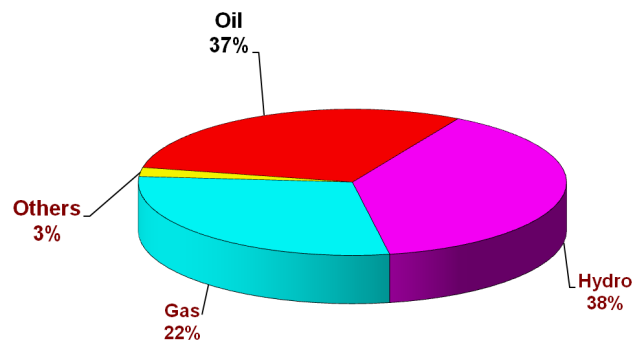
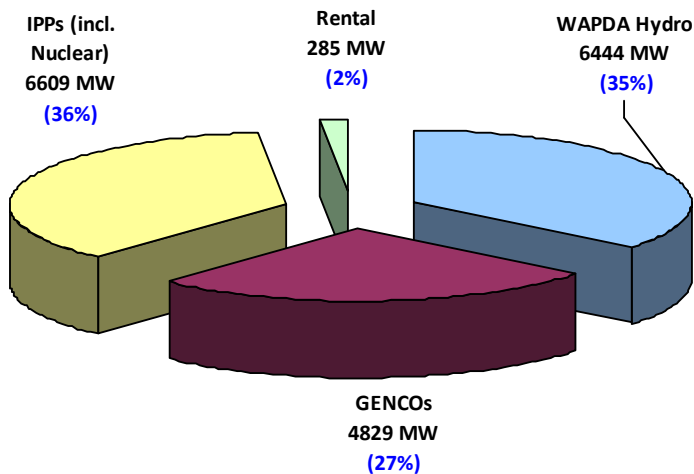
WATER AND POWER SECTOR DEVELOPMENT

- 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 sorts 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 34:66, 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 19000 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.
- 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) Canal Lining (vi) Treatment of Effluent Water (vii) 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.

EXISTING INSTALLED GENERATION CAPACITY



ELECTRICITY GENERATION BY FUEL

PROJECTS PROPOSED FOR THE ASSISTANCE UNDER FRIENDS OF DEMOCRATIC PAKISTAN

1. Diامر-Basha Dam Project
2. Transmission Scheme for Dispersal of Power from Diامر-Basha Dam Project to Major Load Centres in the National Grid
3. Kurram Tangi Dam Project
4. Golen Gol Hydropower Project
5. Tank Zam Dam Project
6. Bunji Hydropower Project
7. Transmission Scheme for Dispersal of Power from Bunji Hydropower Project to Major Load Centres in the National Grid
8. Dasu Hydropower Project
9. Transmission Scheme for Dispersal of Power from Dasu Hydropower Project to Major Load Centres in the National Grid
10. Munda Dam Multipurpose
11. Kachhi Canal Project
12. Lower Palas Valley Hydropower Project
13. Lower Spat Gah Hydropower Project
14. Thor Hydropower Project
15. Tangir Hydropower Project
16. 12 Small/Medium Dams (Phase-I)
17. Hingol Dam Project
18. Bara Dam Project
19. Dispersal of Power from Neelum-Jhelum Hydroelectric Project to Gujranwala
20. Mahl Hydropower Project
21. Kotli Hydropower Project
22. Gulpur Hydropower Project
23. Ultra Mega Power Project/Park
24. Treatment Of Effluent Water of RBOD (Pilot Project)
25. Canal Lining

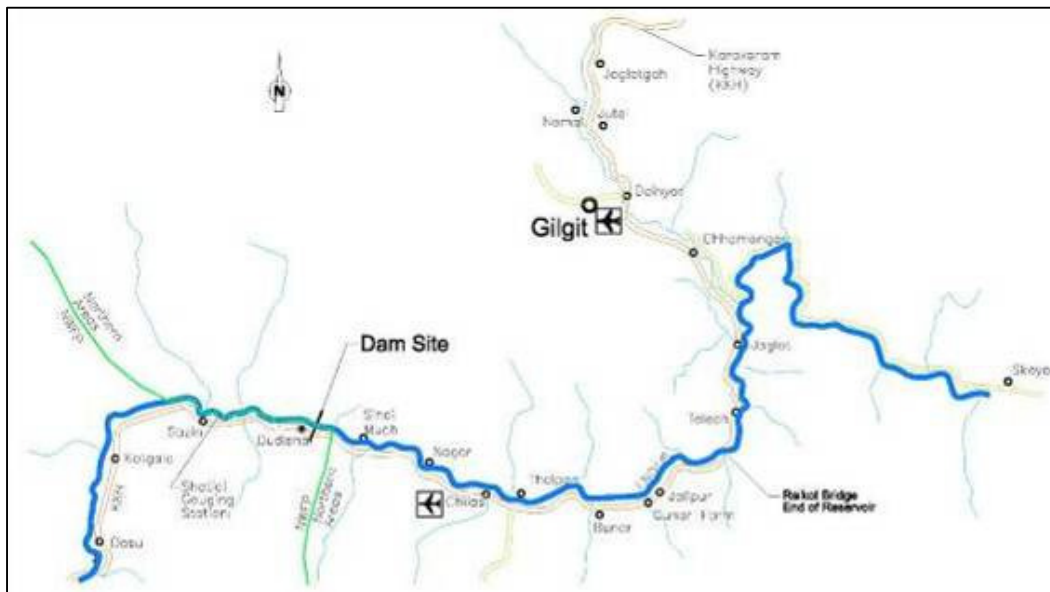
DIAMER BASHA DAM PROJECT

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 17,000 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 Diامر 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\$ 11.17 Billion)
➤ E.I.R.R. (Base Case)	15.3%
➤ Benefit / Cost Ratio (Discount Rate 12%)	1.43
➤ F.I.R.R.	8.04%

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 19000 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 opportunity, particularly to the locals, during the construction and operation
- 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
- Annual Earning of Rs.232.8 Billion.

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
- Savings in Foreign Exchange of Equivalent electricity on imported oil - US\$ 2.85 Billion
- Carbon Credit Benefits – US\$ 0.300 Billion

ENVIRONMENT AND CULTURAL HERITAGE IMPACT ASSESSMENT

- | | |
|-------------------------------|-------------|
| • No. of villages affected | 31 |
| • No. of houses affected | 3037 |
| • Population affected | 28,650 |
| • Agricultural land submerged | 2660 acres |
| • Area to be affected | 37419 acres |
| • Length of KKH submerged | 100 km |
| • Pre-historic rock carvings | 33000 |

RESETTLEMENT ACTION PLAN

The Income level in the project areas is extremely low. The Resettlement Action Plan envisages poverty alleviation. The compensation to be paid for involuntary resettlement would include prescribed possible entitlement as applicable in legislation. Affectees would be resettled in 9 model villages in the close vicinity, with better living condition. Their means of livelihood would be ensured. Affectees would be provided 5 Marla plots free of cost in developed model villages with all civic amenities and also 6 Kanal agricultural land for cultivation on payment. The total cost of PC-I (Part-I) Land Acquisition & Resettlement is estimated Rs.60 billion. Estimated Resettlement plan cost is Rs.12.245 billion. In order to resolve the issue of Resettlement/Land Acquisition, Prime Minister of Pakistan constituted Ministerial Committee, wherein Chief Minister Gilgit Baltistan was an observer and this committee unanimously approved Rs. 40 billion as Land Acquisition charges, agreed by all the stake holders. Council of Common Interests (CCI) under the chairmanship of Prime Minister has approved this project in its meeting held on July 18, 2010.

ENVIRONMENTAL MANAGEMENT PLAN

Environment Management Plan has been prepared. The Plan provides the possible environment impacts measures for the mitigation and monitoring. The estimated cost for the Environmental Management Plan is about 853.96 million.

GEOLOGY, LAND AND SOILS

- Reservoir Impounding
- Construction of dams and appurtenant Structures
- Temporary camps
- Dumping of soil or waste

CLIMATE AND AIR

- Change of local climate through Air pollution

• WATER

- Over use of nullahs for water supply
- Over exploitation of springs
- Pollution of surface water
- Contamination of Indus water due to mixing of sewage. Sewage treatment plants

• FLORA AND FAUNA

- Loss/degradation of natural plants
- Threats to wildlife

• FORESTATION AND FISH STOCK

Due to the construction of the Project over 50,000 trees would be lost. The trees are to be planted on 1:3 ratio for preservation and improvement of ecosystem. The cost of compensation for the lost trees and planting the new trees and is estimated at about US\$ 7 million.

- Anticipated damage to fish stocks due to discharge of effluent in river water
- Two fish hatcheries shall be built for fish culture

• ROCK CARVINGS

- Protection of damage to rock carvings at the dam site and in the quarry areas.
- Physical relocation of most important rock carving objects, where feasible;
- Documentation of all important rock carving objects;
- Production of replicas of carvings for exhibition;
- Establishment of Gilgit-Baltistan Rock Carvings Exhibition Centre.
- Special Project to preserve Rock Carving under the guidance of Dr. Harald Hauptmann in association with Rogers Kolachi Khan & Associates (The Cultural Heritage & Development Consultants)

Project Implementation

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

○ Rs. in Million

Sr. No.	Description of work	Local	Foreign	Total Cost	Const. Period (Yrs.)
1.	Contract Lot-1 (Concrete Dam and Related Structures including Diversion Tunnels and Permanent Access Bridge)	87680	58480	146160	9
2.	Contract Lot-2 (Underground Works and Related Structures (Left and Right Banks)	40960	13840	54800	6.4
3.	Contract Lot-3 (Hydro-Mechanical Equipment and Hydraulic Steel Structures)	3360	30400	33760	8
4.	Contract Lot-4 (Power Plant Generation Equipment (Left and Right Bank)	8240	74160	82400	7
5.	Contract Lot-5 (Electrical High Voltage Equipment and Power Plant Electrical Equipment (Left and Right Bank).	8720	76320	85040	7

Year wise phasing of Project Cost

Period	Financial Phasing (US \$ in Million)		
	Total	LCC	FCC
I. Pre Construction			
2009-10	317.30	317.00	-
2010-11	460.47	341.74	118.73
Sub Total-I	777.77	659.04	118.73
II. Construction			
2011-12	380.18	299.03	81.15
2012-13	689.40	511.11	178.29
2013-14	1056.89	542.75	514.14
2014-15	1211.23	676.84	534.39
2015-16	1463.71	808.26	655.45
2016-17	1603.29	935.90	667.39
2017-18	1398.67	933.54	465.13
2018-19	1104.50	828.44	276.06
2019-20	1088.06	879.61	208.45
Sub Total-II	9995.93	6415.48	3580.45
III. Post Construction			
2020-21	404.54	191.91	212.63
IV. Total (I+II+III)	11178.24	7266.43	3911.81

Present Status

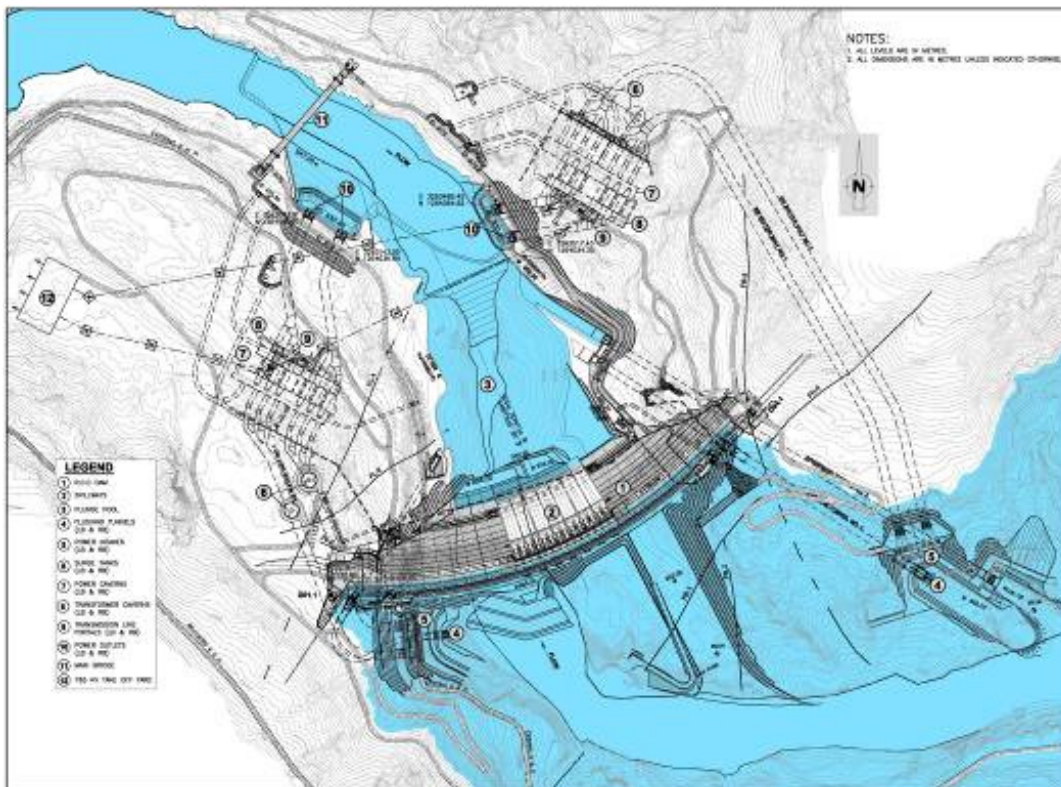
- Detailed Engineering Design of Diamer Basha Dam Project (DBDP) was completed in June-2008.
- PC-I for Land Acquisition and Resettlement was approved by Executive Committee of National Economic Council (ECNEC) on 6.11.2008 for Rs. 60 billion.
- Main PC-I for DBDP was approved by ECNEC on 20.08.2009 for Rs.894.257 billion.
- Resolution on Consensus of Diamer Basha Dam Project approved from Council of Common Interest (CCI) on 18.07.2010.
- Rs. 92 million were released to DCO Kohistan Khyber Pakhtunkhwa for acquisition of land for contractor's camp.
- In June 2010, Rs. 1000 million has been released by Govt. of Pakistan to WAPDA for acquisition of land in Gilgit-Baltistan and released to the Land Acquisition Collector.
- Rs. 15 billion has been allocated in PSDP 2010-11. Rs. 2 billion released by Govt. of Pakistan to Gilgit Baltistan for Land acquisition.
- Pre-qualification of contractors and selection of project consultants shall be started soon.
- Contract awarded for construction of Project Offices and Staff Colonies.

TENTATIVE TIMEFRAME FOR OVERALL IMPLEMENTATION

ACTIVITY	DURATION																				
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21		
I Detailed Engineering Design and Tender Documents																					
1 Feasibility Study Stage-I (Completed by NEAC)	■																				
2 Detailed Engineering and Preparation of Tender Documents Based on World Bank/ADB Guidelines (By DBC)					■																
3 Additional Investigations, Studies and Model Testing (WAPDA /DBC)					■																
II Project Implementation																					
1 Pre-construction Activities Including Project Colony in Thor Valley, Land Acquisition, Relocation of KKH										■											
2 Main Construction Activities (Lot 1 to 5)										■											
2.1 Tendering Process Upto Award										■											
2.2 Mobilization of Contractor(s)										■											
2.3 Construction										■											
3 Reservoir Impounding (Upto FRL of 1160 masl)															■		■				
III Post Construction / Defect Liability Period																					
																				■	

■ Continuous Activity ■■■ Intermittent Activity

PROJECT LAYOUT



FINANCING OF DIAMER-BASHA DAM PROJECT

ELECTRO-MECHANICAL WORKS

Total Estimated Cost US\$ 11.178 Billion

Request for Total Foreign Assistance US\$ 5 Billion

Request for Foreign Assistance for
Supplier's Credit/Public Private Partnership
for Electro-Mechanical Works US\$ 2.5 Billion

Detail as under:

- Hydro-Mechanical Equipment & Hydraulic Steel Structures US\$ 422 Million
(Hydro-mechanical equipment and hydraulic steel structures works will spread over 6 years, commencing in year 2011.)
- Power Plant Generation Equipment US\$ 1030 Million
(Power plant generation equipment works will spread over 6 years, commencing in year 2012)
- Electrical High Voltage Equipment & Power Plant Electrical Equipment US\$ 1063 Million
(Electrical, high voltage equipment and power plant electric equipment works will spread over 7 years, commencing in year 2012)

CIVIL WORKS

Request for Foreign Assistance
through Soft Loans for Civil Works US\$ 2.5 Billion

Detail is as under:

- Concrete Dam & Related Structures including Diversion Tunnels etc. US\$ 1827 Million
(The construction period will spread over 6 years, commencing in year 2010.)
- Underground works & Related Structures US\$ 685 Million
(The construction period will spread over 6 years, commencing in year 2011).

TRANSMISSION SCHEME FOR DISPERSAL OF POWER FROM DIAMER BASHA DAM PROJECT

Diamer 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 Diamer Basha HPP is on Indus River, 315 km upstream of Tarbela Dam. The 765 kV HVAC Transmission Scheme for Dispersal of Power from Diamer 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

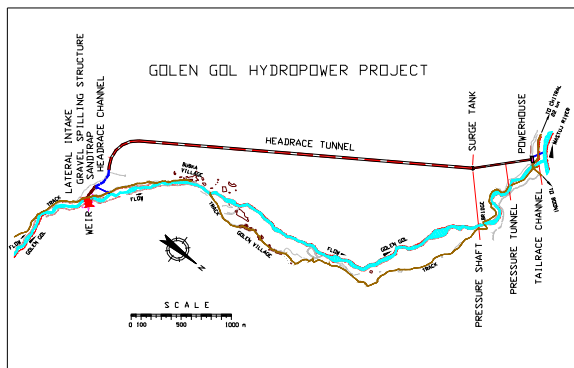
The contract for feasibility study for evacuation of power from Northern Areas has been awarded to JV comprising of P.B. (UK), Teshmont (Canada) and Mirza Associate Pakistan on 26.06.2009.

The estimated cost of the above Power Dispersal Scheme for Diamer Basha HPP is about US\$ 1400 Million which is offered for Supplier's Credit.

GOLEN GOL HYDROPOWER PROJECT

LOCATION

The project is located on Golen Gol Nullah, a tributary of Mastuj River, 25 Km from Chitral Town in NWFP. The project is about 550 km from Islamabad.



SALIENT FEATURES

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

PRESENT STATUS

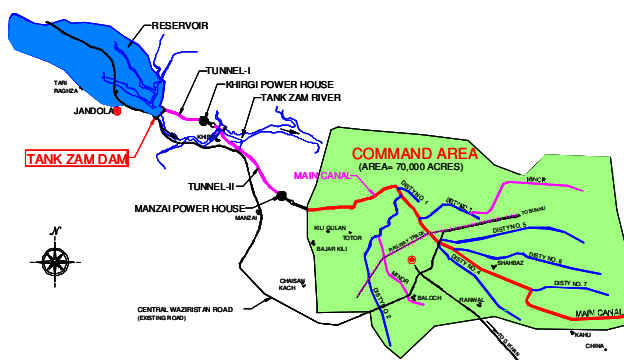
- Feasibility Study completed by HEPO/GTZ in 1997 is updated in 2005.
- Study for Detailed Design and preparation of Tender Documents completed by a joint venture of PES, FICHTNER, Engineering Associates.
- Construction of O&M WAPDA Staff Colony is in progress and will be completed in 2011.
- Lot-2 & 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 Mott McDonald 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)**

FINANCING OF GOLEN GOL HYDROPOWER PROJECT

Total Estimated Direct Cost	US\$ 130 million
▪ Electro-Mechanical Works	US\$ 22 Million (Request for Public Private Partnership)
▪ Transmission Line	US\$ 23 Million (Request for Supplier's Credit)
▪ Civil Works	US\$ 37 Million (Request for soft loan)

TANK ZAM DAM PROJECT

The proposed Tank Zam Dam is situated across Tank Zam River near Hinis Tangi about 30 miles from D.I. Khan of North West Frontier Province (NWFP).



This project was conceived by WAPDA under portfolio of Small/Medium Dams and proposed on Tank Zam about 30 Miles from Tank City in D.I. Khan District of NWFP. The proposed dam will store 216,000 Acres Feet of water in gross, 160,000 Acres Feet in live and has cultivable command area of 70,000 Acres and generate 25.5 MW of electricity on its completion. It has an EIRR of 16.04%. Tank Zam Dam will play significant role in socio-economic development of the area and will provide development opportunities to become a source of fraternity. The estimated cost of the project is Rs.19.9 billion/US\$ 234 million.

Objectives

Socio-economic uplift of the remote areas and women emancipation.

Benefits

Storage of flood water for:

- Irrigated agriculture development with high efficiency irrigation system for optimal use of land and water resources.
- Hydro power generation.
- Flood mitigation.
- Fisheries development.
- Recreation.

Salient Features

Catchment Area	840 sq miles
Mean annual rainfall	9.92 inches
Estimated Mean Annual Run-off	2,60,630 AF

Main Dam

Type	Earth fill Dam
Height	275 ft.
Length	1285 ft
Gross storage capacity	2,16,000 AF
Live storage capacity	1,60,000 AF
Reservoir area	3,610 acres
Cultivable Command Area (CCA)	70,000 acres
Installed Capacity	25.5 MW

Project Cost

Rs.19.9 billion

EIRR

16.04%

CURRENT STATUS

- Govt. of Kyber Pakhtoonkhwa requested WAPDA to take up the project for construction in Phase-I of Small/Medium Dam.
- WAPDA initiated detailed engineering design of the Project.

FINANCING OF TANK ZAM DAM PROJECT

Total Estimated Cost	US\$ 234 Million
▪ Civil Works	US\$ 134 Million
▪ Electro Mechanical Works	US\$ 50 Million

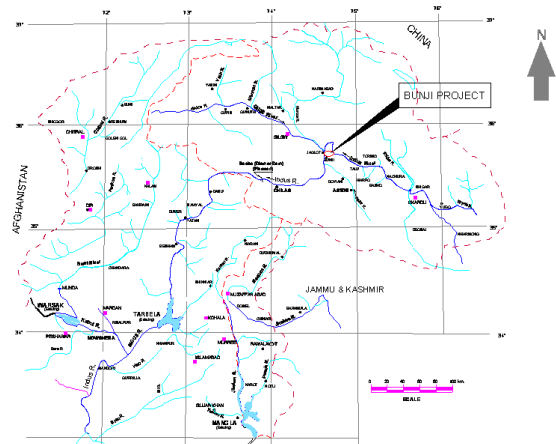
FUTURE FINANCING PHASING

Financial Year	Rs. Billion	US\$ Million
2010-11	4.2	50
2011-12	5.1	60
2012-13	5.1	60

BUNJI HYDROPOWER PROJECT

INTRODUCTION

Bunji hydropower project is run of a river project proposed to be located on Indus river, with dam and powerhouse 85 and 60 km respectively from Gilgit city in Northern Areas of Pakistan. The dam and powerhouse areas are accessible via KKH, 610 and 560 km respectively from Islamabad. The project would utilize Indus river drop in a loop of 45 km through 7.8 km long headrace tunnels.



A 190 m high dam with crest length of 400 m would create 22 km long reservoir. Five 7.8 km long power tunnels would divert a design discharge of 1900 m³/s to an underground powerhouse which will house 20 Francis turbines and generators with an installed capacity of 7,100 MW.

The powerhouse would be connected through three number 765 KV and 800 km long transmission lines to National Grid.

The project has no adverse environmental impacts or resettlement issues.

SALIENT FEATURES (As per draft Feasibility Report)

Installed Capacity (MW)	7100
Gross Head (m)	445
Design Discharge (m ³ /sec)	1900
Mean Annual Energy (GWh)	24088
No. & Type of Turbine	20 (Francis)
Type of Dam	Gravity RCC
Height of Dam (m)	190
Headrace Tunnels	5,7,8 km each
Estimated Project Cost	US\$ 6.8 Billion
EIRR	15%
B.C.Ratio	1.40:1
Estimated construction period	8 Years

PRESENT STATUS

- Hydro Planning Organization in association with short term consultants finalized the Pre-Feasibility report in March 2005.
- ECNEC approved the PC-II for carrying out feasibility study and detailed design on 14.12.2005 for Rs.832.716 million inclusive of FEC of Rs.232.733 million. Revised PC-II amounting to Rs.2089.0 Million has been submitted to Ministry of Water & Power in October 2009.
- Consultancy Contract Agreement signed on 25.4.2007 for Feasibility study, Detailed Engineering design and preparation of tender document with a joint Venter of the following Consultancy firms:
 - M/s Mott MacDonald Ltd (Lead Partner)
 - M/s Sogreah Consultants SAS
 - M/s Nippon Koei Co. Ltd.
 - M/s MM Pakistan (Pvt) Ltd
 - M/s DMC
- Hydro Planning Organization in association with short term consultants finalized the Pre-Feasibility report in March 2005.
- Draft Feasibility Report was submitted by the Consultants on March 31, 2009. Comments on the report were discussed with Consultants to finalize the Feasibility Report. Feasibility Report is awaited.
- Draft Engineering Design report submitted by Consultants and is under review.

COST ESTIMATES

Description	Estimated Cost (US\$ Million)		
	Local	Foreign	Total
Civil Works	1273.05	1591.65	2864.70
Electro-Mech. Equipment	369.91	1479.62	1849.53
Transmission Line	1122.67	436.60	1559.27
Supervision & Management	376.41	188.21	564.62
Total Base Cost	3142.04	3696.07	6838.11

FINANCING OF BUNJI HYDROPOWER PROJECT

Total Estimated Direct Cost

US\$ 6.8 Billion

- Request for Assistance US\$ 3.5 Billion
- Electro-Mechanical Works US\$ 1.5 Billion
(Request for Public Private Partnership)
- Transmission Line US\$ 1.6 Billion
(Request for Supplier's Credit)
- Civil Works US\$ 2.9 Billion (Request for soft loan)

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.



SALIENT FEATURES

Capacity (MW)	4320
Annual Energy (GWh)	21300
Gross Head (m)	210
Design Discharge (m ³ /s)	2600
Dam Height (m)	233 above bed rock
Type of Dam	Roller Compacted Concrete
Gross Storage Capacity	1.15 MAF
Power Tunnel (Km)	3.1 (average)
Powerhouse Type	Underground
No. of Units & Type of Turbines	8 units, Vertical Francis
Total Base Cost (Million US\$)	5206
Detailed Design study period	18-months
Estimated Construction period (years)	8

PRESENT STATUS

- PC-II Proforma approved by ECNEC on September 29, 2003 for Rs. 796.87 million with FEC Rs.100.00 million.
- The Feasibility Study has been completed by a J.V. comprising of the following on 28th February, 2009.
 - M/s. NESPAK, M/s. ACE, M/s. Colenco, M/s. MWH
- World Bank offered Financing for Detailed Engineering Design and Tender Documents and Project Construction if Project would be developed in Stages.
- WAPDA accepted the proposal of World Bank on 15.04.2010 and abandoned the earlier process of hiring of Consultants.
- The Funding from WCAP for Detail Engineering & Preparation of Tender Documents was approved by Steering Committee on WCAP in its meeting held on 13.04.2010.
- EOI approved by Member (Water) and sent to World Bank for NOC on 21.04.2010.
- After vetting of World Bank on 28.04.2010. EOI placed in Newspaper on 29.04.2010. EOI submission date is 29-5-2010.
- Request for Proposal is being prepared

FINANCING OF DASU HYDROPOWER PROJECT

Total Estimated Direct Cost	US\$ 5.3 Billion
▪ Request for Assistance	US\$ 1.55 Billion
▪ Electro-Mechanical Works	US\$ 1.14 Billion
	(Request for Public Private Partnership)
▪ Transmission Line	1.15 Billion (Request for Supplier's Credit)
▪ Civil Works	US\$ 1.55 Billion (Request for soft loan)

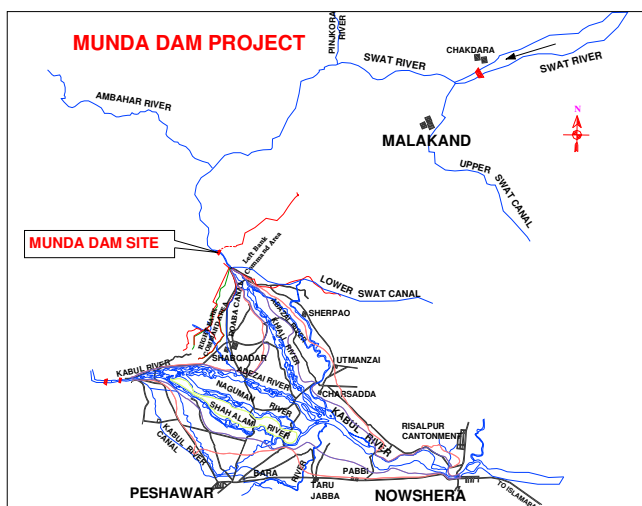
MUNDA DAM MULTIPURPOSE PROJECT

LOCATION

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

OBJECTIVES

- i. Power Generation
- ii. Flood Control
- iii. Irrigation



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 (Peak)	740 MW (Annual Energy 2407 GWh)
Right Bank Culturable Command Area	15098 Acres
Left Bank Culturable Command Area	10057 Acres
Project Cost (Year 2000)	Rs 57.450 Billion (US\$ 1149 Million)
EIRR	13.2%
Construction Period	7 Years

PRESENT STATUS

- Feasibility completed in March 2000.
- Revised PC-II for Detailed Engineering Design and Tender Documents amounting to Rs.652.000 million approved by CDWP in its meeting held on October 11, 2008.
- Expression of Interest (EOI) for short listing of Consultants for Detailed Engineering Design and Preparation of Tender Documents invited from local and foreign consulting firms on November 23, 2010.
- Nine Firms / Joint Venture submitted EOI documents. Evaluation is in process.

FINANCING OF MUNDA MULTIPURPOSE PROJECT

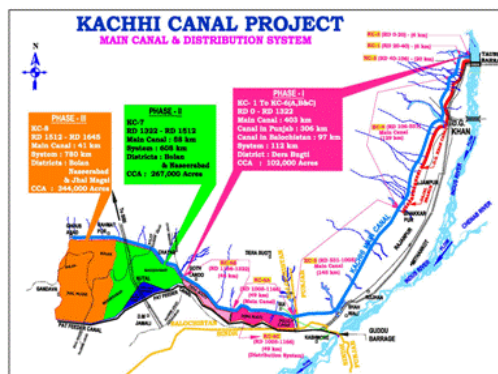
Total Estimated Direct Cost	US\$ 1149 Million
▪ Request for Assistance	US\$ 888 Million
▪ Electro-Mechanical Works	US\$ 226 Million (Request for Public Private Partnership)
▪ Civil Works	US\$ 662 Million (Request for soft loan)

KACHHI CANAL PROJECT

LOCATION

Punjab: Muzaffar Garh, D.G. Khan, Rajanpur Distts:

Balochistan: Dera Bugti, Naseerabad, Bolan, Jhal Magsi Districts



SALIENT FEATURES

- | | |
|---|---|
| <ul style="list-style-type: none"> • Length of Main Canal • Capacity • Distributaries & Minors • Command Area | <p>500 Km (300 Km Lined in Punjab 200 Km Unlined in Balochistan)</p> <p>6000 Cusecs</p> <p>2000 KM</p> <p>713000 Acres</p> <p>PHASE-I: 102,000 CCA</p> <p>PHASE-II: 267,000 CCA</p> <p>PHASE-III: 344,000 CCA</p> |
|---|---|

Agricultural production resulting in boost to economy, improvements in physical environment including atmosphere, climate, land and water, improvement in quality of life due to betterment in socio-cultural and socio-economic conditions. Crop benefits of Rs. 5 Billion per year.

PROJECT BENEFITS

ESTIMATED COST

Rs.31204 Million (Phase-I Rs. **20,000** Million) Approved by ECNEC on 27.09.2003

E.I.R.R.

19.43%

COMMENCEMENT DATE

4 October, 2002

COMPLETION DATE

Dec 2011

Work near completion in Phase-I, Survey is in progress at Phase-II, III.

FINANCING OF KACHHI CANAL PROJECT

Total Estimated Direct Cost

US\$ 450 Million

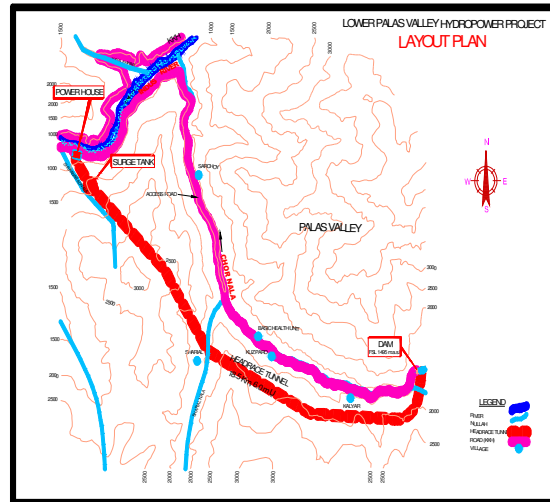
- Civil Works

US\$ 450 Million (Request for soft loan)

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 Pakhtunkhawa. 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	2635 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%

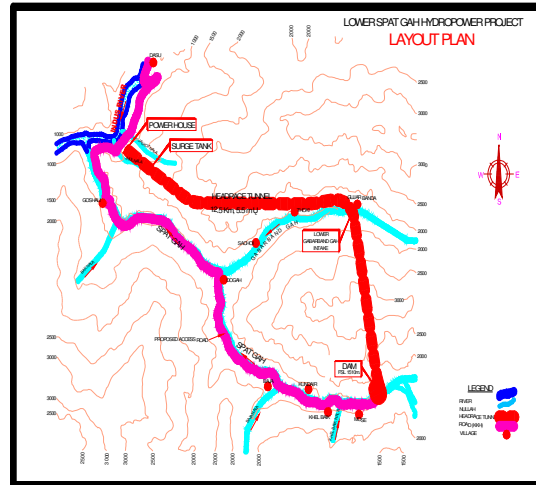
PRESENT STATUS

- The CDWP approved the PC-II for feasibility study on 07.03.2005 for Rs.196.70 Million including FEC of Rs.133.900 Million.
- KfW of Germany has provided financing for carrying out Pre-feasibility studies of 03 projects in Palas valley and Feasibility study of Lower Palas Hydropower Project.
- 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.
- The detailed engineering design and tender documents would take 24 months.
- WAPDA Authority in its meeting on 31.08.2010 has decided to implement Lower Palas Hydropower Project in Public private Partnership (PPP) mode.

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	12.5 km
Pressure Shaft	1143 m
Construction Period	5 Year
Estimated Project Cost	US\$ 697 Million
EIRR	18.4%
FIRR	13.5%

PRESENT STATUS

- The CDWP approved the PC-II for feasibility study on 07.03.2005 for Rs.177.80 Million including FEC of Rs. 95 Million.
- KfW of Germany has provided financing for carrying out Pre-feasibility studies of 03 projects in Spat Gah and Feasibility study of Lower Spat Gah Hydropower Project.
- 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.
- The detailed engineering design and tender documents would take 24 months.
- WAPDA Authority in its meeting on 31.08.2010 has decided to implement Lower Palas Hydropower Project in Public private Partnership (PPP) mode.

THOR HYDROPOWER PROJECT

Project Location

Project is located on Thor Nullah which outfalls into Indus River around 14 km upstream of the Diamer Basha Dam site.

Project Salient Features

Proposed main features of Thor Hydropower Station are as under:-

Working Head	=	105 m
Turbines	=	3 Nos.
Installed Capacity	=	3.6 MW (3 x 1.2 MW Units)
Power Channel:-		
i. Design Discharge	=	4.14 m ³ /s
ii. Length	=	2870 m

Present Status

- After completing the conceptual planning, DBC is now engaged in tender design of the project scheduled for completion by June 2011. Currently, it is proposed to prepare the tender documents for normal LCB.
- The Government of Gilgit-Baltistan has agreed to implement Thor Hydropower Project under Public Private Partnership (PPP) mode through WAPDA.

TANGIR HYDROPOWER PROJECT

Project Location

The project area is accessible from Chilas by K.K.H. road and a jeepable road leads to project area. The project area is located on the left bank of Tangir river, 30 km downstream of Diamer Basha Dam and 430 km from Islamabad.

Project Layout

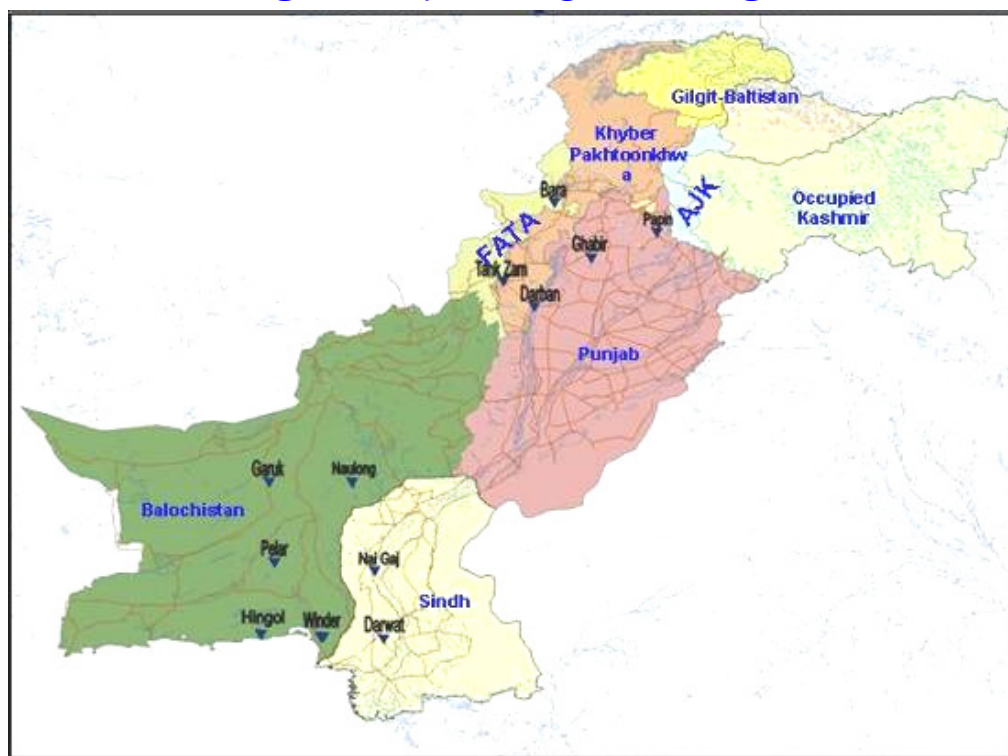
The scheme Tangir Hydropower Project 15.0 MW is a run-of-river scheme, located on the left bank and 4.00 km intermediate stretch of Tangir River. For the proposed scheme, design discharge is 8.70 m³/s and gross head is 215 m. The scheme has been proposed with 3.34 km headrace channel, 360 m penstock and powerhouse on the left bank opposite to Lurg village in Tangir valley.

Weir (Lat, Long, Elev.)	73°-29'-18"	35°-39'-42"	1430 m
Powerhouse (Lat, Long, Elev.)	73°-30'-40"	35°-38'-00"	1215 m
Catchments Area	740 km ²		
Mean Annual Discharge	24.52 m ³ /s		
Design Discharge	8.70 m ³ /s		
Gross Head	215 m		
Net Head	202.9 m		
Capacity	15.0 MW		
Mean Annual Energy	112.34 GWh		
Plant Factor	85.5 %		
Headrace tunnel length	3340 m		
Penstock/pressure shaft	350 m, 1.75 m		
No. & Type of Turbine	2 B.H. 500		
Total Project Cost with IDC	30.967 Million US \$		
Cost/KWh	4.29 US cent		
EIRR	35.0 %		
FIRR	22.56 %		
B/C Ratio	2.23		

Project Status

- The project has been identified by HPO and a Pre-feasibility study is in progress.
- The Government of Gilgit-Baltistan has agreed to implement Thor Hydropower Project under Public Private Partnership (PPP) mode through WAPDA.

SMALL/MEDIUM DAMS



32 SMALL/MEDIUM DAMS IN PAKISTAN PHASE-I – (2009-2012)

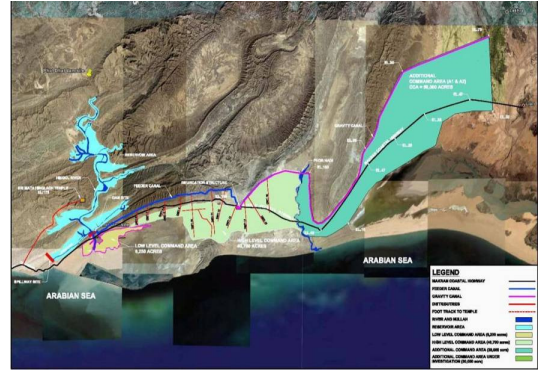
<p>BALUCHISTAN</p> <ul style="list-style-type: none"> • Winder Dam – (0.3 MW) US\$ 148 M • Naulong Dam – (4.4 MW) US\$ 377 M • Hingol Dam – (3.5 MW) US\$ 311 M • Garuk Dam – (0.3 MW) US\$ 21 M • Pelar Dam – (0.3 MW) US\$ 20 M 	<p>NWFP</p> <ul style="list-style-type: none"> • Daraban Zam Dam – (0.75 MW) US\$ 69 M • Tank Zam Dam – (25.5 MW) US\$ 234 M • Bara Dam – (5.8 MW) US\$ 167 M
<p>SINDH</p> <ul style="list-style-type: none"> • Nai Gaj Dam – (4.2 MW) US\$ 332 M • Darawat Dam – (0.45 MW) US\$ 213 M 	<p>PUNJAB</p> <ul style="list-style-type: none"> • Ghabir Dam – (0.15 MW) US\$ 121 M • Papin Dam – (0.2 MW) US\$ 101 M
<p><i>Phase-I – Estimated Cost = US\$ 2114 Million</i></p>	

PHASE-II – (2010-2013)

<p><u>BALUCHISTAN</u></p> <ul style="list-style-type: none"> • Sukleji Dam • Basol Dam • Badinzei Dam 	<p><u>NWFP</u></p> <ul style="list-style-type: none"> • Chaudwan Zam Dam • Sheikh Haider Dam • Chashmai Akor Dam • Chowkas Dam • Totakan Dam • Kuhai Dam
<p><u>SINDH</u></p> <ul style="list-style-type: none"> • Salari Dam • Nali Dam • Khenji Dam • Naing Dam • Sita Dam Project • Upper Makhi Dam 	<p><u>PUNJAB</u></p> <ul style="list-style-type: none"> • Kot Fateh Dam • Mujahid Dam • Lawa Dam • Mohra Shera Dam • Jamalwal Dam
<p><i>Phase-II – Estimated Cost = US\$ 477 Million</i></p>	

HINGOL DAM - LAYOUT PLAN

The dam site is located in District Lasbela across Hingol river in Balochistan Province at a distance of 260 Km North West of Karachi and about 16 Km North of Bridge across Hingol River on Makran Coastal Highway. With the construction of the proposed dam, flood waters of Hingol river will be stored. Gross storage of the reservoir is 2.10 MAF of which an average of about 1.3 MAF water will be annually available for developing irrigated agriculture of command area of 80,000 acres. This project will produce 3.5 MW of power generation with annual energy of 4.4 GWh. Damming the flow of Hingol river will save the flood water for irrigated agriculture development, power generation and water supply for drinking and other domestic uses. The project will bring general uplift of the people in the area by creation of employment and business opportunities. These indirect benefits, such as employment opportunities and consequent rise in the living standard of the people, however cannot be quantified in monetary term. The direct receipt of the project will be available in shape of irrigation service fee (Abiana) and receipt of cost of sale of energy to consumers. The project would greatly increase the development of fisheries in the area and provide recreation and employment opportunities to the residents of the area. The estimated cost of the project will be US\$ 311 Million. Out of which US\$ 227 Million for civil works and US\$ 28 Million for electro-mechanical works are required. EIRR of the project is 16.37%.



SALIENT FEATURES

Type of Dam	Central Core Zoned Dam
Maximum height of Dam	172 ft
Length of Dam	2500 ft
Gross Storage Capacity	1.3 MAF
Installed capacity	3.5 MW
Command Area	80,000 acres
Cropped area	160,000 acres
Cropping Intensity	200%
EIRR	16.37%
B.C. Ratio	1.45:1

CURRENT STATUS

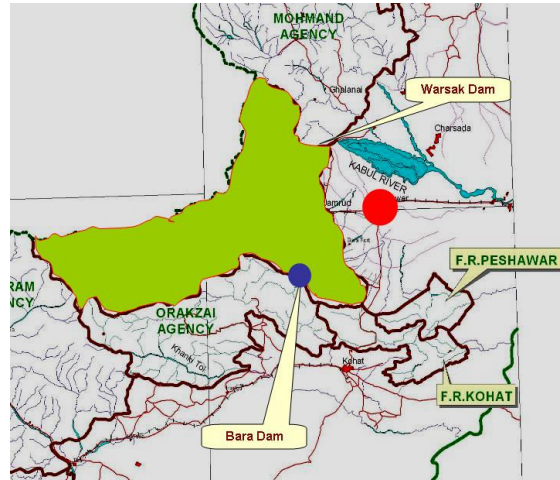
- PC-I Proforma (New Site) cleared by CDWP in its meeting held on November 19, 2009 and cleared for approval of ECNEC.
- Detailed Engineering Design and Tender Documents of the New Site is in progress Studies of the Project (New Site) in progress, to be completed by January 2011.
- Construction bids invited on July 11, 2011.

FINANCING OF HINGOL DAM PROJECT

Total Estimated Direct Cost	US\$ 311 Million
▪ Request for Assistance	US\$ 255 Million
▪ Interest during Construction/ Escalation/Duties & Taxes	US\$ 56 Million
▪ Civil works	US\$ 227 Million (Request for soft loan)
▪ Electro-Mechanical Works	US\$ 28 Million (Request for Public Private Partnership)
▪ The estimated Civil Works cost of US\$ 227 Million is requested through soft loans whereas US\$ 28 Million cost for E&M works is requested for Public Private Partnership / Supplier's Credit.	

BARA DAM

The proposed Bara Dam will be located across Bara river at the confluence of Mastura River in Khyber Agency, Federally Administered Tribal Area (FATA), NWFP. With the construction of the proposed dam, flood waters of Bara river will be stored, which will provide storage of 85,363 AF water annually available for developing irrigated agriculture of command area of 41,729 acres. This project will produce 5.8 MW of power generation. Damming the flow of Bara River will save the loss of life and property in the area. The project will provide assured water supply for drinking and other domestic uses. The project will help general uplift of the people in the area by creation of employment and business opportunities due to construction of the project. These indirect benefits, such as employment opportunities and consequent rise in the living standards of the people, in an area which has experienced considerable militancy lately. The project would greatly increase the development of fisheries in the area and provide recreation and employment facilities to the residents of the area. The estimated cost of the project will be US\$ 167 Million. Out of which US\$ 83 Million for civil works and US\$ 54 Million for electro-mechanical works are required. EIRR of the project is 15.25%.



SALIENT FEATURES

Type	Earth Core Rock fill Dam
Height	302 ft
Length	1477 ft
Reservoir Capacity	85,363 Acres Feet
Power Houses Installed Capacity	5.8 MW (38.1 GWh)
Command Area	41,729 Acres
Cropped Area	83,458 Acres
Cropping Intensity	200%
Project Base Cost	Rs.14.208 Billion
EIRR	15.25%
B.C. Ratio	1.43:1

CURRENT STATUS

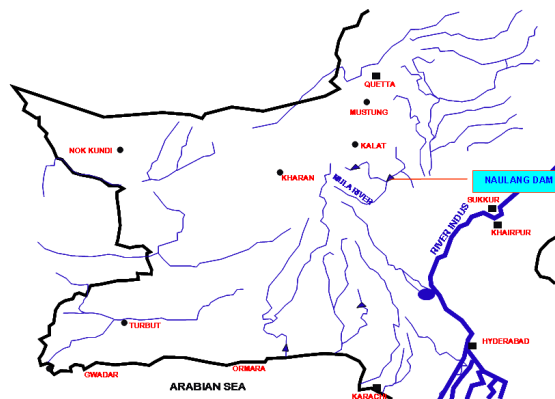
- The Project was approved by ECNEC in its meeting held on September 3, 2009.
- Updated PC-1 amounting to Rs. 5.828 Billion prepared and under Review for approval of ECNEC
- Tenders for construction invited on July 27, 2011.

FINANCING OF BARA DAM PROJECT

Total Estimated Direct Cost	US\$ 167 Million
▪ Request for Assistance	US\$ 137 Million
▪ Interest during Construction/ Escalation Charges/Duties & Taxes	US\$ 30 Million (Local component)
▪ Electro-Mechanical Works	US\$ 54 Million (Supplier's Credit/Public Private Partnership)
▪ Civil Works	US\$ 83 Million (Request for soft loan)

NAULONG DAM

The proposed Naulong Dam will be located on Mula River at Sunth, about 30 kms from Gandava Town in district Jhal Magsi of Balochistan Province. Gandava is tehsil headquarter as well as district headquarter of Jhal Magsi district. With the construction of the proposed dam, flood waters of Mula river will be stored. Live storage of the reservoir is 200,244 Acre Feet will be annually available for developing irrigated agriculture. The total command area will be 47,000 acres with High Efficiency Irrigation System. This project will produce 4.4 MW of power generation with annual energy of 26.6 GWh. Damming the flow of Mula river will save the loss of life and property in the area. Water supply for drinking and other domestic uses. Seepage from the dam will recharge the ground water reservoir and increase the ground water resource. General uplift of the people in the area by creation of employment and business opportunities due to construction of the project. These indirect benefits, such as employment opportunities and consequent rise in the living standard of the people, however cannot be quantified in monetary term. The direct receipt of the project will be available in shape of irrigation service fee (Abiana) and receipt of cost of sale of energy to consumers. The project would greatly increase the development of fisheries in the area and provide recreation and employment facilities to the residents of the area. The estimated cost of the project will be US\$ 377 Million. Out of which US\$ 240 Million for civil works and US\$ 59 Million for electro-mechanical works are required. EIRR of the project is 12.2%.



SALIENT FEATURES

- Average Annual Flow	152,000 AF
- Dam Type	Earth fill
- Dam Height	186 ft.
- Dam Length	2900 ft.
- Gross Storage	242,452 AF
- Live Storage	200,244 AF
- Spillway Design Discharge	438,905 Cusecs
- Fuse Plug Capacity	200,000 Cusecs
- Command Area	47,000 Acres
- Cropped Area	94,000 Acres
- Cropping Intensity	200%
- Installed Capacity	4.4 MW
- Project Cost	Rs.31.962 Billion
- EIRR	12.2%
- B.C. Ratio	1.01:1

CURRENT STATUS

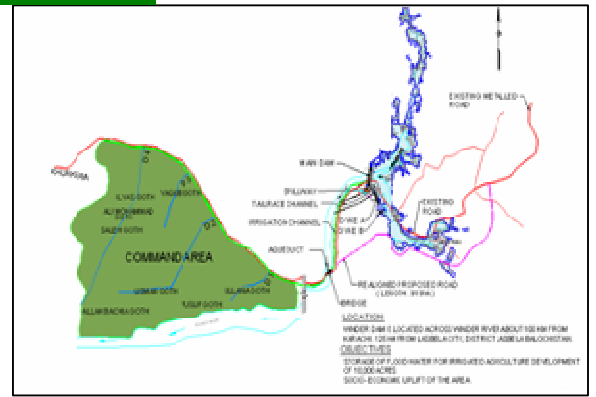
- The Project was approved by ECNEC in its meeting held on September 3, 2009.
- Revised PC-1 amounting to Rs. 31.962 Billion cleared by CDWP in its meeting held on June 29, 2010 for approval of ECNEC.
- Tenders for construction received and opened on April 17, 2010.
- Evaluation of Technical and Financial proposals in process.

FINANCING OF NAULONG DAM PROJECT

Total Estimated Direct Cost	US\$ 377 Million
▪ Request for Assistance	US\$ 299 Million
▪ Interest during Construction/ Escalation/Duties & Taxes	US\$ 78 Million
▪ Civil works	US\$ 240 Million (Request for soft loan)
▪ Electro-Mechanical Works	US\$ 59 Million (Request for Public Private Partnership)

WINDER DAM PROJECT

The proposed Winder Dam will be located Across Winder River about 100 Km from Karachi in District Lasbela, Balochistan. With the construction of the proposed dam, flood waters of Winder River will be stored. Live storage of the reservoir is 36,167 Acre Feet of which will be annually available for developing irrigated agriculture. The total command area will be 20,000 acres with High Efficiency Irrigation System. This project will produce 300 KW of power generation. Damming the flow of Winder River will save the loss of life and property in the area. Water supply for drinking and other domestic uses. Seepage from the dam will recharge the ground water reservoir and increase the ground water resource. Women emancipation by allotment of government land to landless women of the area. General uplift of the people in the area by creation of employment and business opportunities due to construction of the project. These indirect benefits, such as employment opportunities and consequent rise in the living standard of the people, however cannot be quantified in monetary term. The direct receipt of the project will be available in shape of irrigation service fee (Abiana) and receipt of cost of sale of energy to consumers. The project would greatly increase the development of fisheries in the area and provide recreation and employment facilities to the residents of the area. The estimated cost of the project will be US\$ 148 Million. Out of which US\$ 177.6 Million for civil works and US\$ 0.4 Million for electro-mechanical works are required. EIRR of the project is 12.24%.



SALIENT FEATURES

• Type	Earth Core Rockfill Dam (ECDRD)
• Height	31 m (102 ft)
• Length	517 m (1696 ft)
• Estimated Mean Annual Runoff	40.365 AF
• Gross Storage Capacity	36,484 AF
• Live storage capacity	36,167 AF
• Life of Reservoir	32 Years
• Culturable Command Area	10,000 Acres
• Cropped Area	20,000 Acres
• Cropping Intensity	200%
• Hydropower Generation	300 KW
• Spillway Design Flood	150,000 Cusecs
• Project Cost	Rs. 12,412 Million
• EIRR	12.41%
• B.C. Ratio	1.04:1

CURRENT STATUS

- PC-I amounting to Rs.1.696 Billion approved by ECNEC in its meeting held on Sep 3, 2009.
- Ground Breaking Ceremony was graced by the President of Pakistan on Jan. 01, 2010.
- Tenders for construction opened on September 28, 2009 and Letter of Acceptance issued to M/s Techno Engineering – RSWI JV on Feb. 15, 2010.
- Revised PC-1 amounting to Rs. 12.412 billion cleared by CDWP in its meeting held on June 29, 2010 for approval of ECNEC.
- The Contractor is being mobilized.

FINANCING OF WINDER DAM PROJECT

Total Estimated Cost	US\$ 148 Million
▪ Request for Assistance	US\$ 118 Million
▪ The estimated cost of US\$ 148 Million is requested through soft loans.	
▪ Interest during Construction/ Escalation/Duties & Taxes	US\$ 30 Million
▪ Civil works	US\$ 117.6 Million (Request for soft loan)
▪ Electro-Mechanical Works	US\$ 0.4 Million (Request for Public Private Partnership)

GARUK DAM PROJECT

The proposed dam site is located across Garuk River at about 47 Kms South East of Kharan district of Balochistan. With the construction of the proposed dam, flood waters of Garuk River will be stored. Live storage of the reservoir is 66900 Acre Feet, which will be available for developing irrigated agriculture. The total command area will be 13,000 acres with High Efficiency Irrigation System. This project will produce 720 KW of power generation. Damming the flow of Garuk River will save the loss of life and property in the area. Water supply for drinking and other domestic uses. Seepage from the dam will recharge the ground water reservoir and increase the ground water resource. General uplift of the people in the area by creation of employment and business opportunities due to construction of the project. These indirect benefits, such as employment opportunities and consequent rise in the living standard of the people, however cannot be quantified in monetary term. The direct receipt of the project will be available in shape of irrigation service fee (Abiana) and receipt of cost of sale of energy to consumers. The project would greatly increase the development of fisheries in the area and provide recreation and employment facilities to the residents of the area. The estimated cost of the project will be US\$ 21 Million. Out of which US\$ 16.3 Million for civil works and US\$ 0.7 Million for electro-mechanical works are required. EIRR of the project is 12.5%.

PROJECT FEATURES

• Type of Dam	Earth core rock fill.
• Height of Dam	184 ft
• Proposed Length of Dam	2323 ft
• Gross Storage	99,175 AF
• Reservoir Capacity	66,900 AF
• Command area	13,000 Acres
• Cropped Area	26,000 Acres
• Cropping Intensity	200%
• Power Generation	720 KW
• Cost of the Project	Rs. 1.790 Billion
• EIRR	12.50%
• B.C. Ratio	0.92:1

CURRENT STATUS

- PC-I amounting to Rs. 1.790 Billion approved by ECNEC in its meeting held on September 3, 2009.
- Tenders for construction invited on August 17, 2011.

FINANCING OF GARUK DAM PROJECT

Total Estimated Cost US\$ 21 Million

- **Request for Assistance US\$ 21 Million**
 - The estimated cost of US\$ 21 Million is requested through soft loans.
 - Interest during Construction/
Escalation/Duties & Taxes US\$ 4 Million
 - Civil works US\$ 16.3 Million (Request for soft loan)
 - Electro-Mechanical Works US\$ 0.7 Million
(Request for Public Private Partnership)

PELAR DAM PROJECT

The proposed dam site is located about 160 KM from Awaran Town in District Awaran of Balochistan Province. With the construction of the proposed dam, flood waters will be stored. Live storage of the reservoir is 99,175 Acre Feet, which will be available for developing irrigated agriculture. The total command area will be 14,200 acres with High Efficiency Irrigation System. This project will produce 720 KW of power generation. Damming the flow will save the loss of life and property in the area. Water supply for drinking and other domestic uses. Seepage from the dam will recharge the ground water reservoir and increase the ground water resource. General uplift of the people in the area by creation of employment and business opportunities due to construction of the project. These indirect benefits, such as employment opportunities and consequent rise in the living standard of the people, however cannot be quantified in monetary term. The direct receipt of the project will be available in shape of irrigation service fee (Abiana) and receipt of cost of sale of energy to consumers. The project would greatly increase the development of fisheries in the area and provide recreation and employment facilities to the residents of the area. The estimated cost of the project will be US\$ 20 Million. Out of which US\$ 15.3 Million for civil works and US\$ 0.75 Million for electro-mechanical works are required. EIRR of the project is 14.18%.

PROJECT FEATURES

• Type of Dam	Concrete Gravity
• Height of Dam	132 ft
• Length of dam	714 ft
• Gross storage	99,175 AF
• Command area	14,200 Acres
• Cropped Area	28,400 Acres
• Cropping Intensity	200%
• Power generation	720 KW
• Cost of the Project	Rs. 2.75 Billion
• EIRR	14.18%
• B.C. Ratio	1.09:1

CURRENT STATUS

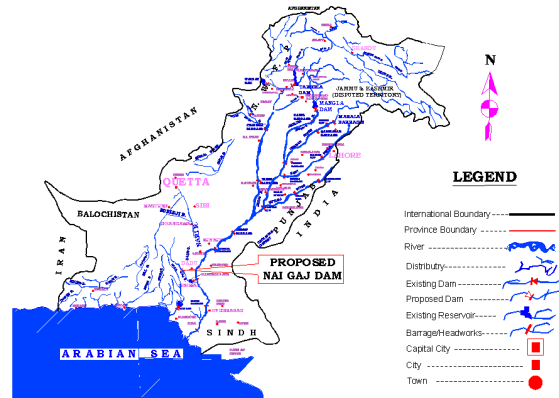
- PC-I amounting to Rs. 1.692 Billion approved by ECNEC in its meeting held on September 3, 2009.
- Tenders for construction invited on August 24, 2011.

FINANCING OF PELAR DAM PROJECT

Total Estimated Cost	US\$ 20 Million
▪ Request for Assistance	US\$ 20 Million
▪ Interest during Construction/ Escalation/Duties & Taxes	US\$ 4 Million
▪ Civil works	US\$ 15.3 Million (Request for soft loan)
▪ Electro-Mechanical Works	US\$ 0.7 Million (Request for Public Private Partnership)

NAI GAJ DAM

Nai Gaj Dam Project is proposed across Gaj river in the gorge area at the edge of Kirthar range at about 65 km (40 miles) north-west of Dadu city in Sindh Province. With the construction of the proposed dam, flood waters of Gaj river will be stored, in a reservoir of capacity 0.160 MAF, which will be annually available for developing irrigated agriculture of command area of 40,000 acres. This project will produce 4.2 MW of power generation. Damming the flows of Gaj River will save the flood water for irrigated agriculture development, power generation, water supply for drinking and other domestic uses and fresh water for Manchar Lake. The project will bring general uplift of the people in the area by creation of employment and business opportunities. These indirect benefits, such as employment opportunities and consequent rise in the living standard of the people, however cannot be quantified in monetary term. The direct receipt of the project will be available in shape of irrigation service fee (Abiana) and receipt of cost of sale of energy to consumers. The project would greatly increase the development of fisheries in the area and provide recreation and employment facilities to the residents of the area. The estimated cost of the project will be US\$ 332 Million. Out of which US\$ 155 Million for civil works and US\$ 27 Million for electro-mechanical works are required. EIRR of the project is 13.18%.



SALIENT FEATURES

Type of Dam	Earth Core Rockfill dam.
Height of Dam	194 Ft
Live Storage	0.16 MAF
Gross Storage	0.30 MAF
Dead Storage	0.140 MAF
Fuse Plug Capacity	74000 Cusecs
Spillway Capacity	253000 Cusecs
Command Area	40,000 Acres
Cropped Area	80,000 Acres
Cropping Intensity	200%
Power House Installed Capacity	4.2 MW
Project Cost (2009)	Rs.28.153 Billion (Revised)
EIRR	13.18%
B.C. Ratio	1.32:1

FINANCING OF NAI GAJ DAM PROJECT

Total Estimated Cost US\$ 332 Million

- **Request for Assistance US\$ 222 Million**
 - IDC/Taxes/Duties/Escalation US\$ 110 Million
 - Civil Works US\$ 155 Million as soft loan
 - E&M Works US\$ 27 Million
(Request for Public Private Partnership)
- PC-I amounting to Rs. 16.924 Billion approved by ECNEC in its meeting held on September 3, 2009.
- Revised PC-1 amounting to Rs. 28.153 Billion submitted to Ministry of Water & Power for arranging approval of ECNEC
- Letter of Acceptance issued to NEIE-SMADB-LILLY-RMS JV on 13 January, 2011.

DARWAT DAM PROJECT

The proposed Darwat Dam Project is located near village Jhangri, District Jamshoro, about 20 KMs from Super Highway in Sindh Province. With the construction of the proposed dam, flood waters of Nai Baran River will be stored, in a reservoir of capacity 121,790 Acres Feet, which will be annually available for developing irrigated agriculture of command area of 25,000 acres with High Efficiency Irrigation System. This project will produce 0.45 MW of power generation. Damming the flows of Nai Baran will save the flood water for irrigated agriculture development, power generation and water supply for drinking and other domestic uses. Women emancipation by allotment of government land to landless women of the area. The project will bring general uplift of the people in the area by creation of employment and business opportunities. These indirect benefits, such as employment opportunities and consequent rise in the living standard of the people, however cannot be quantified in monetary term. The direct receipt of the project will be available in shape of irrigation service fee (Abiana) and receipt of cost of sale of energy to consumers. The project would greatly increase the development of fisheries in the area and provide recreation and employment facilities to the residents of the area. The estimated cost of the project will be US\$ 213 Million. Out of which US\$ 157.2 Million for civil works and US\$ 0.8 Million for electro-mechanical works are required. EIRR of the project is 15.89%.

SALIENT FEATURES

Dam Type	Concrete Faced Rockfill Dam (CFRD)
Length	225 m (738 ft)
Maximum Height	118 ft
Reservoir Capacity	121,790 Acre ft
Power Generation	0.45 MW
Command Area	25,000 Acres
Cropped Area	50,000 Acres
Cropping Intensity	200%

PROJECT COST & ECONOMICS

Cost	Rs.18.085 Billion
EIRR	15.89%
B.C. Ratio	1.57:1

CURRENT STATUS

- PC-I amounting to Rs. 3.175 Billion approved by ECNEC in its meeting held on September 3, 2009.
- Revised PC-1 amounting to Rs. 18.085 Billion cleared by CDWP in its meeting held on June 29, 2010 for approval of ECNEC
- Ground Breaking Ceremony was graced by the President of Pakistan on January 2, 2010.
- Letter of Acceptance issued to M/s Sinohydro-MAJ JV on February 15, 2010.
- The Contractor mobilized to site w.e.f June 30, 2010.
- Contractor started construction of site camps, soil investigations. Completed the topographic survey of Dam Axis, Spillway and the topographic survey of command area.

FINANCING OF DARWAT DAM PROJECT

Total Estimated Cost	US\$ 213 Million
▪ Request for Assistance	US\$ 158 Million
▪ IDC/Taxes/Duties/Escalation	US\$ 55 Million
▪ Civil Works	US\$ 157.2 Million as soft loan
▪ E&M Works	US\$ 0.8 Million (Request for Public Private Partnership)

DARABAN DAM PROJECT

The proposed Daraban Dam will be located on Khora River near existing Zam Burg Tower, 69 KM South West of D. I Khan District of NWFP. With the construction of the proposed dam, flood waters of Khora River will be stored, which will provide storage of 69,739 AF water annually available for developing irrigated agriculture of command area of 16,000 acres. This project will produce 0.75 MW of power generation. Damming the flow of Khora River will save the loss of life and property in the area. The project will provide assured water supply for drinking and other domestic uses. The project will help general uplift of the people in the area by creation of employment and business opportunities due to construction of the project. These indirect benefits, such as employment opportunities and consequent rise in the living standards of the people, in an area which has experienced considerable militancy lately. The project would greatly increase the development of fisheries in the area and provide recreation and employment facilities to the residents of the area. The estimated cost of the project will be US\$ 69 Million. Out of which US\$ 56.25 Million for civil works and US\$ 0.75 Million for electro-mechanical works are required. EIRR of the project is 12.7%.

SALIENT FEATURES

• Type of Dam	Earth Core Rock Fill
• Height of Dam	165 ft.
• Reservoir Storage:	
- Live Storage	69,739 Acres ft.
• Command Area	16,000 acres
• Cropped Area	32,000 Acres
• Cropping Intensity	200%
• Project Cost	Rs.5.828 Billion
• EIRR	12.7%
• B.C. Ratio	1.85:1

CURRENT STATUS

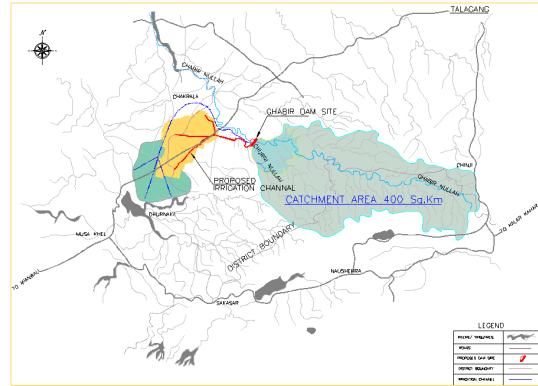
- The Project was approved by ECNEC in its meeting held on September 3, 2009.
- Updated PC-1 amounting to Rs. 5.828 Billion prepared and under Review for approval of ECNEC
- Tenders for construction received on July 20, 2010.
- M/s. DESCON Engineering submitted the bid. Evaluation of bid is under process.

FINANCING OF DARABAN DAM PROJECT

Total Estimated Direct Cost	US\$ 69 Million
▪ Request for Assistance	US\$ 69 Million
▪ IDC/Taxes/Duties/Escalation	US\$ 12 Million
▪ Civil Works	US\$ 56.25 Million as soft loan
▪ E&M Works	US\$ 0.75 Million
	(Request for Public Private Partnership)

GHABIR DAM

The dam is proposed across Ghabir Kas a tributary of Soan River about 9 Km from village Danda Shah Bilawal and 60 Km from Talagang in District Chakwal of Punjab Province. The catchment area up to the dam site is about 417 Sq. Km. The Project will irrigate 15,000 Acres of land. The length of main channel is 45932 feet and length of distributaries 39370 feet with discharge at head 58.60 Cs. The live storage capacity of the dam is 26000 Aft to irrigate the command area of 30000 acres. Gross storage capacity of Dam is 66203 Aft which is sufficient to accommodate the sediments inflow of more than 50 years. The project will provide assured water supply for drinking and other domestic uses. The project will help



general uplift of the people in the area by creation of employment and business opportunities due to construction of the project. These indirect benefits, such as employment opportunities and consequent rise in the living standards of the people, in an area which has experienced considerable militancy lately. The project would greatly increase the development of fisheries in the area and provide recreation and employment facilities to the residents of the area.

The type of dam is Earth Core Rock Fill Dam (ECRD) with core trench with 138 ft height. The Spillway is located left side of dam abutment overflow ogee type. The capacity of Spillway is 48,000 Cs, which is equal to the highest designed flood of 100 years return period after routing through reservoir. The total cost of the Project is US\$ 121 Million.

SALIENT FEATURES

• Type of Dam	Earth Core Rock fill Dam
• Height of Dam	138 FT
• Length of Dam	3,117 FT
• Gross Storage Capacity	66,203 AF
• Live storage Capacity	26,000 AF
• Cultivable Command Area	15,000 Acres
• Cropped Area	30,000 Acres
• Cropping Intensity	200%
• Cost of the Project	Rs.10.184 Billion
• EIRR	13.60%
• B.C. Ratio	1.54:1

CURRENT STATUS

- The Project was approved by ECNEC on Sept. 03, 2009.
- Ground Breaking graced by the President of Pakistan on January 21, 2010.
- Revised PC-I amounting to Rs. 10.184 billion cleared by CDWP in its meeting held on June 29, 2010 approval of ECNEC.
- Bids for construction opened on January 05, 2010. Five Firms submitted bids (M/s.Sinohydro-MAJ JV, M/s.Dongfang Electric Corporation-Technical Associates-Habib Construction JV, M/s.Xinjiang Beixin-Matracon JV, M/s.NEIE-LAC-JV, M/s.CWE).
- Letter of acceptance issued to M/s Dong Fang-Technical Associates and Habib Construction JV at a contract price of Rs.6.048 billion.
- The Contract agreement is in process for signing.
- The Contractor is being mobilized.

FINANCING OF GHABIR DAM PROJECT

Total Estimated Direct Cost	US\$ 121 Million
▪ Request for Assistance	US\$ 112 Million
▪ IDC/Taxes/Duties/Escalation	US\$ 9.0 Million
▪ Civil Works	US\$ 111.8 Million as soft loan
▪ E&M Works	US\$ 0.2 Million (Request for Public Private Partnership)

PAPIN DAM PROJECT

The proposed Papin Dam will be located on Wadala Kas at a distance of about 22 KM on Rawat Dhudhial Road in District Rawalpindi of Punjab Province. With the construction of the proposed dam, flood waters of Wadala Kas River will be stored, which will provide storage of 89,600 AF water annually available for developing irrigated agriculture of command area of 20,000 acres. This project will produce 300 kW of power generation. Damming the flow of Wadala Kas River will save the loss of life and property in the area. The project will provide assured water supply for drinking and other domestic uses. The project will help general uplift of the people in the area by creation of employment and business opportunities due to construction of the project. These indirect benefits, such as employment opportunities and consequent rise in the living standards of the people, in an area which has experienced considerable militancy lately. The project would greatly increase the development of fisheries in the area and provide recreation and employment facilities to the residents of the area. The estimated cost of the project will be US\$ 101 Million. Out of which US\$ 81.305 Million for civil works and US\$ 0.70 Million for electro-mechanical works are required. EIRR of the project is 19.95%.

PROJECT FEATURES

• Type of Dam	Concrete Gravity
• Height of Dam	105 FT
• Length of Dam	460 FT
• Gross Storage Capacity	89,600 AF
• Live Storage	48,600 AF
• Cultivable Command Area	20,000 Acres
• Cropped area	40,000 Acres
• Cropping Intensity	200%
• Installed Capacity	300 KW
• Cost of the Project	Rs.8.609 Billion
• EIRR	19.95%

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 under submission to Ministry of Water & Power for arranging approval of ECNEC.
- Tenders for construction invited on July 20, 2011.

FINANCING OF PAPIN DAM PROJECT

Total Estimated Direct Cost	US\$ 101 Million
▪ Request for Assistance	US\$ 82 Million
▪ IDC/Taxes/Duties/Escalation	US\$ 19 Million
▪ Civil Works	US\$ 81.30 Million as soft loan
▪ E&M Works	US\$ 0.70 Million (Request for Public Private Partnership)

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.

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 245 MW (Revised to 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 was identified by WAPDA and M/s MONENCO (Canada) during early 80s. The project lies along Jhelum River about 25 km downstream from Kohala Bridge and was conceived to be a concrete gravity dam 53 m high with installed capacity of 245 MW. During early 90s, the project was ranked by WAPDA/GTZ and the capacity was enhanced to 500 MW. In year 2002, WAPDA optimized the project for a capacity of 550 MW keeping in view the new location of Kohala hydropower project and abandoning the site of Abbasian hydropower project. PPIB advertised this site to develop Mahl project in private sector during 2005 but no response was received. AJK PPC also advertised the site for its development under Private Public Participation mode but no response was received.

Board of Investment (BOI) Govt. of Pakistan has intimated that Investors from Korea are interested to execute this project.

The proposed Mahl Hydropower Propjet was originally offered by Private Power Infrastructure Board (PPIB) in 2005 to China International Water and Electric Corporation (CWE) and no response was received. It was thereafter transferred to Govt. of AJK for implementation of Project through public private partnership. The Govt. of AJK on 16.9.2009 has requested WAPDA to execute a MOU to implement the Project as a joint venture on terms mutually agreed upon.

Draft MOU sent by Govt. of AJK between AJK Govt. and WAPDA has been reviewed and amended in the light of recommendations G.M. (Hydro) Planning, G.M., CCC and Director (Legal). AJK Govt. has requested WAPDA to prepare feasibility and detailed engineering of this project.

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

GULPUR HYDROPOWER PROJECT

LOCATION

Gulpur-AJK.

SALIENT FEATURES

River	Poonch
Power	100 MW
Energy	475 GWh

ENVIRONMENTAL IMPACT

- No adverse environmental impact

ULTRA MEGA POWER PROJECT/PARK

- GoP may make a comprehensive assessment of Pakistan's future energy needs and alternatives for energy supply
- 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 may be selected for the first UMPP to be awarded in near future.
- Access to electricity is essential for reduction in poverty and improved health, education and economic development
- 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 for the country

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 Hessing 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

PROJECTS PROPOSED FOR THE ASSISTANCE UNDER FRIENDS OF DEMOCRATIC PAKISTAN

US\$ Million

No.	Project	Total Estimated Cost	Public Private Partnership	Soft Loan	Supplier's Credit
1.	Di Amer-Basha Dam Project	11,178	2,500	2,500	
2.	Transmission Scheme for Dispersal of Power from Di Amer-Basha Dam Project to Major Load Centres in the National Grid	1,400			1,400
3.	Kurram Tangi Dam Project	700	100	300	
4.	Golen Gol Hydropower Project	130	22	37	23
5.	Tank Zam Dam Project	234	50	134	
6.	Bunji Hydropower Project	6,838	1850	2,865	
7.	Transmission Scheme for Dispersal of Power from Bunji Hydropower Project to Major Load Centres in the National Grid	1,559			1,559
8.	Dasu Hydropower Project	5,206	1,375	2,253	
9.	Transmission Scheme for Dispersal of Power from Dasu Hydropower Project to Major Load Centres in the National Grid	1,282			1,282
10.	Munda Dam Multipurpose	1,149	226	662	
11.	Kachhi Canal Project	450		450	
12.	Lower Palas Valley Hydropower Project	763			
13.	Lower Spat Gah Hydropower Project	697			
14.	Thor Hydropower Project				
15.	Tangir Hydropower Project	31	31		
16.	12 Small/Medium Dams (Phase-I)	1,639	178	1,173	
17.	Hingol Dam Project	315	30	228	
18.	Bara Dam Project	178	58	88	
19.	Dispersal of Power from Neelum-Jhelum Hydroelectric Project to Gujranwala	225			225
20.	Mahl Hydropower Project				
21.	Kotli Hydropower Project				
22.	Gulpur Hydropower Project				
23.	Ultra Mega Power Project/Park				
24.	Treatment of Effluent Water of RBOD	120	120		
25.	Canal Lining	3030	3030		
	Total:	37,124	9,570	10,690	4,489